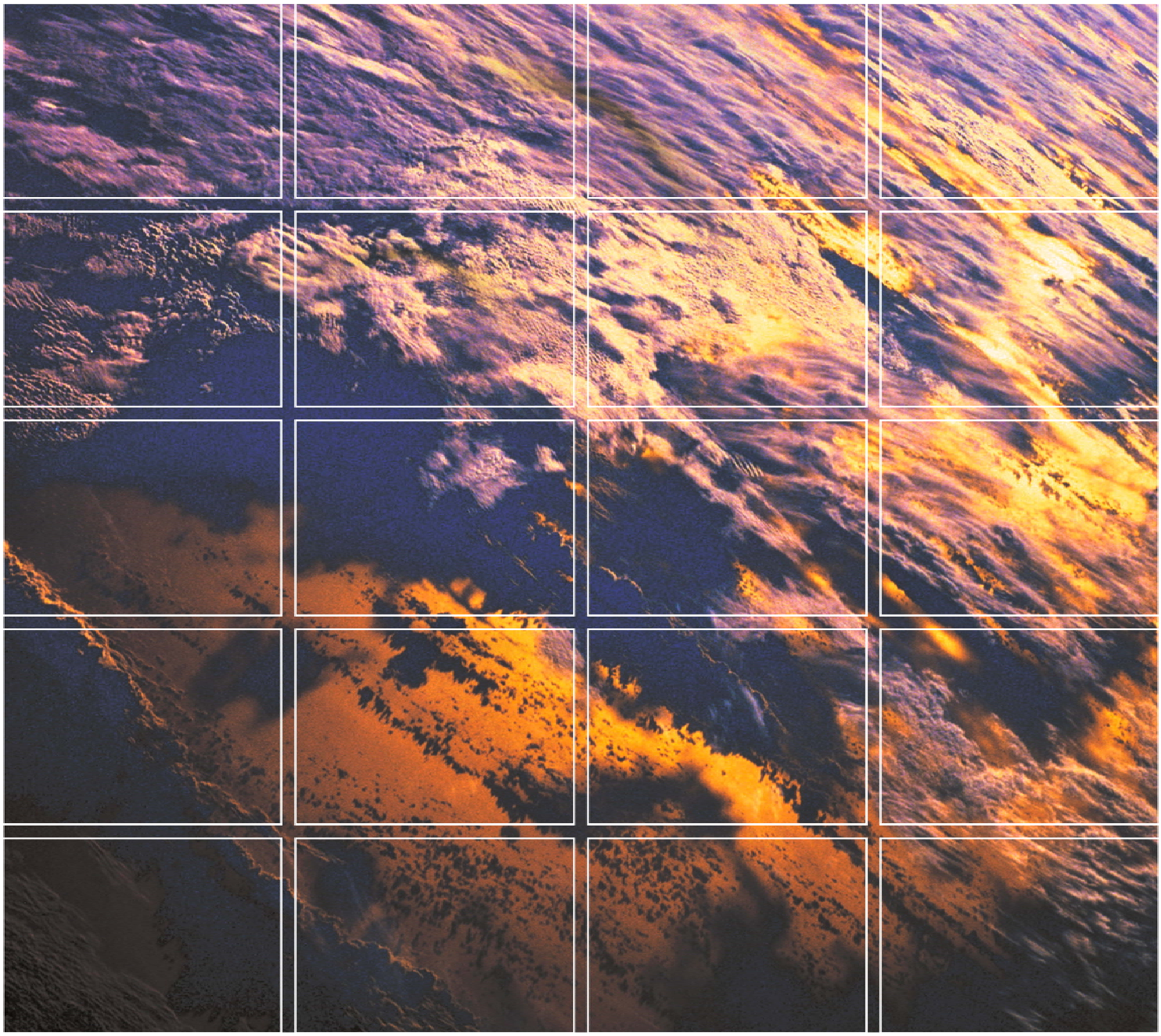


Volume 1
NRE No. 1 Colliery Preliminary Works

Environmental Assessment

Gujarat NRE Coking Coal Limited

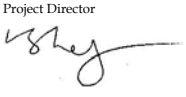
October 2010

0079383RP01 Preliminary Works EA Final

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ERM

Approved by:	*Christine Allen*
Position:	Project Manager
Signed:	
Date:	*1 October, 2010*
Approved by:	*Mike Shelly*
Position:	Project Director
Signed:	
Date:	*1 October, 2010*

Environmental Resources Management Australia Pty Ltd Quality System

This report was prepared in accordance with the scope of services set out in the contract between Environmental Resources Management Australia Pty Ltd ABN 12 002 773 248 (ERM) and the Client. To the best of our knowledge, the proposal presented herein accurately reflects the Client's intentions when the report was printed. However, the application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document. In preparing the report, ERM used data, surveys, analyses, designs, plans and other information provided by the individuals and organisations referenced herein. While checks were undertaken to ensure that such materials were the correct and current versions of the materials provided, except as otherwise stated, ERM did not independently verify the accuracy or completeness of these information sources

SUBMISSION OF ENVIRONMENTAL ASSESSMENT

prepared under Part 3A of the Environmental Planning and Assessment Act 1979

EA PREPARED BY

Names:	***Christine Allen***	***Mike Shelly***
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	NSW 2009	

PROJECT PLAN APPLICATION

Applicant name:	*Gujarat NRE Coking Coal Limited*
Applicant address:	*PO Box 281*
	Fairy Meadow
	NSW 2519
Land to be developed:	*Property description of land to be developed is contained in the EA.*
Proposed development:	*Gujarat NRE Coking Coal Ltd (NRE) seeks approval for the continuation of mining and ancillary operations at NRE No.1 Colliery in the Southern Coalfield.*

ENVIRONMENTAL ASSESSMENT

☑ *An EA is attached which addresses all matters listed under Part 3A of the Environmental Planning and Assessment Act 1979.*

CERTIFICATE

I certify that I have prepared the contents of this EA and to the best of my knowledge:

- *it contains all available information that is relevant to the environmental assessment of the development to which the EA relates; and*
- *it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.*

Signature:		
Name:	*Christine Allen*	*Mike Shelly*
Date:	*01 October 2010*	*01 October 2010*

FINAL REPORT

Gujarat NRE Coking Coal Limited

NRE No.1 Colliery Preliminary Works *Environmental Assessment*

October 2010

Reference: 0079383_Preliminary Works EA

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EXECUTIVE SUMMARY

Gujarat NRE Coking Coal Ltd (NRE) seeks approval for the continuation of mining and ancillary operations at NRE No.1 Colliery in the Southern Coalfield (the Project). This Project is Stage 1 ('Preliminary Works Project') of a proposed major expansion of the Colliery.

NRE is also preparing via a separate application an Environmental Assessment (EA) to seek approval for Stage 2 ('Major Expansion'), being the expansion of its existing operations and upgrade of associated surface facilities at NRE No. 1 Colliery (MP 09_0013). The Major Project Application (MP 09_0013) for Stage 2 is unlikely to reach determination by the December 2010 deadline set by the repealing of the Section 74 of the Mining Act 1992 *and introduction of the* SEPP – Major Development *(see* Section 5.3.1*). The Preliminary Works Project will enable a continuation of existing operations and carrying out of some environmental improvement works at the Russell Vale site pending the completion and determination of the Major Project Application (MP 09_0013) for Stage 2.*

The Preliminary Works Project involves continuing operation of the Colliery, including:

- *augmenting, upgrading and using the existing infrastructure; and*
- *extracting remnant coal reserves within existing mining areas;*
- *extracting up to 1 million tonnes of run-of-mine coal a year from the Bulli and Wongawilli Seams for a period of three years; and*
- *trucking run-of mine coal from the Colliery to the port.*

Environmental improvement works at the Russell Vale site are proposed to better manage stormwater directed through the site by construction of a new channel and improve noise management through construction of noise barriers.

RISK MANAGEMENT

The EA has been prepared to meet the requirements provided by the Director-General of the Department of Planning (DoP) and issues raised by the relevant Government authorities. The assessment has focussed on issues with the potential to impact the environment as identified by the environmental risk assessment undertaken for the Project.

SUBSIDENCE

The Southern Coalfields Inquiry (SCI) report recommends that proponents focus their environmental assessments by placing Risk Management Zones (RMZs) on significant natural features, including rivers; 3rd order streams or above; upland swamps; endangered ecological communities (EEC); threatened species habitat; major cliff lines; and Aboriginal heritage. Identification of significant natural features was a key preliminary step in the assessment process.

Mining is proposed in the following areas:

- *Bulli seam mining in the;*
  - *309 Panel using pillar extraction;*
  - *H Panel using first workings methods;*
  - *V Mains using pillar extraction;*
- *Wongawilli seam mining in the;*
  - *Wonga Mains using first workings;*
  - *P and R Drifts using first workings; and*
  - *gateroads for proposed longwall panels 4 and 5 in Wonga East, using first workings.*

First workings are designed to leave the coal pillars intact and the overlying strata fully supported, resulting in 'zero' subsidence (as defined by Industry and Investment NSW). Subsidence has the potential to occur in two mining areas, the V Mains and 309 Panel. The assessment has focused on these two mining areas and significant natural features have been identified.

Maximum vertical subsidence for V Mains is predicted to be 1.02m. The predicted strains are in the range of +3.3 mm/m to -6.5 mm/m. These levels are regarded as not sufficient to cause tensile cracking in solid rock (Seedsman, 2010). Maximum vertical subsidence for the extraction of 309 Panel is predicted to be 400mm. The associated tilts and strains are anticipated to be approximately +/- 1mm/m, similar to those already recorded for previous extraction in the vicinity of 309 Panel.

A distinct advantage of the type of pillar extraction is that progressive monitoring can be used to limit further extraction should the need arise.

CATCHMENT SURFACE WATER

There are no rivers or 3rd order streams above or adjacent to the 309 Panel. Two 3rd order creeks have been identified in the vicinity of the V Mains area. These are Wallandoola Creek located above the mining area and Lizard Creek located to the east of the mining area. Upland swamps are located along the riparian zone of both Wallandoola Creek and Lizard Creeks. A RMZ has been placed around Wallandoola Creek, however this has not been defined along Lizard Creek, as it is not anticipated this creek or its riparian zone will be affected by subsidence.

Mining in the 309 Panel or V Mains is predicted to result in negligible environmental consequences on Wallandoola Creek, Lizard Creek or their tributaries.

GROUNDWATER

It is anticipated there will be no adverse observable permanent reduction in groundwater levels in the base of Wallandoola or Lizard Creek valleys as a result of the V Mains extraction. Potential subsidence from the extraction of the 309 Panel is not expected to result in any observable adverse impacts on groundwater. Consequently there will be negligible environmental consequences on groundwater in the Project Area.

RUSSELL VALE SOIL AND WATER

The Project involves a continuation of existing mining. No mining in new areas is proposed, as such, no change is expected in the quantity or quality of the water currently being discharged from the Russell Vale site. The discharge from the Colliery is not expected to significantly impact the water quality or quantity in Bellambi Gully Creek over the life of the Project.

The stability of the slopes over the Russell Vale site varies considerably from low risk to high or very high risk. However mitigation measures including improvements to surface and subsurface drainage and revegetation of disturbed areas will reduce this risk.

AIR QUALITY

The air quality assessment indicates that the project is predicted to comply with the long term DECCW air quality impact criteria for PM10, TSP and deposited dust at all receptors. While a maximum of four exceedances of the DECCW short term air quality criteria (maximum PM10 24 hour average concentration) are predicted, it unlikely that the project would have a significant impact on local air quality as the project was not the primary contributor for any of the predicted exceedances.

A number of management measures, many of which are already in practice, are proposed to ensure that emissions to the local air-shed are minimised.

The project is not expected to have significant impact on air quality parameters of dust deposition, PM10 and TSP.

GREENHOUSE GAS

Total emissions over the lifetime of the Project (direct and indirect) have been calculated as being 9 400 174 tCO2–e. Annual emissions are anticipated to peak in 2013, contributing 3 147 471 tCO2–e to atmosphere. This represents approximately 0.16% of the Australian annual total and 0.57% of NSW emissions.

A number of measures, including the purchase and use of energy efficient equipment and maintaining an emissions inventory, will be undertaken by NRE where appropriate, to reduce the greenhouse gas intensity of the Project. Implementation of these measures may enable NRE to further reduce the greenhouse gas intensity of the Project beyond that presented in this assessment.

ACOUSTICS

Noise levels from normal operations are predicted to comply with relevant Project Specific Noise Levels (PSNLs) at most receivers, provided noise mitigation measures such as noise barriers are implemented at the Russell Vale site. Minor exceedances of less than 1dB(A) are predicted at one receiver during day periods and three (3) receivers during evening periods in Russell Vale. Minor exceedances of 3dB (A) or less are predicted during night time periods at five (5) receivers in Russell Vale and Corrimal. The noise levels reported are reasonable, and minor exceedances will be confirmed though the implementation of a noise monitoring program.

Noise levels associated with the Project are predicted to comply with the criteria for sleep disturbance, road traffic noise, cumulative noise and construction noise for each representative area. The works have the potential to progressively reduce noise emissions as older infrastructure is replaced with more modern facilities with consideration for noise reduction.

AQUATIC ECOLOGY

No areas of aquatic habitat were identified above or surrounding the 309 Panel. The main aquatic habitats above and surrounding the V Mains area are provided by the main channel and tributaries of Wallandoola and Lizard Creeks. Predicted subsidence arising from mining in the V Mains area is not expected to have any obvious effects on aquatic habitats or their biota within or immediately downstream of the V Mains area.

Mining Areas

Significant ecological features identified above and surrounding the 309 Panel include an upland swamp 320m west of the panel. Field studies have also indicated that habitat for threatened flora and threatened fauna species might occur within the vicinity of the 309 Panel.

No threatened flora species were recorded within the V Mains area during field surveys, although it is recognised that potential habitat is available for a number of species. The vegetation community Transitional Shale Stringybark Forest recorded within the V Mains area forms part of the Shale Sandstone Transition Forest listed as an EEC under the Threatened Species Conservation Act 1995 and the Environment Protection and Biodiversity Conservation Act 1999. Upland swamps are located along the riparian zone of both Wallandoola Creek and Lizard Creeks. Eight threatened fauna species are confirmed to occur within the V Mains area.

It is considered that the proposed activities will be unlikely to significantly impact ecological values within the mining areas.

Russell Vale

*Potential habitat for the Green and Golden Bell Frog (*Litoria aurea*) was recorded within Dam 6 and a number of other areas at the Russell Vale site. The Green and Golden Bell Frog is listed as endangered under the* Threatened Species Conservation Act 1995 *and the* Environment Protection and Biodiversity Conservation Act 1999. *Surveys for the species undertaken in May and September 2010 did not detect the species within Dam 6. However, it is recognised that the surveys may not have been undertaken during appropriate conditions and therefore, it may be considered that for the purpose of providing effective assessment and management the Green and Golden Bell Frog utilises Dam 6 (i.e. a precautionary approach).*

One other threatened species, Large-footed Myotis, may forage over the dams of the Russell Vale site.

The proposed removal of Dam 6 at the Russell Vale site will impact upon the potential habitat of the Green and Golden Bell Frog and foraging habitat for the Large-footed Myotis. Provided the prescribed mitigation measures are implemented, significant impacts to the Green and Golden Bell Frog or the Large-footed Myotis as a result of the works would be unlikely. Mitigation measures include targeted surveys and development of a habitat enhancement and translocation plan for the Green and Golden Bell Frog.

As a precautionary approach, a referral to the DEWHA for impacts to the Green and Golden Bell Frog will be submitted as part of this proposal.

ABORIGINAL HERITAGE

No items of Aboriginal heritage were identified above or surrounding the 309 Panel. One Aboriginal site 52-2-1223, a shelter with deposit and axe grinding grooves, was identified above V Mains. Subsidence resulting from the extraction of V Mains is predicted to have a negligible risk on this site.

There are no Aboriginal heritage sites or values present within the Russell Vale site.

HISTORIC HERITAGE

A review of legislative frameworks, heritage registers, and previous assessments revealed a number of items of heritage significance at the Russell Vale site. No items of historic heritage will be impacted by the Project.

TRAFFIC AND TRANSPORT

The Project involves a continuation of current production rates of up to 1mtpa. No change in the number of coal transport trucks or employees is proposed. Recent traffic counts have been undertaken along Bellambi Lane to determine the effect of the opening of the Northern Distributor extension in 2009. The project will not impact on the safety and performance of the road network along the transport corridor.

VISUAL AMENITY

Changes to the existing viewscape, resulting from the Project, from publicly accessible view points outside the Colliery are minor.

WASTE

No change to the quantity of operational waste is expected to result from the Project. A small amount of waste will be produced during the construction phase of the Project. Continued implementation of current waste management practices, as amended to reflect improved technology or practice, will minimise potential adverse impacts resulting from waste generation.

SOCIO-ECONOMIC

The social and economic impacts from the Project occur within an existing operation and therefore are not expected to dramatically change the existing socio-economic environment. By allowing the mine to continue to operate the project has an important socio-economic impact as it maintains continuity of employment.

CONCLUSION

The Project is consistent with the objects of the Environmental Planning and Assessment Act 1979, *the recommendation of the SCI report and has taken into account the principles of Ecologically Sustainable Development (ESD). The aim of applying ESD to large resource developments is to ensure long term sustainable outcomes by the integration of profitable business with environmental responsibility, in partnership with the community. Consideration of ESD principles included:*

- *The Precautionary Principle - through identification if potential impacts with adequate scientific certainty to justify proceeding with the proposed development:*

- *Social Equity and Intergenerational Equity - through the continuation of local employment and ongoing sponsorship and funding for community programme:*

- *Conservation of Biological Diversity and Ecological Integrity – through commitments which aim to conserve, enhance and manage habitat within the PAA; and*

- *Improved Valuation and Pricing of Environmental Resources – though investing a higher initial capital expenditure to ensure a sustainable outcome.*

Given that the proposal is essentially a continuation of an existing operation, there are significant environmental and socio-economic benefits that would result from the project. With the comprehensive management and monitoring measures proposed, the project's benefits outweigh the potential adverse impacts and therefore, the Project is in the best interest of the public.

1 BACKGROUND

This chapter introduces and provides a background to the Project, including its historical context and geographical setting. A description of the purpose and structure of this Environmental Assessment Report is also provided.

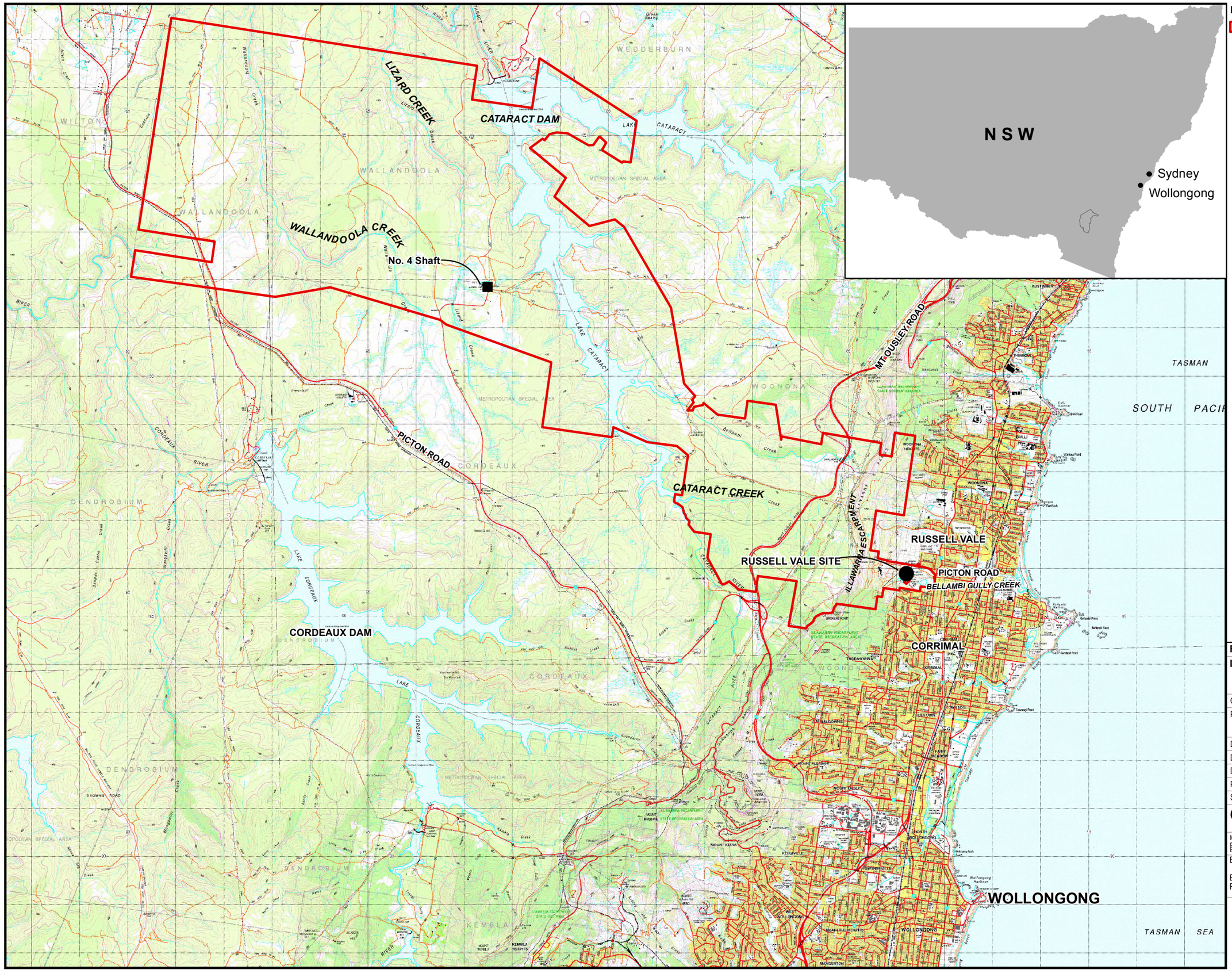
1.1 INTRODUCTION

Gujarat NRE Coking Coal Ltd (NRE) seeks approval for the continuation of mining and ancillary operations at NRE No. 1 Colliery in the Southern Coalfield (the 'Preliminary Works Project'). This project is Stage 1 of a proposed major expansion of the Colliery (see *Section 1.1.2*). 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*.

The Project Application Area (PAA) comprises Consolidated Coal Lease (CCL) 745, Mining Purposes Lease (MPL) 271 and Mining Lease (ML) 1575 and covers a total area of 6 545ha.

Extensive underground mining has been undertaken within the PAA, dating from the late nineteenth century, however a substantial volume of high quality coking coal resources remain along with some potential thermal coal resources. NRE is currently mining coal in the Bulli seam and the Wongawilli seam.

Pursuant to provisions of *State Environmental Planning Policy* (SEPP) – *Major Development 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 undertake an Environmental Assessment (EA) and prepare the associated report.



Legend

Project Application Area

Figure 1.1

Locality Map

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS001_R1.mxd	
Date:	15/09/2010	Drawing Size: A3
Drawn By:	NS	Reviewed By: MK
Projection:	GDA 1994 MGA Zone 56	
Scale:	Refer to scale bar	

N

0 840 1,680 2,520m

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.

Environmental Resources Management Australia Pty Ltd

Brisbane, Canberra, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

1.1.1 Project Overview

The Project will allow continued operation of the Colliery, including:

- augmenting, upgrading and using the existing infrastructure;
- extracting remnant coal reserves within existing mining areas;
- extracting up to 1 million tonnes of run-of-mine (ROM) coal a year from the Bulli and Wongawilli Seams for a period of three years; and
- trucking ROM coal from the Colliery to port.

Environmental improvement works at the Russell Vale site are proposed to better manage stormwater directed through the site by construction of a new channel and improve noise management through construction of noise barriers.

1.1.2 Related Projects

NRE is also preparing an EA to seek a separate approval for Stage 2, being the expansion of its existing operations and upgrade of associated surface facilities at NRE No. 1 Colliery (MP 09_0013). This larger project will have an estimated capital investment value of $250 million. It will include the following activities:

- coal extraction (from the Bulli, Balgownie and Wongawilli seams) in areas known as Wonga East and Wonga West ramping coal production up to 3 million tonnes per annum (mtpa) with a projected mine life of at least 18 years; and
- upgrade of existing mine infrastructure and services at the Russell Vale site, including surface conveyors and coal handling infrastructure, coal sizing, screening, crushing and load-out facilities, site noise and dust controls and a stockpile for ROM coal.

1.2 COMPANY PROFILE

NRE is a public company, which was listed on the Australian Stock Exchange (ASX code: GNM) on 10 July 2007. NRE owns and operates 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 and operates NRE Wongawilli Colliery (former Elouera and Avondale Collieries), which is 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;
- 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 in India to generate "green" power.

1.3 HISTORY OF THE 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 Colliery) in the mid 19th Century. Continuous mining has been a feature of the PAA since 1887 and surface facilities have operated 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 Reservoir commenced in the 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 ROM coal is now transported unwashed to Port Kembla Coal Terminal (PKCT) for shipment to India.

NRE is currently mining in the Bulli coal seam in 310, 312 and "P" panels and in the Wongawilli seam in an area known as Wonga Mains. Current coal production is just under 1 mtpa.

1.4 PROJECT APPLICATION AREA

1.4.1 Description

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.

Part of the eastern portion of the lease is located on the Illawarra Escarpment. Within the PAA, the lip of the Escarpment reaches up to 400m Australian Height Datum (AHD) and slopes steeply down to the foothills at approximately 30m AHD. The steep slopes of the escarpment are heavily vegetated.

The Russell Vale site is located on the lower slopes and foothills of the Escarpment at approximately 140m AHD. 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.

The majority of the PAA comprises an extensive underground lease area, which lies under the Woronora Plateau west of the escarpment. The surface land of the plateau is covered by native bushland and the Cataract Reservoir, with perennial creeks, ephemeral tributary streams and upland headwater swamps. Cataract Reservoir 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.

In addition to the Russell Vale site, NRE has surface leases at one access shaft (No.4 Shaft) and four ventilation shaft sites (No. 1, 2, 3 and 5 Shafts) across the PAA and easements for power and water supply. A brief description of surface sites is provided in *Section 2.1*.

1.4.2 Leases

The PAA covers approximately 6 545 ha, encompassing CCL 745, MPL 271 and ML 1575 shown on *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.

CCL 745 is the largest lease and makes up the majority of the PAA. It covers approximately 6 001 ha, from the Russell Vale pit top over the escarpment and west across the plateau. Most of the proposed mining areas and the surface facility upgrades will take place within this lease area.

ML 1575 makes up the southern portion of the western part of the PAA. It is approximately 544 ha and includes the V Mains area.

MPL 271 is a small surface lease within the centre of the western portion of the PAA. It is located within the Metropolitan Special Area and is covered in bushland. Initially identified as the location for No. 6 Shaft, this MPL is currently unused and at present there is no infrastructure located at the site. There are no proposed works within this lease.

Surface lease areas are shown on *Figure 1.3*.

1.4.3 Infrastructure

Infrastructure above the proposed mining areas includes a Telstra fibre optic cable, electrical transmission lines and roads (see *Figure 1.4*).

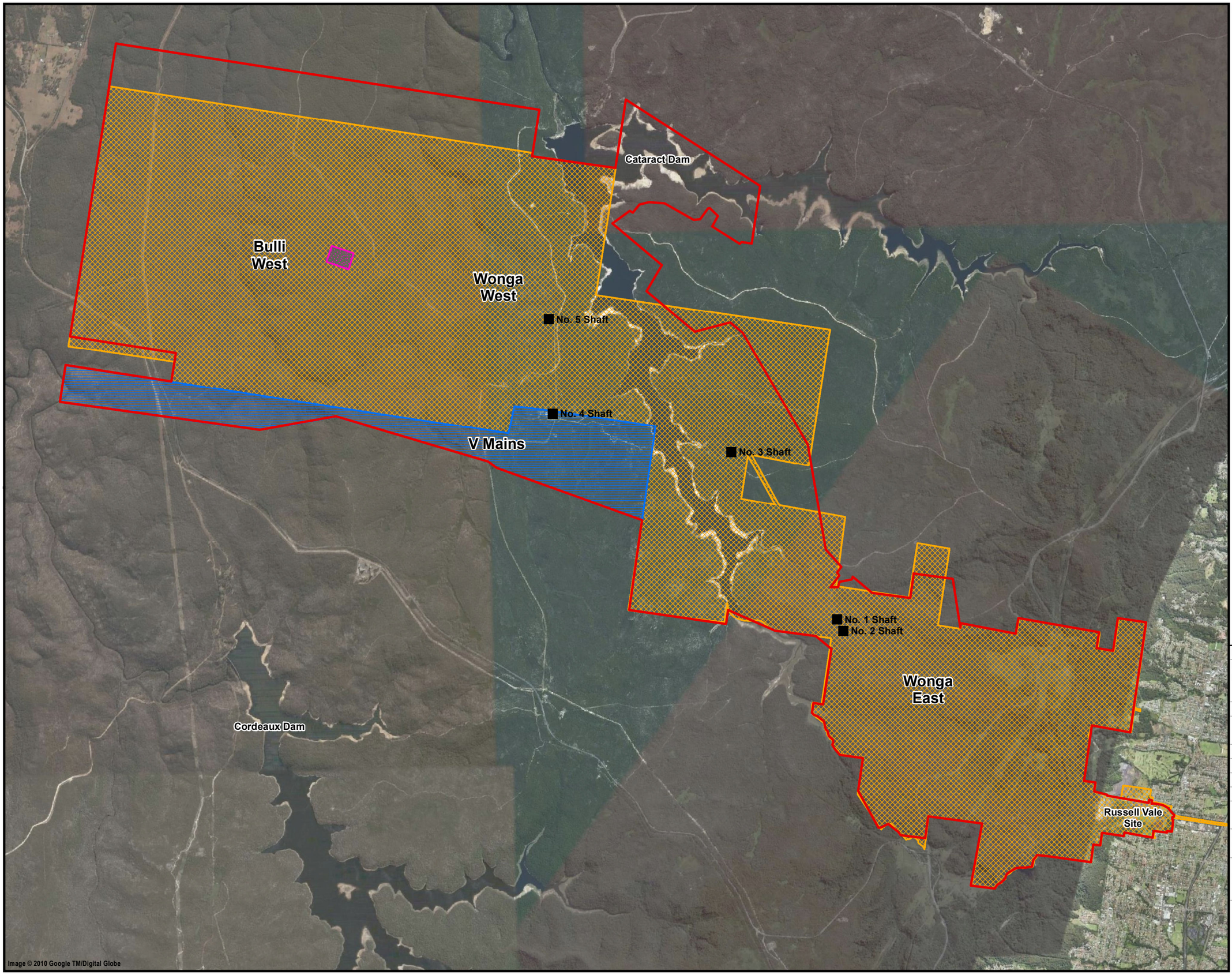
An optical fibre cable crosses the PAA running north-south from Appin to Picton Road following Fire Trail No. 8. This optical fibre cable is the Melbourne-Sydney No.3 optical fibre identified by Telstra as F HOME 2005 48 fibre.

In addition to the power supply to the Colliery there are a number of other electrical transmission lines that cross the PAA. These include a 330kv transmission line (line 11) and a number of transmission lines owned by Integral Energy (one 132kv line and three 33kv lines) that follow Mount Ousley Road and the Escarpment alignment.

The Southern Freeway (Mount Ousley Road) crosses the PAA running north-south, to the west of the Russell Vale site. This is a state road managed by the RTA. The Picton Road crosses the south western portion of the PAA in a northwest southeast direction. It is a major road managed by the RTA.

There are a number of unsealed fire trails across the PAA, the main ones being the No.7 and No.8 Fire Trails. Fire trails within the Metropolitan Special Area are maintained by the SCA. The remaining fire trails are maintained by the Rural Fire Service.

There are a number of old quarry sites on the lease but none are included in the current or planned future operations.



Legend

- Project Application Area

Lease Boundaries

- CCL745
- ML1575
- MPL271

Figure 1.2

Project Application Area and Mining Leases

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS025_R1.mxd	
Date:	09/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
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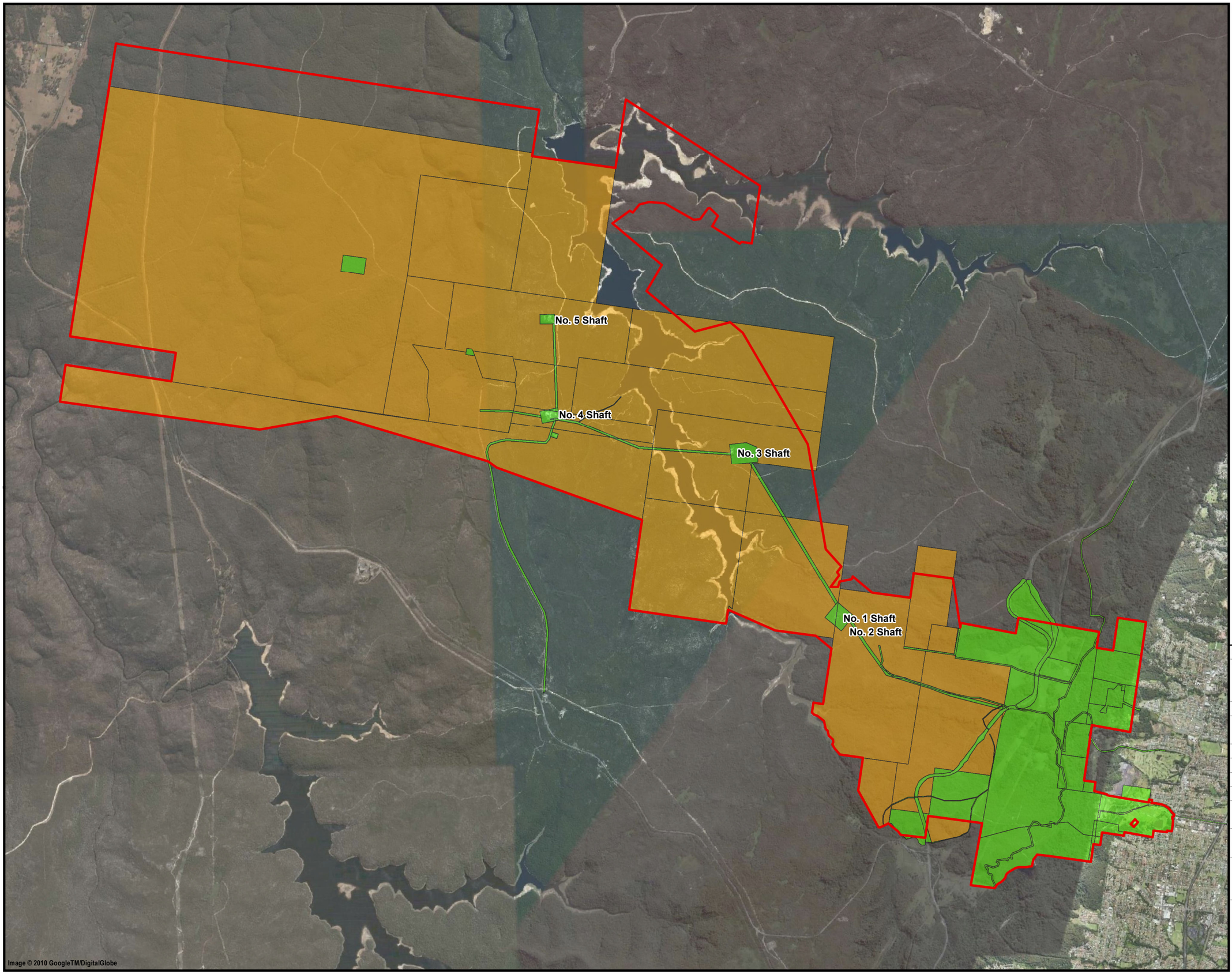
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Legend

- Project Application Area
- Surface Lease
- Underground Lease

Figure 1.3

Surface Lease Areas

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS026_R1.mxd	
Date:	07/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
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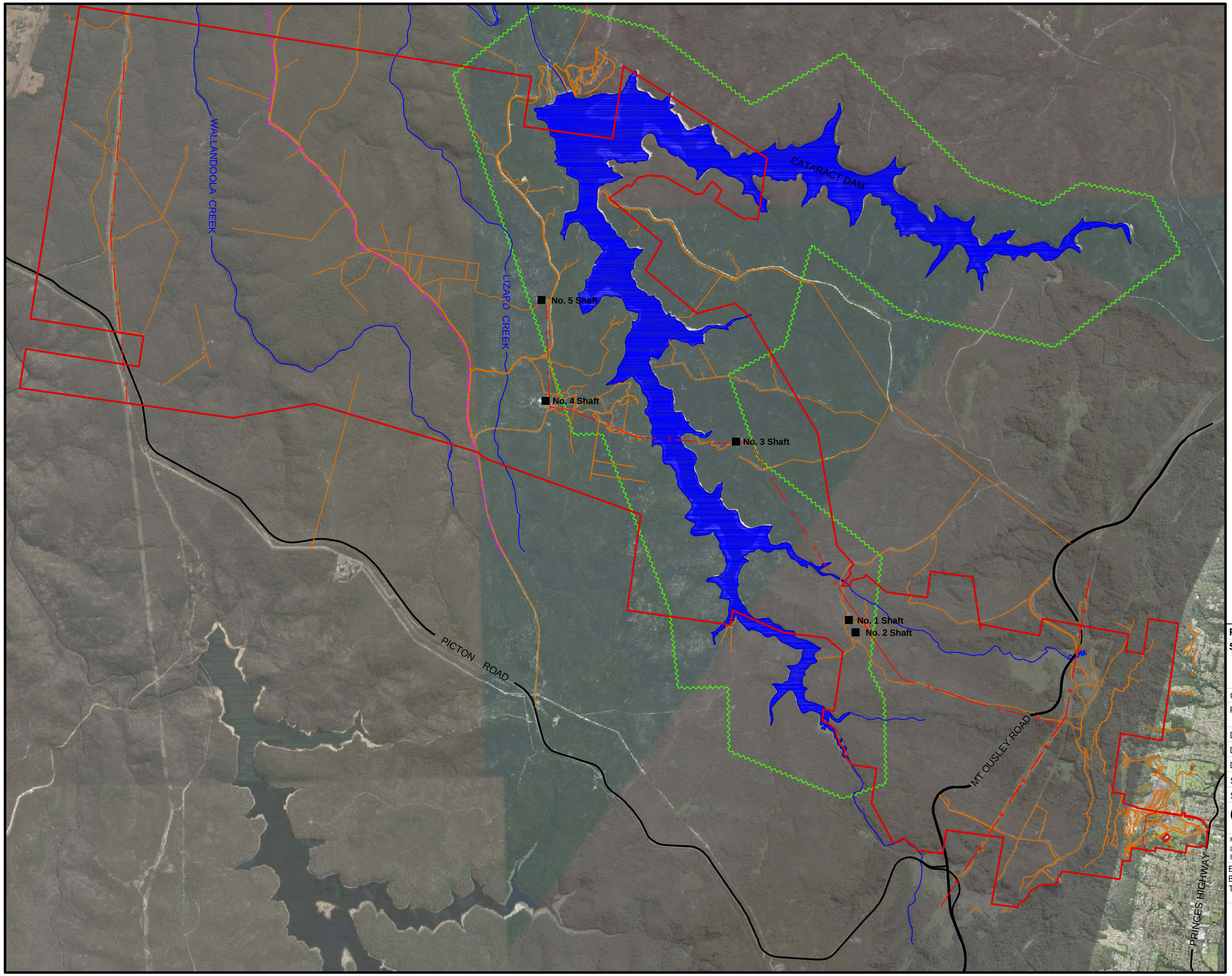
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Legend

- Project Application Area
- Cataract Dam Notification Zone
- Telstra Optic Fibre
- Transmission Line
- Major Roads
- Fire Trails & Access Tracks
- Dam
- Waterway
- Shaft Location

Figure 1.4

Surface Infrastructure

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment		
Drawing No:	0079383s_PW_A001_R1.dwg		
Date:	08/09/2010	Drawing Size:	A3
Drawn By:	NS	Reviewed By:	MK
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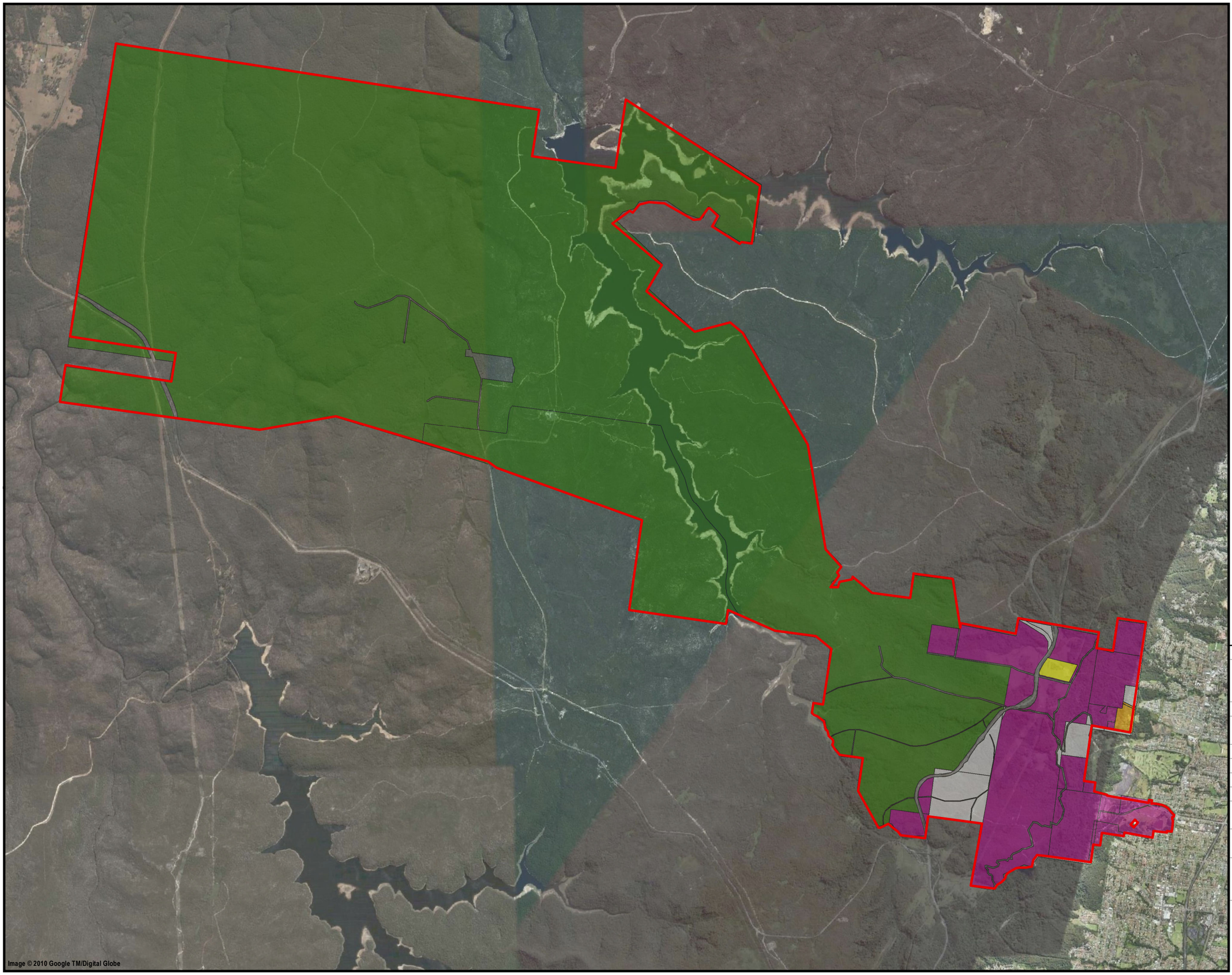
1.4.4 Mining Tenements and Land Ownership

The PAA encompasses three mining leases, CCL 745, MPL 271 and ML 1575 (*Figure 1.2*). CCL 745 is valid until 30 December 2023, MPL 271 until 9 May 2012 and ML 1575 until 18 October 2010, application has been made for a renewal of MPL 271 and ML 1575.

The majority of the surface land within the PAA is owned by the SCA. Relevant tenure and land ownership information is presented in *Table 1.1* and shown on *Figure 1.5*.

Table 1.1 Land Ownership Information

Property ID / Lot Number	DP Plan Number	Owner
Auto Consol 1833-110		Bellpac Pty Ltd
Auto Consol 1644-66		Bellpac Pty Ltd
Auto consol 5333-243 includes:		Bellpac Pty Ltd
Lot 3	DP 60975	Bellpac Pty Ltd
Lot 30 to 32	DP 751301	Bellpac Pty Ltd
Lot 63&68 -71	DP751301	Bellpac Pty Ltd
Lot 1-2	DP 1046069	Bellpac Pty Ltd
Lot 1	DP 1046070	Bellpac Pty Ltd
Lot 130	DP 751301	Bellpac Pty Ltd
Lot 31	DP 1006012	Bellpac Pty Ltd
Lot 1	DP 630761	Bellpac Pty Ltd
Lot 1	DP 986675	Bellpac Pty Ltd
Lot 1	DP 986676	Bellpac Pty Ltd
Lot 1	DP 534522	Bellpac Pty Ltd
Lot 95 to 96	DP 4414	Bellpac Pty Ltd
Lot 97	DP4414	The Council of the City of Wollongong
Lots 1 to 4	DP 225021	Bellpac Pty Ltd
Lot 34	DP 751301	Bellpac Pty Ltd
Lot 6	DP 793358	Bellpac Pty Ltd
Lot 66	DP 751301	Bellpac Pty Ltd
Lot 67	DP 751301	Bellpac Pty Ltd
Lot 1	DP 652833	Bellpac Pty Ltd
Lot 6001	DP 1077301	Bellpac Pty Ltd
Lot 1	DP 77407	Bellpac Pty Ltd
Lot 1	DP1052074	Bellpac Pty Ltd
Lot 2	DP1052074	Bellpac Pty Ltd
Part Lot 6000	DP 1077301	Illawarra Land Pty Ltd
Lot 6500	DP 1083715	Illawarra Land Pty Ltd
Lot 6502	DP 1083715	Ronald Edward Devitt & Jane Wilson
Part Lot 6501	DP1083715	Barbara Jean Williams
Lot 12	DP736121	Integral Energy Australia
Lot 32	DP 1138149	Sydney Catchment Authority



Legend

- Project Application Area

Land Ownership

- Bellpac Pty Ltd
- Illawarra Land Pty Ltd
- Integral Energy Australia
- Private Land
- Sydney Catchment Authority

Figure 1.5
Land Ownership

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS015_R1.mxd	
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1.5 *NEED FOR THE PROJECT*

The Project will enable a continuation of existing operations and the carrying out of some environmental improvement works at the Russell Vale site pending the completion and determination of the Major Project Application (MP 09_0013) for Stage 2.

MP 09_0013 is unlikely to reach determination by the December 2010 deadline set by the repealing of the *Section 74* of the *Mining Act 1992* and introduction of the *SEPP – Major Development* (see *Section 5.3.1*).

Environmental improvement works at the Russell Vale site are required to better manage stormwater directed through the site by construction of a new channel realignment and improve noise management.

1.6 *DIRECTOR GENERALS REQUIREMENTS*

The Director General's Requirements (DGRs) were received on 19 April 2010 and are presented in *Table 1.2*.

Table 1.2 Director General's Requirements

Issue	Description	Relevant Section in Environmental Assessment Report
General Requirements	The environmental assessment must include:	
	• an executive summary;	*Executive Summary*
	- a detailed description of the following within NRE No.1 Colliery holdings and any associated reject disposal area:	
	- historical mining operations;	*Section 1.3*
	- existing and approved mining operations/facilities, including any statutory approvals that apply to the operations/facilities; and	*Chapter 2 and Section 5.8.1*
	- the existing environmental management and monitoring regime;	*Section 5.8.3*
	• a detailed description of the project including:	*Chapter 3*
	- need for the project	*Section 1.5*
	- alternatives considered, including a justification for the proposed mine plan/s and coal rejects disposal strategy on economic, social and environmental grounds;	*Chapter 4*
	- likely staging of the project; and	*Section 3.8*
	- plans of and proposed building works;	*Annex B*
	• a risk assessment of the potential impacts of the project, identifying the key issues for further assessment;	*Chapter 7*
	• a detailed assessment of the key issues specified below, and any other significant issues identified in the risk assessment (see above), which includes	*Chapter 8 to 22 and Annexes E- R*
	- a description of the existing environment, using sufficient baseline data;	

Issue	Description	Relevant Section in Environmental Assessment Report
	- an assessment of the potential impacts of all stages of the project including any cumulative impacts, taking into consideration any relevant guidelines, policies, plans and statutory provisions (see below) and the findings and recommendations of the recent Southern Coalfield Inquiry; - a description of the measures that would be implemented to avoid, minimise and mitigate, rehabilitate/remediate, monitor and offset the potential impacts of the project, including detailed contingency plans for managing any potentially significant risks to the environment; • a Statement of Commitments, outlining all the proposed environmental management and monitoring measures; • a conclusion justifying the project on economic, environmental and social grounds, taking into consideration whether the project is consistent with the objectives of the Environmental Planning and Assessment Act 1979; • a signed statement from the author of the Environmental Assessment certifying that the information contained within the documents is neither false nor misleading.	*Chapter 24* *Chapter 25* *Cover Page*
Key issues	• **Subsidence –** including: - accurate prediction of the potential subsidence effects of the proposed mine plans; - a detailed assessment of the potential impacts and environmental consequences of these subsidence effects on both the natural and built environment • **Soil & Water –** including: - a detailed assessment of the potential impacts of the project on the quantity and quality of the surface and groundwater resources in the Project Area, paying particular attention to site water balance and discharge of mine water and surface runoff into the Bellambi Gully Creek and Bellambi Gully Creek Lagoon; • **Biodiversity –** including; - accurate estimates of clearing or other impacts; - an assessment to of the potential impacts of the project on any terrestrial and aquatic threatened species, populations, ecological communities or their habitats; and - an assessment of the measures that would be implemented to maintain or improve the biodiversity values of the surrounding region in the medium to long term; • **Heritage –** including the potential impacts of the project on Aboriginal and non-Aboriginal heritage, both within the surface infrastructure and proposed mining areas;	*Section 8.4 and Annex E* *Chapter 8 to 22 and Annexes E- R* *Chapter 9, 10 and 11 and Annex F and G* *Chapter 16* *Section 15.3 and Section 16.5* *Section 15.4 and Section 16.6* *Chapter 17 and 18*

Issue	Description	Relevant Section in Environmental Assessment Report
	• **Noise –** including on-site construction and operational noise and off site road noise and vibration impacts from the haulage of coal along the coal transport corridor to Port Kembla Coal Terminal, paying particular attention to sensitive receivers along Bellambi Lane.	*Chapter 14*
	• **Greenhouse** gas – including: - a quantitative assessment of potential scope 1, 2 and 3 greenhouse gas emissions of the project, and qualitative assessment of the potential impacts of these emissions on the environment; and - a detailed description of the measures that would be implemented on site to ensure that the project is energy efficient;	*Chapter 13* *Section 13.3 and 13.4* *Section 13.5*
	• **Transport –** including a detailed assessment of the potential impacts of the project on safety and performance of the road network, specifically along the transport corridor;	*Chapter 19*
	• **Waste –** including: - estimates of the quantity and nature of the potential waste streams of the project, including details on any waste water management systems; - a detailed description of the measures that would be implemented to minimise, reuse, recycle and dispose of any waste produced on site;	*Chapter 21* *Section 21.2 and 21.3* *Section 21.5*
	• **Hazards –** paying particular attention to public safety;	*Section 7.2*
	• **Rehabilitation –** including a description of the proposed rehabilitation strategy for the mine, taking into consideration any relevant strategic and land use planning resource management plans or policies, including: - identifying post-mining land use options; - clearly defining project rehabilitation objectives; - outlining general rehabilitation methods and procedures; and - conceptual final landform design; and	*Chapter 23* *Section 23.2* *Section 23.3* *Section 23.4* *Section 23.5*
	• **Social and Economic** including the cost of rehabilitation, remediation and repair.	*Chapter 22*
Consultation	During the preparation of the Environmental Assessment, you should consult relevant local, State, or Commonwealth Government authorities, service providers, community groups or affected land owners. In particular you should consult with the: • Department of Environment, Climate Change and Water; • Department Industry and Investment; • Sydney Catchment Authority; • Dam Safety Committee; • Mine Subsidence Board; • Roads and Traffic Authority; • Department of Lands; and • Wollongong and Wollondilly Council. The consultation process and the issues raised during this process must be described in the Environmental Assessment.	*Chapter 6*

1.7 PURPOSE OF THE EA

This report has been prepared to:

- provide relevant background information and describe the key components of the proposal;
- outline the legislative framework under which the proposal will be assessed;
- detail the consultation process undertaken for the Project and demonstrate how issues raised have been considered and addressed in the assessment;
- assess the potential environmental impacts of the proposal;
- identify measures to mitigate or negate potential adverse impacts through a Statement of Project Commitments;
- provide justification for the Project;
- provide sufficient information for the relevant agencies to make an informed decision on the matters raised by the DGRs; and
- support the Project Application to gain approval, under Clause 75(F) of the EP&A Act, from the Minister for Planning.

1.8 STRUCTURE OF THE EA

The EA contains two Volumes with the main environmental assessment being contained within Volume 1 and the supporting technical assessments being contained within Volume 2.

Volume 1 has been prepared to ensure that the existing activities and proposed changes are described adequately, the potential environmental impacts assessed are detailed and existing mitigation measures and proposed additional measures proposed are detailed.

Volume 2 contains 18 annexes as follows:

Annex A - Water Management Report NRE No.1 Colliery, Russell Vale

Annex B - JBK Plans

Annex C - NRE No 1 Colliery Russell Vale Site Surface Facilities and On-site Traffic Preliminary Works Part 3A

Annex D - Existing permits and Approvals

Annex E - Subsidence Assessment – Remnant Bulli Areas and Wongawilli First Workings

Annex F - V Mains Surface and Groundwater Assessment

Annex G - Preliminary Works Surface Water and Groundwater Assessment

Annex H - Geotechnical Investigation Proposed Preliminary Works Coal Stockpile and Handling Facility Upgrade

Annex I - NRE No.1 Colliery Preliminary Work Air Quality Assessment

Annex J - NRE No.1 Colliery Preliminary Work Acoustic Assessment

Annex K - NRE No. 1 Mine V Mains Area – Effects of Mine Subsidence on Aquatic Habitats and Biota

Annex L - V Mains Terrestrial Flora and Fauna Assessment

Annex M - Green and Golden Bell Frog Assessment

Annex N - Seven Part Tests

Annex O - Aboriginal Heritage Consultation

Annex P - Aboriginal Heritage Risk Assessment Matrix

Annex Q - Historic Heritage Statement of Significance

Annex R - Visual Assessment Photo Montage

2 EXISTING OPERATIONS

This chapter describes the existing activities and management systems currently in operation at the site.

2.1 SURFACE LEASES

2.1.1 Russell Vale Site

The Russell Vale site occupies approximately 100 ha at the eastern extent of CCL 745. It is on freehold and leasehold land on the lower slopes of the Illawarra Escarpment. Site access is via a private driveway from the Princes Highway, at a signalised intersection with Bellambi Lane. Surface infrastructure at the Russell Vale site is shown in *Figure 2.1* and includes:

- administration offices and amenities;
- maintenance workshops;
- car parking areas and internal sealed and unsealed roads;
- two portal entries located at the level of the Balgownie seam, one for men and materials, and another for the belt road which conveys coal to the surface;
- three recently constructed portal entries one in the Wongawilli seam and the other two in the Balgownie seam, for a new high capacity coal conveyor system, a rubber tyre vehicle transport road and a track road for rail mounted transports, respectively;
- ROM stockpile area and reclaim tunnel;
- two decline belt conveyors from the belt portal to the ROM stockpile area;
- breaker building and conveyor to the truck load-out bins;
- truck load-out;
- vehicle wash;
- weigh bridge;
- water treatment and management facilities; and
- fuel and oil store.

The natural escarpment slopes and steep side slopes of the valley areas within the elevated parts of the Russell Vale site have been modified significantly by filling and excavations in the past, particularly above the central valley area uphill of the ROM stockpile.

Emplacement Area

The Russell Vale Emplacement Area (RVEA) land is jointly owned by Wollongong City Council (WCC) and Bellpac Pty Ltd and lies north of the Russel Vale site. All but a small section of the RVEA is located outside the lease area and outside the PAA. The RVEA operates under a development consent from Wollongong Council which allows refuse to be emplaced on the site from the workings of the NRE No.1 Colliery (see *Section 5.8*). Since 1986 a section of the RVEA has been used as a golf course. The long term intention of this area, as reflected in the current Development Consent D89/839, is that the entire freehold area will be eventually used for recreational purposes as a golf course.



Legend

Project Application Area

Figure 2.1

Russell Vale Site

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS006_R1.mxd	
Date:	03/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
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2.1.2 *Shaft Sites*

There are five shafts within the PAA, four are exclusively ventilation shafts and one a shaft for men, materials and ventilation.

No.1 Shaft is located on a surface lease approximately 5 kilometres north east of the Russell Vale site. It is an upcast ventilation shaft which facilitates fresh air flow through the underground workings. It provides effective ventilation for selected sections of the mine and complements the other upcast No. 5 Shaft that is located on the lease further to the west.

No.2 Shaft is an old ventilation shaft which has been decommissioned. The shaft has not been used for ventilation purposes for over 40 years. No.2 Shaft is located on a surface lease approximately 70 metres from the currently operating upcast No.1 shaft. The site consists of an empty brick building and an old vent fan.

No.3 Shaft is currently a downcast ventilation shaft providing fresh air to the underground workings. It is accessed via one of the SCA owned fire trails.

The No. 4 Shaft and associated facilities are located on a surface lease approximately 10 km north west of the Russell Vale site and surrounded by native bushland within the SCA Metropolitan Special Area. The site is accessed by Fire Trail No.8 leading north off Picton Road. The No. 4 Shaft is used for moving men and materials between the underground workings and surface facilities. 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.

No.5 Shaft like No.1 Shaft is an upcast ventilation shaft which facilitates fresh air flow through the underground workings. The site of No. 5 Shaft includes a compressed air facility, power and water delivery pipeline to the underground workings. The site is accessed via a fire trail leading from No.4 Shaft and is located on a surface lease approximately 11 km north west of the Russell Vale site.

2.2 *UNDERGROUND MINING*

Previous workings date back to the 1880's and involve a combination of old hand workings in the Bulli seam using the Welsh Bord mining method, involving pit ponies and later an endless rope haulage system. As mining progressed to the west and techniques and technology changed so the mine was progressively modernised with the use of continuous miners, shuttle cars and conveyors. Longwall mining was trialled and successfully introduced in the late 1960's. Also longwall extraction was undertaken in the Balgownie seam. In the 1970's a new man access facility was established at No.4 Shaft.

Current workings are in the Bulli seam and include pillar extraction in the T and W Mains area ("200" longwall series in the south and "300" longwall series in the north), first workings in the "P" Panel in the central portion of the site (between Wonga East and West) and the 'P & R' drifts driveage to the east of the 200 longwall series.

There are no current workings in the Balgownie seam.

Current workings in the Wongawilli seam constitute the Wonga Mains driveage. The development of these roadways commenced at the Russell Vale site in 2007.

Figure 2.2 shows the existing and current workings at NRE No.1 Colliery. *Table 2.1* lists underground equipment currently used.

Table 2.1 Underground Equipment

Quantity	Equipment Make & Model	Equipment Type
2	12CM3 wide Head 4.8m	Coal Cutting Machine
2	Dash 3 Continuous Miners	Coal Cutting Machine
1	Joy 12CM 15 Continuous Miner	Coal Cutting Machine
1	Joy 12CM11 Continuous Miner	Coal Cutting Machine
1	Joy 12CM3 Continuous Miner	Coal Cutting Machine
2	Fletcher Bolters	Crawler Mounted Bolter
1	Ramtrack Bolter	Crawler Mounted Bolter
1	Sig Bolter	Crawler Mounted Bolter
1	Bobcat	Diesel Loader
3	Eimco 913 Loaders	Diesel Operated Loader
1	Eimco BW5 Loader	Diesel Operated Loader
3	Klockner Becorit Feeder	Feeder Breaker
6	Breaker Line Supports	Hydraulic Chock Support
4	Diesel Loco MLD 03 25 tonne	Track Mounted Diesel Loco
4	Baldwin DPC	Track Mounted Diesel Man Car
2	Fox diesel Personnel Car	Track Mounted Diesel Man Car
3	Mancar DPC	Track Mounted Diesel Man Car
9	Joy 15 Shuttle Cars	Tyre Mounted Loading Machine
2	Narco Shuttle Cars	Tyre Mounted Loading Machine
2	Wagner	Tyre Mounted Material Transporter
1	People Transporter	Tyre Mounted People Transporter

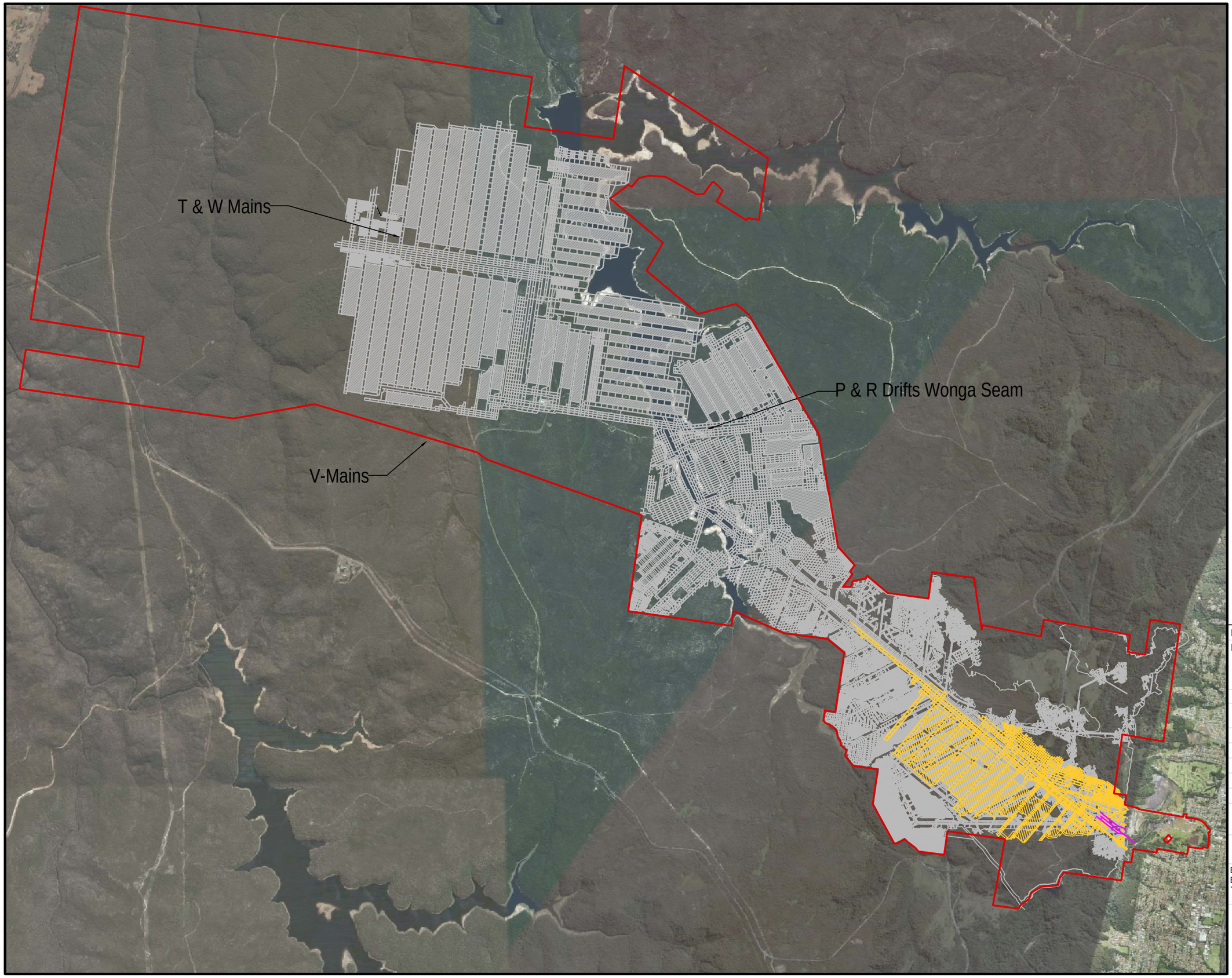


Figure 2.2
Existing and Current Workings

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE No.1 Colliert Preliminary Works Environmental Assesment		
Drawing No:	0079383s_PW_A004_R1.dwg		
Date:	08/09/2010	Drawing Size:	A3
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2.3 ROM COAL PRODUCTION AND HANDLING

Current production at NRE No.1 Colliery is approximately 1 mtpa. Coal handling facilities are situated at the Russell Vale site and shown on *Figure 2.3*.

ROM coal is transported from the working face to the surface via an underground belt conveyor/ vibrating feeder complex. There are two decline conveyors which transport coal from the portal to the stockpile area at the Russell Vale site. These belts are referred to as the Bulli decline belt and the Balgownie decline belt. Both belt conveyors are partially enclosed, to reduce dust emissions.

Coal from the Bulli decline belt is deposited into a coal bin at the base of the decline. Clearance holes in the bin allow the coal to then be deposited on the ground. Coal is then pushed up using a dozer to form the stockpile. The stockpile area has a capacity of up to 80 000t. From the stockpile coal is then loaded through a vibrating screen sizer using an excavator. The coal is processed through the vibrating screen sizer and deposited onto C5 conveyor in the reclaim tunnel, which delivers coal to the Bradford Breaker.

The Bradford Breaker was originally designed to screen down to minus 150mm, but has been re-configured to screen to minus 65 mm. It is currently in a state of disrepair and the deck plates have been removed to allow coal to bypass the breaker.

From the Bradford Breaker, coal travels along the C6 conveyor to the top of a 600 tonne bin. The 600 tonne bin is in line to provide surge capacity to the reclaim system. A 'Hornet' vibrating feeder at the base of the bin deposits the coal onto the C7 conveyor, which transports coal to the truck loading bins.

The truck loading bin consists of three separate bins, of which only one is currently used. The second bin is filled via overflow from the first bin, and the third bin is currently unable to be filled.

Dust suppression at the Russell Vale site is managed using a number of means according to weather and operational demands. These means include

- an automatically controlled fixed stockpile spray system around the ROM stockpile area;
- a mobile water truck that is used throughout the site;
- roadside sprays;
- truck washing facilities that are used for all heavy vehicles as they depart the site;

- a bobcat mounted road sweeper that can be used on all sealed surfaces; and
- fixed water sprays at selected points on a number of surface and underground conveyor systems.

Water used for these purposes is supplied from recycled water sources including mine water and treated storm water. Sprays are used almost daily in one form or another depending on demands.

Oversized waste rock averages approximately 2% of current production. This material has been mechanically screened and is re-used on-site e.g. as road surface and as a clean structural fill material. Alternate re-use strategies will be investigated through the term of this Project.

A temporary stockpile located to the east of the ROM stockpile is used for the storage of high ash coal which has minimal coking properties. This coal is being extracted from the Wonga Mains driveage in the Wongawilli Seam, affected by local geological conditions. This temporary stockpile is being progressively removed from the site and in future, higher ash coal, when it occurs will be stored and blended underground.

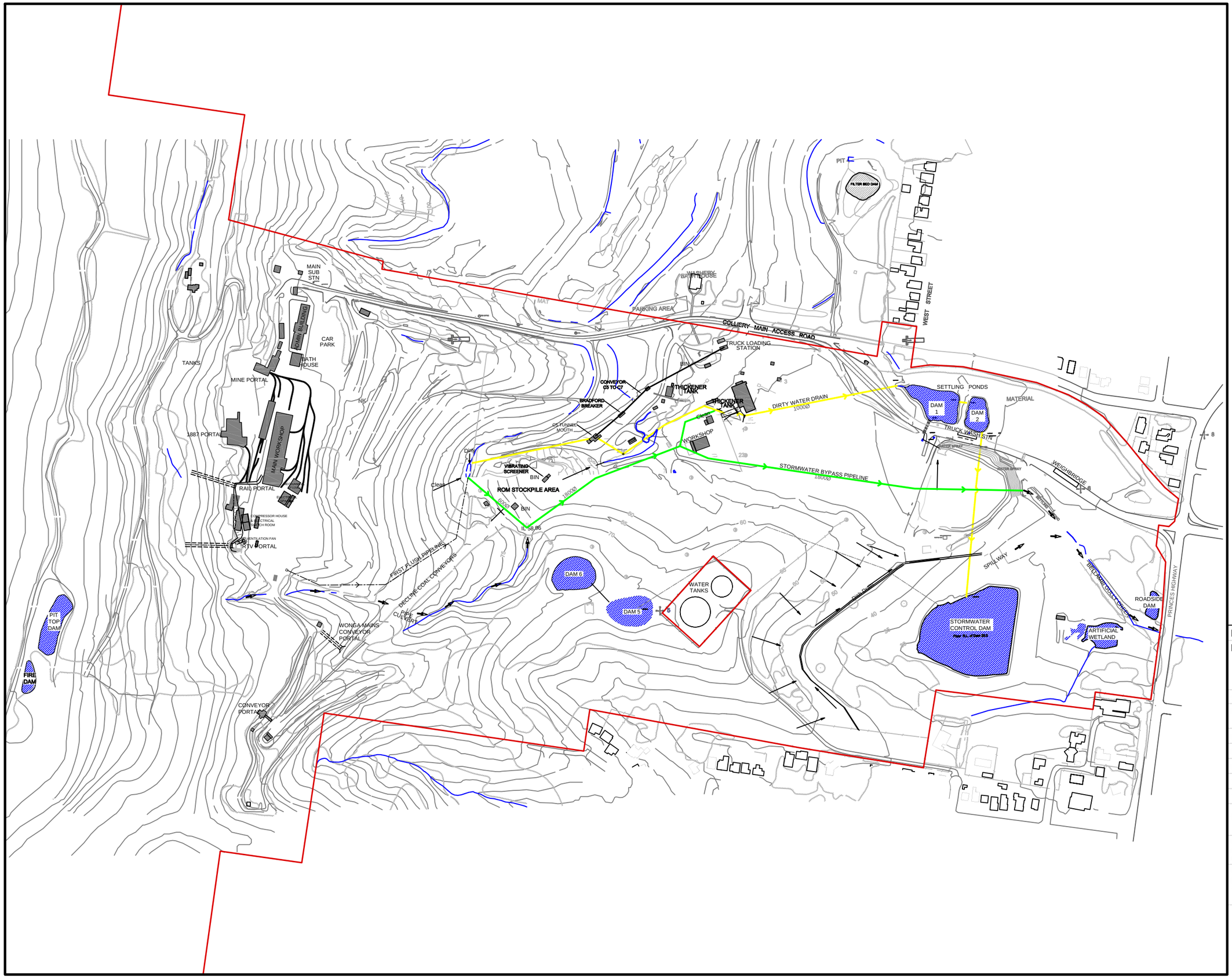


Figure 2.3
Existing Coal Handling Facilities Layout

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment		
Drawing No:	0079383s_PW_A002_R1.dwg		
Date:	08/09/2010	Drawing Size:	A3
Drawn By:	NS	Reviewed By:	MK
Source:	Olsen Environmental Consulting Ref: DP-3673.dwg		
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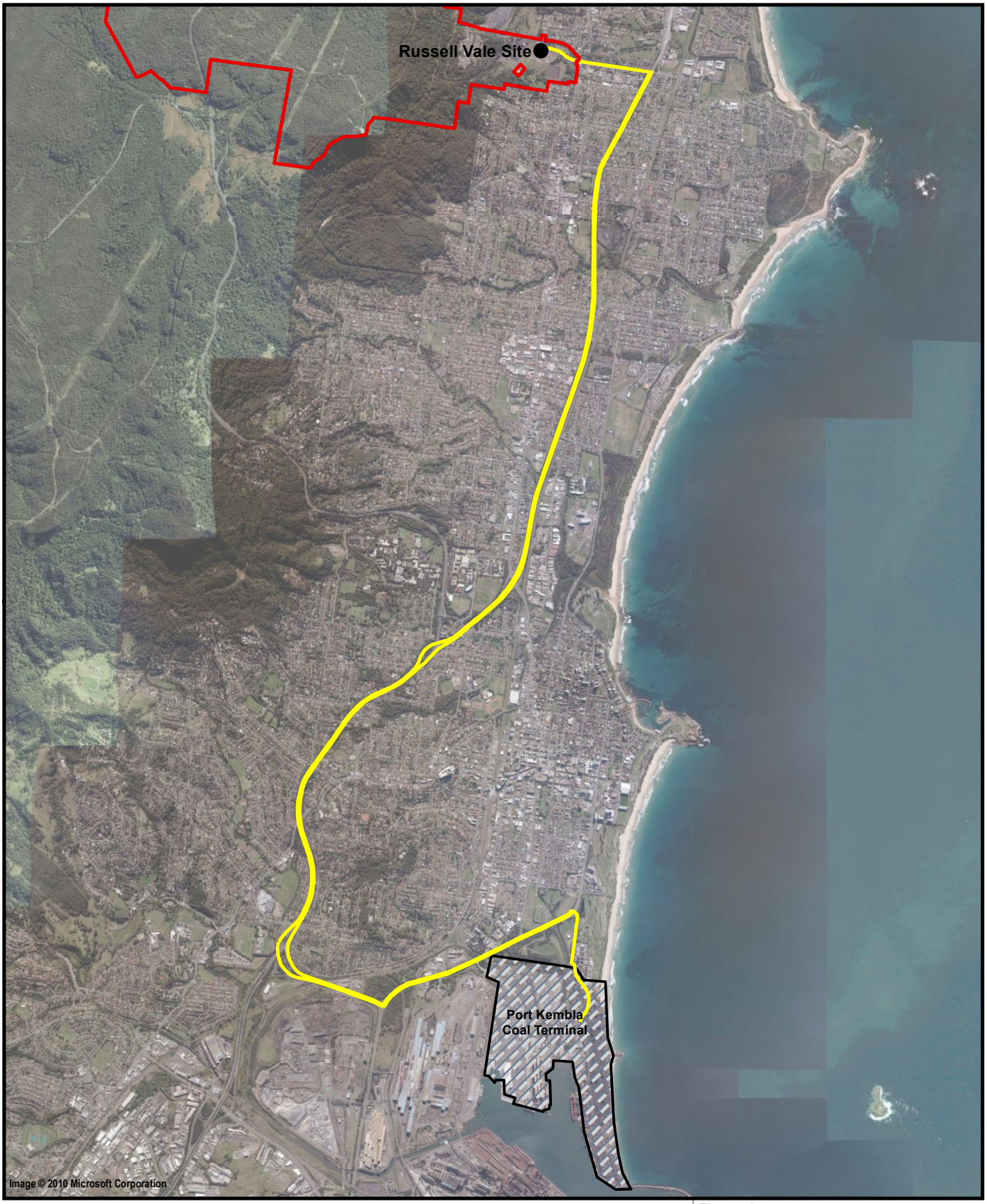
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2.4 *PRODUCT COAL TRANSPORT*

Coal is currently transported, unwashed, by truck from NRE No.1 Colliery to PKCT for shipment to India. Coal transport trucks generally operate between the hours of 7.00am and 6.00pm five days per week (Monday to Friday) and 8.00am to 6.00pm Saturdays. A small number of trucks are occasionally loaded when shipping schedules demand, from the stockpile between 6pm and 10pm Monday to Friday. Average truck loads are approximately 34 tonnes, with up to 134 loaded trucks leaving the site each day.

Trucks leave the site travelling east via Bellambi Lane to the Northern Distributor. Trucks then travel south along the Northern Distributor and on to the Southern Freeway. From the Freeway trucks travel east along Masters Road and Springhill Road to PKCT. The transport route from NRE No.1 Colliery to PKCT is shown on *Figure 2.4*. Trucks are predominantly operated by Brindles Transport.



Legend

- Project Application Area
- Port Kembla Coal Terminal
- Coal Transport Route

Figure 2.4
Coal Transport Route

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS008_R1.mxd	
Date:	03/09/2010	Drawing size: A4
Drawn by:	NS	Reviewed by: MK
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2.5 SUPPORT INFRASTRUCTURE

2.5.1 Power and Telecommunications

The Colliery is supplied from Integral Energy's Bellambi Transmission Substation via the substation located at Russell Vale at the mine pit top level.

An easement for overhead transmission lines exists across the site (running east-west) connecting the Russell Vale site and each of the shaft sites to the electrical grid. A surface lease exists along this easement and it is managed and maintained by NRE. The supply to the mine is 33Kv and it is stepped down using site transformers from the 33Kv to 6.6Kv at Russell Vale site, No. 1 Shaft and No. 4 Shaft. A 6.6Kv supply runs from No. 4 Shaft to No. 5 Shaft and also to a pumping station transformer located just above the high water mark on Lake Cataract.

Communications to the site are provided by Telstra utilising the existing infrastructure along with private communication and data links along the power supply easement.

No changes to the existing power and telecommunication supply arrangements are proposed at surface sites.

2.5.2 Roads and Parking

The Russell Vale site is accessed via Bellambi Lane off the Princes Highway (State Highway No.1). There are a number of internal roads, both sealed and unsealed, providing access to parking and facilities. Parking for approximately 80 vehicles is provided in a gravelled car park adjacent to the administration building.

No.4 Shaft is accessed via a privately owned, sealed access road leading off Picton Road. The Picton Road is a major road managed by RTA. Parking for approximately 120 vehicles is provided in a sealed car park adjacent to the administration building.

2.6 WATER MANAGEMENT

The existing water management system at the Russell Vale site has been described by Beca (2010). The full report *Water Management Report NRE No.1 Colliery, Russell Vale* is provided in *Annex A* and is summarised below. The existing water management arrangement is illustrated on *Figure 2.5*.

2.6.1 *Potable Water Supply*

Russell Vale

Potable water demands at the Russell Vale site are met by connection to Wollongong's reticulated water supply. Potable water is generally supplied to the administration building, bath houses, part of the truck washer, workshop and amenities. However, potable water may also be required to supply the underground mine operations, if process water becomes unavailable.

No.4 Shaft

Water demands at No. 4 Shaft are met by a combination of raw water purchased from SCA and recycled process water. Historically water has been pumped directly via a pipeline from the SCA's Cataract Reservoir to the No.4 Shaft, or brought in by water tanker at a rate of approximately three 25 kilolitre tanker loads per week. Water is stored in elevated reservoirs on site, which allows gravity feed from the storage tanks to the bath house and office.

2.6.2 *Process Water*

Russell Vale

Process water is a combination of:

- clean raw water from surrounding water sources (Corrimal Springs);
- potable water supplemented from the Brick Tank (generally not used) located above the pit top level;
- treated stormwater from the Thickener Tank overflow; and
- water from mine dewatering of underground storages.

Surplus ground water is pumped from the mine workings to the surface at the Russell Vale site, treated and reused within the surface water management system.

Process water is used for a variety of purposes at the surface and underground including dust suppression, vehicle wash, fire fighting and road cleaning. Process water is also used at truck filling points, wash down and on the stockpiles. The truck wash uses a combination of potable and process water.

Process water, together with dirty stormwater, is collected from surface drains in the processing areas and directed to Dam 1 for subsequent treatment within the existing surface water management system (*Section 2.6.3*).

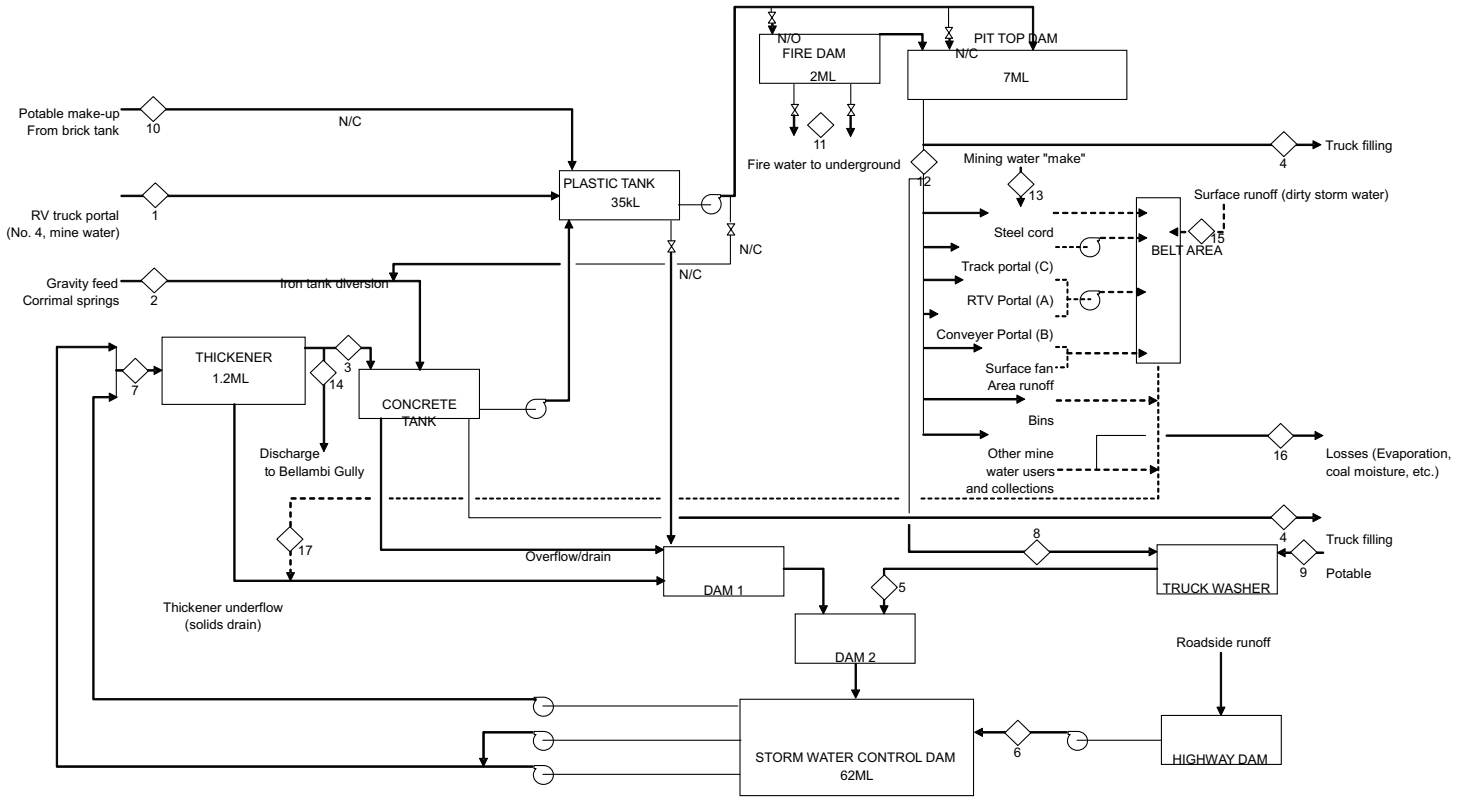


Figure 2.5

Current Russell Vale Block/Process Flow Diagram

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_C001_R0.cdr	
Date:	31/05/2010	Drawing size: A4
Drawn by:	ML	Reviewed by: MK
Source:	Beca (2010)	
Scale:	Not to Scale	

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No.4 Shaft

Mine water is collected underground and pumped back up to the Main Collector Dam on the surface for dust suppression, underground and emergency fire fighting requirements. However, in the event that the Main Collector Dam reaches full capacity, the excess mine water is diverted to the Russell Vale site for treatment and/or discharge.

2.6.3 Stormwater

Russell Vale

The stormwater collection network at the Russell Vale site directs 'dirty water' runoff to a series of dams (both concrete and earthen formed) for primary solids settling prior to treatment.

The Russell Vale site consists of three major catchment zones depending on their location and their land use and grade. These three catchment zones are defined as:

- Upper Catchments – characterized by predominantly natural escarpment and steep heavily vegetated slopes with thick undergrowth. This catchment zone is considered to be 100% clean water with no coal stockpiling or conveyor activities within any of its subcatchments;

- Middle Catchments – including the workshop, offices, a number of existing and proposed portals, and a network of access roads between the stockpile and the Upper Catchments. It is characterized by steep batters of both natural slopes and mine tailing material and will not generally be exposed to coal stockpiling, conveyor operations, or hauling in the proposed mine upgrade; and

- Lower Catchments –dominated by the coal stockpile and haul areas, truck loading facility and settlement basins.

Each catchment has been broken down into sub-catchments based on its location within the overall catchment plan and their dirty water or clean water characteristics. The sub-catchments are described in *Table 2.2* and illustrated on *Figure 2.6*.

Table 2.2 Stormwater catchments

Catchment Name	Description	Water Type
U1 to U3, U5	Natural escarpment catchment which is dominated by heavy trees and undergrowth with a number of unsealed access roads and fire trails.	Clean Water
U4	Site of the original electrical power station of the mine. The natural soil in this location has a high percentage of ash and fine silty materials and is therefore highly prone to erosion.	Clean Water
U5	Natural escarpment catchment which is dominated by heavy trees and undergrowth with a section of unsealed access roads and fire trails.	Clean Water
M1	Characterised by both a section of natural escarpment slopes located below the U2 and U3 catchment and also the workshop and mine portal area.	First Flush
M2	Consists of the office building, and car parking facilities as well as a small section of natural catchment to the west.	Clean Water
M3	Consists of an existing steep man made batter and set down area for materials, items of plant, and deliveries as well as an access road which links this area to the workshop area.	Clean Water
M4	This is a small component of heavily vegetated natural slope adjacent to the M7 conveyor portal catchment.	Clean Water
M5	Consists of steep man made batters and access roads.	Clean Water
M6	Characterised by steep man made batters and access roads.	Clean Water
M7	Located at the southern extent of the Russell Vale site and is the location of the conveyor portal outlet from underground operations.	Dirty Water
M8	Characterised by a long narrow natural ridge and a sealed roadway.	Clean Water
L1	Consists of the ridge and slope immediately adjacent to the proposed clean water diversion channel which runs past the stockpile area.	Clean Water
L2	Consists primarily of the coal stockpile, truck loading bay, and surrounding dirty areas.	Dirty Water



Legend

- Project Application Area
- Catchment Boundary
- Clean Water
- Dirty Water
- First Flush

Figure 2.6

Stormwater catchments at the Russell Vale Site

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment		
Drawing No:	0079383s_PW_A006_R1.dwg		
Date:	08/09/2010	Drawing Size:	A3
Drawn By:	NS	Reviewed By:	MK
Source:	Beca 2010		
Scale:	Refer to scale bar		

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Dirty stormwater and process water is collected and treated together at the Russell Vale site. This water is generally collected into Dam 1, with a gravity overflow to Dam 2. These dams provide some holding volume to aid solids settling prior to routing it to the Stormwater Control Dam (SWCD). Water from Dam 2 is routed (by gravity) to the SWCD together with water pumped from the Highway Dam (this dam collects roadside drainage water). A schematic of the dam water flow is shown in *Figure 2.5*.

Water from the SWCD is then pumped through 1 or 2 pumps (3 installed, maximum 2 on duty and at least 1 on standby) to the Thickener Tank where suspended solids are removed with the aid of flocculent/coagulant dosing. Clarified water from the Thickener tank overflow is either routed to the Concrete Tank for reuse in the mine or discharged to Bellambi Gully Creek via licensed discharge point 2 (LDP2).

The level in the SWCD is managed (by selectively operating pumps) to allow sufficient free volume to receive a 10 year annual recurrence interval (ARI) storm event. The stormwater control dam has a volume of 62ML under normal operating conditions and has been approved to operate as a dry detention basin.

Solids from the Thickener Tank are not further treated and are rerouted to Dam 1 and 2 from where solids removal is periodically performed. Solids removed from the dams are dried, reused on site or blended into ROM coal product where applicable.

Bellambi Gully Creek

Clean stormwater is directed off site via Bellambi Gully Creek. Bellambi Gully Creek currently flows through the site via an underground pipe below the existing ROM stockpile. The pipe has limited a limited capacity and is unable to carry water for a 1 in 100 year flood event. Beyond the Russell Vale site boundary, Bellambi Gully Creek flows east through the suburbs of Russell Vale and Bellambi and discharges into the ocean at Bellambi Beach.

No.4 Shaft

At the No. 4 Shaft, stormwater runoff is directed to the site's Main Collector Dam for recycling. Water collected from the workshop is managed via oil interceptors, then flows to the Main Collector Dam. If required stormwater on site may be harvested and used for dust suppression and other purposes underground.

Any surplus stormwater not recycled on-site (including roof water and water from the car parking) is diverted off-site into the catchment. Off site discharges are dependent on climatic conditions. Water management at No.4 Shaft is not currently licensed by the DECCW.

2.6.4 Sewage

Russell Vale

Sewage generated at the Russell Vale site is disposed of via connection to Wollongong's reticulated sewer.

No.4 Shaft

At the No. 4 Shaft, grey and black water are treated on site in separate Pasveer facilities. The Pasveer treatment system is an automatic extended aeration tank.

The grey water effluent from the bath house is treated using Pasveer No. 1 prior to storage in the main collector dam where it is mixed with mine dewatering water and stormwater overflow. Water stored in this dam is used in the hydrant system for underground operations or emergency response on the surface. As part of NRE's continuing mine upgrade, improvements to the quality of water used for underground purposes are in progress and a tertiary treatment system is being installed to reduce pathogens and achieve a 1mg\L chlorine residual after 30 minutes as required under the former Department of Environment and Conservation (DEC) *Environmental Guidelines for the Use of Effluent by Irrigation 2004*.

Black water is treated using Pasveer No. 2, where the inflow water is aerated then temporarily stored in maturation ponds. Maturation allows for a detention time of several months. This water is generally disposed of via spray irrigation in a designated area or alternatively, a licensed contractor is used for disposal.

Beca (2010) notes that treated black water is disposed of via spray irrigation on site in accordance with the former DEC *Environmental Guidelines for the Use of Effluent by Irrigation 2004*.

The DEC guidelines recommend that the water content (or moisture) requirements of the soil are regularly monitored to ensure that the irrigation site is not overloaded. Soil moisture indicators can be used to determine the maximum amount of effluent that can be applied on the surface without causing saturation of the area or runoff.

NRE utilises a monitoring approach including visual observation for the presence of ponding of water on the surface of the irrigation area. NRE has also constructed trenching along the perimeter of the irrigation area to assist in managing any excess surface water runoff that may enter the catchment, by draining to the stormwater collection dam.

Treated grey water is added to the stormwater collection dam for reuse underground. NRE plans to implement a tertiary treatment system to reduce pathogens resulting in a 1mg\L chlorine residual after 30 minutes as is required under the DEC reuse guidelines. Ongoing monitoring of the disinfection system will be undertaken daily.

2.7 WASTE

Putrescible waste, waste timber and other rubbish are disposed off-site by a licensed contractor at an approved facility. Scrap steel is sold to a metal recycler and waste paper from the administration section is also recycled where possible.

Waste oil is stored temporarily in 4 bulk 1 000L storages prior to removal by a licensed operator. Appropriately sized and maintained bunds surround the above ground storages.

2.8 HAZARDOUS MATERIALS

An explosives storage unit is located at the No.4 Shaft site. A dangerous Goods Licence is held by the Colliery for these items. The licence allows storage for up to 2 000kg of explosives and 5 000 units of detonators (Note: this typically is not the total quantities used). The facility complies with all statutory requirements.

Diesel fuel is stored at the Russell Vale site in a purpose built unit that is double bunded and closely regulated. Although the capacity of this unit is 14 kilolitres the average quantity stored is about 10 kilolitres. At No. 4 Shaft the diesel storage facility is in a bunded area and has a nominal capacity of 9 kilolitres. Fuel quantities stored here average about 7 kilolitres and are also closely regulated.

An oil storage area is located under cover at the Russell Vale site where oil is stored in 20 litre drums. Waste oil is stored in 1 kilolitre bulk tanks that are pumped out by contractor.

2.9 EMPLOYMENT AND HOURS OF OPERATION

NRE No.1 Colliery currently employs approximately 259 staff and 78 contractors as detailed in *Table 2.3.* The shift times are detailed in *Table 2.4.*

Table 2.3 Current Number of Employees at NRE No.1 Colliery

		Number of Employees
Russell Vale		
Head Office Staff		18
Staff		7
Deputies		11
Operators		67
Contractors		30
	Total	**133**
# 4 Shaft		
Staff		28
Deputies		22
Operators		106
Contractors		48
	Total	**204**

Table 2.4 Shift times at NRE No.1 Colliery

Shift	Weekdays	Weekend
Day Shift	6.00am - 2.30pm	10.30am – 10.30pm
Afternoon Shift	2.30pm – 10.30-pm	NA
Night Shift	10.30pm – 6.30am	10.30pm – 10.30am (Friday and Saturday)

Hours of operation for both underground mining operations and surface facilities are 24 hours per day, 7 days per week.

Coal transport trucks generally operate between the hours of 7.00am and 6.00pm Monday to Friday and 8.00am to 6.00pm Saturdays. A small number of trucks and plant operate between 6.00pm and 10.00pm Monday to Friday and 8.00am to 6.00pm on Sundays, when shipping schedules require.

3 PROJECT DESCRIPTION

This chapter details the geology and resource upon which the Project is based and details the proposed mining and surface facility upgrades that are subject to this Project Application.

3.1 GEOLOGY AND RESOURCE DESCRIPTION

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 the Wongawilli seam lies 22 to 25 m below the Balgownie seam. It is estimated that a total of approximately 2.2 million tonnes of ROM coal will be recovered from the mine as part of this Project. This represents a Project life of up to 3 years, with a peak extraction rate of 1 mtpa.

3.2 MINING

3.2.1 Bulli Seam

It is proposed to continue coal extraction from the Bulli seam. Mining areas are shown on *Figure 3.1* and *3.2* and include:

- pillar extraction in 309 Panel;
- first workings in H Panel; and
- development & pillar extraction in "V" Mains.

Pillar extraction will continue in the 309 Panel (the T and W Mains), within the western portion of the lease. 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. Pillar extraction within 309 Panel (T and W Mains) was approved via a Section 138 approval under the *Coal Mines Regulations Act 1982* issued by Industry and Investment NSW (IIN) in 2004 effective until December 2008. In 2007 the approval was extended until December 2010.

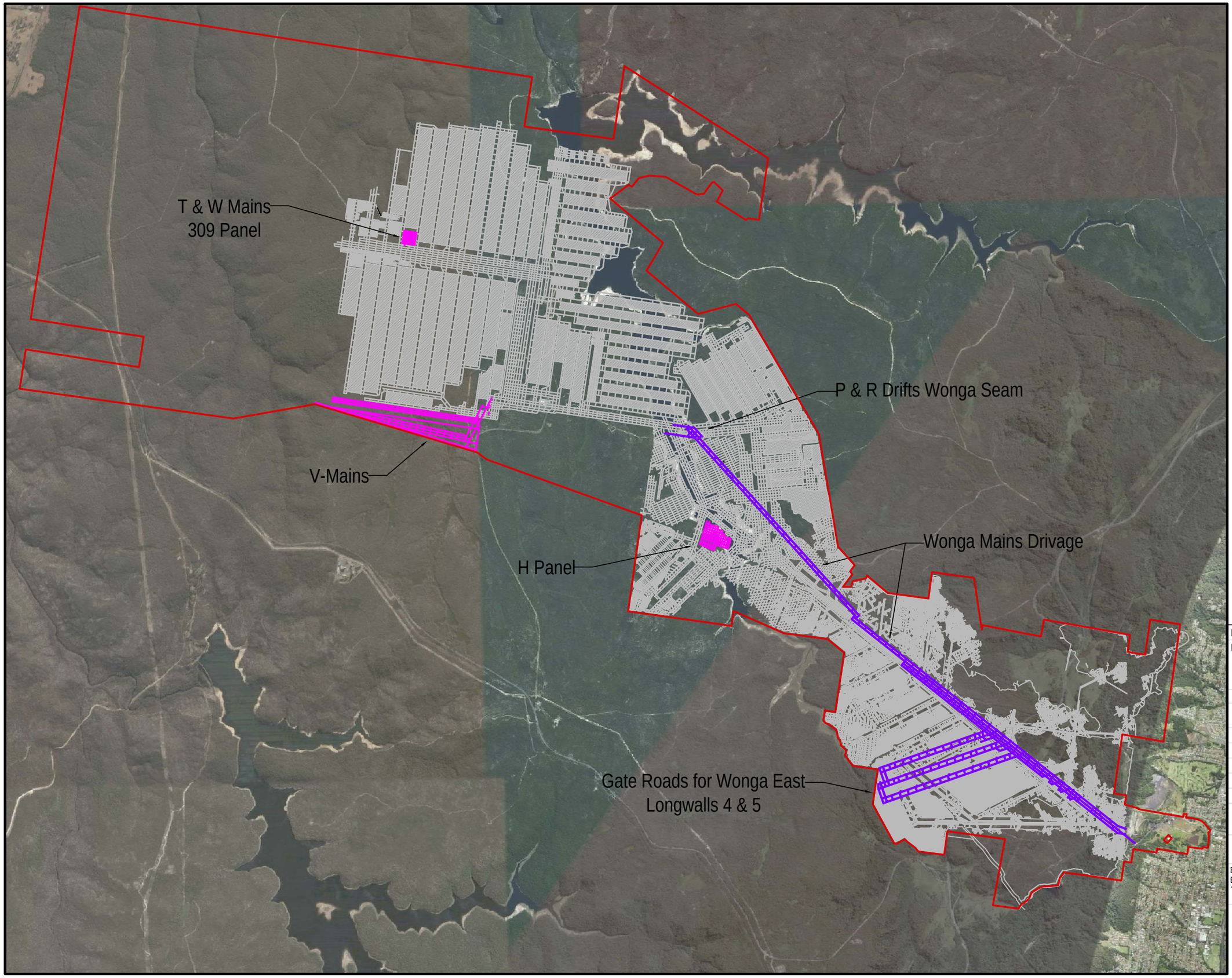
First workings are proposed in H Panel within the central portion of the lease. These workings underlie the stored waters of Cataract Reservoir, however no secondary extraction is proposed. Approval for the H Panel was issued by IIN under Section 363(1) of the *Mining Act 1992* in September 2005.

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 IIN as vertical downward movement of the ground surface that is less than or equal to 20 mm.

It is proposed to continue development of the Bulli seam in the V Mains 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. 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.

A subsidence management plan (SMP) was approved by IIN, on 23 August 2010, for first workings and pillar extraction from the V Mains within the Bulli seam. Production from the V Mains is anticipated to commence in December 2010.



Legend
- Project Application Area
- Bulli Seam
- Wongawilli Seam

Figure 3.1

Proposed Mining Areas and Existing Workings

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment		
Drawing No:	0079383s_PW_A003_R1.dwg		
Date:	08/09/2010	Drawing Size:	A3
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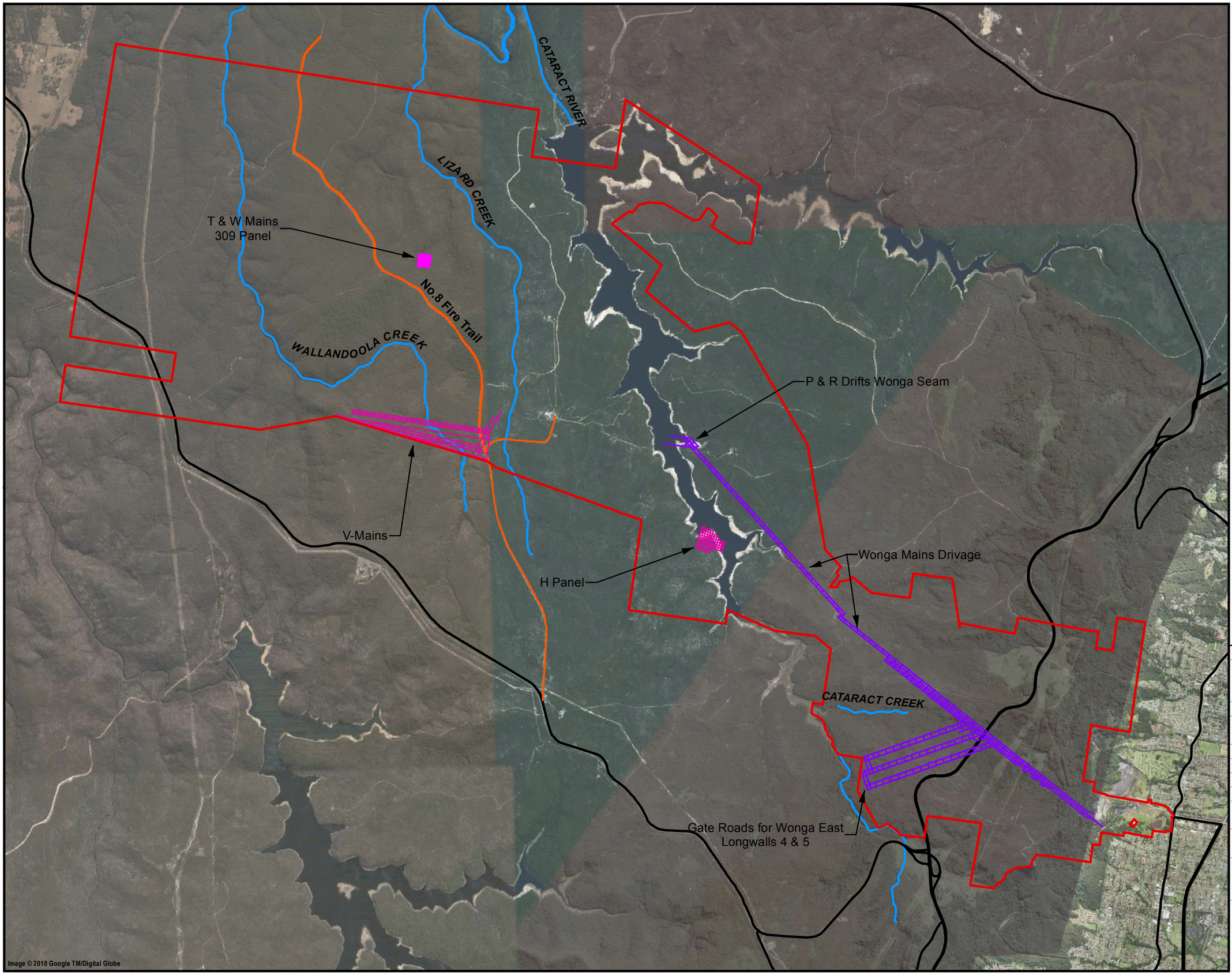
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Legend

- Project Application Area
- Bulli Seam
- Wongawilli Seam
- Creek

Roads

- Major Road
- Fire Trails and Access Trails

Figure 3.2

Proposed Mining Areas

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS003_R1.mxd	
Date:	03/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

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3.2.2 *Wongawilli Seam*

It is proposed to continue coal extraction, within the Wongawilli seam using first workings, as shown in *Figure 3.1* and *3.2* including:

- continued development of Wonga Mains underground access roadways in the Wongawilli coal seam from P & R Drifts to Russell Vale; and
- development of underground exploration roadways for the purpose of confirming the quality of the resource in the Wonga East area, which can potentially form access roadways and gate roads for proposed longwall panels 4 and 5 in Wonga East.

Approval for the P and R drifts was issued by IIN under Section 363(1) of the *Mining Act 1992* in January 2010. Longwall mining in Wonga East will be addressed in the Major Project Application (MP 09_0013). The development of exploration roadways which may ultimately form underground access roadways and gate roads will result in zero subsidence. NRE acknowledges that construction of these access roadways and gate roads does not guarantee approval of longwall mining in the Wonga East area.

Stage 2 works (MP 09_0013) will involve longwall extraction in Wonga East and Wonga West. Development of the Wonga Mains and the gate roads for proposed longwall panels 4 and 5 will provide access to these future extraction areas. First workings in Stage 1, will provide the setup for secondary extraction to commence immediately upon approval of Stage 2.

3.2.3 *Focusing Assessment*

First workings are designed to leave the coal pillars intact, the underground roadways to remain open and the overlying strata to be fully supported, resulting in 'zero' subsidence. Zero subsidence is defined by IIN as vertical downward movement of the ground surface that is less than or equal to 20 mm. As such no subsidence will result from first workings in the H Panel, Wonga Mains or the gate roads for proposed longwall panels 4 and 5. In terms of mining areas, this EA focuses only on areas where subsidence may occur, being the 309 Panel and V Mains.

3.3 *COAL HANDLING FACILITIES*

Proposed upgrades to surface infrastructure have been designed by JBK Engineering and Mining (JBK). The JBK design plans are provided in *Annex B*. The proposed upgrades have been described by Olsen (2010). The full report *NRE No 1 Colliery Russell Vale Site Surface Facilities and On-site Traffic Preliminary Works Part 3A* is provided in *Annex C* and is summarised below.

ROM coal will continue to be transported from the working face to the surface at the Russell Vale site in accordance with the existing operations as described in *Section 2.3*. Bulli seam coal will continue to be transported via the Bulli seam belt to the stockpile until completion of the Wonga Mains driveage. The existing Bulli conveyor will be decommissioned and demolished upon completion of the new driveage, in mid to late 2012.

The Balgownie belt and storage bin will be removed and a newly designed Wongawilli decline belt will be constructed on a similar alignment. The conveyor will be fully enclosed to minimise dust emissions. The new Wongawilli decline belt will be required to deliver Wongawilli coal proposed to be extracted as part of the Stage 2 project. A temporary short stack out conveyor will be constructed at the end of the Wongawilli decline belt to deliver Wongawilli seam coal to the existing stockpile.

A new screening and sizing station will be constructed at the end of the decline just before the existing Bulli bin. Coal will be transferred from the sizing station to both the Bulli bin stockpile and the Wongawilli stockpile via a conveyor and tripper arrangement.

These facilities will be integrated into the existing coal clearance system. The stockpiling capacity will be 60 000 - 80 000 tonnes. The stockpile will continue to be managed with dust suppression sprays.

This stockpile arrangement will include the capability to push out coal from the stockpile. A bund wall will be constructed south of the stockpile to provide a barrier to prevent wet weather coal slumps from travelling into the surface drainage system.

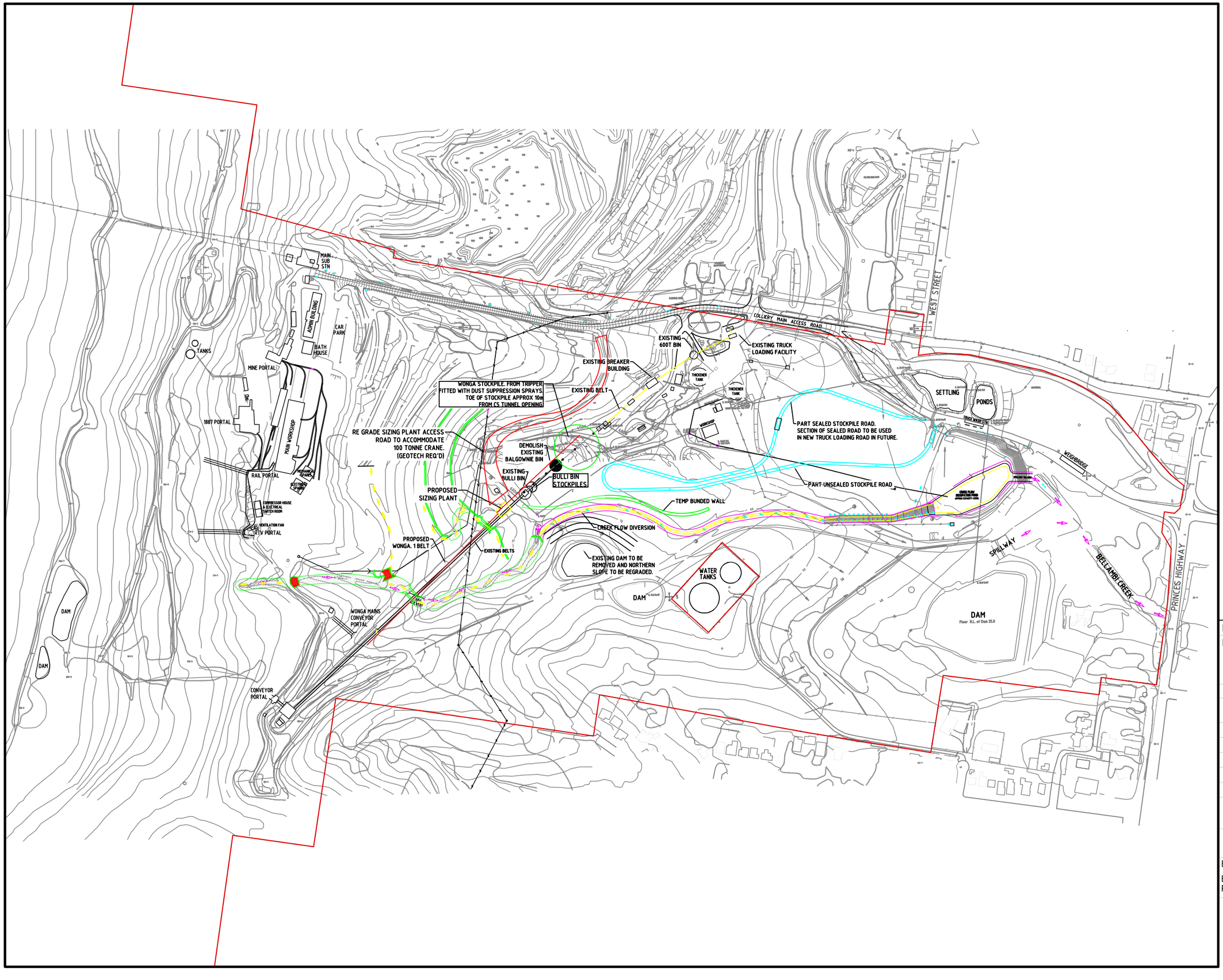
Existing truck loading facilities will be used for day time loading, however, a new internal haul road will be developed, with access from the Colliery main access road to the stockpile area. This will be used for evening trucking when required, where trucks will be loaded directly from the stockpile. The majority of the new internal haul route will be unsealed from the main access road and past the stockpile. The last section of the road will be sealed. Water trucks and dust suppression sprays will be used on the unsealed portion of the road.

Trucks will be washed prior to leaving the site and acoustic screening and bunding will be provided (see *Chapter 14*).

Proposed surface facility upgrades are shown on *Figure 3.3.*

Coal handling infrastructure at the Russell Vale site will be further upgraded during the Stage 2 project, to include new stockpiling arrangements and a new truck loading facility.

There will be no changes to facilities at No.4 Shaft.



Legend

Project Application Area

Figure 3.3

Proposed Surface Facility Upgrades

Client:	NRE Coking Coal Limited		
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment		
Drawing No:	0079383s_PW_A005_R1.dwg		
Date:	24/09/2010	Drawing Size:	A3
Drawn By:	NS	Reviewed By:	MK
Source:	JBK Engineering & Mining		
Scale:	Refer to scale bar		

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3.4 *PRODUCT TRANSPORT*

In accordance with existing operations, unwashed coal will continue to be loaded into trucks for haulage to PKCT and loading into ships. Truck load-out facilities as described in *Section 2.3* will remain unchanged for the day time operations.

Proposed coal transport operations will be between 7.00am to 6.00pm Monday to Friday and 8.00am to 6.00 pm on Saturdays. Trucking will occur on Sundays between 8.00am and 6.00pm when required. A small number of trucks will be loaded from the stockpile between 6.00pm and 10.00pm Monday to Friday.

Trucking in the evenings Monday to Friday and during the day on Sunday will only be used in rare circumstances to achieve shipping deadlines.

3.5 *WATER MANAGEMENT*

The existing surface water management system at the Russell Vale site is described *Section 2.6*. Proposed upgrades to the system are described below.

The existing drainage of the Russell Vale site includes a stormwater pipeline which directs clean water flowing in Bellambi Gully Creek underneath and past the current stockpiling and coal loading arrangements. This system has limited capacity and a previous storm in 1998 together with blockages caused overflow of water onto the ROM pad and mobilised coal onto adjacent lands. To prevent this occurring, it is proposed to remove this pipe and replace it with a suitably designed and engineered open channel constructed on the southern side of the coal stockpile area (*Figure 3.3*).

This channel will follow an alignment along the southern side of the coal stockpile and coal handling facilities and form a new alignment for Bellambi Gully Creek. The drainage system will ensure that Bellambi Gully Creek bypasses the stockpile area in normal and extreme weather conditions.

The channel will flow and cascade into a water stilling pond to reduce the flow velocity prior to the water discharging further along Bellambi Gully Creek. The pond will have a capacity of approximately 4 125kL.

Soil excavated for the construction of the new channel will be virgin excavated natural material (VENM) and will be stockpiled south east of the existing stockpile. Approximately 3 300m^3 of soil is expected to be excavated, stored and gradually used on site for acoustic bunding, landscaping and rehabilitation. This VENM stockpile will be stabilised with grass and stored on site until it can be used in the Stage 2 project. Construction of the new channel will also require the removal of Dam 6, currently located south of the existing stockpile. Dam 6 is currently harvests rain water that falls directly into it.

The upper reaches of Bellambi Gully Creek, south of the workshop area, will be stabilised with appropriately designed and engineered structures or supporting material where required. In addition, large boulders and obstructions will be cleared from the channel in order to minimise the potential for downstream blockages. An existing debris collector will be retained.

A new concrete box culvert will be installed at the point where Bellambi Gully Creek flows under the existing and proposed decline conveyors. In addition, the adjacent downstream ridgelines will be extended to the roadside and the road and the adjacent road to the south will be graded toward the south. This regrading will provide a mechanism that, in the event of blockage of the culvert, stormwater flows will re-enter Bellambi Gully Creek rather than continue down the belt decline towards the dirty water channel/catchment. This will maintain separation of clean and dirty water.

3.6 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.

3.7 EMPLOYMENT AND HOURS OF OPERATION

NRE currently employs approximately 259 permanent staff and 78 contractors. No additional operational staff will be required for this Project. It is estimated that this Project will require an additional 25 construction contractors during a nine month construction phase for these works.

Current underground mining operational hours are 24 hours/day, 7 days/week. Surface facilities operate 24 hours/day, 7 days/ week.

Coal haulage operations occur as described in *Section 3.4*.

3.8 PROJECT TIMING AND SCHEDULE

3.8.1 Operation

Underground mining of the Bulli and Wongawilli seam will constitute a continuation of existing operations. An indicative underground works schedule is presented in *Table 3.1*.

Table 3.1 Indicative underground works schedule

Works	Estimated Finish Date
309 Panel	July 2011
H Panels	May 2011
V Mains	May 2013
Wonga Mains	June 2012
P and R Drifts	December 2010
Gate roads for proposed longwall panels 4 and 5 in Wonga East	December 2011

3.9 CONSTRUCTION

Once the necessary approvals are in place, construction will begin for new surface infrastructure elements. It is anticipated that the construction phase will extend over a period of approximately nine months and the schedule of works is summarised in *Table 3.2*.

Construction will be limited to the following times:

- Monday to Friday, 7:00 am to 6:00 pm;
- Saturday, 8:00 am to 1:00 pm; and
- no construction on Sundays or public holidays.

Table 3.2 Surface works indicative construction schedule

Works	Estimated Start Date	Estimated Finish Date
New Wongawilli decline conveyor	May 2011	November 2011
Bellambi Gully Creek Bypass	January 2011	June 2011
New haulage road	May 2011	May 2011
Sizing unit	May 2011	November 2011
Decommissioning of the Bulli decline conveyor	September 2012	March 2013

A construction management plan will be developed to manage construction works at the Russell Vale site. The plan will address:

- environmental management (further details in *Chapters 11, 12* and *14*);
- traffic management;
- waste management (further details in *Chapter 21*); and
- management of construction works with continues operation of the site.

A temporary contractor's site and lay down area will be established south of the existing truck loading facility. The site will be levelled and paved with a layer of road base for all weather use, with a perimeter security fence.

Construction workforce vehicle access will be via the current access road. Employees will park their vehicles on the temporary contractor's site.

4 PROJECT ALTERNATIVES

This chapter provides an overview of alternative options considered. The advantages and disadvantages of each option are discussed and a justification for the preferred option provided.

4.1 OVERVIEW

Multiple options for key project components have been canvassed over the Project's development phase. Consultation with the DoP, feedback received during community consultation and environmental specialist input were fundamental in modifying the Project plans to meet economic, social and environmental objectives which aim to prevent or minimise negative impacts from the Project.

4.2 PROJECT LOCATION

The location of the Project is primarily defined by the existing NRE No 1. Colliery and the remaining Bulli, Balgownie and Wongawilli Seam coal reserves in CCL 745, MPL 271 and ML 1575. Given these constraints alternative options for the location of the Project are not considered to require further review.

4.3 PROJECT COMPONENT ALTERNATIVES

Alternatives for mine plan and orientation and surface facilities are discussed in the following pages and assessed in *Table 4.1.*

4.3.1 Mine Layout

The mine layout was based on geotechnical suitability and safety, presence of geological structures, presence of existing workings in seams in the above strata and impact on significant surface features. Consideration was given to both natural and built features.

Bulli Seam

Mining in the 309 Panel and first workings in the H Panel within the Bulli seam will remove remnant areas of coal which would otherwise be left unmined. These workings constitute a continuation of existing approved works and as such alternatives for these mine layouts are not feasible, nor have been considered.

V Mains is primarily designed to gain access to the extensive Bulli seam resources west of the Wonga West area. Following the success of the pillar extraction mining technique as practiced in recent years at the mine, a viable extraction area was identified adjacent to the lease boundary. The size and shape of the area is governed by a geological structure (a fault), and the adjacent mine (Cordeaux). As the area is relatively small only two possible orientations could be explored to economically extract the area. The second option was decided as the more economical of the two options whilst maintaining the integrity of the mains and accessing the Bulli reserves.

V Mains Option 1

Mine the area on both sides of the anticipated fault line in an east-west orientation.

V Mains Option Two

Mine the area to the south east of the anticipated fault only.

Wonga Seam

Mining in the Wongawilli seam will include

- continued development of Wonga Mains towards the Wonga West area in a pre-determined orientation that provides the least amount of impact to the environment; and

- development of underground access roadways and gate roads for proposed longwall panels 4 and 5 in Wonga East primarily for the purpose of exploration and confirmation of mining conditions and the quality of the resource in the Wonga East Area.

Longwall mining in the Wonga East area is subject to gaining approval for Stage 2 (MP 09_0013). It is recognised that there is a risk for NRE in assuming approval for this application will be forthcoming, however preparation for the Wonga East panels is important to maintain the continuation of operation of the Colliery. The proposal is consistent with the preferred design for the Wonga East area which has been orientated to avoid Mount Ousley Road.

4.3.2 Surface Facilities

Alternatives for the construction of new surface facilities are very limited. The new facilities which are to be constructed in Stage 2 are proposed to be located within the existing footprint of the coal handling facilities to limit environmental impacts. The current application reflects a decision to continue to operate existing infrastructure whilst introducing a limited amount of new infrastructure consistent with the Stage 2 upgrade.

Option 1

Continue existing operation with no changes and include all proposed upgrades within Stage 2 (MP 09_0013).

Option 2

Implement some changes consistent with the overall upgrade in Stage 2 to provide specific environmental improvements.

Table 4.1 Project Alternatives

Component	Description	Advantages	Disadvantages	Preferred Option
Mine Plan V mains	Option 1	• Maximise coal return	• Not economic • Maintaining the integrity of the mains accessing the western Bulli reserves	NO
Mine Plan V mains	Option 2	• Maximise coal return • Economic	• Maintaining the integrity of the mains accessing the western Bulli reserves	**YES - This is the preferred option as it takes into consideration the significant natural features while ensuring that mining is still economically viable.**
Surface Facilities	No change	• All proposed upgrades can be approved in one application.	• Timing will not allow the continuation of operation of the Colliery.	NO
Surface Facilities	Implement some changes	• Will allow continuation of operation of the Colliery beyond December 2010. • Will improve environmental management of the Russell Vale site.	• Will require an additional application to be submitted.	**YES – will allow continuation of operation.**
Stormwater Channel	Retain existing underground pipe	• No additional construction works required	• Pipe has limited capacity • Risk of blockages and flooding • Potential adverse downstream impacts in storm or flood events	NO
Stormwater Channel	Replace existing pipe with open channel	• Reduces risk of flooding • Reduces risk of erosion • Reduces potential for contamination with dirty water • Reduce risk of adverse downstream impacts in storm or flood events	• Additional construction works required	**YES - This is the preferred option as it reduces the risk of flooding.**

4.4 *'DO-NOTHING' OPTION*

The 'do-nothing' option would leave a large reserve of high quality coking coal unmined within the lease area and, as such, be technically in breach of NRE's obligations under Section 70 Conditions of Mining Leases of the *Mining Act 1992*.

Such an approach would also fail to realise the potential economic and employment benefits of the resource.

Furthermore, if mining does not continue, the associated contributions to industry within Wollongong, the broader region and State will cease. Similarly, a failure to continue coal extraction within the lease boundary areas would not take advantage of NRE's initial investment in capital and personnel and the knowledge of local geological and mining conditions developed during the prior operations. Accessing resources at a later date would be less likely to be economically viable due to the significant costs associated with re-establishing infrastructure and services.

The 'do-nothing' option would also mean the cessation of employment for many if not all of the personnel, and result in both direct and indirect negative impacts on the local community.

5 STATUTORY CONSIDERATIONS

This chapter details the approvals required and the statutory context in which the project must be considered. The details of existing permits and approvals are also covered.

5.1 COMMONWEALTH LEGISLATION

5.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *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 (NES). The EPBC Act also requires Commonwealth approval for certain actions on Commonwealth land. Matters of national environmental significance under the Act include the following:

- World Heritage properties;
- National Heritage places;
- Ramsar wetlands of international importance;
- Threatened species or ecological communities listed in the EPBC Act;
- Migratory species listed in the EPBC Act;
- Commonwealth marine environment; and
- Nuclear actions.

Any proposed action that is expected to have an impact on matters of NES must be referred to the Commonwealth Minister for Environment, Water Heritage and the Arts (DEWHA) for assessment under the EPBC Act, or assessed under the bilateral agreement between the Commonwealth and the State of NSW.

Implications for the Project

The Project is not a controlled action as it is not located within a world heritage area, Ramsar wetland or commonwealth marine environment. The site also is not believed to contain national heritage places, or involve nuclear actions. The Project has the potential to impact on the habitat that could be used by the Green and Golden Bell Frog listed under the EPBC Act. An EPBC referral is to be submitted to the DEWHA together with the EA documentation as supportive material, post EA lodgement.

5.1.2 *National Greenhouse and Energy Reporting Act 2007*

The *National Greenhouse and Energy Reporting Act 2007* ('NGER Act') establishes a national framework for Australian corporations to report greenhouse gas emissions, reductions, removals and offsets, and energy consumption and production, from 1 July 2008. The NGER Act requires corporations that control facilities emitting 25 kilotonnes (25 000 tonnes) or more of greenhouse gas (CO_2 equivalent) per year to register and report their greenhouse gas emissions.

Implications for the Project

NRE is a registered corporation under NGER Act triggering reporting. The company is therefore required to report air emissions associated with the NRE No.1 Colliery, as production will trigger the 25 kilotonnes reporting threshold.

5.1.3 *National Environment Protection Council Act 1994*

The National Environment Protection Council (NEPC) is a statutory body with law making powers established under the *National Environment Protection Council Act 1994* (Commonwealth), and corresponding legislation in other Australian jurisdictions. The objective of the NEPC is to ensure the protection of the environment and heritage of Australia. The NEPC has two primary functions:

- to make National Environment Protection Measures (NEPMs); and
- to assess and report on the implementation and effectiveness of NEPMs in participating jurisdictions.

One NEPM applies to the project, this is the Ambient Air Quality NEPM and is discussed further in *Annex I.*

5.2 *STATE LEGISLATION*

5.2.1 *Environmental Planning and Assessment Act 1979*

The relevant planning legislation for NSW is the *Environmental Planning and Assessment Act 1979* (EP&A Act). The EP&A Act instituted a system of environmental planning and assessment in NSW and is administered by the Department of Planning.

The EP&A Act includes Part 3A, which provides an assessment and approval process for development that is defined as a Major Project. State Environmental Planning Policy (Major Development) 2005 (SEPP MD) defines certain developments as Major Developments under Part 3A of the EP&A Act, which are determined by the Minister for Planning. This Project is development for the purpose of mining and therefore Part 3A of the EP&A Act applies.

This EA, which assesses the likely impact of a Project on the environment, has been prepared in accordance with Section 75F of the EP&A Act and the Department of Planning Director General's Requirements (DGRs) (See *Section 1.6*).

Pursuant to Section 75U the following authorisations are not required for a project approved under Part 3A:

(a) the concurrence under Part 3 of the Coastal Protection Act 1979 of the Minister administering that Part of the Act,

(b) a permit under section 201, 205 or 219 of the Fisheries Management Act 1994,

(c) an approval under Part 4, or an excavation permit under section 139, of the Heritage Act 1977,

(d) a permit under section 87 or a consent under section 90 of the National Parks and Wildlife Act 1974,

(e) an authorisation referred to in section 12 of the Native Vegetation Act 2003 (or under any Act to be repealed by that Act) to clear native vegetation or State protected land,

(f) a permit under Part 3A of the Rivers and Foreshores Improvement Act 1948,

(g) a bush fire safety authority under section 100B of the Rural Fires Act 1997,

(h) a water use approval under section 89, a water management work approval under section 90 or an activity approval under section 91 of the Water Management Act 2000.

Pursuant to Section 75V of the EP&A Act, authorisation of a mining lease under the *Mining Act 1992* or an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in Section 43 of that Act) cannot be refused if they are necessary for carrying out an approved project, and are to be substantially consistent with the approval granted under Part 3A of the EP&A Act.

5.2.2 *Environmental Planning and Assessment Regulations*

Clause 8K of the Environmental Planning and Assessment Regulations (EP&A Regs) states:

….section 74 of the Mining Act 1992 (Mining unaffected by Environmental Planning and Assessment Act 1979) continues to have effect in respect of an existing mining lease until:
(a) the end of the relevant transition period, or
(b) such time as an approval is given to carry out mining operations in the mining area,

whichever is the sooner.

The *relevant transition period* is defined as:

in the case of an existing mining lease in respect of which mining operations are carried out underground – the period ending on the fifth anniversary of the relevant commencement

Section 74(1) of the Mining Act (now repealed) states in part:

(1) While a mining lease has effect:

(a) nothing in, or done under, the Environmental Planning and Assessment Act 1979 or an environmental planning instrument operates so as to prevent the holder of the mining lease from carrying on mining operations in the mining area, and

(b) to the extent to which anything in, or done under, that Act or any such instrument would so operate, it is of no effect in relation to the holder of the mining lease.

(3) This section does not exempt the holder of a mining lease from obtaining any consent under the Environmental Planning and Assessment Act 1979 that the person is required to obtain in connection with the erection of buildings, the opening of roads or the subdivision of land.

As Section 74 was repealed on 15 December 2005, the relevant transitional period ends on 15 December 2010.

5.3 STATE ENVIRONMENTAL PLANNING POLICIES

5.3.1 State Environmental Planning Policy (Major Developments) 2005

SEPP Major Development (SEPP-MD) was prepared to identify projects which would fall under Part 3A of the EP&A Act and clearly articulate the role of the Minister for Planning as the consent authority.

Schedule 1 of SEPP–MD identifies the different classes of development which are defined as Major Developments under Part 3A. The Project is defined as a Major Development under Clause 5 Mining, petroleum production, extractive industries and related industries, which includes:

(1) Development for the purpose of mining that:

(a) is coal or mineral sands mining, or

(b) is in an environmentally sensitive area of State significance, or

(c) has a capital investment value of more than $30 million or employs 100 or more people.

Implications for the Project

The project is 'development for the purpose of mining' and is therefore classified as a Major Development and subject to assessment under Part 3A of the EP&A Act. Therefore in accordance with section 75D (1) of the EP&A Act, the Minister is the approval authority for the Project.

5.3.2 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (SEPP Mining) consolidates and updates planning provisions related to mining and extractive industries as well as requiring potential environmental and social impacts to be addressed.

Implications for the Project

Detailed assessments of the impacts of the proposal on surrounding land uses and natural resources are presented in *Chapters 7* to *23* in this EA. Part 2 of SEPP Mining enables underground mining on any land with consent. Part 3 of the Policy includes specific matters for consideration including compatibility with other land uses, natural resource management and environmental management, resource recovery, transport, and rehabilitation. These matters applicable to the Project are addressed in *Table 5.1*.

Table 5.1 SEPP Mining 2007 Matters for Consideration

Part 3 Matters for Consideration	Project Compliance
Clause 12 Compatibility of proposed mine, petroleum production or extractive industry with other land uses	
Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider: *(i) the existing uses and approved uses of land in the vicinity of the development, and*	Existing uses above the underground mining operations includes Cataract Dam, and the Illawarra escarpment which is zoned environmental conservation and dominated by native bushland. Mount Ousley Road bisects the site and runs along the Illawarra Escarpment. Surrounding land uses adjoining the Russell Vale site include residential and light industrial. Russell Vale, Corrimal and Bellambi townships are located to the south and east respectively. Mining has been a feature of the landscape since 1887. Mining will continue within the environmental conservation zone and whilst subsidence is expected in sections management measures have been prepared to mitigate any negative impacts. The surface infrastructure upgrades adjoining the Russell Vale and Bellambi townships will not reduce the vegetation buffer provided along the Princes Highway and north to existing residences. The amenity impacts associated with mining operations and associated facilities has been considered in *Chapters 12* and *14* and appropriate mitigation measures have been identified.
(ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and	Residential, light industrial and environmental conservation are likely to continue as preferred land uses.
(iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and	Mining has long been a feature of the area and has resulted in local employment and urban development.
(b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and	The public benefit will be through continuing employment opportunities and associated economic benefits (refer to *Chapter 22*).
(c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).	Measures to mitigate incompatibility have been considered and included in the statement of commitments (*Chapter 24*).
Clause 14 Natural resource management and environmental management	
(1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:	
(a) that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,	Impacts to surface water and groundwater have been assessed within Chapters *9*, *10* and *11* respectively.

Part 3 Matters for Consideration	Project Compliance
(b) that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,	Impacts on threatened species and biodiversity are addressed in *Chapter 16.*
(c) that greenhouse gas emissions are minimised to the greatest extent practicable.	Greenhouse gas emissions have been assessed in *Chapter 13*
(2) Without limiting subclause (1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.	Greenhouse gas emissions have been assessed in *Chapter 13.*
Clause 15 Resource recovery	
(1) Before granting consent, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery.	Mine planning has balanced efficiency (resources, recovery & economics) against environmental protection - refer to *Chapter 4.*
(2) Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material.	Mine planning has balanced efficiency against environmental protection.
(3) The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.	Waste produced as part of the mining operations has been assessed within *Chapter 21.* Management measures have been included within the Project.
Clause 16 Transportation	
1) Before granting consent, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following:	Transportation of ROM coal to the Port Kembla Coal Terminal (PKCT) is via the existing road network. No increase in traffic is proposed.
(a) require that some or all of the transport of materials in connection with the development is not to be by public road,	Transport of coal by public road is the current practice and the only option available.
(b) limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,	Coal truck movements are confined to the approved trucking route between the Russell Vale site and PKCT.
(c) require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.	A code of conduct has been prepared. The code aims to minimise impacts on the community and maximise public safety.
(2) If the consent authority considers that the development involves the transport of materials on a public road, the consent authority must, within 7 days after receiving the development application, provide a copy of the application to: *(a) each roads authority for the road, and* *(b) the Roads and Traffic Authority (if it is not a roads authority for the road).*	It is anticipated that the DOP will consult the RTA regarding the traffic impacts associated with the project.

Part 3 Matters for Consideration	Project Compliance
Clause 17 Rehabilitation	
(1) Before granting consent the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development.	A mine closure plan was developed as part of the Mining Operations Plan (MOP) for NRE No.1 Colliery. This plan has been reviewed and resubmitted as part of this EA. It is NRE's intention to consider areas that become surplus to needs for rehabilitation as mining works progress (*Chapter 23*).
(2) In particular, the consent authority must consider whether conditions of the consent should: *(a) require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or*	A mine closure plan was developed as part of the Mining Operations Plan (MOP) for NRE No.1 Colliery (*Chapter 23*).
(b) require waste generated by the development or the rehabilitation to be dealt with appropriately, or	Waste produced as part of the mining operations has been assessed within *Chapter 21*. Management measures have been included within the project.
(c) require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under section 145C of the Act and the Contaminated Land Management Act 1997), or	No soil contamination is expected as a result of the project.
(d) require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.	A mine closure plan was developed as part of the Mining Operations Plan (MOP) for NRE No.1 Colliery (*Chapter 23*). The mine closure plan identifies areas for rehabilitation during mining operations. The plan includes public safety measures to mitigate any adverse impacts.

5.3.3 State Environmental Planning Policy No. 44 - Koala Habitat Protection

Schedule 1 of State Environmental Planning Policy 44 - Koala Habitat Protection (SEPP 44) identifies Wollongong and Wollondilly Local Government Areas as areas where koalas occur.

Under SEPP 44, core koala habitat is defined as an area of land with a resident population of koalas, as evidenced by attributes such as breeding females (that is, females with young) and recent sightings and historical records of a population. Potential koala habitat is defined under SEPP 44 as areas of native vegetation where the trees of the types listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Implications for the Project

Parts of the PAA are potential koala habitat under SEPP 44 of the EP&A Act, given the representation of *E. haemastoma* as a dominant tree species (over 15% of canopy cover). The proposed mining areas are not core koala habitat as there is no evidence to indicate the presence of a resident population of koalas or recent sightings or historical records of a resident population.

As the PAA is not core koala habitat, there are no implications for the consideration and determination of the project.

5.3.4 State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) provides definitions for 'hazardous industry', 'hazardous storage establishments', 'offensive industry' and 'offensive storage establishment'. The definitions enable decisions to approve or refuse a development to be based on the merit of a proposal.

Implications for the Project

All hazardous materials will continue to be managed in accordance with NRE's current management practices that are currently implemented successfully at the Colliery.

Where procedures do not exist for a work activity, a risk assessment is required to be undertaken prior to commencement of work. Risk assessments are aimed at identifying potential risks/ hazards, including environmental risks or hazards, associated with the work tasks.

5.4 REGIONAL ENVIRONMENTAL POLICIES

5.4.1 Drinking Water Catchments Regional Environmental Plan No.1

The Drinking Water Catchments Regional Environmental Plan (DWCREP) 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 project site 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.*"

Implications for the Project

Impacts of the project on the quality of water within lands to which the DWCREP applies are assessed in *Chapter 9*. The assessment concludes that the project will have a neutral effect on water quality.

5.4.2 Illawarra Regional Environmental Plan No.1

The aim of the *Illawarra Regional Environmental Plan No.1* (IREP) plan is to "*maximise the opportunities for the people of the region and the State to meet their individual and community economic and social needs with particular reference to the way in which these needs are related to the allocation, availability, accessibility and management of the region's land resources*". This plan is administered by the local government unless the statutory process identifies a different consent authority as stated with Part 3A.

Coal Mining Activities

Part 4 of the IREP applies to coal mining, transportation and refuse emplacement. The objectives of Part 4 are:

a) *to ensure that proposed development is assessed in relation to the feasibility of its rendering coal resources unavailable,*

b) *to eliminate haulage of coal on public roads as far as practicable in order to overcome conflict with other road users and the adverse environmental impact of such haulage, and*

c) *to provide guidelines for ensuring coal washery refuse emplacements are located and designed with minimum adverse environmental impact.*

Implications for the Project

No increase in road haulage is proposed as part of this project. No coal washery is proposed as part of the Project. All coal is transported unwashed to India.

Development of the Illawarra Escarpment

Part 12 of the IREP identifies provisions relating to development of the Illawarra Escarpment. "*The objective relating to the escarpment is to protect the natural environmental and scenic amenity of the escarpment area, while promoting its use for recreational purposes and accommodating the needs of the coal industry*".

Clause 102 requires the consideration of the following matters prior to granting development consent for a development application along the escarpment.

(a) consider the visual impact of the proposed development when viewed from a public place, and take such measures that will, in its opinion, minimise any visual impact,

(b) (Repealed)

(c) be satisfied that the development will not be subject to slip hazard.

Implications for the Project

The Project will not significantly impact on the visual landscape.

The potential for slip hazard has been addressed by Coffey (2010) and is discussed in *Chapter 11*.

Environmental Heritage

Part 15 Clause 124 identifies the objectives for consideration of environmental heritage being a *building, work, relic, or place of historic, scientific, cultural, social, architectural, archaeological, natural or aesthetic significance.* The objectives seek to:

(a) to encourage the conservation of the environmental heritage of the region, and

(b) to control the demolition and renovation of items identified by this plan as items of the environmental heritage of the region.

Clause 128 states that consent shall not granted to the "carrying out of development in the vicinity of an item of the environmental heritage unless it has made an assessment of the effect which the carrying out of that development would have on the historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance of the item of the environmental heritage and its setting".

Implications for the Project

A number of items within the NRE No.1 Colliery (formerly the South Bulli Colliery) are listed as environmental heritage items under Schedule 1 of the IREP. The impact of the project on these items is assessed in *Chapter 18*. The assessment concludes no items listed as environmental heritage items under the IREP will be impacted as part of the Project.

5.5 OTHER STATE LEGISLATION

5.5.1 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) provides an integrated system of licensing for potentially polluting industries. Schedule 1 of the POEO Act identifies types of development that require an Environmental Protection Licence (EPL). Included in Schedule 1 is mining for coal.

Clause 28 defines mining for coal as:

(1) "*processing or handling of coal (including tailings and chitter) at underground mines or open cut mines.*

(2) The activity to which this clause applies is declared to be a scheduled activity if:

(a) it has a capacity to produce more than 500 tonnes of coal per day, or

(b) it has disturbed, is disturbing or will disturb a total surface area of more than 4 hectares of land by:

(i) clearing or excavating, or

(ii) constructing dams, ponds, drains, roads, railways or conveyors, or

(iii) storing or depositing overburden or coal (including tailings and chitter).

Implications for the Project

Environment Protection Licence (EPL) number 12040 issued under the POEO Act applies to the operations at NRE No.1 Colliery. The licence regulates water quality, volume discharges and requires dust monitoring at the site.

5.5.2 Mining Act

The *Mining Act 1992* refers to the granting of Mining Leases and mining activities generally and, amongst other legislative instruments, places controls on methods of exploration and mining, the disposal of mining waste, rehabilitation and environmental management activities. This site currently has an approved Consolidated Coal lease (CCL) 745, Mining Purpose Lease (MPL) 271 and Mining Lease (ML) 1575. The *Mining Act 1992* is administered by the IIN.

Implications for the Project

Under the *Mining Act 1992*, environmental protection and rehabilitation are regulated by conditions in all Mining Leases, including requirements for the submission and approval from the IIN of a MOP prior to the commencement of operations. A MOP for the Colliery has been accepted by the IIN.

5.5.3 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 TSC Act lists threatened species, populations and ecological communities under Schedules 1 and 2 of the Act, that are priorities for conservation within NSW. The potential impacts on threatened species have been considered in accordance with the requirements of the TSC Act and the EP&A Act.

Schedule 3 of the TSC Act lists Key Threatening Processes for species, populations and ecological communities within NSW. *Alteration of habitat following subsidence due to longwall mining* is listed as a Key Threatening Process under the TSC Act.

Implications for the Project

Although this Project does not include longwall mining, the presence of threatened flora and fauna species and endangered ecological communities were investigated is discussed in *Chapter 16*. The ecological assessment, found that, provided the prescribed mitigation measures are implemented, significant impacts to threatened species and ecological communities, including the Green and Golden Bell Frog as a result of the works would be unlikely.

5.5.4 Sydney Water Catchment Management Act 1998

The *Sydney Water Catchment Management Act 1998* is administered by the Sydney Catchment Authority. The role of the SCA is to:

a) to manage and protect the catchment areas and catchment infrastructure works, and

(b) to be a supplier of raw water, and

(c) to regulate certain activities within or affecting the outer catchment area as well as the inner catchment area.

Consultation with the SCA has been undertaken throughout the assessment process to ensure that the Project is consistent with the aims of the *Sydney Water Catchment Management Act 1998.*

Sydney Catchment Authority Special Areas Strategic Plan Of Management 2007

The *Sydney Catchment Authority Special Areas Strategic Plan of Management 2007* (SASPoM) was prepared to protect the water quality in Sydney's drinking water catchment. The Special Areas are the lands which surround Sydney's drinking water storages and are declared under the *Sydney Water Catchment Management Act 1998*. Due to protective management and restricted access the Special Areas have high ecological values.

Implications for the Project

As parts of the lease fall within the Metropolitan Special Area, the SASPoM is relevant to the proposed development. The goals of the SASPoM are to "*protect and optimise water quality entering storages*" and "*conserve ecosystem integrity, natural and cultural values*."

5.5.5 Water Management Act 2000

The *Water Management Act 2000* (WM Act) incorporates the provisions of various acts relating to the management of surface and groundwater in NSW, and provides a single statute for the regulation of water use and works that affect surface and groundwater, both marine and fresh. The WM Act is administered by the NSW Office of Water (NOW).

Implications for the Project

The proposal does not require the extraction of water from any Regulated River Water Source and no water sharing plans apply to the Project Area. Accordingly, there is no approval required.

Potential impacts to the regional and local surface and groundwater systems have been addressed in detail in *Chapters 9, 10 and 11*. NRE has lodged an application for a water licence.

No additional licences are required under the WM Act for works associated with the continuation of underground mining at the NRE No.1 Colliery. A Controlled Activity Approval will be sought from NOW for construction of the Bellambi Gully Creek bypass.

5.5.6 Coal Mine Health and Safety Act 2002

The *Coal Mine Health and Safety Act 2002* is administered by the IIN and regulates activities undertaken on coal mines to ensure that the health, safety and welfare of persons involved in their operation are protected. Activities undertaken at the NRE No. 1 Colliery will continue to be undertaken in accordance with this Act.

5.5.7 Dam Safety Act

Under Schedule 1 Cataract Dam is a prescribed dam for which the Dam Safety Committee (DSC) has the following functions:

(a) to maintain a surveillance of prescribed dams, the environs under, over and surrounding prescribed dams and the waters or other materials impounded by prescribed dams to ensure the safety of prescribed dams,

(b) to examine and investigate the location, design, construction, reconstruction, extension, modification, operation and maintenance of prescribed dams, the environs under, over and surrounding prescribed dams and the waters or other materials impounded by prescribed dams,

(c) to obtain information and keep records on matters relating to the safety of dams,

(d) to formulate measures to ensure the safety of dams,

(e) to make such reports or recommendations to the Minister or any other person in relation to the safety of prescribed dams as the Committee considers necessary or appropriate,

(f) to make reports and recommendations with respect to the prescription of dams for the purposes of this Act,

(g) to exercise such other functions as are conferred or imposed on the Committee by or under this or any other Act or the regulations, and

(h) to do such supplemental, incidental and consequential acts as may be necessary or expedient for the exercise of its functions.

Implications for the Project

Consultation with the DSC has occurred during the assessment process for the Stage 2 project. There are no proposed second workings within the dam notification area. Some of the proposed first workings are within the dam's notification area; however these will not result in subsidence. Approval will be sought from the DSC for all mining within the notification area.

5.6 NON-LIMITING STATE LEGISLATION

This section reviews other legislation which applies to the Project Area. In some instances Part 3A effectively limits the applicability or necessity for gaining further approvals or permits. Where this occurs, it is identified in the following sections.

5.6.1 *National Parks and Wildlife Act 1974*

The *National Parks and Wildlife Act 1995* (NPW Act) is administered by the DECCW. An object of the NPW Act is to conserve objects, places or features (including biological diversity) of cultural value within the landscape.

Sections 87 of the NPW Act requires a permit to disturb or excavate land for the purpose of discovering an Aboriginal object and Section 90 requires consent to destroy an Aboriginal object. However, Section 75U of the EP&A Act excludes projects approved under Part 3A from requiring these permits.

5.6.2 *Fisheries Management Act 1994*

The *Fisheries Management Act 1994,* as amended by the *Fisheries Management Amendment Act 1997,* is administered by the DECCW and includes provisions to declare and list threatened species of fish and marine vegetation, endangered populations and ecological communities, and key threatening processes. Section 75U of the EP&A Act excludes projects approved under Part 3A from requiring a permit under sections 201, 205 or 219 of this Act.

5.6.3 *Heritage Act 1977*

The *Heritage Act 1977* is administered by the Heritage Branch of the DoP and protects the natural and cultural history of NSW (with emphasis on non-Aboriginal cultural heritage) through protection provisions and the establishment of a Heritage Council. As this proposal is being assessed under Part 3A of the EP&A Act, an approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977* does not apply (see section 75U of EP&A Act). However the Heritage Branch must still be notified of the discovery of any 'Relic' during works.

5.6.4 *Native Vegetation Act 2003*

Clause 12 of the *Native Vegetation Act 2003* is administered by the DECCW and requires consent from the Minister for the clearing of 'native vegetation'. Section 75U of the EP&A Act excludes projects approved under Part 3A from requiring "*an authorisation referred to in section 12 of this (or under any Act to be repealed by that Act) to clear native vegetation*".

5.7 *LOCAL PLANNING INSTRUMENTS*

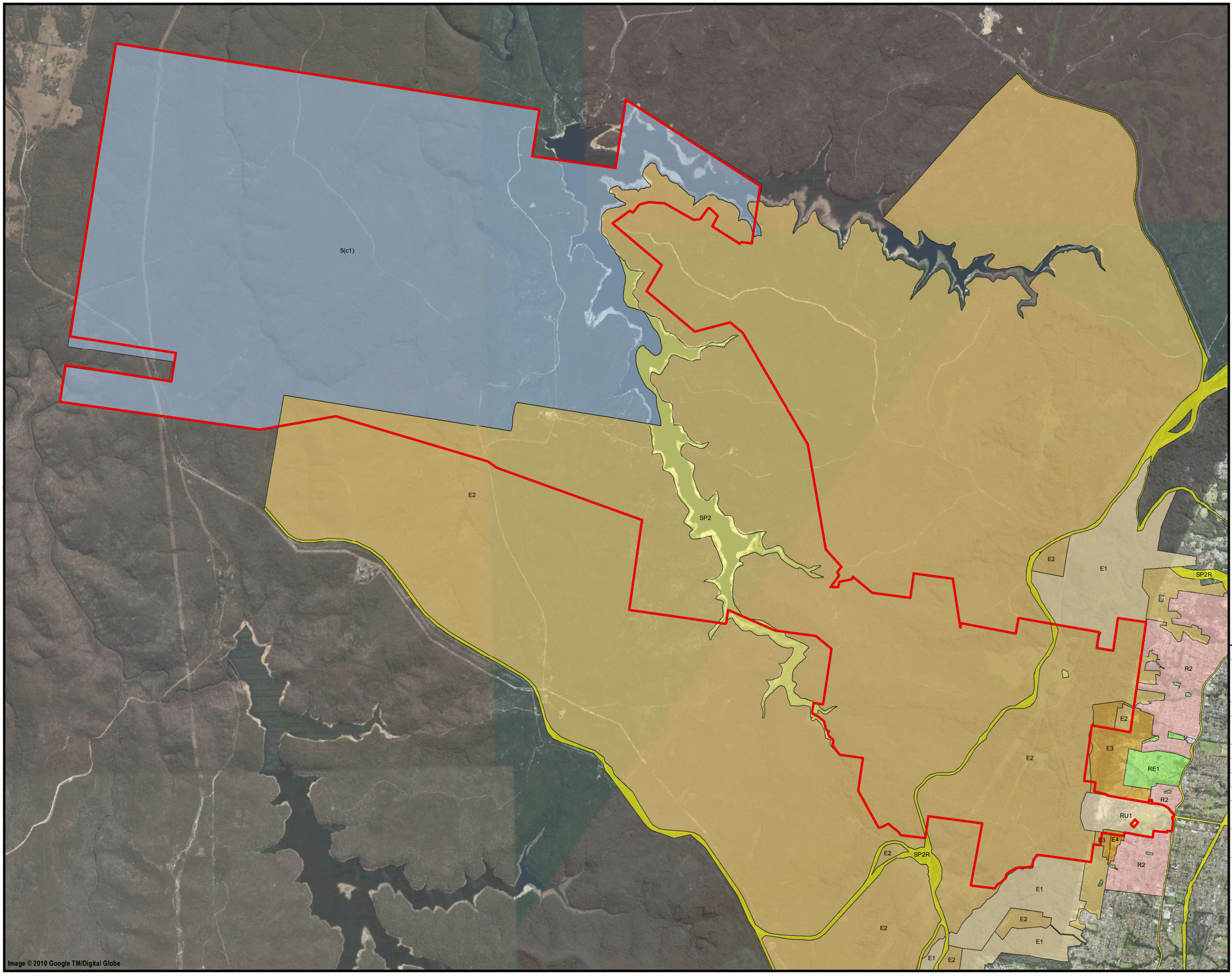
The PAA lies within two local government areas, Wollongong and Wollondilly. Applicable land use zonings are shown on *Figure 5.1*.

5.7.1 Wollongong Local Environmental Plan 2009

Under the *Wollongong Local Environmental Plan 2009* (WLEP 2009) the PAA is subject to a number of different zones including Zone RU1 Primary Production, E2 Environmental Conservation, and SP2 Infrastructure.

Implications for the Project

Extractive industries are permissible within the RU1 – Primary Production zone subject to development consent. Mines are prohibited in both zones E1 and SP2. It is noted that SEPP Mining permits the development, notwithstanding the provisions of the WLEP.



Legend

- Project Application Area

Zoning (Wollongong LEP 2009)

- E1 - National Parks and Nature Reserves
- E2 - Environmental Conservation
- E3 - Environmental Management
- E4 - Environmental Living
- IN2 - Light Industrial
- R2 - Low Density Residential
- RE1 - Public Recreation
- RU1 - Primary Production
- SP2 - Infrastructure
- SP2R - Infrastructure

Zoning (Wollondilly LEP 1991)

- 5(c1) - Special Uses (Water Catchment) Zone

Figure 5.1

Land use zonings

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery - Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS014_R1.mxd	
Date:	10/09/2010	Drawing size:A3
Drawn by:	NS	Reviewed by:MK
Scale:	Refer to Scale Bar	

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0 490 980 1,470m

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5.7.2 Wollondilly Local Environment 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. The objective of the zone is *to protect land which is designated as being part of a water catchment area from land uses which adversely affect, or are likely to adversely affect, the environmental quality of these areas*. Extractive industries and mines are permissible within this zone with development consent.

5.7.3 Draft Wollondilly Local Environment Plan 2009

The draft *Wollondilly Local Environmental Plan 2009* (Wollondilly LEP 2009) was exhibited pursuant to Section 65 of the EP& A Act until 14 December 2009 and applies part of the PAA. Under the Draft Wollondilly LEP 2009 the PAA is subject Zone E2 Environmental Conservation.

Industries are prohibited in zone E2. It is noted that SEPP Mining permits the development, notwithstanding the provisions of the draft LEP.

5.8 EXISTING PERMITS AND APPROVALS

5.8.1 Development Consents

There is one development consent in force for NRE No.1 operations as follows:

- Development Application D2004/32 – being development described as decommissioning and removal of coal washery plant - Bellpac No.1 Colliery (formerly South Bulli Colliery).

The decommissioning and removal of the old washery plant (Application No. D2004/32) has been largely completed and much as the washery has been removed. However, the removal of two coal stacking gantries and submission of a final heritage report are still pending. A copy of the development consent is provided in *Annex D*.

The emplacement area adjacent to the Colliery operates under consent D89/839 from Wollongong Council which allows refuse and waste rock to be emplaced on the site from the workings of the NRE No.1 Colliery (then known as the South Bulli Colliery).

The emplacement area is not within the PAA and is not intended to be used for future operations as coal will be shipped unwashed to India. Rehabilitation of the emplacement area is considered primarily the responsibility of the land owner and will be undertaken in accordance with the consent.

5.8.2 Mining Approvals

NRE has approval for mining in the areas listed in *Table 5.2*.

Table 5.2 Mining approvals

Mining Area	Approval Granted
V Mains SMP	An SMP approval was granted by IIN on 23 August 2010.
Pillar extraction within 309 Panel (T and W mains)	Approved via a Section 138 approval under the *Coal Mines Regulations Act 1982* issued by Industry and Investment NSW (IIN) in 2004 effective until December 2008. In 2007 the approval was extended until December 2010. On 21 September 2010 IIN extended this approval to 30 June 2012.
H Panel	Approval was issued by IIN under Section 363(1) of the *Mining Act 1992* in September 2005.
P and R drifts	Approval was issued by IIN under Section 363(1) of the *Mining Act 1992* in January 2010.

5.8.3 Environmental Protection Licence 12040

NRE No.1 Colliery holds an Environmental Protection Licence (EPL) for the mining and handling of 500 000 to 2 000 000 tonnes of ROM coal. Under the conditions of EPL12040, NRE are required to monitor dust levels at five monitoring locations within and around the Russell Vale site. Dust levels are monitored using dust gauges, with two gauges located on West Street and one each on Broker Street, Midgely Street and within the Russell Vale site (*Figure 5.2*).

In addition NRE is required to monitor water quality and water quantity from 3 licensed discharge points (LDP) within the Russell Vale site. These points are shown on *Figure 5.2.* LDP 1 and 3 monitor stormwater from the site while LDP 2 monitors wastewater. The sampling method, units of measure, and the frequency of monitoring must be done in accordance with the conditions of the EPL. A copy of the EPL is provided in *Annex D.* The results and findings of the monitoring program must be submitted to the DECCW in an Annual Return.

The EPL has also required a number of Pollution Reduction Programs (PRP) be implemented at the Colliery. The most recent PRP (completed in October 2009) required a noise investigation and mitigation program to be implemented at the Colliery.



Legend

Project Application Area

EPL Monitoring Locations

Dust Monitoring

Discharge to Waters

Figure 5.2

Licenced Monitoring and Discharge Points at the Russell Vale Site

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS012_R1.mxd	
Date:	07/09/2010	Drawing size: A4
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

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0 50 100 150m

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5.8.4 Water Licence

An application for a water extraction licence for NRE No. 1 Colliery has been submitted to NOW. That application is pending determination.

5.8.5 Mining Operations Plan

A Mine Operations Plan (MOP) is currently in force for NRE No.1 Colliery. The MOP is an operations manual for the Colliery and sets out environmental management and monitoring regimes to be followed and is summarised in *Table 5.3*. The MOP also details a rehabilitation strategy for the closure of the mine.

Table 5.3 Key MOP Environmental Management and Monitoring Measures

Issues	Management and Monitoring Measures
Air Quality	• Management of dust through water sprays on the stockpile, water trucks to dampen stockpiles and roads, and an operating truck wash. • Monitoring of dust levels as per the EPL.
Erosion and sediment	• Management of sediment runoff through the existing stormwater system • Visual monitoring of control structures
Water quality	• Water quality is monitored as per the EPL
Weeds	• Ongoing and progressive control of weeds on the property has been contracted out to the Noxious Weeds Branch officers associated with Wollongong City Council or private contractor.
Noise	• Maintaining equipment in good working order. • Consultation with EPA, local residents and mine personnel. • Ongoing awareness training of all staff and operators of heavy equipment
Mine Subsidence	• Regular monitoring by survey. • Subsidence Monitoring Plans have been prepared, which include specific independent technical reports and subsidence monitoring requirements.
Waste	• Putrescible waste, waste timber and other rubbish are disposed of using the services of a licensed contractor. • Scrap steel is sold to a metal recycler. • Waste paper from the administration section is also recycled where possible. • Waste oil is removed by a licensed contractor for recycling off site.

5.9 RECOMMENDATIONS OF THE SOUTHERN COALFIELDS INQUIRY REPORT

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. Presented in *Table 5.4* is a summary of how the Project has taken into consideration 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).

Table 5.4 Southern Coal Fields Inquiry Report Checklist

Recommendation	Response	Reference
Assessment And Regulatory Processes		
1. *Risk Management Zones (RMZs) should be identified in order to focus assessment and management of potential impacts on significant natural features. RMZs are appropriate to manage all subsidence effects on significant natural features, but are particularly appropriate for nonconventional subsidence effects (especially valley closure and upsidence). Consequently, RMZs should be identified for all significant environmental features which are sensitive to valley closure and upsidence, including rivers, significant streams, significant cliff lines and valley infill swamps.*	RMZs have been applied to significant natural features including Wallandoola Creek, a 3rd order creek, which lies above the V Mains area. There are no significant cliff lines. Aboriginal heritage items have been identified and assessed according to significance, there are no highly significant aboriginal sites that are likely to be affected by the proposed mining. Environmental impact assessment has been focused on the RMZs where the effects of subsidence are likely to impact.	*Annex F*
2. *RMZs should be defined from the outside extremity of the surface feature, either by a 40° angle from the vertical down to the coal seam which is proposed to be extracted, or by a surface lateral distance of 400 m, whichever is the greater. RMZs should include the footprint of the feature itself and the area within the 40o angle (or the 400 m lateral distance) on each side of the feature.*		
3. *RMZs for watercourses should be applied to all streams of 3rd order or above, in the Strahler stream classification. RMZs should also be developed for valley infill swamps not on a 3rd or higher order stream and for other areas of irregular or severe topography, such as major cliff lines and overhangs not directly associated with watercourses.*		
4. *Environmental assessments for project applications lodged under Part 3A should be subject to the following improvements in the way in which they address subsidence effects, impacts and consequences:*	It is considered that the approach in this EA is consistent with recommendation 4 including the following:	
• *a minimum of 2 years of baseline data, collected at an appropriate frequency and scale, should be provided for significant natural features, whether located within an RMZ or not;*	• NRE have gathered a comprehensive data set for each of the environmental studies.	*Chapter 9 -16*

Recommendation	Response	Reference
• *identification and assessment of significance for all natural features located within 600 m of the edge of secondary extraction;*	• All significant natural features with 600m of secondary extraction have been identified and taken into consideration in establishing study areas.	*Chapter 8 - 17*
• *better distinction between subsidence effects, subsidence impacts and environmental consequences;*	• A subsidence assessment has been prepared detailing the predicted subsidence from mining. This assessment has informed technical studies specifically surface water, groundwater, aboriginal heritage and terrestrial and aquatic ecology which have assessed the environmental consequences resulting from the subsidence.	*Annex E*
• *increased transparency, quantification and focus in describing anticipated subsidence impacts and consequences;*	• Subsidence is predicted in only two small mining areas, the 309 panel and the V Mains. The 309 panel has been subject to a s138 approval and an SMP has been approved by IIN for the V Mains.	*NA*
• *increased communication between subsidence engineers and specialists in ecology, hydrology, geomorphology, etc;*	• A risk workshop was held as part of the V Mains SMP process to allow better communication and discussion of subsidence impacts on significant features.	*NA*
• *key aspects of the subsidence assessment (particularly in respect of predicted impacts on significant natural features and their consequences) should be subject to independent scientific peer review and/or use of expert opinion in the assessment process; and*	• Subsidence is predicted in only two small mining areas, the 309 panel and the V Mains. The 309 panel has been subject to a s138 approval and an SMP has been approved by IIN for the V Mains.	*NA*
• *increased use of net benefit reviews by both mining proponents and regulatory agencies in assessing applications.*	• the net benefit of the proposal has been considered	*Chapter 25*
5. *Due to the extent of current knowledge gaps, a precautionary approach should be applied to the approval of mining which might unacceptably impact highly-significant natural features. The approvals process should require a 'reverse onus of proof' from the mining company before any mining is permitted which might unacceptably impact highly-significant natural features. Appropriate evidence should include a sensitivity analysis based on mining additional increments of 50 m towards the feature. If such mining is permitted because the risks are deemed acceptable, it should be subject to preparation and approval of a contingency plan to deal with the chance that predicted impacts are exceeded.*	A subsidence assessment has been prepared detailing the predicted subsidence from mining. This assessment has informed technical studies specifically surface water, groundwater, aboriginal heritage and terrestrial and aquatic ecology which has assessed the environmental consequences resulting from the subsidence. Significant natural features have been identified and the consequences of predicted subsidence assessed. It is important to note that the mining method (pillar extraction) enables modification to the mine design if required.	*Annex F and Chapter 8*

	Recommendation	Response	Reference
6.	*Approved mining within identified RMZs (and particularly in proximity to highly-significant natural features) should be subject to increased monitoring and assessment requirements which address subsidence effects, subsidence impacts and environmental consequences. The requirements should also address reporting procedures for back analysis and comparison of actual versus predicted effects and impacts, in order to review the accuracy and confidence levels of the prediction techniques used.*	Monitoring of ground movements in the V Mains will be undertaken to measure the extent to which the actual ground movements may differ from those that have been predicted and to periodically review the impacts in the light of additional data. Monitoring in Wallandoola and Lizard Creek will also be undertaken. The assessments indicate that subsidence consequences are predicted to be not significant	*Annex F and Chapter 8*
7.	*Part 3A of the Environmental Planning and Assessment Act 1979 should be the primary approvals process used to set the envelope of acceptable subsidence impacts for underground coal mining projects. This envelope of acceptability should be expressed in clear conditions of approval which establish measurable performance standards against which environmental outcomes can be quantified. Once a project has approval under Part 3A, the Subsidence Management Plan approval should be restricted to detailed management which ensures that the risk of impacts remains within the envelope assessed and approved under Part 3A. In cases where a mining project approval under Part 3A of the EP&A Act does not yet exist, the SMP process should take a greater role in assessing and determining the acceptability of impacts.*	It is considered that this recommendation applies to the NSW Government.	*NA*
8.	*The acceptability of impacts under Part 3A (and, in the interim, the SMP process) should be determined within a framework of risk-based decision-making, using a combination of environmental, economic and social values, risk assessment of potential environmental impacts, consultation with relevant stakeholders and consideration of sustainability issues.*	This EA has been prepared utilising a risk based framework for the assessment of potential impacts and consequences of the Project, as well as management measures to help mitigate these. • Significant natural features in close proximity to the proposed mining areas were identified through a series of technical assessments. There are no significant natural features in the 309 Panel area. In the V Mains the risks were assessed at a Risk Management Workshop attended by relevant stakeholders. Risks are considered to be not significant and can be managed by appropriate monitoring.	*Chapter 7, 8, 9, 10, 15 and 16*

	Recommendation	Response	Reference
9.	*Mining which might unacceptably impact highly-significant natural features should be subject to an increased security deposit sufficient to cover both anticipated rehabilitation costs (as at present), and potential rehabilitation costs in the event of non-approved impacts to the highly significant feature. The higher deposit should be commensurate with the nature and scale of the potential impact and should be attached to the mining lease by DPI under powers available to its Minister under the Mining Act 1992. If non-approved impacts occur and the feature is not able to be remediated by the mining company, then the deposit should be able to be forfeited as compensation for the loss of environmental amenity.*	Significant natural features are not expected to be impacted by mining related subsidence.	*Chapter 8, 9, 10, 15 and 16*
10.	*Consideration should be given to the increased use within Part 3A project approvals of conditions requiring environmental offsets to compensate for either predicted or non-predicted impacts on significant natural features, where such impacts are non-remediable.*	The Project will not involve any clearing of native vegetation and based on predicted subsidence is not expected to have significant impacts on significant natural features. Therefore it is considered that offsets are not required for this project.	*Chapter 8 and 16*
11.	*Mining companies should ensure that they consult with key affected agencies as early as possible in the mine planning process, and consult with the community in accordance with applicable current industry and Government guidelines (e.g. NSW Minerals Council's Community Engagement Handbook and DoP's Guidelines for Major Project Community Consultation). For key agencies (e.g. DECC and SCA), this engagement should begin prior to the planning focus stage of a project application.*	Consultation with key affected agencies, in particular the DoP, DECCW and IIN was sought at an early stage in the process of the project application. Ongoing consultation with the agencies continued through out the development of the EA and the previously prepared SMP. A number of community information sessions have been held to discuss the project with the community and allow for recognition of feedback.	*Chapter 6*
12.	*Government should provide improved guidance to both the mining industry and the community on significance and value for natural and other environmental features to inform company risk management processes, community expectations and Government approvals. This guidance should reflect the recognition that approved mining would be expected to have environmental impacts.*	Noted	*NA*

Recommendation	Response	Reference
Subsidence Impact Management		
13. *The coal mining industry and Government should undertake additional research into the impacts of subsidence on both valley infill and headwater swamps. This research should focus on the resilience of swamps as functioning ecosystems, and the relative importance of mining induced, climatic and other factors which may lead to swamp instability.*	Noted – Monitoring is proposed as part of the V Mains SMP and will be undertaken for upland swamps within the V Mains area.	*NA*
14. *The coal mining industry should undertake additional research into means of remediating stream bed cracking, including:* • *crack network identification and monitoring techniques;* • *all technical aspects of remediation, such as matters relating to environmental impacts of grouting operations and grout injection products, life spans of grouts, grouting beneath surfaces which cannot be accessed or disturbed, techniques for the remote placement of grout, achievement of a leak-proof seal and cosmetic treatments of surface expressions of cracks and grouting boreholes; and* • *administrative aspects of remediation, in particular, procedures for ensuring the maintenance and security of grout seals in the long term.*	Noted	*NA*
15. *Coal mining companies should develop and implement:* • *approved contingency plans to manage unpredicted impacts on significant natural features; and* • *approved adaptive management strategies where geological disturbances or dissimilarities are recognised after approval but prior to extraction.*	An adaptive management approach, incorporating contingency plans, will be implemented for the Project. This will involve monitoring of ground movements and to periodically review the impacts in the light of additional data. Note that an advantage of Pillar extraction is the ability to modify the mine layout if required.	*Chapter 8*
16. *Government should review current control measures and procedures for approval and management of non-mining related impacts on Southern Coalfield natural features. These include various forms of discharge into rivers and streams, as well as water flow control practices. The impacts of such non-mining factors must be recognized when assessing the value of significant natural features in the region, and the assessment of appropriate control strategies.*	Government responsibility	

Recommendation	Response	Reference
Prediction Of Subsidence Effects And Impacts		
17. *The coal mining industry should escalate research into the prediction of non-conventional subsidence effects in the Southern Coalfield and their impacts and consequences for significant natural features, particularly in respect of valley closure, upsidence and other topographic features.*	Noted	*NA*
18. *Coal mining companies should place more emphasis on identifying local major geological disturbances or discontinuities (especially faults and dykes) which may lead to non-conventional subsidence effects, and on accurately predicting the resultant so-called 'anomalous' subsidence impacts.*	A Dyke has been identified south of the V Mains area. The major dyke is some 5m thick and mainly hard with coked coal some 4m either side. Strong jointing was noted to have developed parallel to the dyke underground.	*Annex F and Chapter 8*
19. *In understanding and predicting impacts on valleys and their rivers and significant streams, coal mining companies should focus on the prediction of valley closure in addition to local upsidence. Until prediction methodologies for non-conventional subsidence are more precise and reliable, companies should continue to use an upper-bound, or conservative, approach in predicting valley closure.*	Valley closure is not predicted for this project	*Annex F and Chapter 8*
20. *Mining companies should incorporate a more extensive component of subsidence impact prediction with respect to natural features, in any future planning submissions. Such predictions should be accompanied by validation of the prediction methodology by use of back-analysis from previous predictions and monitoring data.*	A subsidence assessment has been undertaken for the project. Subsidence predictions were extrapolated from the results of extensive monitoring of subsidence in the adjacent areas of NRE No.1 Colliery.	*Annex F and Chapter 8*
Environmental Baseline Data		
21. *Regulatory agencies should consider, together with the mining industry and other knowledge holders, opportunities to develop improved regional and cumulative data sets for the natural features of the Southern Coalfield, in particular, for aquatic communities, aquifers and groundwater resources.*	NRE has provided all monitoring data to all relevant government agencies. these government agencies are considered to be the most appropriate organisations to manage this data set.	*NA*
22. *Coal mining companies should provide a minimum of two years of baseline environmental data, collected at appropriate frequency and scale, to support any application under either Part 3A of the Environmental Planning and Assessment Act 1979 or for approval of a Subsidence Management Plan.*	NRE have gathered a comprehensive data set for each of the environmental studies in this EA.	*Chapter 9 -16*

6 STAKEHOLDER ENGAGEMENT

This chapter summarises the consultation undertaken with key stakeholders including the local community and government agencies that has occurred in regards to this Project and the Major Project Application (MP 09_0013)

6.1 COMMUNITY ENGAGEMENT

This project represents a transitional phase of works pending the approval of Stage 2 (MP 09_0013). NRE has undertaken consultation and information sharing with the local community around the Russel Vale site. This has included distribution of community newsletters and public information sessions (*Table 6.1*). Whilst the consultation has focussed on the big picture, the issues raised are relevant to the preliminary works proposed in this Project and have influenced the staging of environmental works.

Table 6.1 Summary of community consultation

Date	Consultation	Purpose
April 2008	Newsletter 1	To outline key contact details (1800 number and email).
April 2008	Information Session 1	To provide an opportunity for the wider community to obtain information regarding the proposal. It also provided a forum for issues of concern to be raised directly with project team members. Representatives from both NRE and ERM were present to respond to questions. Community members were encouraged to register their interest to ensure that they received all future project information.
October 2008	Newsletter 2	To provide the wider community with an overview of the proposal and the environmental assessment process and ensure the community was kept up to date with the progress of the environmental assessment and project development. The newsletter also advertised the date, time and location for the project information session held at Corrimal Community Centre
October 2008	Information Session 2	To provide a greater understanding of the scope of the assessment and the steps required to gain approval. To provide an opportunity for community feedback
December 2008	Newsletter 3	To provide feedback on the previous information session held in October 2008.
March 2009	Newsletter 4	To update the community on the progress of the project and inform them on the next information session.
March 2009	Information Session 3	To keep the community informed of the project progress and provide an opportunity for community feedback
February 2010	Newsletter 5	To inform the local community of the up coming information session at which preliminary assessment results were to be presented.
March 2010	Information Session 4	To provide some feedback to the community on the assessment so far and provide an opportunity for community feedback.
May 2010	Information Session 5	To advise the community of NRE's latest plans and the proposal to divide the project into two stages, providing detail of Stage 1 Preliminary Works.

The majority of concerns raised at the information sessions relate to road haulage and noise and dust from the Colliery. Water management and water flows in Bellambi Gully Creek downstream of the Russell Vale site have also been of concern. NRE has considered these concerns on board and the environmental improvements proposed in this Project will assist in addressing these issues. *Table 6.2* lists the key issues raised by the community which have been addressed as part of this Project.

Table 6.2 Key community issues addressed in this Project

Issue Category	Specific Issues	How the issues are being addressed	Relevant section in the Environmental Assessment Report
Water Management	Issues of concern relating to water management included: • concerns that the 1998 water and coal spill event could happen again; • creek pollution - less aquatic life in the streams than there used to be; • concerns about water quality in Bellambi Gully Creek; and • concerns about flooding in backyards.	• A new Bellambi Gully Creek bypass channel will be constructed to better mange stormwater flows across the site. • Barriers will be constructed to ensure coal does not enter the channel. The channel will only conduct water from clean water catchments.	*Chapter 11*
Noise	Noise related issues were commonly raised by people who attended the information session. The key issues relating to noise was the impact on amenity. Specific concerns were raised regarding the noise generated from current activities occurring at the Russell Vale site.	• There have been progressive improvements at the site including replacement of vent fans and drive head. • All new infrastructure will include noise attenuation and screening as required. • A new bund wall will be constructed along the northern boundary of the site to mitigate noise in residential areas.	*Chapter 14*
Air Quality	Air quality related issues were also a major concern for people attending the information sessions. Specific issues were raised regarding dust from truck haulage on residential properties and Bellambi Lane	• Historically, all trucks were washed prior to leaving the site. Alternate arrangements are being trialled that ensure the trucks are clean and dry prior to leaving the site thereby reducing drip waste and dust impacts along Bellambi Lane.	*Chapter 12*

Trucking	Concerns about truck driver behaviour and speeding.	• A meeting was held with truck drivers including contractor personnel to discuss issues including:
		  • re-enforcing the driver code of conduct and what is appropriate driver behaviour;
		  • interaction between truck drivers and the local community; and
		  • incident reporting.
		• An audit of the transport operation system on and offsite is conducted monthly.
			Chapter 19

6.2 *GOVERNMENT AGENCY CONSULTATION*

Consultation was undertaken with Government departments and agencies throughout the environmental assessment process. Consultation included meetings and consultations held with key agencies.

A chronology of the consultation undertaken is provided in *Table 6.3.*

Table 6.3 Summary of Consultation Undertaken

Date	Agency	Method of Contact	Issues Raised	Relevant section of report
21 December 2005	SCA	Meeting	• Meeting to discuss V Mains and installation of monitoring devices.	*Chapter 9*
20 June 2008	Southern Coalfields Executive Working Group (EWG – includes DoP, DECCW, IIN, SCA, NOW, DSC)	Meeting	• Meeting was held with the EWG to introduce the NRE No.1 Colliery project	Stage 2
26 November 2008	EWG	Meeting	• Subsidence predictions need to be cumulative. • Geomorphic mapping must be done. • A groundwater gaps analysis (surface to seam analysis) needs to be undertaken. • Ecology surveys must cover all seasons. • Surface and groundwater interactions need to be assessed under the SCA guidelines. • Noise assessment must take into account the extension of the Northern Distributor. • Need to address mine closure plans for Russell Vale and shaft sites.	*Chapter 8* Stage 2 Stage 2 *Chapter 16* *Chapter 9 and 10* *Chapter 14* *Chapter 23*
28 January 2009	EWG	On site meeting	• Coal seam gas utilisation • Need to address swamp clusters	*Chapter 13* *Chapter 16*
20 March 2009	EWG	Meeting	• Meeting was held with the EWG to discuss the progress of the NRE No.1 Colliery project	Stage 2
15 July 2009	DSC	Meeting	• Need to maintain adequate barriers between longwalls and the lake, and to adequately separate future workings from the 500 series longwalls that underlie the lake so as to prevent re-activation of existing goafs. Need to maintain an adequate barrier between proposed workings and the dam wall and spillway. • Proposed working should be outside the 1 km barrier around the dam wall and spillway.	*Chapter 3*

Date	Agency	Method of Contact	Issues Raised	Relevant section of report
10 August 2009	DECCW	Meeting	• Proposed methodology - Field survey will target previously identified archaeological sites and landforms where there is the potential for the sites to be impacted by both conventional and non conventional subsidence, dependent on OH&S issues. • There was a general consensus to this methodology.	*Chapter 17*
13 November 2009	RTA	Meeting	• NRE initiated discussion with RTA to consider potential impacts on Mt. Ousley Road	Stage 2
November 2009	IIN and DECCW	Meeting	• Discussion and inspection of V Mains extraction area	*Chapter 8*
17 December 2009	TransGrid	Meeting	• NRE advised that infrastructure management plans will be developed in consultation with TransGrid.	Stage 2
18 December 2009	Wollondilly Council	Meeting	• Council requested a copy of the Aboriginal heritage assessment report Council requested further information regarding traffic impacts within the council area.	The aboriginal heritage report will be sent with the EA to Council. No additional traffic impacts are expected in the Council area, as all heavy vehicle traffic will enter the site at Russell Vale.
21 December 2009	Department of Lands	Letter	• Letter sent to inform department of project and confirm crown lands.	*Section 1.4*
23 December 2009	Mine Subsidence Board	Meeting	• Mining close to major infrastructure channels of communication have been initiated and ongoing.	*Chapter 8*

Date	Agency	Method of Contact	Issues Raised	Relevant section of report
27 January 2010	Integral Energy	Meeting	• NRE advise that management plans will be developed for infrastructure in consultation with Integral. • Integral – advised that subsidence monitoring lines be installed as a tool to measure impacts for the towers in the 'Wonga East' area of mining. Integral raised the possibility of setting up a 'working group' with MSB, Ross Seedsman, and Integral. NRE advised to investigate this possibility	Stage 2
01 February 2010	EWG	Meeting	• Concern that there is not enough information available to understand how older workings in Wonga East (with unknown geometry) may potentially affect subsidence • Cumulative subsidence needs to be taken into account. • Stream mapping needs to identify existing damage • Will need to justify why 200mm subsidence impact on creek is OK. • The (subsidence) report needs to clearly set out why the maximum won't happen. • The possibility of a peer review was discussed and what form this should take.	Stage 2
09 February 2010	NOW	Meeting	• Surface and groundwater monitoring to date was discussed, as well as subsidence experienced in other mining areas within the Colliery. • Comment made that the extent of Lizard Creek and its nature, would not allow efficient remediation measures to take place. • Licensing requirements were also raised.	Stage 2
24 February 2010	DoP	Meeting	• Possibility of submitting a separate Part 3A application for a transitional phase of works including continuing underground works and urgent surface works at NRE No.1 Colliery	Whole EA
10 March 2010	DoP	Meeting	• Procedure for transitional stage was discussed. • A meeting was proposed with DECCW and IIN to confirm they agree with the assessment approach.	Whole EA
29 March 2010	SCA	Meeting	• Concerned that mining in Wonga East has not been discussed with technical SCA staff with regards to the Notification Area. Asked if subsidence predictions would be reviewed by an expert panel. • Raised concerns regarding previous impacts and water flows. • The SCA were advised that the Preliminary Works Part 3A is being progressed as a result of discussions with DoP.	Stage 2

Date	Agency	Method of Contact	Issues Raised	Relevant section of report

31 March 2010	DoP
	DECCW
	IIN
		Meeting	• Departments advised that all issues need to be assessed including:
			  • Traffic
			  • Noise
			  • Air quality
			  • Dirty water discharge
			  • GHG
			  • Traffic
			  • Rehabilitation
				Whole EA

13 April 2010	DECCW	Meeting	• DECCW advised that a quantitative assessment is not required along Bellambi Lane, and that the implementation of better management practices (such as truck washing on site entry as suggested by NRE) is a better way forward.	*Chapter 12*

28 April 2010	Wollongong City Council	Meeting	• The Council was concerned about
			  • traffic noise
			  • dust along Bellambi Lane
				Annex I and *J* and *Chapters 12* and *14*

06 May 2010	RTA	Meeting	• RTA advised of a new risk evaluation process and Steering and Technical Committee required to be informed of project. • RTA advised that a formal agreement and terms of reference documentation will be required and approved. RTA will forward on to NRE for review and endorsement. • RTA requested a copy of final traffic report • RTA advised that they will be conducting traffic counts on Bellambi Lane to determine effects on traffic flow since the opening of the Northern Distributor.	Stage 2
06 May 2010	DEWHA	Meeting	• A meeting was held to discuss the impacts of the proposed surface works on potential Green and Golden Bell Frog habitat at Russell Vale. An EPBC referral is to be submitted together with the EA documentation as supportive material, post EA lodgement.	*Chapter 16*

7 RISK ASSESSMENT

The risk assessment identifies the potential risks associated with the Project. These have informed the level of assessment and preparation of technical studies and mitigation measures.

7.1 INTRODUCTION

Table 7.1 contains an assessment of the potential environmental risks identified for this Project. This risk assessment was intended to guide the level of assessment to be undertaken in the EA. It is important to note that all risk ratings are based on the proposed activity taking place with no management measures in place.

Table 7.1 Risk Assessment

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Scope of Works for Environmental Assessment	Justification
Subsidence	V mains	Vertical subsidence of ground surface, ground tilts and strains and non-conventional subsidence effects, with associated environmental impacts.	Moderate	• Rely on detailed subsidence assessment undertaken for the V Mains SMP, currently being reviewed by IIN.	Assessment for this area has already been undertaken. Monitoring and management plans have been developed to manage subsidence within this area.
	Panel 309	Vertical subsidence of ground surface, ground tilts and strains and non-conventional subsidence effects, with associated environmental impacts.	Low	• Rely on subsidence assessment undertaken for s138 approval. Document monitoring undertaken to date.	An assessment for pillar extraction in this location has already been undertaken and approved by IIN. To date there has been no adverse consequence of subsidence on natural and manmade features.
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 are within the existing footprint of surface operations.
Landslip	Russell Vale site	Landslip during the construction of the by pass channel in potentially unstable ground.	Moderate	• Undertake a geotechnical assessment of the site	A geotechnical assessment of the site will determine the suitability of the land for construction and recommend ways to ensure stability during construction and operation.
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.	Moderate	• Rely on assessments undertaken for the V mains SMP and Panel 309 s138 approval and monitoring undertaken to date.	An assessment for pillar extraction has already been undertaken and appropriate management and monitoring plans have been developed in conjunction with the SMP. Management & monitoring plans have proven to be effective with no apparent adverse consequences to date.

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Scope of Works for Environmental Assessment	Justification
	Demand for Infrastructure	Existing services will be adequate for the project	Low	• existing services will be documented	The proposal will not increase demand for infrastructure as no increase in production or employees is proposed at this stage.
Surface Water	Surface Operations	Altered water quality and flows in receiving streams due to changes in site runoff or off-site discharges during construction and operation.	Moderate	• Review existing water quality and flows against ANZECC guidelines. • Review site erosion and sediment controls both during construction and operation and water and wastewater management strategies. • Identify any additional management, mitigation and monitoring measures required during construction and operation.	Construction of the Bellambi Gully Creek by pass channel and other surface facility works has potential to impact on water quality during construction. A review of existing operations will inform modifications to the water management system to be included in the Major Project Application (MP 09_0013) for expansion of operations.
	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.	Moderate	• Rely on assessments undertaken for the V mains SMP and Panel 309 s138 approval and monitoring undertaken to date.	An assessment for pillar extraction has already been undertaken. Management plans have been developed and monitoring of the 312, 311 & 310 pillar extraction has not identified any adverse consequences. Proposed workings will not result in subsidence impacts.
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.	Low	• Rely on assessments undertaken for the V mains SMP and Panel 309, s138 approval and monitoring undertaken to date.	An assessment for pillar extraction has already been undertaken. Areas to be mined are predominantly remnant reserves of coal surrounded by previous larger scale extraction. Hence minor impacts to groundwater are expected due to proximity of older extraction.

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Scope of Works for Environmental Assessment	Justification
	Mine Water Management	Additional groundwater inflow into mine workings.	Low	• Document existing management system	Groundwater inflows will be managed by NRE's existing mine water management system.
Air Quality	Surface facilities	Existing operations coupled with modified plant have the potential to create adverse impacts on air quality at adjacent residences.	Moderate	• Quantify existing air quality • Predict future air quality at all sensitive receivers by qualitative modelling	Provides an understanding of air quality impacts on adjacent receivers.
Greenhouse Gas		GHG emissions from electricity consumption, releases from coal and rock strata and combustion of fossil fuels.	Low	• Undertake GHG emission calculations • Identify GHG reduction and energy conservation measures.	This level of assessment is in keeping with the guidelines and will identify management measures required.
Acoustics	Construction noise	Increase in noise levels at sensitive receivers near the Russell Vale site during construction.	Moderate	• Calculate construction noise levels to be experienced at adjacent residence. • Assess predicted noise levels against DECCW guidelines.	The proposed assessment approach is in keeping with DECCW policy.
	Operational noise	Operational noise levels have the potential to affect 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 DECCW guidelines. • Identify any additional management, mitigation and monitoring measures required.	This level of assessment is in keeping with DECCW guidance. Detailed assessment is warranted to address the potential for changes to noise levels at sensitive receivers. Site upgrade has the potential to reduce noise emissions.
		Traffic noise levels at residences along the haul route.	Low	• Consider existing traffic noise environment, having regard to the opening of the Northern Distributor. • Document existing traffic noise management practices.	Provides an understanding of noise impacts on adjacent receivers.

Aspect		Identified Environmental Risks associated with the Project	Level of Risk	Scope of Works for Environmental Assessment	Justification
Ecology	Surface Operations	Adverse affects on threatened flora and fauna associated with potential impacts of surface works	Low	• Undertake site survey to determine potential habitat for threatened species. • Assess potential impact of works on any area of habitat.	Assessment will focus on areas of disturbance.
	Underground Operations	Subsidence impacts on habitat of threatened flora and fauna species and endangered ecological communities.	Low	• Rely on assessments undertaken for the V mains SMP and Panel 309 s138 approval and monitoring undertaken to date	An assessment for pillar extraction has already been undertaken. Subsidence monitoring to date has recorded no adverse impacts.
Historic heritage		Impacts to heritage values and heritage listed items at the Russell Vale site.	Low	• Review existing studies/ data.	A heritage survey of the site has been conducted as part of the larger NRE No.1 Colliery project. The data collected in this survey will be used to inform this assessment.
Aboriginal heritage		Impacts to Aboriginal heritage items or values as a result of subsidence or construction activities.	Low	• Rely on assessments undertaken for the V mains SMP and Panel 309 s138 approval and monitoring undertaken to date.	An assessment for pillar extraction has already been undertaken. Potential subsidence impacts have been previously assess as low to negligible and this is supported by monitoring
Traffic and transport		Impacts on the safety and capacity of the surrounding road network.	Low	• Review PKCT traffic assessment • Consider the traffic implications of the extension to the Northern Distributor. • Document exiting traffic management practices.	A detailed impact assessment is not required as no increase to traffic moments is proposed.
Visual		Adverse impact on visual amenity of sensitive receivers.	Low	• Brief visual analysis. • Identify measures if required to minimise visual impact of construction and operation.	Given the limited views of surface infrastructure and the relatively minor changes proposed to the mining character of the Russell Vale site, a detailed visual assessment is not required.

Aspect	Identified Environmental Risks associated with the Project	Level of Risk	Scope of Works for Environmental Assessment	Justification
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 during operation. Construction waste will be disposed of in accordance with DECCW guidelines.
Hazard and Risk	Release of hazardous material to the environment, fire, public safety	Low	• Identify all potential hazards	The Project in not expected to increase risk. All hazards and risks will be managed via existing practices.
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.	The Project represents a continuation of mining activities at the site.
	Adverse impacts to amenity of nearby residents.	Low	• Identify measures to mitigate any potentially negative impacts.	The Project represents a continuation of mining activities at the site.

7.2 HAZARDS

Bush Fire

Fires originating in the mining area would be unlikely to present serious impacts to the coastal townships, but may pose a significant risk to Project infrastructure, NRE staff, contractors and equipment. The Project is unlikely to increase the risk of bush fire across the PAA.

The bush fire risk in respect of NRE infrastructure will be managed by existing management procedures including:

- slashing or otherwise managing vegetation to control fuel build-up;
- maintenance of fire breaks;
- ongoing communication with the NSW Rural Fire Service; and
- site fire fighting water and equipment and emergency response procedures.

Public Safety

Issues relating to public safety are a matter of regular consideration given the close proximity of the Russell Vale site to local residential areas. Of particular concern is the unauthorised entry onto the property, especially of young people during school holiday periods.

Also of concern are the trucks transporting coal and the potential hazard they may cause for local pedestrian and vehicular traffic.

Other steps taken to ensure public safety include;

- signage around the site to inform the public of the dangers of entering the site. Signs are replaced if damaged;
- maintenance of boundary fences particularly adjacent to residential areas;
- random mobile patrols (by a private security company) of the site and some adjacent streets, covering after hours, weekend and public holiday periods;
- locking access gates after hours;
- installation of camera surveillance facilities at both the Russell Vale and No.4 shaft sites;
- sealing or locking off entrances to portals where possible;

- installation of extra gates on some of the internal roads around the Russell Vale site in an attempt to minimise access for trail bikes after normal daytime hours;

- implementation of a driver code of conduct and driver education; and

- limiting the speed of trucks entering and leaving the site.

Hazardous Material

Explosives and detonators are stored in a purpose built facility at the No.4 shaft site. NRE hold a Dangerous Goods Licence for this material

Oil and fuels are stored in appropriately sized, bunded, above ground storages at the Russell Vale site and at the No.4 Shaft. The total capacity of these storages is approximately 8 000 litres. Waste oil is stored temporarily in four bulk 1000 litre storages prior to disposal by a licensed operator.

8 SUBSIDENCE

This chapter assesses the amount and type of subsidence predicted to occur as a result of underground mining.

8.1 INTRODUCTION

NRE commissioned Seedsman Geotechnics Pty Ltd (Seedsman) to undertake a subsidence assessment of the mining areas (Seedsman, 2010). The full version of the report *Subsidence Assessment – Remnant Bulli Areas and Wongawilli First Workings* has been included as *Annex E* and is summarised in this chapter.

The proposed mining areas are (*Figure 3.2*):

- Bulli seam mining in the;
    - 309 Panel using pillar extraction;
    - H Panels using first workings;
    - V Mains using pillar extraction;
- Wongawilli seam mining in the;
    - Wonga Mains using first workings;
    - P and R Drifts using first workings; and
    - gateroads for proposed longwall panels 4 and 5 in Wonga East, using first workings.

First workings are designed to leave the coal pillars intact, the underground roadways to remain open and the overlying strata to be fully supported, resulting in 'zero' subsidence. Zero subsidence is defined by IIN as vertical downward movement of the ground surface that is less than or equal to 20 mm. As such no subsidence will result from first workings. This chapter focuses only on areas where subsidence may occur, being the 309 Panel and the V Mains.

8.2 *EXISTING ENVIRONMENT*

The SCI report recommends that proponents focus their environmental assessments by placing Risk Management Zones (RMZs) on significant natural features. Significant features are defined as including:

- rivers;
- 3rd order streams or above;
- upland swamps;
- endangered ecological communities (EEC);
- threatened species habitat;
- major cliff lines; and
- Aboriginal heritage.

8.2.1 *309 Panel*

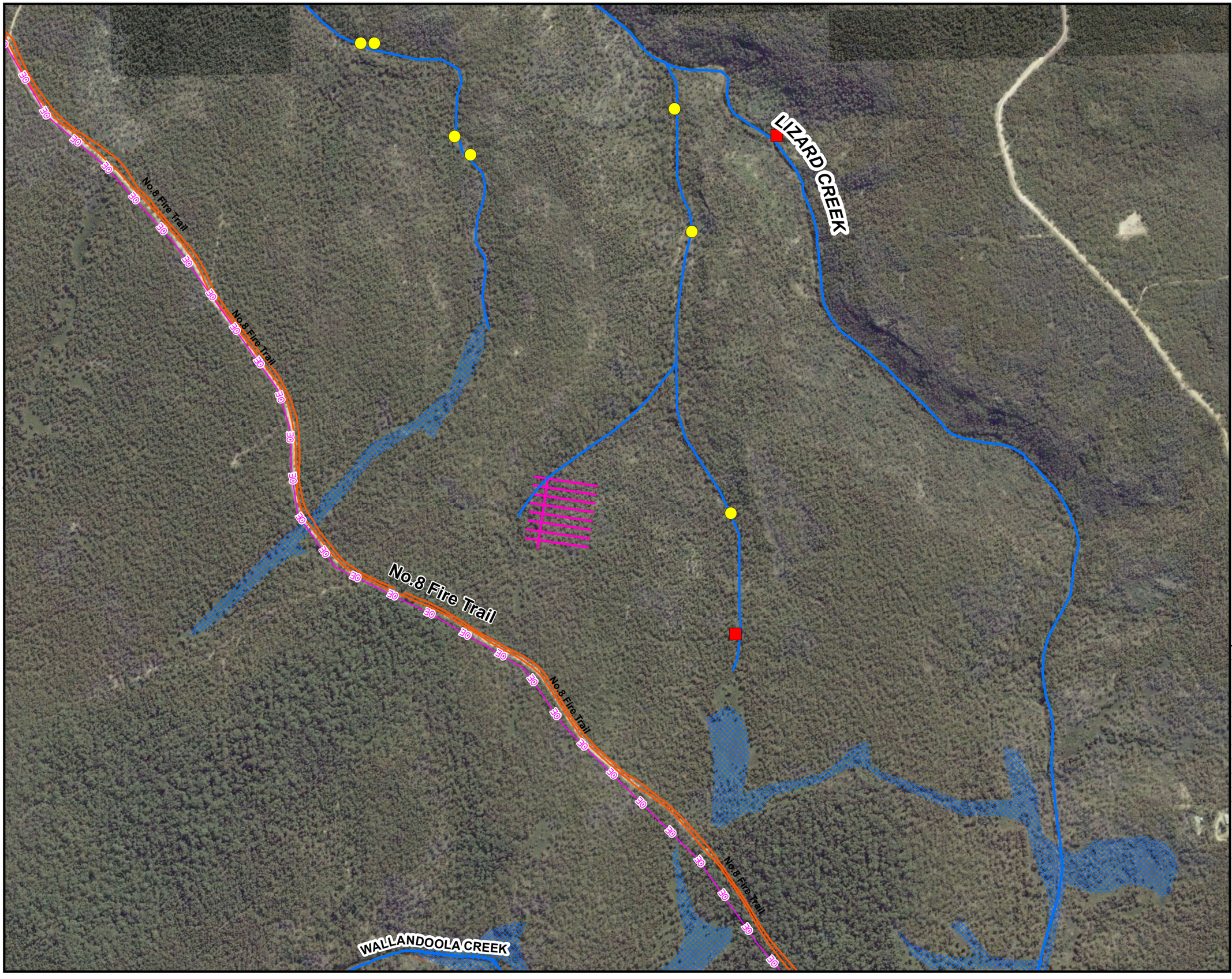
Natural Features

Significant natural features identified above and surrounding the 309 Panel include an upland swamp 320m west of the panel. There is a 1st order ephemeral tributary overlying the western edge of the 309 Panel. Field studies have indicated that habitat for threatened flora and threatened fauna species may occur within the vicinity of the 309 Panel. These species are listed in *Section 16.4.2*. Significant features above the 309 panel are shown on *Figure 8.1*.

There are no rivers, 3rd order streams, cliff lines or Aboriginal heritage sites above or surrounding the 309 Panel.

Public Utilities

There are no public utilities above the 309 Panel. The No.8 Fire Trail is situated approximately 200 metres south of the panel. A Telstra optical fibre cable follows the No.8 Fire Trail. Public utilities are shown on *Figure 8.1.*



Legend

- 309 Panel
- Fire Trail
- Fibre Optic Cable
- Waterway
- Swamps

Threatened Species

- Giant Burrowing Frog
- Red-crowned Toadlet

Figure 8.1

Location of features above the 309 Panel

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS030_R0.mxd	
Date:	08/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

N

0 90 180 270m

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8.2.2 V Mains

Natural Features

Two 3rd order creeks have been identified in the vicinity of the V Mains area. These are Wallandoola Creek located above the mining area and Lizard Creek located to the east of the mining area. Upland swamps are located along the riparian zone of both Wallandoola Creek and Lizard Creeks. An RMZ has been placed around Wallandoola Creek. A Risk Management Zone has not been defined along Lizard Creek as it is not anticipated this creek or its riparian zone will be affected by subsidence (see *Annex F*).

No threatened flora species were recorded within the V Mains area during field surveys, although it is recognised that potential habitat is available for a number of species as listed in *Section 16.4.1*.

The vegetation community *Transitional Shale Stringybark Forest* recorded within the V Mains area forms part of the *Shale Sandstone Transition Forest* listed as an EEC under the TSC Act and EPBC Act.

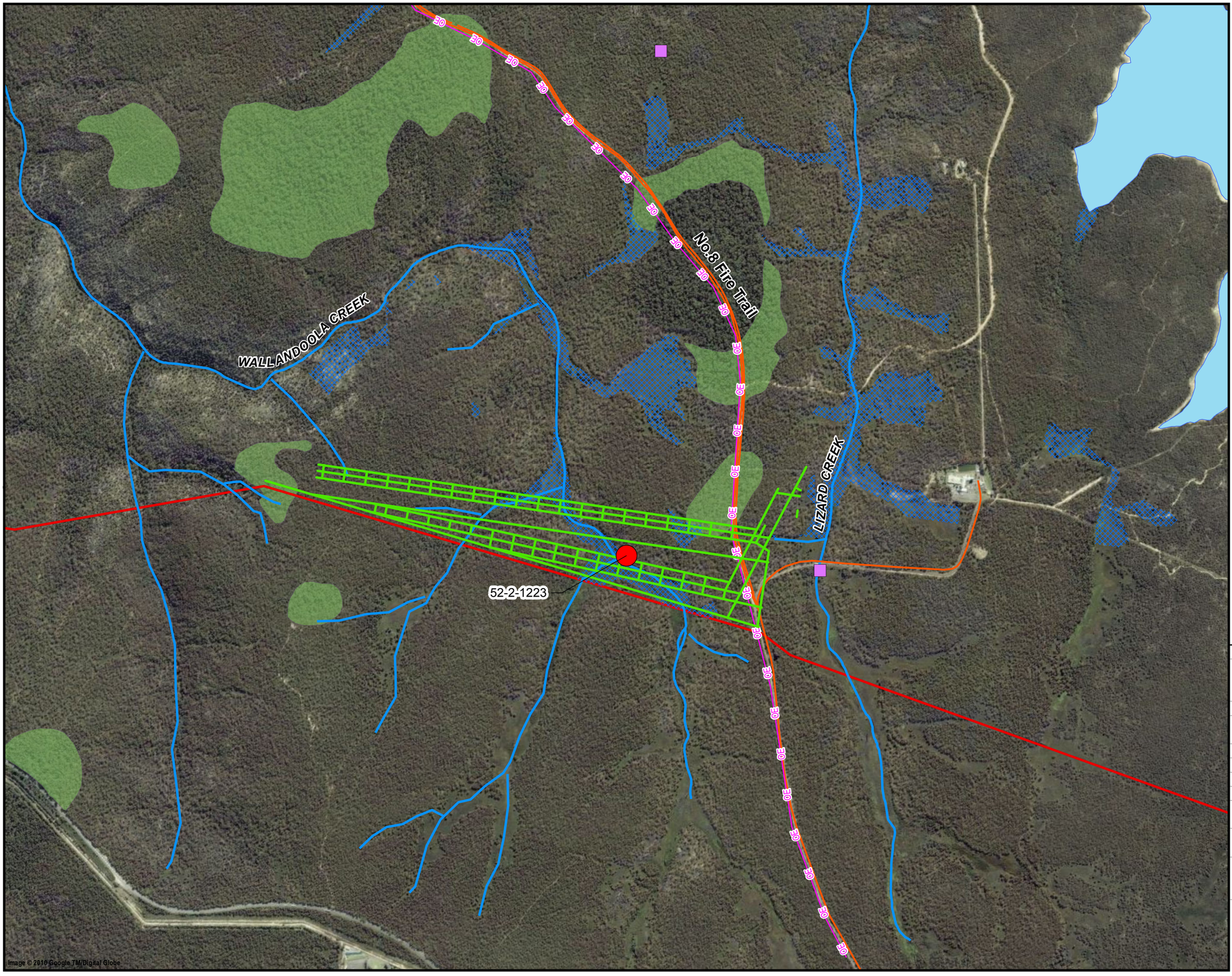
Threatened fauna species confirmed to occur within the V Mains area are listed in *Section 16.4.1.* Natural features within the V Mains area are shown on *Figure 8.2.*

Aboriginal Heritage

An Aboriginal heritage site 52-2-1223, Wallandoola Site 2, is located above the V Mains (*Figure 8.2)*. The site is a shelter with deposit and axe grinding groove. Wallandoola Site 2 is of moderate scientific significance (see *Section 17.6.5*).

Public Utilities

The No.8 Fire Trail runs north south through the eastern end of the V Mains area. A Telstra optical fibre cable follows the No.8 Fire Trail. Public utilities within the V Mains area are shown on *Figure 8.2.*



Legend

- Project Application Area
- AHIMS Site
- Red-crowned Toadlet
- V Mains
- Fibre Optic Cable
- Fire Trails and Access Trails
- Creek
- Swamps
- Cataract Dam
- Transitional Shale Stringybark Forest

Figure 8.2

Location of features within the V Mains Area

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS032_R1.mxd	
Date:	08/09/2010	Drawing size:A3
Drawn by:	NS	Reviewed by:MK
Scale:	Refer to Scale Bar	

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0 160 320 480m

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8.3 PREVIOUS SUBSIDENCE

To the immediate north of V Mains, the 200 series longwalls have been extracted. The maximum subsidence measured from these longwalls was 1.3m, with most of the subsidence being between 1.05m and 1.20m. A very similar layout further north (300 series) resulted in maximum vertical subsidence of about 0.9m. Previous and proposed workings are shown on *Figure 3.1.*

A subsidence survey line has been monitored during the recent pillar extraction of the T and W Mains, particularly for panels 312, 311 and 310, in the area immediately to the west of the 309 Panel. A maximum subsidence of about 150mm has been recorded to date from this extraction.

Subsidence data from the longwalls to the east of V Mains indicate a maximum vertical subsidence of 1.1 m. The vertical subsidence above the panels to the south west (the closed Cordeaux Colliery longwalls) is estimated to have been in the order of 1.2m to 1.3m.

8.4 PREDICTED SUBSIDENCE

8.4.1 V Mains

Subsidence predictions for the V Mains were extrapolated from the results of extensive monitoring of subsidence in the adjacent areas of NRE No.1 Colliery (as discussed in *Section 8.3*).

Maximum values for predicted subsidence parameters including vertical movement, horizontal movement, tilt, curvature and horizontal strain are presented in *Table 8.1.* The predicted subsidence, tilt and strain contours are shown in *Figure 8.3 to 8.5*.

Table 8.1 Maximum predicted subsidence parameters

Subsidence Parameter	Estimated Maximum Values
Vertical movement	1.02 m
Horizontal movement	0.43 m
Tilt	6.1 mm/m
Curvature	0.05 km-1 to 0.09 km-1
Horizontal strain	- 6.5 mm/m to + 3.3 mm/m

1. *Seedsman (2010)*

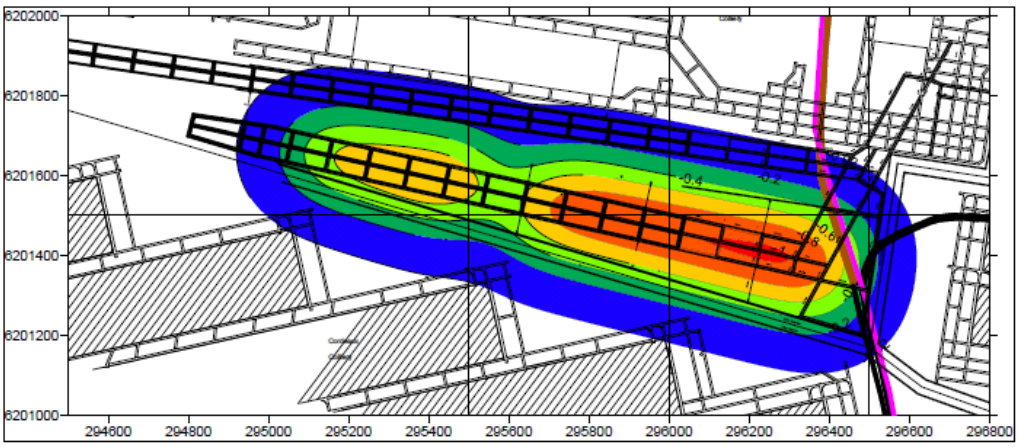


Figure 8.3 *Vertical movements (m) above V Mains (Source: Seedsman, 2010).*

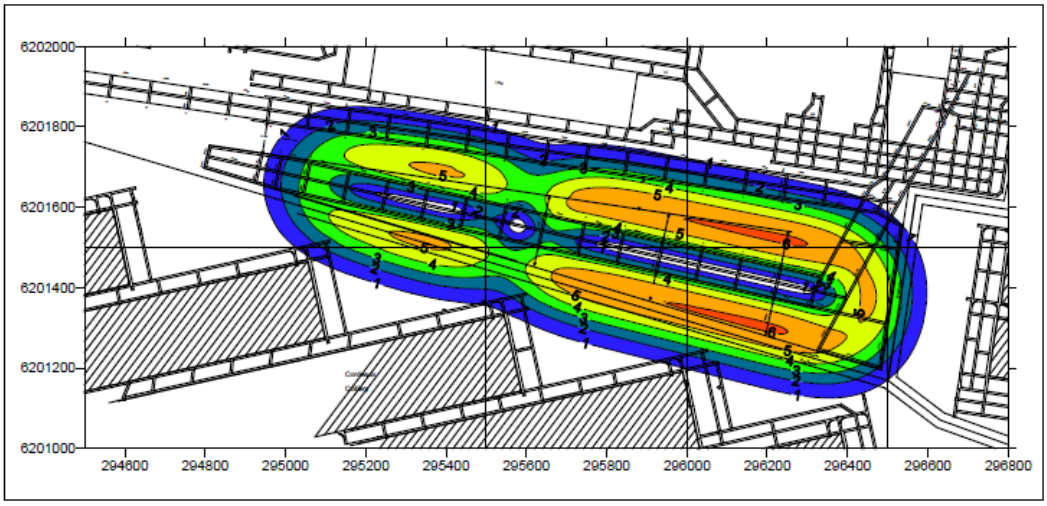


Figure 8.4 *Tilts above V Mains (mm/m)*

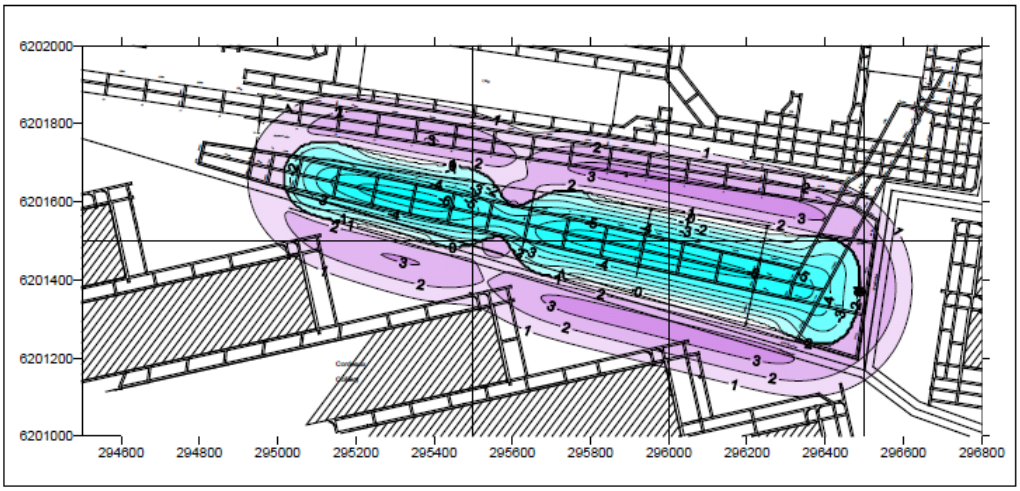


Figure 8.5 *Maximum strains above V Main (mm/m)*

These estimates represent the maximum systematic movements. Based upon subsidence monitoring from the adjoining areas and an understanding of the geology of the V Mains area it has been assessed that the predictions, particularly for systematic deformation, are reliable.

8.4.2 309 Panel

Subsidence predictions for the 309 Panel were extrapolated from the results of monitoring of subsidence in the adjacent extraction panels. Seedsman (2010) has assessed that mining in the 309 Panel will induce up to 200mm of vertical movement. When added to the subsidence induced from previously mined surrounding panels, the total vertical movement is forecast to be between 150mm to 400mm. The associated tilts and strains are anticipated to be approximately +/- 1mm/m similar to those already recorded.

8.5 IMPACT ASSESSMENT

For the 309 Panel and V Mains, it is noted that the predicted subsidence is similar in magnitude to that which has already developed in the immediately adjacent areas. Seedsman (2010) has assessed that the impacts will be similar. There are no reports of adverse impacts from the Cordeaux or South Bulli operations in this area.

The subsidence deformations induced by the mining will affect relatively flat terrain with very few rock outcrops. This should mean that systematic impacts will dominate and there will be few disordered movements. Also it has been identified that the lack of any defined valley formation means there should be no measurable or identifiable valley closure and upsidence.

8.5.1 309 Panel

Upland Swamp

GeoTerra (2010) states that the potential subsidence due to pillar extraction of Panel 309 is not anticipated to cause observable adverse impacts on the headwater upland swamp water levels or water quality in the tributary of Lizard Creek which is located 320m to the west of the proposed workings.

Threatened Species

The species which were identified as likely to occur in the 309 Panel area were assessed (refer *Section 16.5.2)*. The results of the assessments concluded no significant impacts expected for these species.

No.8 Fire Trail and Telecommunication Lines

Seedsman (2010) states that, mining of the 309 Panel will have no impact on the No.8 Fire Trail and the Telstra optical fibre cable.

8.5.2 V Mains

For the V Mains the predicted strains are in the range of +3 mm/m to -6 mm/m. These levels are regarded as not sufficient to cause tensile cracking in solid rock (Seedsman, 2010). The tensile strains may cause existing joints to open slightly but only to relatively shallow depth. No interconnected cracking to the workings is predicted. Without interconnected cracking, there is no potential for loss of surface water. Monitoring of piezometric levels in the Hawkesbury and Bulgo Sandstone indicate no adverse impacts associated with the earlier mining at Bellambi West and Cordeaux.

Creeks and Swamps

GeoTerra (2010) states that the potential subsidence due to pillar extraction of V Mains is not anticipated to create observable adverse impacts on Wallandoola or Lizard Creek or the water levels or water quality of their associated upland swamps.

Threatened Species

No threatened flora species are expected to occur and be impacted by subsidence within the V Mains area. The threatened fauna species which were identified as likely to occur in the V Mains area were assessed as described in S*ection 16.5.1*. The results of the assessments concluded no significant impacts expected for all species.

Aboriginal Heritage

The impact assessment undertaken for Wallandoola Site 2 (see *Section 17.6.6*) concluded that the site has negligible risk of impact.

No.8 Fire Trail

With the predicted levels of strain, there may be minor cracking and bump formation in the Fire Trail. These impacts can be readily remediated. Compression bumps may present a hazard to vehicles travelling at speed.

There is a single gate to restrict access to the Fire Trail. This gate may be adversely impacted by subsidence movements as there is potential that movement of a gate's hinge post or hitching post may result in the gate being unable to open or close fully. Minor repairs to the gate may be required.

Telecommunication Lines

The optic fibre follows the fire trail and crosses the V Mains area where the subsidence is predicted to be the greatest. In particular, some compressive strains are predicted.

Strains may develop in the direction of the cable, with maximum tensile strains in the order of 2 mm/m and maximum compressive strains in the order of 4 mm/m.

8.6 MANAGEMENT AND MITIGATION MEASURES

8.6.1 Subsidence Management Plan

A Subsidence Management Plan (SMP) (ERM, 2009a) has been prepared for the extraction of coal within the V Mains area of the NRE No.1 Colliery. The SMP was approved by IIN on 23 August 2010. The mitigation measures outlined in the SMP as amended by the conditions of approval will be undertaken as apart this project. The SMP conditions require negligible environmental consequences to be achieved in Wallandoola Creek and associated swamps. The SMP will ensure that all management measures are effectively implemented throughout the duration of the project.

The SMP contains a number of sub plans including:

- a subsidence monitoring program;
- a terrestrial ecology subsidence management plan;
- a surface and groundwater subsidence management plan;
- an aquatic ecology subsidence management plan;
- a fire trail subsidence management plan;
- an archaeology subsidence management plan;
- a Telstra subsidence management plan; and
- a public safety subsidence management plan.

Each of the sub plans contains a detailed monitoring regime outlining the monitoring required (including frequency, locations, methodology and parameters to be measured), trigger levels, actions to be undertaken if trigger levels are reached and reporting requirements.

Subsidence Monitoring Program

The SMP includes a subsidence monitoring program which has been developed to measure, record, and report on the nature and extent of ground movement as a consequence of pillar extraction in the V Mains.

The location of the survey line will follow the No.8 Fire Trail and will involve 60 monitoring stations at 20m intervals along the 1 200m line. The subsidence monitoring program will include:

- monitoring before, during and after mining;
- a set of pre-determined triggers; and
- responses and actions that flow from the identification of each trigger.

The results from subsidence monitoring will report the parameters of total and incremental subsidence and any variations in horizontal strain. Visual inspections of subsidence monitoring lines through the various stages will also be recorded. A distinct advantage of the type of mining method (pillar extraction) is that progressive monitoring can be used to limit further extraction should the need arise.

No.8 Fire Trail

Mitigation measures recommended for the management of the No.8 Fire Trail are detailed in the SMP and include:

- signs erected to warn motorists of potential subsidence impacts, including a recommended speed limit;
- daily inspections (Monday to Friday) during mining under the fire trail;
- a pre-approved treatment strategy; and
- road rehabilitation if required, including regular regrading of the affected sections of the access road.

Telecommunication Lines

Mitigation measures recommended for the management of the Telstra optical fibre cable include a management plan developed in consultation with Telstra. A management plan for the cable is currently in place for mining of the T and W Mains. NRE has made a request to Telstra and are in the stages of finalising this plan extending it to cover the V Mains. The plan will involve cable signal monitoring with Telstra management procedures to be followed if signal loss is detected as defined in the SMP (ERM, 2009a).

8.6.2 Section 138 Approval for 309 Panel

The 309 Panel, as part of the T and W Mains, was approved under s138 of the Coal Mines Regulations Act 1982. This approval sets out a number of conditions relating to the environment and subsidence including:

- submission of a monthly environmental monitoring report;
- development of an environmental monitoring program for surface water courses and swamps;
- implementation of an environmental management plan to manage potential subsidence impacts on the surface water courses and swamps;
- development and implementation of a management plan, in consultation with Telstra to manage potential impacts on the fibre optic cable;
- undertaking a management program to ensure public safety;
- undertaking subsidence management review meetings with relevant stakeholders; and
- implementation of a subsidence monitoring/reporting program .

These conditions have been implemented by NRE during extraction of the T and W Mains, or are ongoing. Management measures specific to the 309 Panel are summarised in *Table 8.2*.

8.6.3 Natural Features

Subsidence impacts on natural features in the V Mains and mitigation measures to address these impacts are outlined in the SMP and summarised in *Table 8.2*. Measures include pre, during and post mining monitoring.

No significant impacts are predicted to occur at significant features in the 309 Panel and as such no monitoring has been recommended in this area. Additional fauna surveys in suitable seasons will be undertaken to detect the threatened frogs predicted to be most at risk if impacts from subsidence do occur.

8.6.4 Summary

NRE have committed to undertake a range of mitigation measures for the Project as outlined in *Chapter 24*. Mitigation measure for subsidence related impacts are summarised in *Table 8.2*.

Table 8.2 Summary of subsidence mitigation measures

Issue	Mitigation Measures		Reference
	309 Panel	V Mains (as per SMP)	

Subsidence	• Continuation of subsidence monitoring as per 300 series	• Monitoring total and incremental subsidence and variation in horizontal strain:
		  • once prior to mining;
		  • every 14 days during mining; and
		  • once a month for two months post mining.
			8.6.1

Surface water	• Water quality monitoring in Wallandoola and Lizard Creeks:
	  • every 2 months prior to mining;
	  • fortnightly during mining; and
	  • monthly post mining.
	• Stream water level, or spot flow monitoring and sampling conducted fortnightly during mining at the same locations and times as water quality monitoring.
	• Stream bed and bank stability and vegetation will be photographically recorded prior to, during and post mining.
			Section 9.4

Groundwater	No significant impacts are expected to occur as a result of extraction of the 309 Panel	• Groundwater quality monitoring will be undertaken at P6:
		  • bimonthly prior to mining;
		  • monthly during mining; and
		  • quarterly post mining.
		• Standing water levels will be monitored:
		  • every 12 hours prior to mining;
		  • twice daily (automatic) and monthly (manual) during mining; and
		  • quarterly post mining.
		• Mine inflows will be monitored monthly during and post mining.
			Section 10.4

Aquatic Ecology	• No impacts predicted so no mitigation required.	• Continuing documented observations of habitats.	*Section*

Issue	Mitigation Measures		Reference
	309 Panel	V Mains (as per SMP)	
			15.4
Terrestrial Ecology	• Additional fauna surveys in suitable seasons to detect the threatened frogs.	• Monitoring of the important habitat areas pre and post mining. • Additional fauna surveys in suitable seasons to detect the threatened frogs and the Giant Dragonfly during and post mining.	*Section 16.6*
Aboriginal Heritage	• There are no Aboriginal heritage sites with the 309 Panel area.	• Monitoring of site 52-2-1223 • once pre mining; • once as the mining face is passing the site; and • at three, six and 12 months after mining.	*Section 17.7.2*
Historic Heritage	• There are ho historic heritage sites within the 309 Panel area	• There are ho historic heritage sites within the V Mains area	*Section 18.4*
Public Unities	• No public utilities will be impacted by extraction of the 309 Panel.	• Daily documented inspections of the No.8 Fire Trail during mining and month inspection post mining, with remediation as required.	*Section 8.6.1*
		• A management plan will be put in place with Telstra to manage impacts on the fibre optic cable including signal monitoring (by Telstra), subsidence monitoring as described above and procedures to follow in the event of signal loss.	*Section 8.6.1*

9 CATCHMENT SURFACE WATER

This chapter provides an assessment of potential impacts on surface water resources resulting from proposed mining within the PAA. Measures to manage these impacts are also provided.

9.1 INTRODUCTION

NRE commissioned GeoTerra Pty Ltd (GeoTerra) to undertake a surface water assessment for the V Mains area for the purposes of an SMP application (GeoTerra, 2009). The full version of the report has been included as *Annex F* and is summarised below.

In addition, GeoTerra has prepared an assessment of the potential hydrological effects resulting from all proposed mining area. This assessment (GeoTerra, 2010) is provided in *Annex G*. This chapter focuses only on areas where subsidence may occur, being the 309 Panel and the V Mains.

9.2 EXISTING ENVIRONMENT

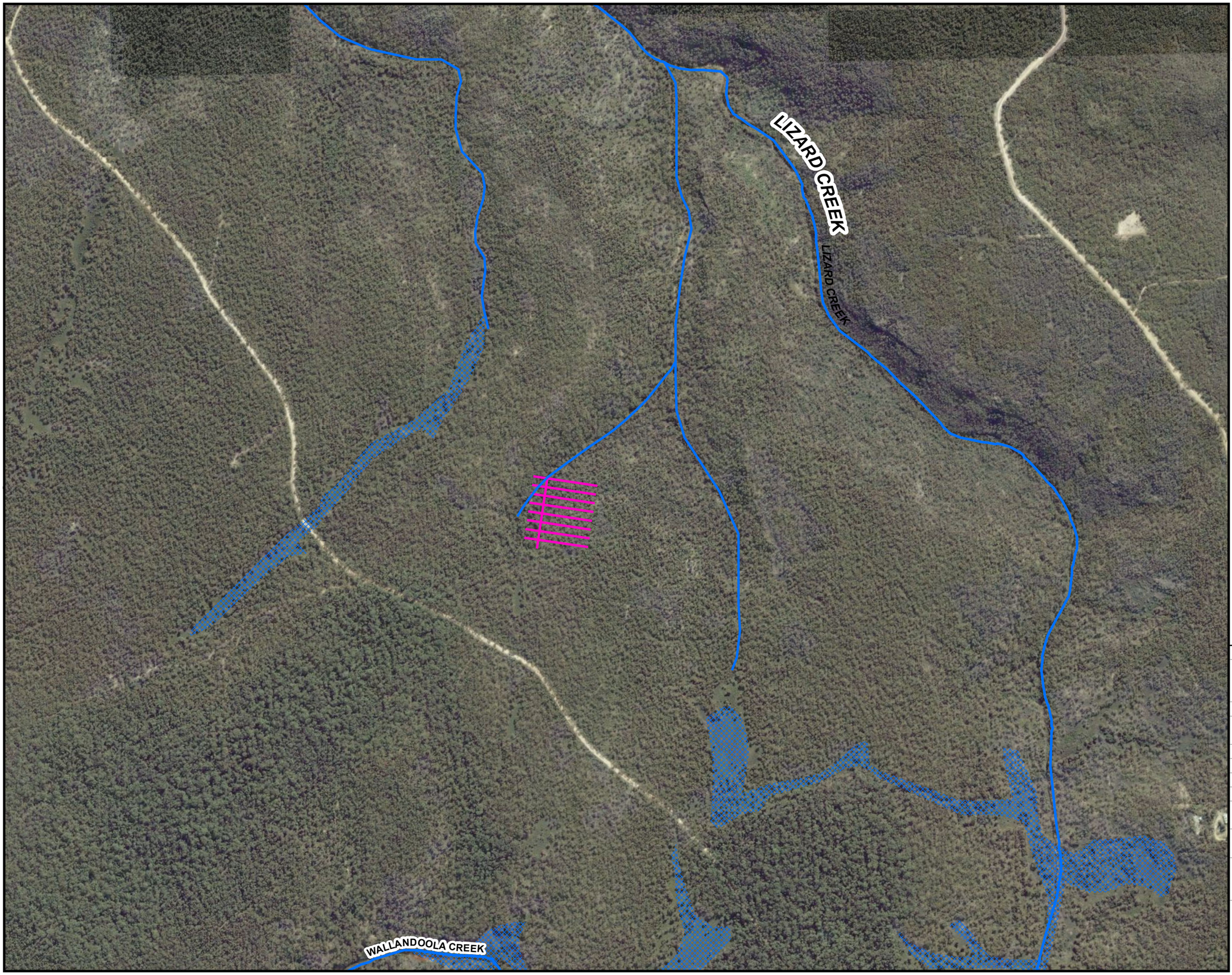
9.2.1 309 Panel

There is one unnamed 1st order tributary overlying the western edge of the 309 Panel (see *Figure 9.1*). This tributary flows north into a 2nd order tributary, and then into Lizard Creek (Lizard Creek is discussed further in *Section 9.2.2*). This unnamed tributary is ephemeral and has been observed to have dry weather groundwater base flow seeping from a sandstone headwall (Ecoengineers, 2009).

The terrain of this area is relatively flat and the closest swamp is located approximately 320m to the west of the 309 Panel. This swamp is a headwater swamp that lies within a northerly draining tributary that flows into Lizard Creek. The swamp is up to approximately 1.2km long and 40m wide.

9.2.2 V Mains

Two creeks have been identified in the vicinity of the V Mains area, Wallandoola Creek, located above the mining area and Lizard Creek located to the east of the mining area (*Figure 9.2*). Both creeks are located within the SCA restricted access Metropolitan Special Area.



Legend

- 309 Panel
- Surface Water
- Swamps

Figure 9.1

Surface water features above the 309 Panel

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS031_R0.mxd	
Date:	08/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

N

0 90 180 270m

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The main channel of Wallandoola Creek is classified as a Schedule 2 stream with third order or higher channels (GeoTerra, 2009). It drains in a north-northwest direction over the V Mains. A second order, ephemeral tributary drains into Wallandoola Creek to the northeast in the middle of the V Mains area. The creek is incised into the weathered, massive to cross bedded Hawkesbury Sandstone and erodes into lower strata as it drains downstream. The stream reach falls by approximately 10 m over a run of 1250 m within the potential subsidence footprint and has an average gradient of 0.8 mm/m.

Within the V Mains area, Wallandoola Creek is characterised by extended pools backed up behind isolated exposed sandstone ledges. The stream banks can be up to 0.5 to 1.0 m high within a well defined channel. Up to approximately 100 m of flanking riparian sedge / upland swamp vegetation may be present along each stream bank.

Wallandoola Creek valley fill swamp 1 (Wcvfs1) overlies the upstream reaches of the V Mains area. It extends up to approximately 120m wide where the creek channel is present either as an indiscernible channel amongst the swamp in the upper reaches near the southern boundary between the NRE and BHPB leases, then migrates into a more distinctive channel with a series of open pools.

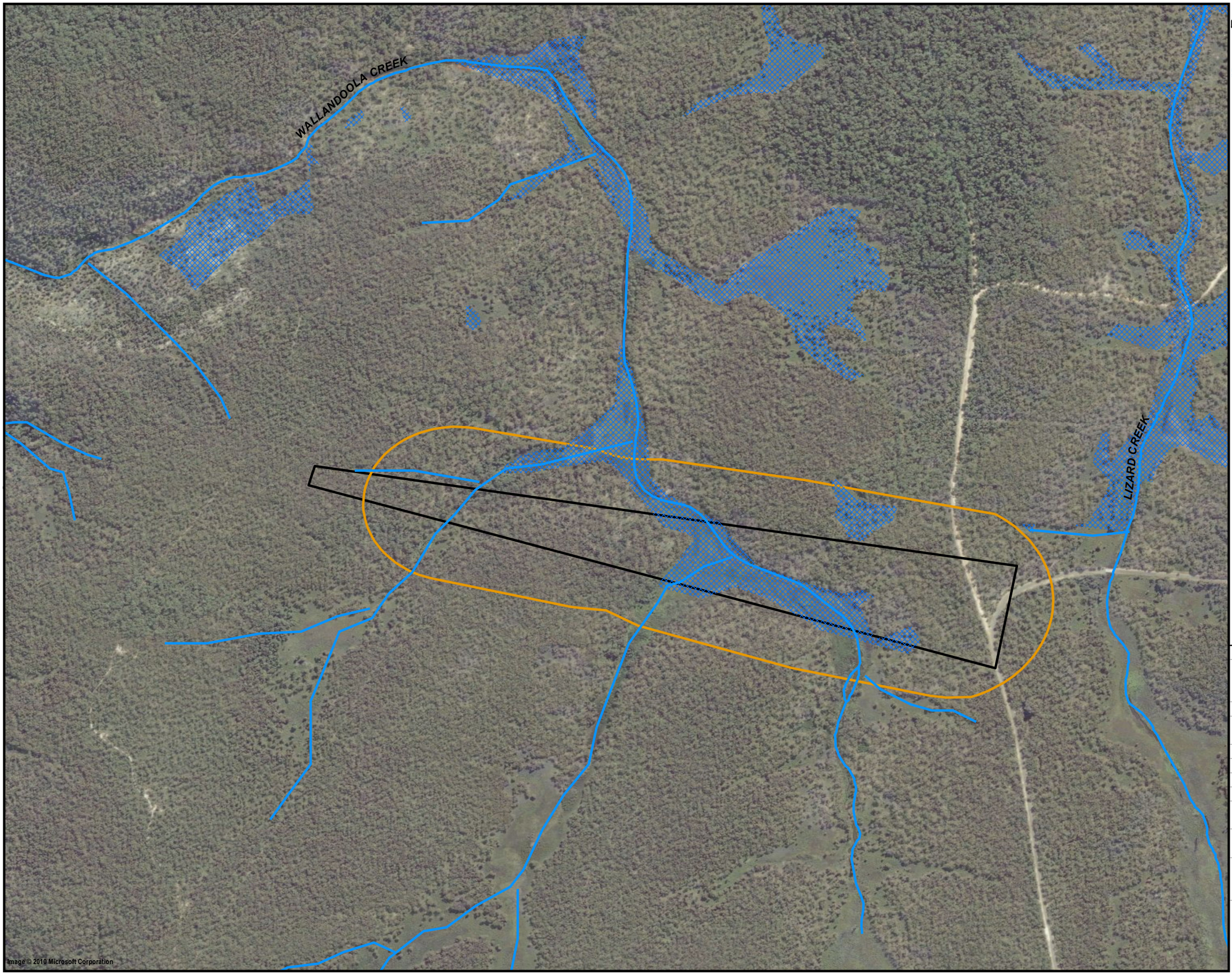
Wallandoola Creek has been previously undermined by southwest - northwest oriented longwall panels within the BHPB Cordeaux workings to the south of the V Mains. However, no specific studies were conducted on the subsidence effects on stream flow, stream water quality or upland swamps prior to this mining being undertaken.

The main channel of Lizard Creek is classified as a Schedule 2 stream with third order or higher channels (GeoTerra, 2009). The creek generally drains in a northerly direction. It is incised into the weathered massive to cross bedded Hawkesbury Sandstone, and erodes into lower strata as it drains downstream. The stream reach falls by approximately 10 m over a run of 1400 m adjacent to the V Mains, with an average gradient of 0.71 mm/m.

The stream reach of Lizard Creek nearest the V Mains area is generally characterised by extended, shallow, reed filled pools backed up behind isolated exposed sandstone ledges. The stream banks are generally less than 0.5 m high within a less well defined channel. Up to approximately 100 m of flanking riparian sedge or upland swamp vegetation may be present along each stream bank.

Lizard Creek has been previously undermined by both east - west and southwest - northeast oriented longwall panels within the BHPB Cordeaux workings to the south of the NRE No. 1 Colliery. However, no specific studies were conducted on the subsidence effects on stream flow, stream water quality or upland swamps prior to this mining being undertaken.

Stream mapping of both Wallandoola and Lizard Creek is provided in *Annex G*.



Legend

- V-Mains Application Area
- Predicted Subsidence Footprint
- Creek/River
- Swamps

Figure 9.2

Surface Water Features Within the V Mains Area

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS009_R1.mxd	
Date:	07/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

N

0 100 200 300m

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Water Flows

Volumetric stream flow monitoring has been conducted in Lizard Creek in the vicinity of V Mains since mid September 2009 at the culvert crossing on Fire Road 8 (LC3). The results of this monitoring are presented in *Annex G*.

Volumetric stream flow monitoring upstream and within the V Mains area for both Wallandoola and Lizard creeks, is not feasible as there is no distinctive channel within valley fill swamp Wcvfs1, and as a result, the water moves down the creek as a pervasive flow within the swamp, as opposed to within a confined channel.

In order to provide an observation of any potential change in stream flow in Wallandoola Creek at V Mains, pool height water level monitoring has been conducted at sites up and downstream (WC1 and WC4 respectively). This data is provided in *Annex G*. The upstream site, WC1, overlies the BHPB Cordeaux Colliery Bulli seam longwall subsidence area, whilst the downstream site, WC4, lies over the western periphery of the NRE Bulli seam longwall 211 subsidence zone.

Site WC1 does not show an enhanced pool drainage rate. WC4 has an enhanced rate of pool water level reduction, with water observably flowing into a crack located upstream of Waterfall W1 during extended dry periods.

Water Quality

Water quality monitoring commenced in Wallandoola Creek and Lizard Creek initially during September 2001, with regular data collected since July 2007. The data is presented in *Annex G* and summarised below.

The pH in Wallandoola Creek ranges from 3.35 to 6.83and is outside the ANZECC 2000 South Eastern Australia Upland Stream criteria (6.0-7.5). Salinity ranges from 56µS/cm to 199µS/cm. Since regular monitoring began in July 2007, the stream's overall salinity has been rising by between 70 µS/cm and 135µS/cm in confluence with the reducing rainfall runoff in the catchment.

Iron levels in Wallandoola Creek do not show any significant recurring trend with distance downstream apart from an isolated peak in iron oxyhydroxide precipitation at WC4 over Longwalls 209 and 210. Iron levels discharging downstream of the 200 series longwalls are below 0.5mg/L.

No apparent rise in sulfate levels at any one location is present which would indicate the notable dissolution of sulfuric acid following iron sulfide weathering resulting from subsurface flow through surficial cracks in subsided / cracked Hawkesbury Sandstone.

Monitoring indicates the creek is within the acceptable range for potable water, however it can exceed the ANZECC 2000 95% Species Protection Level for Freshwater Aquatic Ecosystem Guidelines for the following parameters, depending on the flow conditions at the time of sampling;

- filtered zinc at all sites for the majority of the time;
- total nitrogen at some sites for part of the time with no regular pattern;
- total phosphorous occasionally at each site, with no regular pattern; and
- filtered aluminium on one occasion at site WC2.

The pH in Lizard Creek ranges from 2.50 to 6.83 and is outside the ANZECC 2000 South Eastern Australia Upland Stream criteria. Salinity ranges from 19µS/cm to 273µS/cm. Iron levels in the creek show an overall trend to lower concentrations with distance downstream. Monitoring indicates the creek is within the acceptable range for potable water, however it is generally outside the ANZECC 2000 South Eastern Australia Upland Stream criteria for pH and can be above the ANZECC 2000 95% Species Protection Level for Freshwater Aquatic Ecosystem Guidelines filtered zinc, total nitrogen, total phosphorous, filtered copper and filtered aluminium.

Based on water quality monitoring data from Lizard Creek and Wallandoola Creek, there are no observable cumulative impacts from the southern, adjoining BHPB Cordeaux workings, which are upstream of the proposed workings in the PAA.

No stream water monitoring data is available within the Cordeaux lease prior to the undermining of Lizard or Wallandoola Creeks by BHPB, and therefore it is not possible to assess whether there were, or the magnitude of, any changes to stream water quality from subsidence at Cordeaux.

9.3 IMPACT ASSESSMENT

9.3.1 Stream Flow

Wallandoola Creek

Wallandoola Creek does not pass through the zone of maximum predicted subsidence. Predicted subsidence at Wallandoola Creek is expected to be approximately 0.8 m, with a strain of 3.3 – 6.5 mm/m. Given the low levels of predicted subsidence and the highly vegetated and sediment covered nature of Wcvfs1, and the stream bed and banks, it is predicted that there will be no observable loss of stream flow over V Mains in Wallandoola Creek.

No observable surface water flow depletion has been recognised over previously subsided valley fill swamps in the lease area, and any loss that may occur would be mitigated by the plastic nature of the saturated, weathered sandstone substrate and the high organic sediment cover in the creek.

Subsidence cracks are not predicted in Wallandoola Creek. No significant, observable uplift is predicted within the channel of Wallandoola Creek.

Any modification of stream flow can affect the function and integrity of ecological systems, whilst enhanced recharge from streams to shallow ephemeral aquifers can raise the groundwater table and potentially dry up restricted portions of a stream. As no changes to stream flow are anticipated, there will also be no environmental consequences resulting from flow loss, particularly in the ephemeral tributary streams.

Lizard Creek

Lizard Creek is located outside the potential subsidence footprint. As such no observable loss in stream flow is anticipated in Lizard Creek adjacent to V Mains or in the first order tributary overlying Panel 309.

9.3.2 Stream Water Quality

The proposed mining is anticipated to have a negligible impact on stream water quality in the Wallandoola Creek or Lizard Creek catchments.

Due to the low levels of predicted subsidence and low associated strains and tilts, along with the lack of observed adverse effects from previous subsidence in the PAA, it is not anticipated that an adverse impact on water quality will occur over the proposed V Mains or Panel 309 mining areas.

9.3.3 Stream Bed and Bank Stability

A subsidence trough of up to 1.02m deep may develop between the Wallandoola and Lizard Creek channels (Seedsman Geotechnics, 2008). The Lizard Creek tributary over Panel 309 will have a less than 400mm deep subsidence trough.

The low degree of subsidence, and the low associated tilts and strains are anticipated to have a negligible environmental consequence on stream bed or bank stability in the Wallandoola Creek or Lizard Creek catchments.

9.3.4 Stream Pools

The predicted tilts are anticipated to have a negligible environmental consequence on stream pools in the Wallandoola Creek or Lizard Creek catchments.

Although the maximum predicted tilt of 6.1mm/m within V Mains exceeds the stream bed gradient of 0.8mm/m, the tilt would be oriented perpendicular to the reach of the stream, and therefore it is not anticipated that subsidence will oppose the stream gradient and that surface water pondage will not be adversely affected in terms of pool volume or retention time.

9.3.5 Upland Swamps

The predicted extraction of V Mains is anticipated to have a negligible environmental consequence on valley fill swamp Wcvfs1.

Swamps, however, can also be affected by variations in factors such as the geomorphic, hydrological, physical and biological processes in effect at the time of undermining, along with the climatic conditions at the time of, and subsequent to, subsidence.

Low water tables during extended dry periods, erosion in localised areas, the effect of bushfires and changes in sediment transport can all adversely affect upland swamps.

9.3.6 Gas Emissions At Surface

The dilation in the strata immediately beneath the base of a stream due to valley bulging is restricted to the shallow surface strata, up to 20m below the surface and does not provide a direct conduit for the release of gases from underlying, deeper strata.

Due to the previous extraction of the Bulli Seam and the associated subsidence and overburden cracking that may have previously occurred, the proposed secondary extraction of V Mains and Panel 309 are anticipated to have a negligible impact on potential gas emissions in the Wallandoola Creek or Lizard Creek catchments.

9.4 MITIGATION MEASURES

As adverse impacts on water quality are unlikely to occur as a result of subsidence and the following mitigation measures will be implemented, the project is considered to have a neutral effect on water quality.

9.4.1 Monitoring And Management

Mitigation measures recommended for the management of surface water systems within the V Mains area are detailed in the SMP and include:

- monitoring programmes including:
  - daily automated monitoring of selected pool water depths upstream, within and downstream of the V Mains area;
  - Water quality monitoring in Wallandoola and Lizard Creeks:
    - every 2 months prior to mining;
    - fortnightly during mining; and
    - monthly post mining.
  - stream water level, or spot flow monitoring and sampling conducted at all locations on the same day (as water quality monitoring); water depths in the stream monitoring sites should be automatically monitored and photographed during site visits;
  - trigger values for selected pollutants of concern should be set within the context of a Triggers Action Response Plan (TARP) after one year of full data is collected, and where the values are exceeded, the cause and effect of the exceedance should be investigated and a management plan developed if the cause is directly related to mining;
  - potential bedload movement in and downstream of the subsidence area visually monitored during and after significant flow events;
  - vegetation in the stream and banks visually monitored before and after any stream is undermined;
  - rainfall monitored daily at the mine and the nearest Bureau of Meteorology weather station for the duration of mining;
- an end of panel extraction report will be prepared, which summarises all monitoring over the period. The report will outline any changes in the surface water in the V Mains area; and
- results of the monitoring programmes will be reviewed one year after pillar extraction has been completed and an updated ongoing monitoring and remediation program will be developed in association with IIN, NOW and the SCA.

9.4.2 Rehabilitation and Remediation

A distinct advantage of the type of mining method (pillar extraction) is that progressive monitoring can be used to limit further extraction should the need arise.

If any unexpected adverse impacts occur as a result of subsidence on the streams over the proposed mining area, a Stream Rehabilitation Management Plan and Remediation Register will be implemented to manage remediation in accordance with approval from the SCA.

10 GROUNDWATER

This chapter provides an assessment of potential impacts on groundwater resources within the PAA resulting from the Project. Measures to manage these impacts are also provided.

10.1 INTRODUCTION

NRE commissioned GeoTerra to undertake a groundwater assessment for the V Mains area for the purposes of an SMP application (GeoTerra, 2009). The full version of the report has been included as *Annex F* and is summarised below.

In addition GeoTerra has prepared an assessment of the potential hydrological effects resulting from all proposed mining area. This assessment (GeoTerra, 2010) is provided in *Annex G*. This chapter focuses only on areas where subsidence may occur, being the 309 Panel and the V Mains.

10.2 EXISTING ENVIRONMENT

Three main aquifer systems are present in the Study Area, namely:

- unconsolidated, perched ephemeral colluvial aquifers within upland swamps;
- perched ephemeral aquifers within the dual porosity shallow Hawkesbury Sandstone; and
- deeper basement Hawkesbury Sandstone and underlying lithologies in a variable sequence of aquicludes and aquitards comprising mainly mudstones and shales and low yielding dual porosity aquifers in sandstones and coal seams.

Due to the steep topography and limited alluvium within the Cataract Reservoir storage, there is no notable groundwater bearing stream based alluvium in the study area.

The V Mains area is located within the Hawkesbury Sandstone - South-East groundwater flow system (GFS) within the Metropolitan Water Supply Catchment Area that includes Cataract Dam. This is the only recognised economic aquifer in the area. Water quality in the Hawkesbury Sandstone is good, but deteriorates rapidly towards the northern limits of the Southern Coalfield. In the vicinity of the NRE No. 1 Colliery, the salinity is generally in the range 1000-3000 mg/L.

The Hawkesbury Sandstone has relatively low yield although it has higher permeability compared to other units and is capable of higher groundwater yields. Groundwater flow through bedding discontinuities, fractures and joints predominates over primary rockmass porosity within the alternating sheet and massive facies, where flow is primarily horizontal.

No groundwater supplies have been obtained from sandstone aquifers within the V Mains area. However, it is possible that smaller, shallower, low yielding aquifers could be present near the surface as perched ephemeral aquifers.

Vertical continuity within the underlying Narrabeen Group is interrupted by the Bald Hill Claystone which is a major aquitard, whose thickness is consistent across the V Mains area. This unit retards vertical flow from the Hawkesbury Sandstone.

The base of the Narrabeen Group, at the top of the Bulli Seam, is marked by the Wombarra Claystone which is also an aquitard that limits vertical flow into workings. The Coal Cliff Sandstone lies between the two.

The Narrabeen Group is a much poorer aquifer than the Hawkesbury Sandstone, with no known use in the Southern Coalfield. The low permeability of the Narrabeen Group lithologies is substantiated by the common experience of "dry mines" in the Southern Coalfield.

Groundwater Dependent Ecosystems

Groundwater dependent ecosystems present within proposed mining areas include:

- terrestrial vegetation in upland swamps including Wcvfs1 which overlies the V Mains area. Swamp vegetation can be susceptible to changes in groundwater seepage inflow rates, the balance between rainfall and evaporation, the effect of bushfies and changes to the erosional regime;
- baseflows in streams, which can be affected by changes in groundwater seepage inflow rates to a stream and the balance between rainfall and evaporation.

10.2.2 Groundwater Monitoring

Water Levels

To date, groundwater investigations in the Study Area have involved the installation of 6 swamp piezometers, 7 open standpipe and 6 vibrating wire array piezometers with drilling extending to 325m below surface.

Perched groundwater levels within valley fill and headwater swamps have been monitored in the Study Area since July 2006 and range from no standing water after extended dry periods to depths of up to 1.8m below surface.

Water levels from open standpipe piezometers installed in the upper Hawkesbury Sandstone indicate that piezometers east of Cataract Reservoir are significantly more responsive to rainfall than to the west of the reservoir, with eastern group varying by up to 17.05m, whilst the western group vary by up 0.7m. Standing water levels across all bores range from 7.49 to 39.63 mbgl.

Water Quality

Upland swamps monitored have electrical conductivities ranging from 58 to 1121µS/cm. The pH range from 4.23 to 6.01 indicates a longer term trend to becoming more alkaline.

Monitoring indicates the swamp salinity is generally within the acceptable range for potable water, however is outside the ANZECC 2000 South Eastern Australia Upland Stream criteria for pH and can be above the ANZECC 2000 95% Species Protection Level for Freshwater Aquatic Ecosystem Guidelines for filtered copper, filtered zinc, total nitrogen and total phosphorous.

Groundwater within the upper Hawkesbury Sandstone ranges from 106 - 420µS/cm with a pH from 3.37 - 5.45. It is outside the ANZECC 2000 South Eastern Australia Upland Stream criteria for pH and can be above the ANZECC 2000 95% Species Protection Level for Freshwater Aquatic Ecosystem Guidelines for filtered copper, filtered zinc, filtered aluminium, total nitrogen and total phosphorous.

10.3 IMPACT ASSESSMENT

10.3.1 Aquifer / Aquitard Interconnection

Piezometer monitoring at NRE No.1, as well as across the Southern Coalfield, indicates that hydraulic connection of surface water, shallow perched or the regional Hawkesbury Sandstone aquifers through the Bald Hill Claystone into the underlying aquifers, or the mine workings will not occur above the proposed V Mains or Panel 309 workings.

Mining induced cracking and vertical subsidence of strata over the extraction area can occur up to 20m below the surface. This can alter the pre-mining horizontal flow along or above aquitards to generate a combination of vertical and horizontal flow regimes, as aquitards are breached and water drains from higher to lower strata. Vertical flow continues down the strata until the drainage is restricted by intact aquitards, at which point the flow then resumes its horizontal dominance.

Below the surface 20m deep cracked zone, an increased horizontal flow component can occur due to dilation and bending of strata, even though the layers are not actually breached by vertical cracking. The increased horizontal permeability extends across the subsided area, gradually diminishing as the subsidence and dilation decreases out to the edge of the subsidence zone.

No adverse interconnection of regional aquifers and aquitards is anticipated within 20m of the plateau surface as there are no recorded aquifers in this interval. There may be an increased rate of recharge into the shallow overburden following rainfall due to the increased secondary porosity and permeability of the cracked sandstone / shales. This can either result in higher discharge volumes and duration of temporary rain dependent seeps along cliff lines or higher recharge rates to underlying aquifers.

10.3.2 Groundwater Levels

Upland Swamps

Based on the lack of observed adverse effects on water levels and water holding capacity within previously undermined valley fill and headwater swamps at NRE No.1 Colliery, it is predicted that there will be negligible change in the water levels in the valley fill swamp WCvfs1 due to mining V Mains.

No swamps overlie the proposed Panel 309 extraction area.

Regional Groundwater

Temporary lowering of the regional piezometric surface, by up to 15m, over the V Mains and Panel 309 subsidence area due to horizontal dilation of strata may occur due to the increase in secondary porosity and horizontal permeability within the Hawkesbury Sandstone. This effect will be more notable directly over the area of greatest subsidence and dilation, and will dissipate laterally out to the edge of the subsidence zone.

Permanent post mining reduction in water levels within the Hawkesbury Sandstone is not anticipated as no new outflow paths from the subsidence area are anticipated as the subsidence areas are not within any eroded gorge sections of the creeks.

10.3.3 Seepage and Baseflow from Swamp Wcvfs1

Lowering of intermittent, perched water levels within the valley fill swamp Wcvfs1 may occur after extraction of V Mains through cracking of the underlying weathered sandstone, which would allow water to infiltrate into the underlying sandstone substrate.

Based on observation of previously undermined swamps at NRE No.1 and across the Southern Coalfield, it is not anticipated that the seepage volume, duration or baseflow to Wallandoola Creek will be adversely affected.

10.3.4 Stream Flow and Groundwater Interaction

The current interaction between surface water, perched and regional groundwater systems involves a net contribution of groundwater to the surface system in wet periods, while in dry conditions there is a net loss of surface water. The resulting surface flow depends on the relative balance between seepage inflow and outflow.

Groundwater seepage to the local streams can occur at isolated seeps along the creek beds after significant rainfall. The seeps are generally located at the interface between coarser and underlying finer sandstone or shale layers which restrict vertical flow through the bedrock and enhance lateral flow. Most observed seeps in the local streams are anticipated to flow at less than 1L/sec.

No significant change to groundwater inflow or outflow, to or from Wallandoola Creek over V Mains or the first order Lizard Creek tributary over Panel 309, is anticipated to occur on the basis that the:

- proposed extraction areas are relatively small areas which will be mined by pillar extraction, as opposed to longwall mining.
- previous Bulli seam mining has already depressurised this area;
- minor depressurisation that occurs over the proposed workings will not be transmitted to surface; and
- hydraulic fracture connection from the Bulgo Sandstone to the Hawkesbury Sandstone, through the Bald Hill Claystone is not predicted.

10.3.5 Potential Inflow to Mine Workings

Based on the low permeability of the Bald Hill Claystone and Stanwell Park Claystone aquitards both pre and post mining, it is predicted that there will be no discernible flow into the proposed workings. Vertical hydraulic connection to the workings is restricted by the Bald Hill Claystone aquitard, which will not be breached due to subsidence as it is below the depth of surface cracking and overburden bedding dilation.

Loss of stream flow or groundwater to the underlying workings has not been observed in any mines in the Southern Coalfield at similar depths of cover to the proposed V Mains or Panel 309 secondary workings.

10.3.6 Groundwater Quality

Observations at NRE No.1, and generally across the Southern Coalfields, indicate that groundwater quality within the Hawkesbury Sandstone or upland swamps has not been adversely affected by mining. However there may be increased iron hydroxide precipitation and a lowering of pH if the groundwater is exposed to "fresh" surfaces in the strata with dissolution of unweathered iron sulfide (marcasite).

The degree of iron hydroxide and pH change is difficult to predict, and can range from no observable effect to a distinct discolouration of the Hawkesbury Sandstone groundwater. It should be noted that the sandstone aquifer at NRE No.1 already has significant iron levels.

Acidity (pH) changes of up to 1 order of magnitude may occur, however the change will be reduced where the aquifer has sufficient bicarbonate levels.

Subtle changes may occur with regard to dissolved aluminium, nickel, zinc, iron or manganese levels through oxidation and dissolution of iron sulfide (marcasite) or iron carbonate (siderite) following localised subsidence induced fracturing within the aquifer.

Based on observations of groundwater over previous Bulli seam extraction areas in the PAA, the proposed secondary extraction of V Mains and Panel 309 is predicted to have a negligible impact on groundwater quality in the valley fill swamp Wcvfs1 and the regional Hawkesbury Sandstone aquifer.

10.4 MONITORING MEASURES

Adverse subsidence impacts on the groundwater resource are not expected to occur from the mining of the V Mains. However, monitoring measures are recommended for the management of groundwater as outlined in the V Mains SMP. These include:

- monitoring programs including:
  - standing water levels in Wcvfs1 (P6) will be measured:
    - daily prior to mining;
    - twice daily (automatic) and monthly (manual) during mining; and
    - quarterly post mining.

- at least one appropriately purged and collected, stored and transported groundwater sample will be collected from P6 to enable ongoing assessment of any subsidence related changes in groundwater quality at the following times:

  - bimonthly prior to mining;

  - monthly during mining; and

  - quarterly post mining

- mine inflows will be monitored through measurement of all water pumped into and out of the NRE No. 1 workings prior to, during and after the proposed mining period;

- an end of panel extraction report will be prepared, which summarises all monitoring over the period. The report will outline any changes in the surface water in the potential subsidence footprint; and

- results of the monitoring programs will be reviewed one year after pillar extraction has been completed and an updated ongoing monitoring and remediation program will be developed in association with the IIN, NOW and the SCA.

No significant impacts are expected to occur, as a result of the extraction of the 309 Panel.

10.4.1 Rehabilitation and Remediation

If any unexpected adverse impacts occur as a result of subsidence on the upland swamps over the proposed mining area, a Rehabilitation Management Plan will be implemented to manage remediation in accordance with approval from the SCA.

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11 SOIL AND WATER

This chapter provides an assessment of potential impacts on surface water resources surrounding the Russell Vale site resulting from the Project. It also addresses issues associated with geotechnical stability and erosion. Measures to manage these impacts are also provided.

11.1 INTRODUCTION

NRE commissioned Beca Pty Ltd (Beca) to undertake an assessment of the water management system for the NRE No.1 Colliery. The full report *Water Management Report NRE No. 1 Colliery, Russell Vale* and associated hydrology report has been included as *Annex A* and is summarised below.

NRE commissioned Coffey Geotechnics Pty Ltd (Coffey) to undertake a geotechnical assessment the Russell Vale site. The full report *Geotechnical Investigation Proposed Preliminary Works Coal Stockpile and Handling Facility Upgrade* has been included as *Annex H* and is also summarised below.

11.2 EXISTING ENVIRONMENT

11.2.1 Water Management

Management Systems

The existing water management system at the Russell Vale site has been described in *Section 2.6* and broadly includes:

- potable water – which is supplied by connection to the Sydney Water reticulated water supply;
- mine water – which is dewatered from mine workings and reused on site. Excess mine water is collected with stormwater, processed through the existing onsite treatment system and the excess is discharged in accordance with EPL 1240; and
- stormwater – clean water is diverted around the site, while dirty water is treated and reused on site with surplus treated on site and discharged (with mine water) to Bellambi Gully Creek accordance with EPL 1240.

Bellambi Gully Creek

Bellambi Gully Creek currently flows through the site via an underground pipe below the existing ROM stockpile. NRE currently holds an Environmental Protection Licence (EPL 12040) that allows discharge from a single licensed discharge point (LDP2) of treated water up to 2.5ML/d to Bellambi Gully Creek under dry weather conditions. The licence permits a greater than 2.5ML/d treated water discharge for only 72 hours post a rainfall event greater than 10mm in 24hrs. Bellambi Gully Creek flows from the Russell Vale site, under the Princes Highway, past several industrial premises, under the Northern Distributer, through residential streets, under the railway line, through Holy Spirit High School grounds. Bellambi Gully Creek then flows out into the ocean at Bellambi Beach, approximately 850m north of and in a separate catchment to Bellambi Lagoon. The stream length is approximately 3km from LDP2 to Bellambi Beach and comprises either culverts under main transport structures and roads, or a disturbed creek bed, through urban areas.

The natural flow through Bellambi Gully Creek is highly variable. The low lying area east of the Princes Highway is cleared of natural vegetation. The catchment is small and the gully reacts quickly to rain, rising rapidly and falling to a trickle for extended periods.

Water Quality

Water quality sampling in Bellambi Gully Creek and discharge into the gully is summarised in *Table 11.1.*

Table 11.1 Water Quality Bellambi Gully Creek

Analyte	Bellambi Gully Creek [1]	Russell Vale Discharge LDP2	ANZECC [2] Guidelines	Licence
pH	8.1-9.2	7.1-9	6.5-8(9)	6.5-9.2
Oil & Grease mg/L	<0.1	<0.1	-	10
Total Dissolved Solids mg/L	1220-1900	1100-1900	125-2200	-
TKN mg/L	0.4-0.9	0.4-1.1	0.5	-
TP mg/L	0.08-0.3	0.03-0.12	0.05	-
TSS mg/L	1-52	13-27	-	50

1. From Wollongong Northern Coastal Creeks and Lagoons report by WBM January 2006 and NRE testing
2. Australian and New Zealand Environment Conservation Council's Guidelines for Fresh and Marine Water Quality, lowland rivers (ANZECC)

11.2.2 Site Stability

The natural escarpment slopes and steep side slopes of the valley areas within the elevated parts of the Russell Vale site are generally underlain by talus, colluviums and residual soils. These slopes have also been modified significantly by filling and excavations in the past, particularly above the central valley area uphill of the stockpile site (the 'western fill area').

Coffey has carried out a number of geotechnical assessments within the NRE No.1 Colliery over the past 20 years. Previous studies indicate that the hillside areas of the escarpment and footslope areas present various levels of landslide risk and the types of landslide that could occur, ranging from small slumps in fill batters and watercourse banks to large scale failure of the western fill area and talus/colluvial slopes on the upper escarpment slopes.

Coffey (2010) has divided Bellambi Gully Creek into 5 sections. The conditions of each section and other areas of proposed work at the Russell Vale site are summarised in *Table 11.2*

Table 11.2 Site Stability

Location	Surface Condition	Subsurface condition
Section 1 – Upper Portion of Bellambi Gully Creek	This section of the gully has been substantially modified by manmade activities, and has experienced significant erosion of its floor and banks, mainly during major rainfall events on the escarpment. Local slumping of the steep banks has occurred particularly where runoff from the western fill area occurs.	The general subsurface conditions comprise local fill (mainly coalwash), overlying colluvium and/or talus that comprise cobbles and boulders in a silty to gravelly clay matrix. The fill materials have eroded and collapsed along the northern banks where they occur. The natural soils exposed are generally stiff or very stiff and prone to erosion and slumping when oversteepened.
Section 2 – Bellambi Gully Creek Below Bulli Conveyor	This section of the gully is mainly natural gully floor except for a concrete lined area which includes a number of sandstone boulders embedded into the concrete. The remainder of the gully floor has a rocky floor comprising mainly including sandstone cobbles and boulders.	This section of the drainage channel passes through a largely natural gully incised into talus/colluvium with numerous sandstone cobbles and boulders exposed. No significant exposures of bedrock were observed over the bed or banks of the watercourse.
Section 3 – Diversion Channel Downstream of Culvert Headwall	Parts of the hillside over the alignment of the proposed bypass channel and also above and below the channel have been modified by previous excavations and filling. Coffey (2010) is aware of previous erosion, seepages and slumping over parts of this slope. It is likely that the seepages originated from water stored in the Dam No.6 near the crest of the ridge.	Subsurface investigations have been carried out over the hillside above and below this section of the proposed diversion channel. The test pits over the lower slopes uphill of the diversion channel indicate local fill (remnants from coal stockpiles) overlying stiff to very stiff silty clays up to about 1m thick, with extremely weathered rock of volcanic origin occurring below the residual soils.
Section 4 –	This section of the channel continues	This section of the channel comprises

Location	Surface Condition	Subsurface condition
Diversion Channel East of Stockpile	along an access track above a steep batter. This batter exposes soil and weak rock, and has experienced some localised slumping and erosion.	extremely to highly weathered thinly bedded siltstone or sandstone with carbonaceous shale or coal evident. Some local slumping of this batter has occurred. This section of the channel also crosses a shallow gully or depression on the hillside that may include some fill from previous coal stockpiles in the area.
Section 5 – Diversion Channel Eastern End of Section 4 Down to Stilling/Dissipation Basin	The ground surface over this area has been modified by excavations for the access road and also filling has occurred.	A test pit in the elevated area east of the proposed channel encountered very stiff to hard clay overlying highly weathered shale at a depth of about 1.3m. Boreholes within the proposed dissipation pond, encountered deep coal waste including tailings overlying stiff to very stiff clay where weathered sandstone was encountered.
Coal Sizing Plant	There is a small terraced area uphill of the proposed sizing plant under the conveyor and a steep batter below this terrace that appears to comprise mainly spill materials from the conveyor and earlier coal stockpiles in the area. Weathered rock is exposed along the uphill (cut batter) side of an access track up the north-western side of the existing conveyor.	The site for the proposed coal sizing plant is expected to be underlain by fill comprising coal spillages from the existing Bulli conveyor. Colluvium comprising silty to gravelly clay with cobbles and boulders may be encountered beneath the fill.
Coal Stockpile and Conveyor/Sizer Access Road Upgrade	The proposed coal stockpile is located about 50m to east (downslope) of the toe of the western fill area. The hillside area to the west comprises part of an existing access road, drainage collection area and terraced western fill area. The western fill area has been revegetated and has a good cover of trees and undergrowth. The slopes to the north of the stockpile site comprise part of the western fill area and an area covered in thick vegetation. An access road crosses the slope on a cut to fill terrace.	Previous subsurface investigations indicate fill up to 5.7m deep and rock at about 6.5m. Subsurface conditions are expected to be variable beneath the proposed stockpile, comprising coal and coalwash overlying alluvial and colluvial deposits made up of soils including clays, silts, sands and gravels with some cobbles and boulders. Groundwater inflows would be expected within the fill and underlying natural soils. The proposed haul road will cross a well defined ridge and over the crest and northern sideslopes. Rock is expected to occur at relatively shallow depths of less than 2m except where fill occurs.

11.3 IMPACT ASSESSMENT

11.3.1 Water Management

Water Quantity

Bellambi Gully Creek is highly urbanised and disturbed, though relatively well vegetated in sections. The discharges of water from the mine will be less than the flow experienced during high rainfall events. Erosion in Bellambi Gully Creek associated with mine water discharge would be insignificant compared with the flows experienced during high rainfall events.

The water balance by Beca (2010) shows that currently during dry weather conditions approximately 15kL/h of water could be discharged to the creek. This compares favourably with the 20kL/h hour average calculated from actual discharge data for the period July 2008 to June 2009. It is understood that the difference is probably made up of a small amount each for the mine water make and the dirty stormwater stream. These streams were assumed to be zero for the purposes of this balance.

This application is for Stage 1 Preliminary Works on site. The project will not result in a change in the amount of mine water make or the catchment of Bellambi Gully Creek. That is to say that the Project will not result in a change to the amount of water discharged into Bellambi Gully Creek. NRE propose to investigate further potential for water reuse on site as part of the Stage 2 project.

Water Quality

Results of monitoring indicate that while Russell Vale LDP2 and Bellambi Gully Creek water quality sometimes exceed ANZECC freshwater guidelines for lowland rivers, it has a similar water quality to the background water quality in the creek and other creeks in the area (see *Annex A* for water quality of similar creeks).

Current discharge concentrations for total phosphorus are less than background levels in the creek. Algae growth or other biological growth (caused by excess amounts of phosphorus) is more pronounced in stagnant water. Discharging some water through the creek reduces this stagnation and may reduce the associated algal growth.

The Project involves no change in the predicted quality of the water to be discharged at LDP2. As part of the Stage 2 project NRE propose to investigate further water treatment on site, including the potential for further separation of process water and dirty storm water as appropriate. An investigation for improving the management of solids from the water treatment plant on site is also proposed in Stage 2.

The new channel has been designed having regard to the recommendations outlined in both *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004) and *Managing Urban Stormwater: Soils and Construction Volume 2E Mines and Quarries* (Dept. Of Environment and Change 2008). (Beca 2010). The primary focus of the concept is that clean upper catchment flows will be diverted around the operational areas to minimise dirty water treatment volumes.

Flooding

Construction of the proposed Bellambi Gully Creek channel will not result in a change to the catchment or the amount of water flowing through the Creek. The channel is not designed to retard large rainfall events, but rather to improve water quality and flows through the site. As there will be no change to the volume of discharge, there is no potential for the project to increase downstream flooding.

The new channel will result in providing a means by which clean and dirty water across the site will be better separated. It will convey clean water from the escarpment through the site and keep it clean, reducing potential contamination with coal and other sediment. Cleaner water reduces the risk of blockages downstream and the risk of out of channel flows.

A dissipation pond will be constructed at the eastern end of the channel to reduce the velocity of water flowing down the channel and to assist in solids management, prior to leaving the site.

It is noted that there have been incremental changes made to the channel downstream of the Russell Vale site. These changes may have the potential to impact flooding of the creek in this downstream section, however these potential issues and remediation, should they be required, are out of the control of NRE and have not been addressed as part of this proposed new channel alignment.

11.3.2 Stability

Bellambi Gully Creek Realignment Channel

The stability of the slopes over the proposed Bellambi Gully Creek channel varies considerably from low risk at the eastern end, to high or very high risk over the elevated western end. The types of landslide that may affect the drainage channel include the following:

- deep seated movement of the soil mass in the steep hillside areas in Sections 1 to 3;
- oversteepening due to erosion and subsequent collapse of the banks that currently expose fill and natural soils in sections 1 and 2;
- relatively shallow landsliding over the sideslopes of the ridge due to oversteeping of the slope where cut and fill batters occur in Sections 3, 4 and 5; and
- creep movements of the soil mass on the steep slopes.

Proposed Coal Sizing Plant, Stockpile and Conveyor/Sizer Access Road Upgrade

The coal sizing plant will be located on a steeply sloping area adjacent to the Bulli Conveyor. There is currently a moderate risk of landslide activity in this area, mainly associated with the loose fill.

The coal stockpile site has been positioned about 50m away from the toe of the re-vegetated western fill area. There remains some risk of landslide within the western fill area, however improvements to surface and subsurface drainage, the revegetation of this area and the provision of a buffer zone between the stockpile and toe of western fill area will reduce the risk of the stockpile being affected by a landslide in the western fill area.

The proposed haul road will cross relatively steep slopes that are underlain by locally deep fill and local instability has occurred on these fill slopes.

11.3.3 Erosion

The following excavations may have the potential to result in erosion and sedimentation

- **Construction of the Bellambi Gully Creek realignment channel** – will involve excavation of a new channel approximately 1.2m deep, 2.5m wide for 750m. Construction of the channel will also require the removal of Dam 6 and regrading of surrounding areas.
- **Construction of the new Wongawilli decline conveyor** – will involve a small amount of excavation for the placement of gantry poles.
- **Construction of the new internal haulage road** – will involve excavation and levelling of the area east of the existing stockpile.

11.4 MANAGEMENT AND MITIGATION MEASURES

11.4.1 Water Management

A number of management measures are already in place at NRE No.1 Colliery to improve the quality and quantity of discharge water. These measures are:

- treatment of dirty stormwater and mine water on site prior to discharge. TSS is reduced to less than 50mg/L;
- diverting dirty stormwater from hard surfaces into the stormwater control dam (SWCD) and storing in the SWCD prior to treatment and then reuse or discharge via LDP2. This reduces solids, but also holds the water in the dam, reducing flow rates through Bellambi Gully Creek during storm events;
- keeping the SWCD at a level that allows 30ML of stormwater to be captured on site, reducing the flow and flood potential downstream; and
- properly storing and bunding chemicals. Dosing of flocculent is metered and monitored on site. Trigger points are used to manage the flocculent dosage level.

Mitigation measures that will be implemented as part of this project are:

- removing the underground pipe section of Bellambi Gully Creek and replacing it with a suitably designed and engineered open bypass channel constructed on the southern side of the coal stockpile area. This will result in better separation of clean and dirty water on site and a reduced risk of uncontrolled flows across the site;

- a dissipation pond will be suitably constructed with an overflow at the end of the channel to reduce the energy of flows along Bellambi Gully Creek;

- upgrades to a small section of the existing channel, including suitably engineered and designed structures to reduce the velocity of water flowing down the gully, and hence erosion potential; and

- existing and proposed channels will be maintained regularly to reduce debris build up and ensure integrity and there by minimise scouring and obstructions to flows during major flow events.

11.4.2 Stability

Mitigation measures required to manage stability of the Russell Vale site include:

- Section 1 of Bellambi Gully Creek will be lined with reno-mattresses, reinforced concrete and energy dissipation structures at culverts. The concrete base will use turned down edge beams to key into the natural surface. Reno mattress will need to be tied down by anchors extending at least 2m into the bed;

- the banks of Section 1 of Bellambi Gully Creek will be protected by concrete or gabion walls stepped up the banks and tied into the concrete base. The lining of the banks will extend to within 2m of the highest point of each bank and at least 1.5m above the highest expected flow level. The upper 2m of the watercourse banks will be trimmed where possible to batters no steeper than 2H:1V. These trimmed batters will be lined with shotcrete;

- the bed and banks of Section 1 of Bellambi Gully Creek will be trimmed to a suitable grade for lining and large durable sandstone boulders where available will be embedded into the concrete base for energy dissipation;

- concrete drop structures and/or lined spillways will be constructed from culvert outlets in Section 1;

- the culvert under the Bulli conveyor will be upgraded to include the use of concrete drop structures and lining;

- a new headwall or dam wall will be constructed at the mouth of the channel, in conjunction with a stilling basin/debris trap. The dam wall will be keyed into the floor and banks of the watercourse socketing into rock;

- the upslope side of the channel will be designed as a retaining wall;
- the hillside above and below the channel will be reshaped to reduce the thickness and extent of soil to provide a bench or terrace within which the drainage channel can be constructed. The re-shaped slope will be top dressed and re-vegetated following the earthworks;
- where required the channel will be supported on footings socketed into highly to moderately weathered rock. These footings will be shear walls/beams aligned perpendicular to the contours;
- the design of the steep section of the slope at the take-off point (western end of Section 3) will be subject to detailed subsurface investigation;
- unretained batters in stiff clay soils or weak rock will not be steeper than 3H:1V. Unretained batters in highly to moderately weathered rock will not be steeper than 2H:1V;
- energy dissipation will be implemented along the concrete lined channel and before entering the dissipation pond at the eastern end;
- surface water from the slopes above the channel will be intercepted and diverted appropriately to the channel;
- the screening and sizing station will be supported on bored piles socketed at least 3m into highly to moderately weathered rock with a serviceability bearing capacity of at least 1500kPa at the base of each pile. The piles will be structurally tied at the surface by a reinforced concrete 'floor' slab or by reinforced concrete tie-beams;
- a retaining wall will be constructed along the uphill side of the coal sizing plant;
- fill placed in the existing stockpile area will be supervised by an engineer in accordance with AS3798. The select fill should be placed and compacted in 200mm layers (compacted thickness) to a minimum dry density ratio of 100% as per Standard (AS1289 5.1.1). Existing loose materials and remains of any previous structures will need to be removed to expose stiff natural soils or dense fill materials before placing any select fill;

- batter slopes for the conveyor/sizer access road upgrade will not be steeper than 2H:1V in very stiff clays or extremely weathered rock, and not steeper than 1H:1V in highly to moderately weathered rock. Batter slopes for well compacted granular fill should not be steeper than 2H:1V. For batter slopes higher than 3m, further design requirements will need to be considered, including benching, drainage measures and possible erosion protection (e.g. by shotcrete); and

- a suitably qualified geotechnical consultant will review design drawings for the conveyor/sizer access road upgrade, including long sections, cross sections and design of batters and surface water drains.

11.4.3 Erosion

Erosion controls will be installed where there is potential for transport of sediments following excavation. Controls will be implemented in accordance with the *Soils and Construction Managing Urban Stormwater Manual* (Landcom, 2004, known as the "Blue Book") which will be retained on site at all times.

A Construction Management Plan will be prepared and include the following controls:

- works will not take place during heavy rainfall;

- undertake stripping of topsoil, if required, immediately before starting bulk earthworks and stockpile for rehabilitation or revegetation works on site;

- suitable areas for any temporary stockpiling of excavated soil and debris (on flat ground) will be clearly identified and delineated before the commencement of works;

- ensure stockpiles are:

  - constructed on the contour at least two (preferably five) metres from hazard areas, particularly likely areas of concentrated water flows or slopes steeper than 10 percent;

  - stabilised if they are to be in place for more than 10 days. The stockpile of VENM excavated from the construction of the bypass channel will be grassed;

  - protected from run-on water by installing water diversion structures upslope; and

  - installed with sediment filters immediately downslope to protect other lands and waterways from pollution (see *Figure 11.1*); and

- all erosion, sediment control and runoff diversion measures will be established before any excavation begins. These will be left in place throughout works execution and beyond works completion until all surfaces have been fully restored and stabilised.

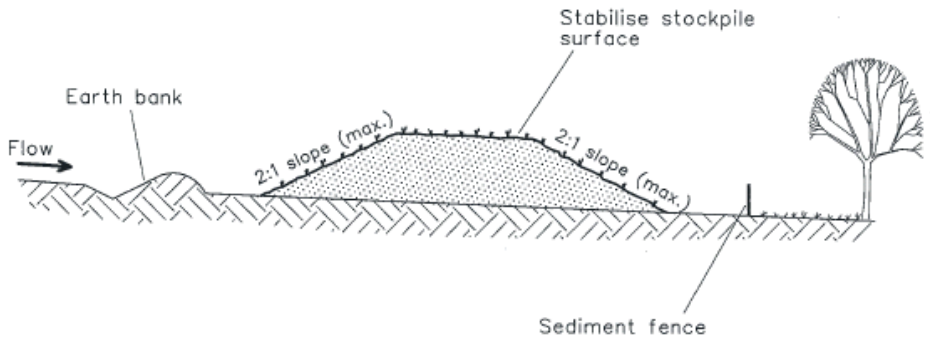


Figure 11.1 Construction of a Stockpile ***Source: the 'Blue Book'***

11.5 CONCLUSION

Water management at Russell Vale has been assessed considering potential impacts on the water quality and quantity in Bellambi Gully Creek. A comparison of water quality in Bellambi Gully Creek and similar creeks in the area indicates that the discharge from the site is not expected to significantly impact the water quality or quantity in the Gully over the next three years under current production rates.

The construction of the Bellambi Gully Creek channel will assist to reduce the risk of blockages in the stormwater system. A dissipation pond at the end of the newly constructed channel will aim at reducing the energy of the clean stormwater flowing across the site and down Bellambi Gully Creek.

The implementation of sediment and erosion controls during construction will maintain water quality of surrounding resources during construction.

As part of the Stage 2 Major Expansion Project NRE propose to investigate further water treatment and reuse on site, including the potential to further separate process water and dirty storm water.

NRE also anticipates undertaking further investigations for improving the management of solids from the water treatment plant on site.

12 AIR QUALITY

This chapter provides a summary of the air quality impact assessment including the potential impacts of the Project on the surrounding community. Measures to manage these impacts are also provided.

12.1 INTRODUCTION

An air quality assessment was undertaken for the Project by ERM, addressing operational activities at the Russell Vale site. The key potential air quality issues considered in this assessment are:

- total suspended particulates (TSP);
- particulate matter less than 10 microns (PM_{10}); and
- deposited dust.

The report was prepared in accordance with the DGRs and DECCW's assessment requirements. The air quality assessment was carried out in accordance with the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales*, DECC, August 2005.

This chapter sets out the key findings of the assessment. Further details are provided in the *NRE No. 1 Colliery – Preliminary Works Air Quality Assessment* presented in *Annex I.*

12.2 EXISTING ENVIRONMENT

12.2.1 General Meteorological Conditions

Meteorology plays a major role in determining the location and scale of off-site impacts of air pollutant activities. Meteorological files suitable for modelling using AERMOD have been prepared by ERM. The file utilises data on wind speed, wind direction and ambient temperature from an Automatic Weather Station (AWS) operated and maintained by the DECCW located in Wollongong, approximately 6 kilometres (km) south of the site.

Information as to the development of the meteorological file is included in *Annex I.*

12.2.2 Climate

Long term climatic data is available from a Bureau of Meteorology (BoM) weather station located, approximately 6 km south of the site. The data is presented in *Annex I.*

On average, January is the warmest month in Bellambi and the coolest month is July. The mean annual rainfall in Bellambi is 1039 mm. On average, February is the wettest month.

12.2.3 Background Concentrations

Background air quality is a measure of the existing air quality in the absence of the project activity. The background air quality is due to sources (natural or otherwise) other than the site.

Dust Concentration

In the absence of daily monitoring data for Russell Vale, the closest site at which the DECCW monitors particulate matter is at Wollongong, approximately 6 km south of the site. The Wollongong station continuously measures PM_{10} concentrations. Daily data for January to December 2007 has been provided by the DECCW.

To undertake a cumulative assessment of annual PM_{10} ground level concentrations, the annual average of the 24 hour Wollongong records has been used. The annual average PM_{10} concentration estimated from this data is 19.7 µg/m3.

A background concentration for TSP has been estimated at 50.4 µg/m3, based on a particle size distribution with PM_{10} being approximately 39.1% of TSP.

Dust Deposition

There is no background dust deposition data (i.e. data not including dust generated from the Colliery) available for the Russell Vale area. As such background dust deposition concentrations have not been included in the model.

Dust monitoring data is available from NRE, with monitoring locations shown on *Figure 12.1*. Data for the period August 2009 to July 2010 is provided in *Table 12.1*. This data does not identify background concentrations, but gives an indication of total dust depositions around the Russell Vale site from a variety of sources including the Colliery, coal trucks, other vehicles, fires and other land uses in the locality.

Table 12.1 NRE dust monitoring data August 2009 to July 2010

Monitor	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Annual monthly Average
G1 - Rear No.2 Broker St.	1.7	**5.8**	1.4	**10.9**	3.2	3.5	1.1	3.1	1.6	0.9	0.8	1.5	2.9
G2 - North End Midgley St.	2.0	**5.2**	**11.7**	2.1	2.0	1.4	1.3	1.0	1.3	0.3	0.9	0.4	2.5
G3 - Sydney Water Compound	**7.9**	**4.6**	1.1	3.4	2.1	3.1	1.5	2.0	0.9	0.4	0.8	0.5	2.4
G4 - SW Corner 30 West St.	0.9	**5.0**	0.4	2.4	1.2	1.4	0.7	1.2	1.0	0.3	1.0	0.5	1.3
G5 - Rear No. 22 West St.	1.0	**6.5**	0.7	1.8	1.9	1.1	0.9	1.1	1.3	0.6	0.4	0.8	1.5
G6 - Lyndon Drive	3.9	5	1.0	**10.8**	1.6	2.4	1.1	1.9	0.9	0.6	0.5	0.6	2.5
G7- Cnr Bellambi Lane & Princess Hwy	1.9	6	0.7	**4.6**	3.4	2.5	1.5	2.5	2.3	1.5	1.1	1	2.4
G8 - 95 Keerong Ave	1.7	2.7	0.9	3.9	4.4	2.4	0.7	2.3	1.7	2	0.7	0.9	2.0

1. All results indicate the amount of insoluble solids recoded and are presented in grams/m^2 /month

Note: the certain spikes as indicated in the results above are attributed to vandalism and the dust storm in Sept 2009

It can be seen from the data presented in *Table 12.1* with the exception of the spikes, that the dust deposition levels, inclusive of all activities in the vicinity of the Russell Vale site, are significantly lower than the DECCW annual monthly average criterion for insoluble solids of 4g/m^2/month.

12.2.4 Bellambi Lane

Bellambi Lane is a two-lane undivided local road. The northern side of the road is lined by residential properties and zoned for residential use. The dwelling houses have access from Keerong Avenue, with access to the Bellambi Lane denied by a high fence. Land use on the southern side of Bellambi Lane is a mix of residential and industrial. Land on the south side of Bellambi Lane is zoned Industrial (IN2).

Bellambi Lane is the start of the haul route for coal trucks from the site. Coal trucks leave the site via the Bellambi Lane/Princes Highway intersection and travel east approximately 725m along Bellambi Lane to the Northern Distributor.

Dust monitoring locations G7 and G8 are located at the corner of Bellambi Lane and the Princes Hwy and 95 Keerong Ave respectively and both capture dust generated on Bellambi Lane from coal trucks (in addition to the variety of sources discussed in *Section 12.2.3*).



Legend

- Project Application Area
- EPL Dust Monitoring
- Additional Monitoring Locations

Figure 12.1
EPL Dust Monitoring SItes

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS033_R0.mxd	
Date:	07/09/2010	Drawing size: A4
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

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12.3 EMISSIONS INVENTORY

A detailed emission inventory is presented in *Annex I.* Activities on site which are expected to generate particulate emissions include:

- ROM coal stockpiling;
- loading haul trucks;
- using on site unsealed haul roads; and
- transfer and handling of coal by mobile plant.

Activities which may have the potential to generate emissions but are minor and so have not been included in the model include:

- conveyor transfer of ROM coal to the stockpile;
- the screening and sizing plant;
- emissions from blasting; and
- emissions from ventilation shafts.

There is potential for dust to be generated as a result of trucks hauling coal offsite along the haul route. Since trucks from NRE make up a larger proportion of heavy vehicular traffic along Bellambi Lane and a small proportion along the remaining haul route, the focus has been Bellambi Lane. Dust generated as a result of the movement of trucks hauling coal along Bellambi Lane could be caused as a result of inadequate load covers, which is being managed by the enforcement of a drivers' code of conduct as described in *Section 12.6*.

Dust may also be generated through entrainment and drip waste. Historically, trucks were washed prior to leaving the site. As the trucks exited the site and travelled along Bellambi Lane dripping water containing dust particles can be deposited along the road. When the water dried a dusty layer may be left on the road which has the potential to be kicked up by other trucks, vehicles or the wind. NRE is trialling not washing trucks at all. Trucks are kept clean on site preventing the need for washing and thus avoiding drip waste. This is discussed further in *Section 12.6*.

Dust on Bellambi Lane will be managed as described in Section *12.6*.

12.4 DISPERSION MODELLING ASSESSMENT

12.4.1 Modelling Methodology

This assessment used the AMS/EPA Regulatory Model (AERMOD) dispersion model to predict potential emissions from the proposed operations. AERMOD is a steady-state plume model, which incorporates current understandings of flow and dispersion in complex terrain. The details of modelling methodology are provided in *Annex I*.

12.4.2 Model Receptors

A Cartesian grid has been set-up over the Russell Vale site and grid receptors spaced at regular intervals starting at 50 metres, and increasing to intervals of 500 metres, out to a distance of 5 kilometres from the mine.

A representative sample of nearby residences was chosen as discrete receptors in the modelling assessment. A detailed list of discrete representative receptors is presented in *Table 12.2*.

Table 12.2 Discrete Receptor Locations

Receptor	Description	Eastings [1]	Northings [1]
R1	6 Broker St.	306516	6196055
R2	29 West St.	306470	6196085
C5	Taylor Place	305889	6195417
C1	48 Lyndon St – West	305949	6195521
C2	48 Lyndon St.	306081	6195570
C3	Midgley St.	306558	6195596
R4	4 Broker St.	306746	6195951
C6	Robson St., Logger 2	306187	6195291
C4	Bloomfield Ave., Logger 3	306322	6195424
R3	Moreton St., Logger 1	306568	6196087

1. MGA Zone 56

The locations of the sensitive receptors are shown in *Figure 12.2*.



Legend

Project Application Area

1 Sensitive Receptor

Receptors

R1	6 Broker St.
R2	29 West St.
C5	Taylor Place
C1	48 Lyndon St – West
C2	48 Lyndon St.
C3	Midgley St.
R4	4 Broker St.
C6	Robson St., Logger 2
C4	Bloomfield Ave., Logger 3
R3	Moreton St., Logger 1

Figure 12.2
Receptor Locations

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No. 1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS016_R0.mxd	
Date:	23/05/2010	Drawing size: A3
Drawn by:	JF	Reviewed by: MK
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12.4.3 *Model Input Data*

The following information was collected for volume sources:

- source location coordinates;
- source length, width and height; and
- contaminant emission rates.

Annex I provides summaries of the model input data used for this assessment.

12.5 *IMPACT ASSESSMENT*

12.5.1 *Overview*

The dispersion modelling assessment uses contemporaneous meteorological and monitoring data – they both cover the period January-December 2007. This allows the (incremental) ground level concentrations predicted by the dispersion model on a given day to be added to the background data recorded at Wollongong on the same day for a cumulative assessment.

Table 12.3 presents a summary of the maximum predicted incremental ground level concentrations for the modelled receptor where highest concentrations were predicted.

The concentration contours presented in *Figure 12.3* to *12.5* show that the predicted concentrations are localised around the site and decrease rapidly with distance from the site.

Table 12.3 Maximum Incremental Ground Level Concentrations

Pollutant	Maximum Increment[1]	Background[2]	Cumulative	Criterion[3]	% of Criterion
Sensitive Receptors					
PM_{10} – 24 hour (µg/m³)[4]	2.28	49.00	**51.28**	50	**103%**
PM_{10} – 24 hour (µg/m³)[5]	26.17	19.10	45.27	50	90.5%
PM_{10} – Annual (µg/m³)	4.71	19.7	24.41	30	81.4%
TSP – Annual (µg/m³)	14.7	50.6	65.30	90	72.6%
Dust Deposition – Annual (g/m²/month)	0.16	2.9 [6]	3.06	2 (incremental) 4 (cumulative)	8%

1. Maximum increment has been estimated based on dispersion modelling.
2. Background data derived from the DECCW Wollongong TEOM monitoring data
3. Criteria are sourced from DECCW (2005) *"Approved Methods for the Modelling and Assessment of Air Pollutants in NSW"*
4. Predicted concentration on day of maximum background
5. Predicted concentration on day of maximum incremental concentration
6. Annual monthly average from last 12 months of NRE monitoring data at site G1. This does not represent a true background as it includes dust from the site.



Legend

- Project Application Area
- Sensitive Receptor

PM10 Concentration (µg/m^3)

- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- >60

Receptors

R1	6 Broker St.
R2	29 West St.
C5	Taylor Place
C1	48 Lyndon St – West
C2	48 Lyndon St.
C3	Midgley St.
R4	4 Broker St.
C6	Robson St., Logger 2
C4	Bloomfield Ave., Logger 3
R3	Moreton St., Logger 1

Figure 12.3
Concentration Contours – PM10 Maximum 24 hour Average

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No. 1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS017_R1.mxd	
Date:	03/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

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Legend

- Project Application Area
- Sensitive Receptor

PM10 Concentration (µg/m^3)

- 6 - 10
- 10 - 14
- 14 - 18
- 18 - 22
- >22

Receptors

R1	6 Broker St.
R2	29 West St.
C5	Taylor Place
C1	48 Lyndon St – West
C2	48 Lyndon St.
C3	Midgley St.
R4	4 Broker St.
C6	Robson St., Logger 2
C4	Bloomfield Ave., Logger 3
R3	Moreton St., Logger 1

Figure 12.4
Concentration Contours – PM10 Annual Average

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No. 1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS018_R1.mxd	
Date:	03/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
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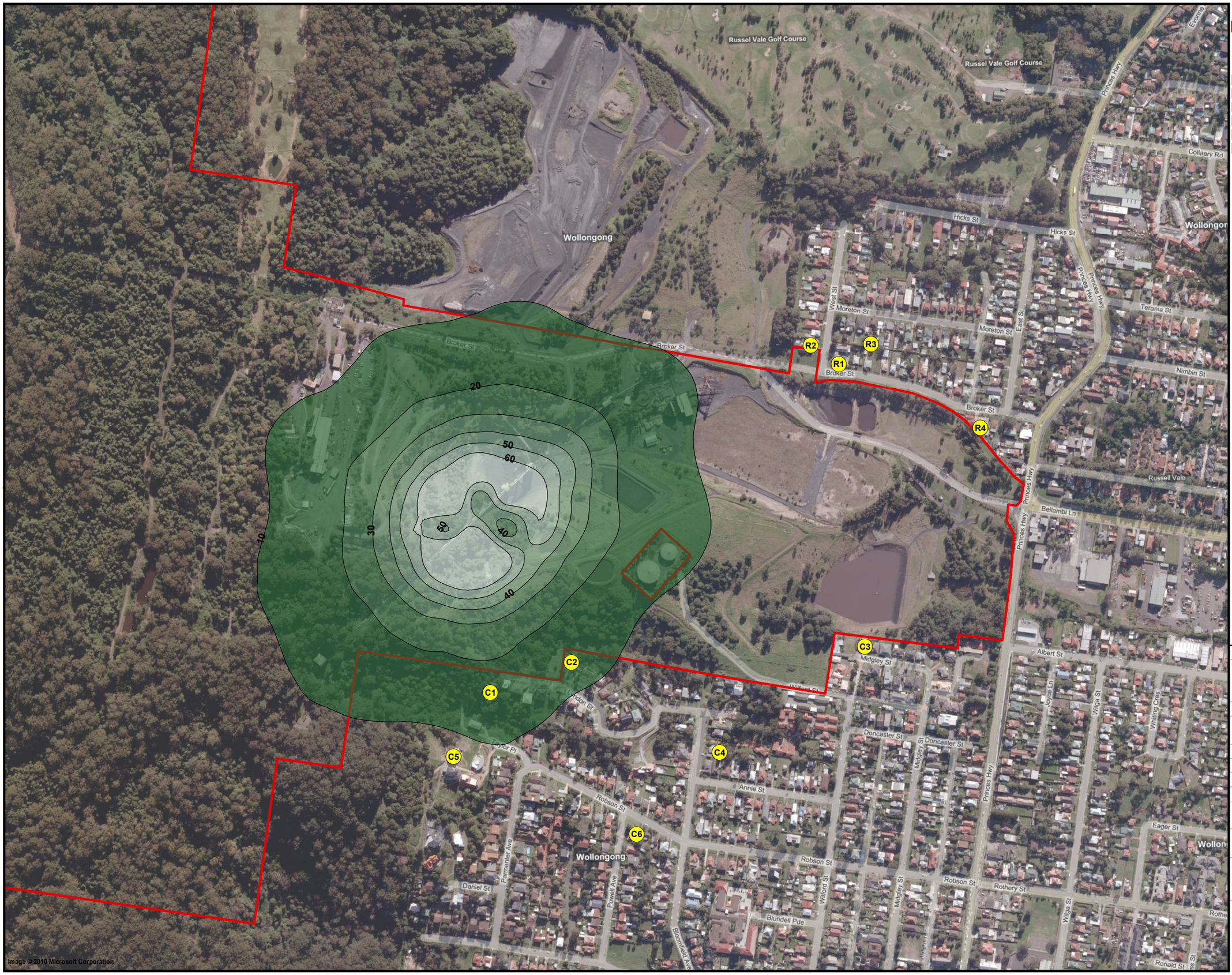
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Legend

- Project Application Area
- Sensitive Receptor

TSP Concentration ($\mu g/m^3$)

- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- >60

Receptors

R1	6 Broker St.
R2	29 West St.
C5	Taylor Place
C1	48 Lyndon St – West
C2	48 Lyndon St.
C3	Midgley St.
R4	4 Broker St.
C6	Robson St., Logger 2
C4	Bloomfield Ave., Logger 3
R3	Moreton St., Logger 1

Figure 12.5
Concentration Contours – TSP Annual Average

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No. 1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS019_R1.mxd	
Date:	03/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

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12.5.2 Short Term (24 Hour Average) Impacts

PM10 – Short Term (24 Hour) Average

The predicted ground level concentrations of PM_{10} (24 hour average) are below the DECCW nominated criteria when considered in isolation. The PM_{10} 24 hour criterion is exceeded on four occasions over the year when emissions are considered in conjunction with existing background concentrations.

The highest background recorded at Wollongong (below the NSW criterion) was 49.0 $\mu g/m^3$, and the maximum increment predicted by the modelling on that day was 2.28 $\mu g/m^3$ (at Receptor 1), giving a cumulative impact of 51.28 $\mu g/m^3$, representing 103% of the DECCW criteria.

The highest predicted incremental concentration at any sensitive receptor was 26.17 $\mu g/m^3$ predicted at Receptor 1. The background data recorded at Wollongong on that day was 19.10 $\mu g/m^3$, and the cumulative impact of 45.27 $\mu g/m^3$ represents 90.5% of the relevant criteria.

The NEPM guidance for PM_{10} 24 hour concentrations indicates that the criterion of 50 $\mu g/m^3$ may be exceeded 5 times in a calendar year. Given the extent of the data used in the assessment, the cumulative assessment undertaken using contemporaneous background data indicates that the mine is in compliance with NEPM guidelines.

12.5.3 Long Term (Annual and Monthly Average) Impacts

Total Suspended Particulates (TSP) – Long Term (Annual) Average

The predicted ground level concentrations of TSP (annual average) comply with the NSW assessment criterion of 90 $\mu g/m^3$ at existing sensitive receptors.

The maximum predicted incremental TSP concentration was 14.7 $\mu g/m^3$. The background level derived from monitoring data at Wollongong for 2007 was 50.6 $\mu g/m^3$, and the cumulative impact of 65.3 $\mu g/m^3$ represents 72.6% of the criterion.

Particulate Matter Less Than 10 Micron (PM10) – Long Term (Annual) Average

The maximum predicted incremental PM_{10} (annual average) concentration was 4.71 $\mu g/m^3$ at Receptor 1. The average background recorded at Wollongong for 2007 was 19.7 $\mu g/m^3$, and the cumulative impact of 24.41 $\mu g/m^3$ represents 81.4% of the criteria.

Dust Deposition

The predicted incremental ground level dust deposition rates comply with the NSW assessment criterion of an increment of 2g/m^2/month at modelled receptors. The maximum predicted increment was 0.16 g/m^2/month, which represents 8% of the incremental criterion.

Due to the lack of available DECCW provided background dust deposition data for the assessment area, a cumulative impact assessment is not possible. As a conservative approach, the predicted incremental ground level dust deposition rate has been added to the annual monthly average of NRE monitoring data (*Table 12.1*) to give an indicative cumulative dust deposition rate of 3.06 g/m^2/month. This figure is conservative as dust generated from the Colliery is counted twice, by adding the incremental prediction to the monitoring data. Notwithstanding this, the figures are within the DECCW criteria and represent 77% of the cumulative annual average criterion of 4g/m^2/month.

12.6 MANAGEMENT AND MITIGATION

A number of management measures are already in place to reduce the generation of particulate emissions. These measures are outlined as follows.

Nature of the Material

The inherent high moisture content (estimated at 7%), of the coal being extracted, reduces potential for dust emissions to atmosphere compared to other extracted materials.

Materials Handling

Coal is transported on site using a network of covered conveyors, which results in much lower emissions of dust than using onsite haul trucks to transport coal to the ROM pad.

Management of Exposed Areas

Exposed areas will consist of one main stockpile area up to a maximum of 2 hectares in area and the smaller storage yard/top flat area (~0.6 hectares). Water sprays will continue to be used on these areas to minimise air borne dust on an as needs basis.

Offsite Transport

Road haul coal trucks will be covered before leaving the site in order to minimize the potential for dust impacts due to product loss through wind erosion. Drivers are required to abide by the Driver's Code of Conduct which includes mitigation measures such as mandatory covering of trucks. NRE has committed to re–enforce the Driver's Code of Conduct, through continuing regular driver education (tool box talks).

To ensure dust emissions along coal haul routes are effectively managed, alternate truck washing arrangements are under consideration. These arrangements will ensure trucks are clean and dry prior to leaving the site, thereby reducing drip waste and dust impacts along Bellambi Lane, which is expected to reduce emissions to negligible levels. Possible truck washing arrangements may include:

- not washing trucks at all. NRE are currently trialling this option. Trucks arrive onsite clean and are kept on clean hardstand areas of the site. This negates the need for washing trucks and thus avoids creating drip waste; or

- washing trucks as they arrive on site. Trucks would be kept on clean hard stand areas and allowed to dry on site prior to leaving. Trucks would then exit the site once dry again avoiding the creation of drip waste.

12.7 CONCLUSIONS

A review and assessment has been conducted of the potential air quality impacts associated with the current operation and throughput of the NRE No. 1 Colliery, taking into account the proposed changes to coal handling facilities.

The results of modelling indicate:

- the project is predicted to comply with the long term DECCW air quality impact criteria for PM_{10}, TSP and dust at all receptors;

- the project is predicted to exceed maximum 24 hour average PM_{10} criterion on four days at one receptor, which is within the allowable five day exceedance limit;

- the highest predicted incremental concentration of PM_{10} (24 hour average) at modelled sensitive receptors was 26.17 µg/m3 representing 52.3% of the nominated criteria (50 $\mu g/m^3$); and

- the maximum predicted increment of dust deposition was 0.16 g/m^2/month, which represents 8% of the incremental criterion. The predicted cumulative dust deposition rate, using monitoring data as a conservative approach, was 3.06 g/m2/month, representing 77% of the criterion.

The project would therefore have no significant impact on the long term air quality parameters of dust deposition, annual average PM_{10} and TSP.

While a maximum of four exceedances of the DECCW short term air quality criteria (maximum PM_{10} 24 hour average concentration) of 50 µg/m^3 is predicted it unlikely that the project would have a significant impact on local air quality due to the following:

- the project was not the primary contributor for any of the exceedances. These predicted cumulative exceedances would largely result from windblown salt and other operations in and around the area;

- the modelling considers that a range of activities occur concurrently during the one 24 hour period, which can be considered a 'worst case' approximation of emissions from site activities. The maximum 24 hour increments are predicted when this worst case activity level coincides with worst case meteorological conditions.

A number of management measures listed in *Section 12.6*, many of which are already in practice, are proposed to ensure that emissions to the local air-shed are minimised. Fundamentally the coal stockpiling and related operations at the site represents the greatest potential source of dust. So, provided the trucks are clean and loads are covered, there is a reduced potential for dust generation.

13 GREENHOUSE GAS EMISSIONS

This Chapter provides an assessment of the greenhouse gas impact from the Project by estimating Project specific emissions, putting these into the context of Australia-wide emissions and presenting measures to minimise emissions and greenhouse gas impact.

13.1 INTRODUCTION

Emissions of greenhouse gases will result from activities associated with the Project. This chapter outlines the approach used to estimate emissions of greenhouse gases from the Project as well as an interpretation of the magnitude of these emissions.

In the context of this assessment, greenhouse gas emissions refer to the 'basket of six' greenhouse gases regulated by the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol:

- carbon dioxide (CO2);
- methane (CH4);
- nitrous oxide (N2O);
- hydrofluorocarbons (HFCs);
- perfluorocarbons (PFCs); and
- sulphur hexafluoride (SF6).

13.2 GREENHOUSE GAS LEGISLATION AND GUIDANCE

In Australia, the principal guidance for greenhouse gas emissions estimation is the Commonwealth Department of Climate Change's (DCC) *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines 2008*. The Technical Guidelines use emission factors from the DCC *National Greenhouse Accounts (*NGA*) Factors,* updated in June 2009. The NGA Factors provide a single source of current greenhouse gas emission factors for use by Australian organisations. The emission factors are also designed to be consistent with the emissions estimates reported in Australia's *National Greenhouse Gas Inventory*.

13.2.1 Direct and Indirect Emissions

Emissions of greenhouse gases from the Project can be categorised as 'direct' and 'indirect' emissions.

The NGA Factors adopts the emissions categories of the international reporting framework of *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* (WRI/WBCSD). These emission categories are as follows:

- *Scope 1* covers direct emissions from sources within the boundary of an organisation such as fuel combustion.

- *Scope 2* covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another facility. Scope 2 emissions result from the combustion of fuel to generate the electricity, steam or heat and do not include emissions associated with the production of the fuel. Scopes 1 and 2 are carefully defined to ensure that two or more organisations do not report the same emissions in the same scope.

- *Scope 3* includes all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned, or controlled, by the organisation (i.e. produced by third-party organisations outside of the Project Area).

13.2.2 Boundary of Assessment

The boundary for this greenhouse gas impact assessment has been defined as those emissions directly attributable to the proposed underground mining activities at the site, defined as 'the Project'.

The largest source of Scope 1 emissions for the Project, will result from coal seam gas (CSG) vented during underground coal extraction.

Scope 2 emissions will result from electricity consumption for onsite activities including: underground mining equipment, conveyor belt motors, overhead cranes in the workshop, compressors, ancillary equipment and administration facilities.

In addition to Scope 1 and Scope 2 emissions, this assessment will also consider Scope 3 emissions indirectly associated with the Project. Scope 3 emissions considered within the boundary of this assessment will result from:

- indirect emissions associated with the use of coal in off-site coke manufacturing processes;

- emissions associated with road transport of ROM coal to PKCT for export;

- emissions associated with shipping transport of ROM coal from PKCT to India; and

- indirect emissions associated with the extraction of fuels, to supply diesel.

Table 13.1 details the greenhouse gas emission sources included in this assessment.

Table 13.1 Greenhouse Gas Emission Sources included in this Assessment

Scope 1 – Direct Emissions	Scope 2 –Indirect Emissions from Purchased Energy	Scope 3 – Other Indirect Emissions
CSG vented during coal extraction	Electricity usage on site (machinery, conveyor belts, overhead cranes, compressors, ancillary plant and administration facilities)	Road transport of ROM coal product from site to PKCT & empty truck return journey
		Shipping transportation of ROM coal product from PKCT to India
CSG vented from coal extraction – post mining		Use of saleable coal as coking coal for steel manufacturing
Fuel use onsite – Diesel used in mining and processing equipment		Use of saleable coal as thermal coal for power generation
Diesel consumption from construction		Indirect emissions for fuel extraction associated with diesel supply

Of the emissions sources identified in *Table 13.1* it is important to note that Scope 1 and 2 sources are those under direct management control of NRE. That is, NRE is able to implement measures which will directly effect emissions associated with these sources - in the case of electricity usage, through reducing consumption.

Scope 3 sources are not under direct management control and therefore the opportunity to reduce emissions from these sources is less direct.

13.3 METHODOLOGY

The following assumptions have been made for the purposes of this assessment:

- the mine will continue using existing equipment and infrastructure for the extraction, stockpiling, and transportation of ROM coal. Some construction activities are anticipated, associated with the construction of a new conveyor (and ancillary equipment) and some environmental improvements on the Russell Vale site;

- ROM coal extraction is expected to be 1Mtpa;

- operational lifetime of the project, for the purposes of the Part 3A Assessment, will be 3 years, that being from 2011 – 2013;

- ROM coal will not be washed prior to transportation and, as such, volumes of coal transported to PKCT will also be up to 1Mtpa; and

- extracted coal is anticipated to be of varying grades. Therefore, of the ROM coal product shipped to India, 52.4% will be used as saleable coking coal and 28.6% will be used as saleable thermal coal. The remaining exported ROM coal, 19%, will be separated as waste product in India.

Table 13.2 details the emission estimates for Scope 1 sources.

Table 13.2 Scope 1 Source Annual Emission Estimates

Source	Timeframe	Activity Level	Scope 1 Emission Factor	Estimated Emissions (t CO_2-e)
CSG vented during coal extraction	Peak Year of Production [1]	1 000 000 t ROM coal mined	0.0105778 (tCO2 Vented/t ROM Coal Extracted) 0.7887487 (tCO2-e Vented from CH4/t ROM Coal Extracted.[2])	799 327
CSG vented from coal extraction (post mining)	Peak Year of Production	1 000 000 t ROM coal mined	0.014 co2-e/t product.[3]	14 000
Diesel Use – On Site Operations	Peak Year of Production.	622 kl	0.0699 - Emission Factor (tCO2-e/GJ)[4]	1 787
Diesel Use – Construction	1 Year of Construction	3.3 kl	0.0699 - Emission Factor (tCO2-e/GJ)	9
			Total	**815 123**

1. Given that ROM coal production is expected to be constant, at 1Mtpa, Scope 1 emissions are also expected to be constant throughout the operational lifetime of the project.
2. This report applies emission factors developed by the Site and used in 2009 NGER Annual Reporting based on Method 4, Section 3.6 '*NGER (Measurement) Determination 2008*'.
3. '*NGER (Measurement) Determination 2008*'. Method 1 - 3.17 - Subdivision 3.2.2.4 'Fugitive Emissions from Post-Mining Activities' = 0.014 co2-e/ t product
4. *Scope 1* Diesel fuel combustion emission factor taken from Table 4; '*NGA Factors, June 2009*'.

As highlighted in *Table 13.2*, fugitive release of CSG will represent by far the largest source of Scope 1 emissions from this project.

Table 13.3 details the emission estimates for Scope 2.

Table 13.3 Scope 2 Source Annual Emission Estimates

Source	Timeframe	Activity Level	Emission Factor	Estimated Emissions (tCO_2-e/ annum)
Energy from consumption of grid electricity.	Peak Year of Production (2013)	134 290.8 MWh/annum (Net Power Consumption)	0.81 (tCO_{2-e} /MWh)[1]	108 104
			Total	**108 104**

1. CO2 intensity of grid electricity in NSW is based on emission intensity modelling conducted by ACIL Tasman (2008). The assessment applies the modelling scenario 'business as usual', which models reductions associated with the Federal Government's Mandatory Renewable Energy Target (MRET) of 20% by 2020 but does not include modelling for any CPRS scenarios.

Table 13.4 shows the emission estimates for Scope 3 sources.

Table 13.4 Scope 3 Source Emission Estimates for Single Year of Production

Source	Consumption	Activity Level/Conversion Factor	Emission Factor	Estimated Emissions (tCO_2/annum)
Road transportation of ROM coal from the site to PKCT.	1Mtpa (1)	14.1 km journey. 58 800 trips/annum	0.546l/km (2)	1 221
Shipping transportation of ROM coal from PKCT to India.	1Mtpa	Assumed distance of journey: 12 000 km 6 shipping journeys/annum (3)	0.007 kg CO_2 per tonne km (4)	84 000
Use of saleable coal as coking coal for steel manufacturing.	80 524 tpa used as coking coal	0.752 Coking Coal Carbon content factor (tC/t fuel) (5)	2.757 (tCO_2-e/t fuel) (6)	1 444 317
Use of saleable coal as thermal coal for power generation.	285 714 tpa used as thermal coal	0.663 Black (Thermal) Coal Carbon content factor (tC/t fuel) (7)	2.43 (tCO_2-e/t fuel) (8)	694 571
Indirect emissions for fuel extraction associated with diesel supply.	659 kl/annum	25 434.33 (GJ annum)	0.0053 tCO_2-e (9)	135
			Total	**2 224 244**

1. Given that ROM coal production is expected to be constant, at 1Mtpa, Scope 3 emissions are also expected to be constant throughout the operational lifetime of the project.
2. Source – '*AGO Factors and Methods Workbook 2006'* Table 4: Fuel consumption rates for 'Heavy Trucks'. Heavy Trucks are assumed to be 'articulated trucks' by the Workbook.
3. Assuming shipping load capacity of 175 000 DWT.
4. UK, Department for Environment Food and Rural Affairs (Defra) greenhouse gas (GHG) conversion Methodology, 2008. Assuming 'Large Bulk Carrier'.
5. Based on 'coking coal carbon content Factor', '*NGA Factors, June 2009'*-Table 32: 'Solid fuels and certain coal based products'.
6. Applying standard carbon-CO_2 conversion of 3.667.
7. Based on 'black (thermal) coal carbon content factor', '*NGA Factors, June 2009'*-Table 32: 'Solid fuels and certain coal based products'.
8. See Footnote '6'.
9. Scope 3 diesel fuel combustion emission factor - *NGA Factors* 2008; Table 38.

13.3.1 *Summary of Total Project Emissions*

Figure 13.1 presents the percentage contributions of Scope 1, 2 and 3 emissions sources.

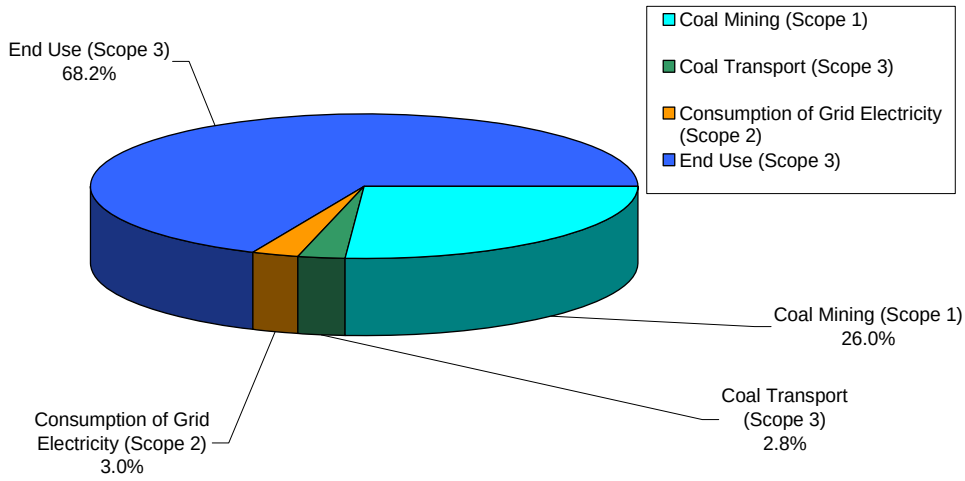


Figure 13.1 Greenhouse Emissions Sources – Scopes 1, 2 and 3

Scope 1 direct emissions for the project life of three years are estimated at 2 445 367 tCO_2-e, representing approximately 26 per cent of overall emissions from the project. Nearly all of the Scope 1 emissions are from CSG released during mining.

Scope 2 emissions for the project life of three years are estimated at 282 072 tCO_2-e, representing approximately three per cent of overall emissions.

Scope 3 emissions for the project life of three years will represent 6 672 35 tCO_2-e, or approximately 71 per cent of total greenhouse gas emissions associated with the Project.

Table 13.5 summarises the total estimated Scope 1, 2 and 3 emissions due to the Project.

Table 13.5 Summary of Greenhouse Gas Emissions for Project

Source	Estimated Total Emissions (tCO_{2-e}/annum)
Scope 1	
CSG vented during coal extraction	2 397 980
CSG vented from coal extraction – post mining	42 000
Fuel use onsite – Diesel use from mining and processing equipment	5 360
Diesel use - construction	27
Total	2 445 367
Scope 2	
Energy from consumption of grid electricity.	282 072
Total Scope 1 + 2	**2 727 439**
Scope 3	
Road transport of ROM coal product from site to PKCT	3 664
Shipping transportation of ROM coal product from PKCT to India.	84 000
Use of saleable coal as coking coal for steel manufacturing	1 444 317
Use of saleable coal as thermal coal for power generation	694 571
Indirect emissions for fuel extraction associated with diesel supply.	135
Total	6 672 735
Cumulative Total for Scopes 1,2 & 3	**9 400 174**

13.4 IMPACT ASSESSMENT

The Project is anticipated to mine 1Mtpa of coal over the three year operational lifetime (Note: total life of mine is approximately 30 years). Total greenhouse gas emissions for a single year of operations have been calculated at approximately 3 147 471 tCO_2-e, or; 9 400 174 tCO_2-e aggregated over the lifetime of the Project.

It has recently become clear that our climate is now changing at a rate unprecedented throughout much of human history. Significant increases in average global temperatures have been observed over the last half century. The scientific consensus is that human activity is the number one cause of these changes. The Intergovernmental Panel on Climate Change (IPCC), established by the World Meteorological Organisation and the United Nations Environment Program, has concluded that it is very likely that a variety of human activities which emit greenhouse gases (one of which is coal mining) are responsible for most of the observed increase in globally averaged temperatures since the mid-20th century (DECCW, 2010a).

Climate models indicate that further increases in greenhouse gases will lead to continued global warming, more heatwaves, fewer frosts, less snow and a rise in sea level. Rainfall over most parts of the world may increase, but some places in the mid-latitudes, including parts of Australia, may become drier. Vulnerable natural systems, such as alpine fauna and coral reefs, are likely to suffer most as a result of climate change (DCCEE, 2010).

National annual greenhouse gas emissions were estimated for Australia in 2007 at 597 156 550 tCO_2-e (DCCEE, 2010b). Total NSW emissions for the same period were estimated at 162 720 510 t CO_2-e (DCCEE, 2010b). Therefore, emissions from the Project (Scope 1 and 2) are estimated to be approximately 0.16% of the Australian annual total and 0.57% of NSW emissions.

13.5 MINIMISING ENERGY CONSUMPTION AND GREENHOUSE GAS EMISSIONS

13.5.1 Reducing Direct Project Emissions

The Federal Government intends to introduce a Carbon Pollution Reduction Scheme (CPRS) in Australia. Coal mining is expected to be included in the scheme, however, to-date, the Government has not been successful in passing CPRS legislation through Parliament. On 27 April 2010, the Federal Government announced that it would delay the introduction of its CPRS until 2013. If re-elected, it is expected that the Federal Government will continue to advocate a CPRS with a 2013 commencement date. It is unclear how changes to the introduction date will impact on recent amendments to the CPRS that propose to increase assistance to the coal industry. The Federal Opposition's stated policy position is to not introduce a CPRS if voted into Government. It instead has proposed a series of direct measures to reduce Australia's emissions profile without introducing a 'cap and trade' system.

The project has identified a number of opportunities to help mitigate the greenhouse gas emissions impact of the Project. These opportunities include:

- the efficiency of all mobile and fixed equipment has been considered during procurement for fuel-powered equipment and it is anticipated that there will be fuel efficiency gains associated with upgraded equipment;
- energy audits will be held when practicable to ensure that the mine is using current practice techniques to minimise energy use and is operating at optimum energy levels;
- site management will ensure that equipment is maintained to retain energy efficiency;
- the inventory of emissions developed for this assessment will be maintained;

- emissions and abatement strategies will be reported annually as part of internal environmental reporting and National Greenhouse and Energy Reporting System obligations;

- upgrade of trucking fleet to 38t trucks there by reducing the number of truck movements and GHG emissions; and

- NRE understand the CSG emissions make up the largest component of Scope 1 emissions and anticipates that the feasibility of mechanisms and technological processes to capture fugitive CSG will be formally assessed in 2015. Although out side the scope of this project, based on the outcomes of the assessment, it is expected that the site will investigate opportunities to capture and/or re-use ventilation gases.

These greenhouse mitigation and monitoring mechanisms and programmes will be used throughout the life of the proposed mining operations.

13.6 CONCLUSION

The assessment of total emissions over the lifetime of the Project (direct and indirect) have been calculated as being 9 400 174 tCO_2–e. Annual emissions are anticipated to peak in 2013, contributing 3 147 471 tCO_2–e to atmosphere.

Peak year direct greenhouse gases emissions (Scope 1 and 2) are estimated to be approximately 923 226 $tCO_{2\text{-}e}$/annum in 2013, meaning that the peak year greenhouse intensity of the Project will equate to approximately 0.92 $tCO_{2\text{-}e}$ for each tonne of ROM coal material extracted. Total direct emissions over the operational lifetime of the project are estimated at 2 727 439 $tCO_{2\text{-}e.}$

In calculating the direct emissions profile, it is estimated that the Project will contribute approximately 0.16 per cent of emissions to the Australian annual greenhouse gas emissions total and approximately 0.57 per cent of emissions to the NSW annual total.

This chapter has presented a number of measures, which will be undertaken by NRE to reduce the greenhouse gas intensity of the Project. Implementation of these measures may enable the site to further reduce the greenhouse gas intensity of Project beyond that presented in this assessment.

14 ACOUSTICS

This chapter provides a summary of the noise impact assessment of NRE No.1 Colliery including the potential impacts on the surrounding community. Measures to manage these impacts are also provided.

14.1 INTRODUCTION

A noise assessment was undertaken for the Project by ERM, addressing operational activities at the Colliery. The key elements considered in this assessment are:

- pit top/operational noise;
- noise associated with coal haulage;
- vibration; and
- construction noise.

The report was developed in accordance the DGRs and Department of Environment, Climate Change & Water (DECCW)'s assessment requirements. Accordingly, impact assessment, as described by the DECCW Industrial Noise Policy (INP) was carried out to determine potential impacts from the development and operation of the Project. Traffic noise generation associated with the Project on public roads is assessed in accordance with the DECCW's Environmental Criteria for Road Traffic Noise (ECRTN). Construction noise has been assessed in accordance with the DECCW's Interim Construction Noise Guidelines (2009) (ICNG).

This chapter sets out the key findings of the assessment. Further details are provided in the full *NRE No.1 Colliery Preliminary Works Noise Assessment* presented in *Annex J.*

14.2 EXISTING ENVIRONMENT

14.2.1 Sensitive Receivers

The nearest receivers to the proposed development are located to the north and north-east in Broker and West Streets, Russell Vale; to the south-east in Midgley Street, Lyndon Street and Taylor Street to the south in Corrimal. Representative receiver locations were chosen to provide an indication of the extent of potential noise emissions associated with the proposed development.

Noise monitoring and assessment locations were selected as representative areas for the noise sensitive receivers. *Figure 14.1* presents representative area locations, and noise monitoring locations are presented in *Table 14.1.*

Table 14.1 Noise Sensitive Receiver Locations

ID	Location	INP Classification	Coordinates (MGA zone 56)		RL m, AHD
			Easting	Northing	
C1	48 Lyndon St (west) Corrimal	Suburban	306041	6195588	65.55
C2	48 Lyndon St Corrimal	Suburban	306081	6195570	62.56
C3	Midgley St Corrimal	Suburban	306558	6195596	37.18
C4	Bloomfield Avenue Corrimal	Suburban	306322	6195424	45.27
C5	Taylor Place Corrimal	Suburban	305889	6195417	90.91
C6	Robson St Corrimal	Suburban	306187	6195291	55.08
R1	6 Broker St Russell Vale	Suburban	306516	6196055	36.86
R2	29 West St Russell Vale	Suburban	306470	6196085	39.02
R3	Moreton St Russell Vale	Suburban	306568	6196087	34.85
R4	4 Broker St Russell Vale	Suburban	306746	6195951	29.19



Legend

- Project Application Area
- Receiver Location
- Representative Receiver Location

Source:

Image © 2009 Google TM/Digital Globe

Figure 14.1

Sensitive Receivers

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383h_EA_PW_004_R1.cdr	
Date:	09/09/2010	Drawing size: A4
Drawn by:	JD	Reviewed by: MK
Scale:	Refer to Scale Bar	

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14.2.2 Background Noise

Unattended Continuous Noise Monitoring

Noise monitoring was undertaken by ERM using continuous noise loggers from 1 December 2008 to 25 December 2008 to determine existing ambient noise environment at the receiver locations. The background (L_{A90}) and amenity (L_{Aeq}) noise levels within the residential receiver areas adjacent to the study area were assessed using the results of this monitoring.

A summary of the results of the unattended continuous noise monitoring are provided in *Table 14.2*. Noise data during any periods of rainfall and/or wind speeds in excess of 5 m/s (18 km/h) at the microphone were discarded in accordance with INP weather-affected data exclusion methodology.

Table 14.2 Summary of Existing Ambient Background Noise Levels

Representative Locality	Description [1]	Rating Background Noise Level (RBL), LA90 dB(A) [2]	LAeq, Period, dB(A) [3]
R3 Moreton St, Russell Vale	Daytime	38	53
	Evening	34	49
	Night	32	47
C4 Bloomfield Ave, Corrimal	Daytime	37	53
	Evening	36	53
	Night	32	47
C6 Robson St, Corrimal	Daytime	39	63
	Evening	38	55
	Night	36	51

1. For Monday to Saturday, Daytime 7.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 7.00 am. On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am. Morning Shoulder is from 6.00 am - 7.00 am Monday - Saturday.
2. LA90 represents the level exceeded for 90 per cent of the interval period and is referred to as the average minimum or background noise level.
3. LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period
4. As per the INP Application Notes July 2006, the RBL for evening must not be greater than the daytime RBL, and the night time RBL must not be greater than the evening RBL. When this occurs the RBL is adjusted to the lower value and the measured value is shown in brackets.

Road Traffic Noise Monitoring

Unattended noise monitoring was undertaken to determine existing road traffic noise levels along Bellambi Lane. Noise monitoring consisted of a series of unattended continuous measurements conducted between 22 February 2010 and 4 March 2010 at 63 Bellambi Lane and 99 Bellambi Lane using environmental noise loggers.

The results of the unattended continuous noise monitoring at the two locations on Bellambi Lane are summarised in *Table 14.3*. The summary includes the L_{eq} or the average noise energy calculated over a fifteen hour period ($L_{eq, 15hr}$) and a one hour period ($L_{eq, 1hr}$).

Table 14.3 Summary of Existing Road Noise Levels

Location	Leq, 15hr, dB(A)	Leq, 1hr Day, dB(A)
63 Bellambi Lane	65	67
99 Bellambi Lane	63	64

14.2.3 Meteorological Conditions

Noise propagation over distance can be significantly affected by the prevailing weather conditions. Source to receiver winds, the presence of temperature inversions and drainage flow effects can enhance received noise levels. To account for these phenomena, the INP specifies meteorological analysis procedures to determine the prevalent weather conditions that enhance noise propagation in a particular area, with a view to determining whether they can be described as a feature of the project area. Meteorological conditions of the area are described in *Annex J.*

14.3 PROJECT SPECIFIC NOISE CRITERIA

14.3.1 Operational Noise

The acoustic environment is classified as suburban by the NSW INP. Therefore the 'suburban' assessment criteria have been adopted at the potentially affected receivers nearest the proposed development area.

The relevant intrusive and amenity noise criterion and resulting operational project-specific noise levels for the residential receivers surrounding the Russell Vale site, with respect to the background noise monitoring locations, are presented in *Table 14.4*.

Table 14.4 Project-Specific Noise Levels

Receivers	Period [2]	RBL LA90	Intrusive Criteria LAeq, 15min	INP Recommended LAeq	Adjusted [3] Amenity Criteria LAeq, Period	PSNL LAeq, 15min
R1 R2 R3 R4	Daytime	38	43	55	55	43
	Evening	34	39	45	45	39
	Night	32	37	40	40	37
C1 C2 C3 C4	Daytime	37	42	55	55	42
	Evening	36	41	45	45	41
	Night	32	37	40	40	37
C5 C6	Daytime	39	44	55	55	44
	Evening	38	43	45	45	43
	Night	36	41	40	40	40

1. All levels are dB(A)
2. Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night 10.00 pm to 7.00 am. On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am
3. Recommended LAeq refers to an adjusted amenity criterion which accounts for existing industrial noise.

14.3.2 Sleep Disturbance

The relevant sleep disturbance criterion for the residential receivers surrounding the area is presented in *Table 14.5*.

Table 14.5 Sleep Disturbance Criteria

Representative Locality	Representative Receivers	RBL LA90,15min, dB(A) [1]	Noise Level LA90,15min, dB(A)
R3 Moreton St, Russell Vale	R1, R2, R3, R4	32	47
C4 Bloomfield Ave, Russell Vale	C1, C2, C3, C4	32	47
C6 Robson St, Russell Vale	C5, C6	36	51

1. Night time only

14.3.3 Road Traffic Noise Criteria

Due to recent extension of the Northern Distributor to Bulli, Bellambi Lane would now be considered to be a collector road for the purpose of this assessment; hence road traffic impacts along Bellambi Lane will be indicative of worst-case noise impacts relating to traffic noise.

The relevant road traffic noise criteria for the roads associated with the proposed operations are provided in *Table 14.6*.

Table 14.6 Road Traffic Noise Criteria

Type of Development	Criteria		Where Criteria are Already Exceeded
	Day 7.00am - 10.00pm	Night 10.00pm - 7.00am	
Northern Distributor	60 dB(A) LAeq, 15hr	55 dB(A) LAeq, 9hr	Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.
Bellambi Lane	60 dB(A) LAeq, 1hr	55 dB(A) LAeq, 1hr	

14.3.4 Construction Noise

A quantitative assessment methodology has been adopted for the potential construction noise impacts associated with the proposed development in accordance with the ICNG. The proposed project specific construction noise criteria are presented in *Table 14.7*.

Table 14.7 Project Specific Construction Noise Criteria

Representative Locality	RBL, LA90 [1]	Noise Level LAeq, 15min, dB(A) [1]
R3 Moreton St, Russell Vale	38	48
C4 Bloomfield Ave, Russell Vale	37	47
C6 Robson St, Russell Vale	39	49

14.3.5 Vibration

Potential vibration sources include movement of coal trucks. The coal transport route passes local residences, in particular along Bellambi Lane. Based on historical assessments for similar vehicle movements and receiver offset distances, vibration levels at this distance are expected to be less than 0.2 mm/s, which is the human threshold of perception of vibration. As a result vibration impacts associated with truck movements are predicted to comply with DECCW criteria and are expected to have minimal impact on the community.

14.4 EQUIPMENT AND DESIGN MITIGATION

Due to the close proximity of the Russell Vale site to residences in Russell Vale and the Corrimal area, the implementation of low noise equipment will be essential to meet the appropriate INP noise goals. The acoustic design parameters for acoustically significant plant and equipment for the Project are presented in *Annex J*.

Based on the outcomes of preliminary modelling, the following mitigation measures were incorporated in the model:

- a 3 m high barrier/ bund on the north side of the haul route to south of Broker Street, Russell Vale across the intersection with West Street; and
- a 3.6 m high roadside barrier on the north side of the haul route from the weighbridge to Princes Hwy.

The locations of these mitigation measures are presented in *Figure 14.2*. The final design and location will be subject to local site constraints and limitations particularly considering site infrastructure and services such as powerlines, pipelines and site access constrains.



Legend

- Project Application Area
- Barrier Location

Source:

Image © 2009 Google TM/Digital Globe

Figure 14.2

Location of Mitigation Measures

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383h_EA_PW_005_R1.cdr	
Date:	09/09/2010	Drawing size: A4
Drawn by:	JD	Reviewed by: MK
Scale:	Refer to Scale Bar	

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14.5 NOISE MODELLING

The noise model incorporated identifiable and significant noise source data, meteorological data, surrounding terrain characteristics and the effects of proposed barriers. The model uses this information to predict the contributed noise levels from the proposed operations at the nearest potentially affected receivers.

Sound Power Levels (SWL) of acoustically significant plant and equipment associated with the Project have been incorporated into the noise model.

14.5.1 Operational Modelling Scenarios

The noise model was run for daytime, evening and night time operations based on normal operations with the proposed haul road for evening period ROM stockpile loading. The modelling incorporated the assumptions outlined in *Table 14.8*.

Table 14.8 Normal Operations – Equipment Use and Operating Hours

Equipment	Hours of operation	% of time operating	Comment
1x dozer	7.00am to 6.00pm Mon to Fri 8.00am to 6.00pm Sat	60% of operational hours	The Dozer will push sized coal into the re-claim points for loading into the trucks via the existing truck loading infrastructure
1x excavator 345	7.00am to 10.00pm	60% of operational hours	-
Existing conveyors	24x7	100%	Covered
Proposed conveyor	24x7	100%	Enclosed
New sizer	27x7	100%	Enclosed
Existing truck loader	7.00am to 6.00pm Mon to Fri 8.00am to 6.00pm Sat	100% of daytime hours	10 trucks per hour
Evening operating loading from ROM stockpile	6.00pm to 10.00pm [1]	100% evening hours	6 trucks per hour along revised haul route
1. Trucking in the evenings Monday to Friday and on Sunday will only be used in rare circumstances to achieve shipping deadlines.			

The model assumes that all acoustically significant plant and equipment operates simultaneously.

14.6 NOISE ASSESSMENT

14.6.1 Operational Noise Assessment

The noise model was used to calculate noise levels from operations at the nearest residential receiver locations under the worst-case scenario of all plant and equipment operating. The predicted noise contours around the Russell Vale site for each operating period are presented in *Figure 14.3*.

The single point calculation results for the proposed operational scenarios are presented in *Table 14.9* and are compared to the respective Project Specific Noise Levels (PSNL).

Table 14.9 Calculated Operational Noise Levels

ID	Daytime Calm		Evening Calm		Night Calm	
	Predicted Level	**PSNL LAeq, 15min**	**Predicted Level**	**PSNL LAeq, 15min**	**Predicted Level**	**PSNL LAeq, 15min**
C1	38	42	37	41	37	37
C2	39	42	38	41	**38**	37
C3	39	42	37	41	36	37
C4	37	42	37	41	36	37
C5	40	44	40	43	40	40
C6	37	44	36	43	36	40
R1	43	43	**40**	39	**39**	37
R2	**44**	43	**40**	39	**39**	37
R3	43	43	**40**	39	**40**	37
R4	42	43	39	39	**38**	37

1. All levels are dB(A)
2. Exceedances presented in bold text.

The results in *Table 14.9* indicate that noise levels from normal operations incorporating noise mitigation measures would comply with relevant PSNLs at most receivers for day and evening periods.

Minor exceedances of less than 1dB(A) are predicted at one receiver during day periods and three (3) receivers during evening periods in Russell Vale.

Minor exceedances of 3dB (A) or less are predicted during night time periods at five (5) receivers in Russell Vale and Corrimal.

Moreton Street (R3) is predicted to experience noise levels up to 3 dB (A) over the PSNLs. This location receives direct line of sight exposure to the site operations.

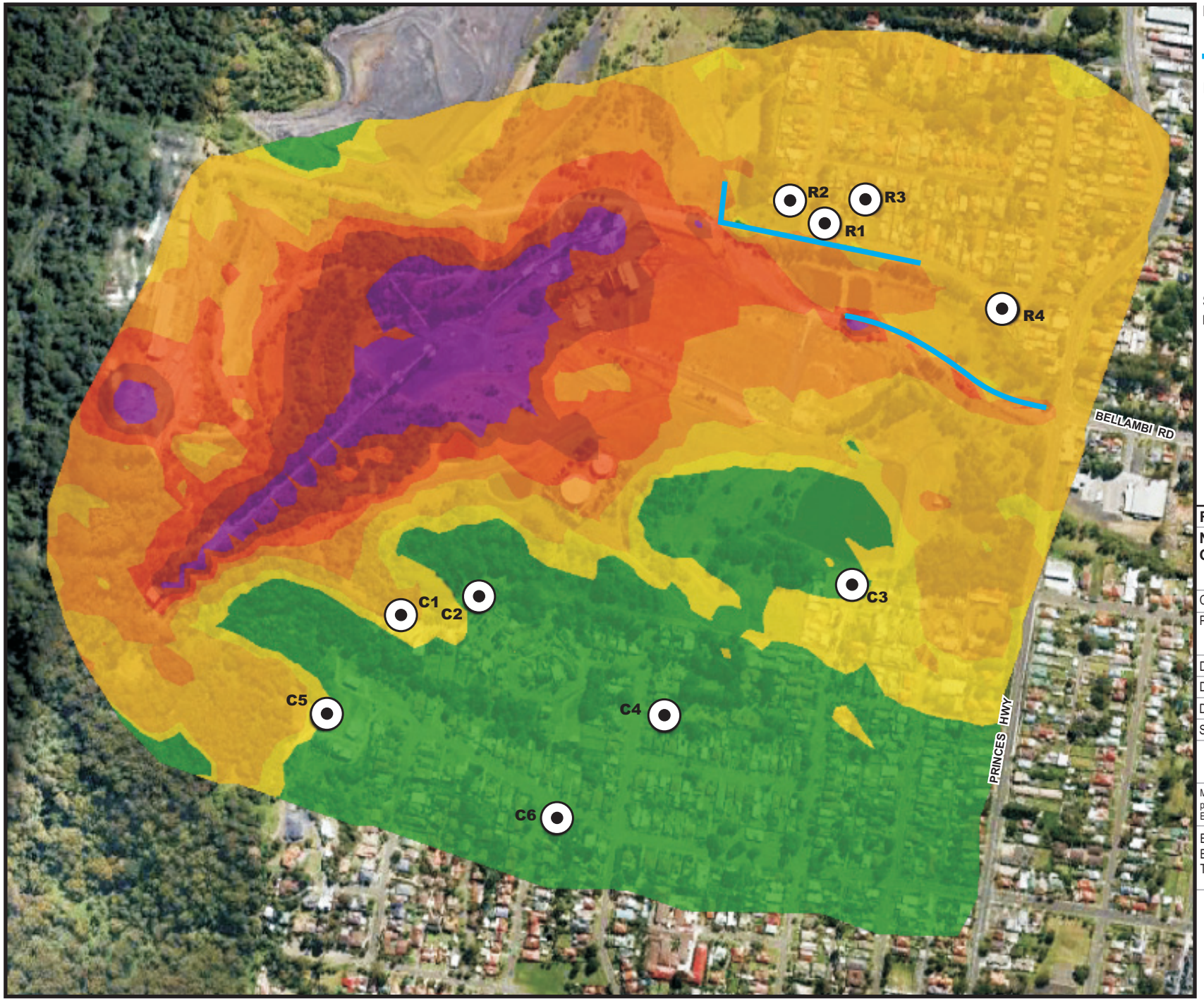
The noise levels reported would require validation from attended noise monitoring upon commencement of operations.

The major contributing noise sources at these locations are the existing conveyors. The results indicate that in order to achieve further noise reductions during the night time period mitigation of the existing conveyors would be required.

It is noted that the existing Bulli decline conveyor is to be decommissioned and demolished on completion of the new driveage which is anticipated to be in mid to late 2012.

14.6.2 Sleep Disturbance

Noise levels associated with the Project are predicted to be less than 47 dB(A) at all receivers during night time periods, which complies with the sleep disturbance criteria for each representative area as outlined in *Table 14.5*.



Legend

Receiver Location

Barrier Location

Noise Levels

99dBA
65dBA
60dBA
55dBA
50dBA
44dBA
42dBA
35dBA

Source:

Image © 2009 Google TM/Digital Globe

Figure 14.3

Noise Contours for Normal Operations - Calm Conditions

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383h_EA_PW_006_R0.cdr	
Date:	26/05/2010	Drawing size: A4
Drawn by:	JD	Reviewed by: MK
Scale:	Refer to Scale Bar	

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14.6.3 Road Traffic Noise Assessment

Unattended noise monitoring was undertaken to determine the contribution of Project-related road traffic noise levels along Bellambi Lane. To quantify the effect of the traffic from the existing operations at the Project, road traffic noise levels were measured on days that trucks were operating and on days that trucks were not operating.

The results of this monitoring are provided in *Table 14.10*. The summary includes the L_{Aeq} calculated over a fifteen hour period ($L_{Aeq, 15hr}$) and a one hour period ($L_{Aeq, 1hr}$).

Table 14.10 Existing Road Traffic Noise Levels

Location	Description	Leq, 15hr dB(A)	Leq, 1hr, Day dB(A)
63 Bellambi Lane	Project-related Trucks Operating	65.3	67.1
	Project-related Trucks Not Operating	65.3	67.5
	Difference	**0.0**	**- 0.3**
99 Bellambi Lane	Project-related Trucks Operating	62.6	64.4
	Project-related Trucks Not Operating	61.7	63.9
	Difference	**- 0.9**	**0.5**

The results of the road traffic noise monitoring indicate that Project-related truck movements do not contribute significantly to daytime traffic noise along Bellambi Lane, with noise levels varying by less than 1 dB(A) when Project-related trucks are operational.

To verify the findings of the noise logging, traffic counts were completed on Bellambi Lane, west of the northern distributor, between 30 August and 6 September 2010. The traffic data has been used to assess the validity of the measured noise levels on Bellambi Lane. Road traffic noise calculations, based on the traffic counts, have been completed in accordance with the procedures set out in the *Calculation of Road Traffic Noise* (CoRTN, UK DoT, 1988). This procedure is referenced in the Department of Environment, Climate Change and Water's (DECCW – formerly the EPA) *Environmental Criteria for Road Traffic Noise* (1999).

Predicted noise levels, based on actual 2010 post NDE traffic volumes on Bellambi Lane range between 60.0 and 61.9 dB(A). The measured range was 62.6 and 65.3 dB when NRE trucks were operating, and 61.7 and 65.3 dB when NRE trucks were not operating. Although on the lower end of the range, the predicted levels based on traffic volumes are comparable with the actual measured noise levels.

In general terms, road traffic needs to increase by 25% (or decrease by 20%) to change road traffic noise by 1 dB(A). Two way road traffic for an average weekday since the construction of the Northern Distributor has resulted in a reduction of 60% in road traffic on Bellambi Lane. Project related trucks contributed up to 4% of traffic on Bellambi Lane during the weekday, and no more than 6% on a Saturday during traffic survey period.

Predicted road traffic noise levels, based on measured traffic volumes are comparable with the measured noise levels on Bellambi Lane reported in the noise assessment. NRE truck movements do not contribute significantly to daytime traffic noise along Bellambi Lane.

Therefore road traffic impacts associated with the Project will be minimal and comply with relevant criteria as there will be no changes to road transportation.

14.6.4 Cumulative Noise Impact Assessment

The INP allows assessment of the potential cumulative noise impacts associated with existing and future developments by defining appropriate noise emission criteria with respect to maintaining the noise amenity at residential receivers and considering applicable consent limits. The cumulative impact of the Project has been assessed in relation to preserving the noise amenity at the nearest residential receivers.

The recommended amenity noise levels for all receiver areas are 50 dB (A) $L_{Aeq, Day}$, 45 dB (A) $L_{Aeq, Eve}$ and 40 dB (A) $L_{Aeq, Night}$.

Predicted intrusive noise levels from the project are below 50 dB(A) $L_{Aeq, 15min}$ during daytime periods, and 40 dB(A) $L_{Aeq, 15min}$ during evening and night time periods at the nearest residential receivers. Hence, the cumulative $L_{Aeq, Period}$ noise emission would not add to existing noise levels and would comply with INP amenity criteria during all operating periods for all residential receivers.

14.6.5 Construction Noise Impacts

Construction will involve short activities over nine months including site preparation, earthworks, construction of access roads and site facilities.

The single point calculation results for the construction are presented in *Table 14.11* and are compared to the respective construction noise criteria.

Table 14.11 Predicted Construction Noise Levels

Representative Area	Predicted Level LAeq, 15min dB(A)	Construction Noise Criteria LAeq, 15min, dB(A) [1]
R1	48	48
R2	47	48
R3,	46	48
R4	43	48
C1	39	47
C2	38	47
C3	41	47
C4	37	47
C5	39	49
C6	37	49

The results presented in *Table 14.11* indicate that construction noise levels are predicted to comply with the DECCW's construction noise criteria at all residential receiver locations.

14.7 MANAGEMENT AND MITIGATION MEASURES

14.7.1 Operational Noise Mitigation

The following mitigation measures will be implemented to achieve compliance to within 2-3 dB (A) of the PSNLs for all operating periods:

- 3 m high barrier will be constructed to south of Broker Street near the intersection with West Street, subject to powerline constraints;
- 3.6 m high barrier will be constructed to north of the internal access road from weighbridge to Princes Hwy; and
- the existing Bulli decline conveyor will be decommissioned and demolished on completion of the new driveage starting in mid to late 2012.

Attended noise monitoring will be undertaken upon the commencement of operations to confirm predictions. Noise barriers will be located subject to site constraints.

14.7.2 Construction Noise Mitigation

Construction will be limited to Monday to Friday 7am to 6pm and 8am to 1pm Saturday and all residents will be notified of the start of works. Where feasible, silenced site equipment will be used to minimise environmental noise emissions. Any complaints regarding environmental noise emissions will be investigated and responded to in an appropriate manner.

Personal protective equipment, such as ear protection, may be required by contractors operating particular machinery on site, or if there is numerous plant/s operating simultaneously.

All works will be undertaken in accordance with the DECCW's Interim Construction Noise Guideline (2009).

14.7.3 Noise Management Plan

An operational Noise Management Plan (NMP) will be developed to specifically address potential noise impacts associated with the proposed operations at the nearest receivers.

The NMP will outline methods and procedures to manage the following:

- results of the regular noise monitoring program on-site and within the surrounding area;
- response to any complaints or issues raised by the owner of the affected residence; and
- noise mitigation measures and operating procedures to ensure compliance with noise goals.

14.7.4 Noise Monitoring Program

An operational noise monitoring program will be developed to monitor noise emissions from the proposed operations to determine ongoing compliance with PSNLs and to identify any further feasible noise mitigation measures that can be implemented.

The monitoring program will be implemented upon commencement of operations during periods of maximum production with the objective of confirming the acoustic performance of the proposed operations. Further monitoring will be undertaken as a result of any complaints received during the life of the proposed operations.

14.7.5 Reporting

The results of the noise monitoring program will be reviewed by the operations manager to assess compliance with the goals outlined in *Section 14.3* and reported in accordance with any requirements of the development consent or EPL.

15 AQUATIC ECOLOGY

Where mine related subsidence is predicted to occur in the vicinity of creeks this chapter provides an assessment of potential impacts on the aquatic ecology of the PAA resulting from the Project. Measures to mitigate these impacts are also provided.

15.1 INTRODUCTION

There are no areas of potential aquatic habitat at the Russell Vale site or adjacent to the 309 Panel mining area. The aquatic ecology assessment has therefore focussed on the V Mains area.

NRE commissioned Cardno Ecology Lab Pty Ltd (Cardno Ecology Lab) to undertake an aquatic ecology assessment for the V Mains area for the purposes of an SMP application (Cardno Ecology Lab, 2009). Cardno Ecology Lab have been monitoring the V Mains area since 2007. This assessment draws upon the monitoring results collected during that period.

This chapter sets out the key findings of the assessment. Further details are provided in *NRE No. 1 Mine V Mains Area – Effects of Mine Subsidence on Aquatic Habitats and Biota* presented in *Annex K*.

15.2 EXISTING ENVIRONMENT

The main aquatic habitats within and adjacent to the V Mains area are provided by the main channel and tributaries of Wallandoola and Lizard Creeks. Both creeks are characterised by the presence of upland swamps.

Upland swamps within the NRE No. 1 lease areas occur in either headwater tributary valleys that are characteristically derived from colluvial sand movement from Hawkesbury Sandstone dominated ridgelines, or along the riparian zone of the major creeks (GeoTerra, 2009).

Upland swamps can be classified as "in-valley" or "headwater" upland swamps, however, only in-valley swamps are present in the V Mains area. In-valley, in-stream or valley floor swamps occur along well defined drainage lines. They occupy relatively flat sections of streams within the main valleys and can form through sediment deposition behind logs at choke points in a stream or terminate at 'steps' in the underlying sandstone substrate (GeoTerra, 2009).

Wallandoola Creek

The section of Wallandoola Creek traversing the V Mains area is poorly defined and dominated by swamp vegetation with only a few small permanent pools. Three areas of potential aquatic habitat have been identified within or adjacent to the V Mains area.

1. Two small sections of semi-permanent aquatic habitat within an unnamed tributary of Wallandoola Creek traversing the potential subsidence footprint. At the upstream end of this location, there is a pool with swamp habitat. At the downstream end of this location, the outflow from the swamp flows over a bedrock cascade into a small pool.

2. A series of large pools that have been identified approximately 300 m downstream of the V Mains area. There are several deep holes in the bedrock which would provide permanent refuge habitat during extended dry periods. There are several aquatic habitat features within this location, including snags, overhanging bank vegetation, rock crevices, earthen banks and beds of aquatic plants.

3. A watercourse approximately 250 m north of the western extent of the V Mains area, characterised by a sandstone valley, provides a number of pools which may be potential aquatic habitat. There are several aquatic habitat features within this location, including cascade-riffles, snags, overhanging bank vegetation, rock crevices, earthen banks and beds of aquatic plants.

Numerous in stream aquatic macrophytes, including ribbonweed (*Vallisneria gigantea*) and spikerush (*Eleocharis sp.*), were observed within the large pools in Wallandoola creek. The native sedge *Juncus sp.* and sawsedge (*Gahnia sp.*) were common along the banks of these pools.

There were fewer macroinvertebrate fauna families than expected in Wallandoola Creek.

Lizard Creek

The furthest upstream area of significant permanent aquatic habitat in Lizard Creek is situated at the point of outflow from the headwater swamp approximately 300 m upstream of the No. 4 Shaft access road crossing. At the upstream end of this location, there is a series of gentle cascades over bedrock substratum with one small pool with a maximum depth of 1.5 m.

Approximately 300 m downstream of this, there are two large pools with a maximum depth of 3 m separated by a large stand of spikerush (*Eleocharis sp.*). The substratum varies between sandstone bedrock, and deposits of sand and silt in the pools. The aquatic habitats within this location include snags, overhanging bank vegetation, rock crevices, earthen banks and aquatic plants.

The unnamed tributaries of Lizard Creek are small ephemeral watercourses with very little permanent aquatic habitat.

Aquatic macrophytes observed in-stream within Lizard Creek include ribbonweed and spikerush. Native sedge *Juncus sp.*, *Gahnia sp.* and numerous small ferns were common along the banks.

No fish were caught in the upper reaches of Wallandoola Creek and Lizard Creek during the baseline survey. However, native freshwater crayfish (*Euastacus sp.*) were observed and their burrows were found at both of the locations surveyed in each creek.

15.3 IMPACT ASSESSMENT

Predicted subsidence arising from mining in the V Mains area is not expected to have any obvious effects on stream flow or water quality. As such it is highly unlikely that there would be any observable flow-on effects on aquatic habitats or their biota within or immediately downstream of the V Mains area.

However there is a possibility of a localised increase in the natural stream gradient. This is a result of the maximum predicted tilt (6.1 mm/m) being greater than the stream bed gradient of Wallandoola Creek (0.8 mm/m) and Lizard Creek (0.71 mm/m). The increase in gradient could lead to an increase in flow rate, migration of flow channels and erosion of the stream bank and bed erosion. If erosion occurs, the quality of some of the habitats available for occupation by aquatic biota would decline.

An increase in the stream gradient could also lead to a reduction in the volume and retention time of pools within the V Mains area. This could affect the continuity of the watercourses by decreasing the connectivity between habitats, particularly during periods of low flow. As there are only a few small, permanent pools within the V Mains area the maximum impact on aquatic biota could be locally significant only within a small 300 m reach of the watercourse directly above the mine area. There are only a few small, permanent pools within this section of Wallandoola Creek and a few small areas of semi-permanent aquatic habitat within its unnamed tributary, this represents only a very small proportion of the local aquatic habitat. The relatively large pools 300 m downstream in Wallandoola Creek would be largely unaffected.

Potential impacts on upland swamps are thought to be similar to those on streams and rivers, caused by tensile cracking and tensile/shear movement of joint and bedding planes in the rocks below headwater swamps. However GeoTerra (2009) has concluded, on the basis of the maximum subsidence predictions, that extraction of coal from the V Mains area will not have any observable adverse effects on upland swamps.

15.4 MANAGEMENT MEASURES

Although mining is not expected to have any observable adverse effects on aquatic habitats measures recommended for the management of aquatic ecology to maintain biodiversity values are outlined in the SMP. These are:

- observations of aquatic habitats and surveys of aquatic macroinvertebrates at impact and control locations in the headwater swamp regions during and after mining;
- a survey of aquatic macroinvertebrates (at impact and control locations) if regular water quality monitoring program detects changes in the depth and quality of the water within Wallandoola Creek and Lizard Creek that are greater than anticipated on the basis of the subsidence predictions; and
- a continuation of baseline monitoring.

16 TERRESTRIAL ECOLOGY

This chapter provides an assessment of potential impacts on ecological values of the PAA resulting from the Project. Measures to mitigate these impacts are also provided.

16.1 INTRODUCTION

This chapter provides ecological assessments of three separate areas of the project; V Mains, 309 Panel and Russell Vale site (see *Figure 3.1*). Each of these three areas has been investigated for flora and fauna values and for the potential for impacts from proposed activities within each area.

The ecological assessments included a desktop survey and field investigations. Desktop research included analysis of relevant literature, databases and existing vegetation mapping for the areas. Field investigations assessed the distribution and condition of habitat for threatened species, populations and ecological communities within the areas, and surveyed for threatened flora and fauna.

The assessments were designed to meet the assessment requirements of the DoP and have been prepared with consideration of the draft *Guidelines for Threatened Species Assessment* prepared by Department of Environment and Conservation (DEC) (now DECCW) and the Department of Primary Industries (DPI) (now the IIN), in 2005. The assessments include the following:

- an evaluation of the impacts of the proposal including consideration of the potential effects of the proposal on threatened species, populations or ecological communities; and
- a discussion of measures to avoid impacts and where it is not possible to avoid impacts, identify measures to mitigate impacts.

16.2 PROJECT DESCRIPTIONS

The ecology assessment addressed areas where subsidence or surface disturbance are anticipated as described below.

16.2.1 V Mains

Gujarat NRE proposes to mine the 2.5 m thick Bulli seam within the V Mains at a depth of between 445 m in the west and 460 m in the east of the site (see *Figure 3.1*). Access to the V Mains will be provided via extension of the underground travelling roadways from existing workings.

16.2.2 309 Panel

It is proposed to continue pillar extraction in the 309 Panel (the 'T and W mains') (see *Figure 3.1*). The coal will be continuously removed from the working face onto 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.

16.2.3 Russell Vale Site

The existing drainage of the Russell Vale site includes a clean stormwater pipeline which directs clean water flowing in Bellambi Gully Creek underneath and past the current stockpiling and coal loading arrangements. It is proposed to remove this pipeline and replace it with a realigned, suitably designed and engineered open channel constructed on the southern side of the coal stockpile area (see *Figure 3.3)*

This channel will follow an alignment along the southern side of the coal stockpile and coal handling facilities and form a new alignment for Bellambi Gully Creek. The drainage system will focus on ensuring that Bellambi Gully Creek bypasses the stockpile area in normal and extreme weather conditions. The channel will flow and cascade into a water stilling pond (existing) to slow the flow velocity prior to the water discharging downstream into the current alignment of Bellambi Gully Creek.

Construction of the channel and works within the upper reaches of the existing channel will require the removal of less than 1ha of native vegetation and will also require the removal of Dam 6, currently located south of the existing stockpile.

16.3 METHODS

Background literature reviews and database searches provided data on flora and fauna species, populations, communities and habitats known to occur within the locality (being the area within a 10 km radius of the Project Area). For the Russell Vale site, species known exclusively from the escarpment were excluded from the assessment, as the Russell Vale site occurs on the coastal plain, and has different habitat types to those found on the escarpment, despite their proximity.

Background information reviewed in the assessment process included:

- topographic map, aerial photograph and Geographic Information System (GIS) interpretations;
- existing vegetation mapping of the area (NPWS 2004);
- the NSW DECCW Atlas of NSW Wildlife database;
- Birds Australia, Royal Botanic Gardens and Australian Museum databases; and
- the Department of the Environment, Water, Heritage and the Arts (DEWHA) on-line search tool for MNES.

16.3.1 V Mains and 309 Panel (T and W Mains)

NRE commissioned ERM to undertake a terrestrial ecology assessment of the V Mains area for the purposes of an SMP application (ERM 2009b). The assessment and survey targeted the potential subsidence footprint and surrounding areas (V Mains study area). The full version of the report has been included as *Annex L*, with the main findings of that assessment provided in this chapter.

Umwelt (2004) assessed the ecological impacts of predicted mine subsidence for the T and W Mains. The vegetation of the study area was surveyed along five separate walking transects. The aims of the walking transects were to identify and describe vegetation communities present, as well as to identify any threatened species.

As part of the Umwelt (2004) report, a fauna habitat assessment was undertaken within the area proposed for mining. An assessment of the different habitat types present was undertaken during the transect surveys. The fauna habitat assessment involved identifying features considered to offer habitat values for native fauna species.

Surveys of the V Mains area were undertaken in June 2006, August 2006 and November 2008. The 309 Panel area was assessed by Umwelt (2004) and also included in surveys undertaken by ERM for the Stage 2 project, with surveys being undertaken November 2008, February 2009, March 2009, October 2009 and January 2010. Surveys undertaken included mammal, bird, reptile, amphibian and flora investigations.

Additional detail on the methods used to survey the V Mains is provided in *Annex L.* No targeted surveys for threatened species were undertaken by ERM specifically within the 309 Panel area. The consideration of occurrence of species within the 309 Panel area has been based on the results of the Umwelt (2004) studies and the Stage 2 investigations (ERM).

16.3.2 Russell Vale Site

A one day site inspection of the Russell Vale site was undertaken on 27 April 2010. Areas investigated during the site inspection included Bellambi Gully Creek, the dams on site, and native vegetation along the gully that could be affected by the proposed works. The grassy areas around Dam 6 and the artificial wetland at the eastern end of the Russell Vale site were searched for adult frogs and the water was observed for any sign of tadpoles or adult frogs basking on reeds. Quiet listening was undertaken for approximately 20 minutes at Dam 6. Dam 5 was also observed for tadpoles and any frog calls.

Biosis Research Pty Ltd (Biosis) undertook follow-up field surveys of Dam 6 between 4 and 6 May 2010 the Biosis report is attached as *Annex M.* Biosis carried out further surveys between 7 and 9 September 2010. These surveys targeted the Green and Golden Bell Frog at Dam 6 and more widely at a number of dams that contain suitable habitat for the Green and Golden Bell Frog (*Litoria aurea*), the Biosis report is attached in *Annex M*. *Figure 16.3* shows the location of the waterbodies that were surveyed. To provide a comprehensive assessment the survey included areas outside the PAA which display Green and Golden Bell Frog habitat characteristics.

16.4 RESULTS - EXISTING ENVIRONMENT

16.4.1 V Mains

Vegetation

Five vegetation communities were identified within the V Mains study area and these are described below and shown on *Figure 16.1.* Communities present include:

- *Sandstone Gully Peppermint Forest* - This vegetation community is a tall dry shrubby forest which occurs on sheltered slopes and gullies (NPWS 2004) and was noted within the central portion of the V Mains study area, west of Wallandoola Creek;

- *Transitional Shale Stringybark Forest (Shale Sandstone Transition Forest)* - This community is a moderately tall forest that generally occurs in drier areas (NPWS 2004) and was noted in two small patches, at the eastern and western extents of the V Mains study area. It is a component of the larger endangered ecological community Shale Sandstone Transition Forest (listed as endangered under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act));

- *Exposed Sandstone Scribbly Gum Woodland* - This vegetation community is open woodland that occurs on ridges and exposed slopes (NPWS 2004) and was noted as the dominant community across the V Mains study area;

- *Upland Swamps: Fringing Eucalypt Woodland* - This community occurs adjacent to Lizard Creek and Wallandoola Creek; and

- *Upland Swamps: Sedgeland-Heath Complex* - This community contains a low dense cover of sedges and small shrubs in low depressions or adjacent to upland swamps (NPWS 2004) and was noted along Wallandoola Creek and its tributaries, and along the banks of Lizard Creek.



Source:
The Native Vegetation of the Woronora, O'Hares and Sydney Metropolitan Catchments (NPWS, 2003)

Figure 16.1
Natural Features within V Mains study area

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS013_R1.mxd	
Date:	03/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

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0 100 200 300m

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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Threatened Flora Species

No threatened flora species were recorded within the V Mains area during field surveys, although it is recognised that potential habitat is available for the following nine threatened flora species:

- *Acacia baueri* subsp. *aspera;*
- Bargo Geebung *(Persoonia bargoensis);*
- *Epacris purpurascens* var. *purpurascens;*
- Deane's Melaleuca (*Melaleuca deanei*);
- Hairy Geebung *(Persoonia hirsuta* subsp. *evoluta);*
- Needle Geebung *(Persoonia acerosa);*
- Prickly Bush-pea *(Pultenaea aristata);*
- Small-flower Grevillea *(Grevillea parviflora* subsp. *parviflora);* and
- Woronora Beard-heath *(Leucopogon exolasius).*

Endangered Ecological Communities

The *Transitional Shale Stringybark Forest* recorded within the V Mains area forms part of the *Shale Sandstone Transition Forest* listed as endangered under the TSC Act and as endangered under the EPBC Act.

Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems within the area include swamps (see *Figure 16.1*), Wallandoola Creek and associated creekline vegetation.

Fauna and Fauna Habitat

The V Mains area is relatively undisturbed and provides a mosaic of habitat types for native flora and fauna. Disturbance is generally limited to minor access tracks and the No. 8 Fire Trail that provides access to the No.4 Shaft and SCA lands to the north. All vegetated sites are dominated by native flora species.

Forest and woodland areas provide habitat for a range of animal species. Trees in these areas are of various ages, providing fauna with a range of shelter and foraging resources. Tree hollows were observed within both forest and woodland areas and provide nesting and shelter habitat for a range of arboreal mammals and birds.

Fallen branches and logs are relatively abundant within the forest and woodland areas, providing resources for ground-dwelling mammal, birds and reptiles. The occurrence of dense ground vegetation interspersed with open areas provides preferred habitat for ground mammals such as bandicoots and small birds.

Lizard Creek and Wallandoola Creek both flow northwards through the V Mains area. The presence of fringing vegetation and pools of various depths along the watercourses provides a diversity of habitats for amphibian and aquatic species, as well as fresh water resources for terrestrial species.

A total of 19 mammal species, 63 bird species and a range of insectivorous bats were recorded across the V Mains area (2009b). Very few reptiles were detected at the site, which may reflect its recent fire history. Amphibian activity was high along the creeks and within swamps and ephemeral pools that had formed along small tracks.

In accordance with the EP&A Act, the EA must assess whether the area contains potential or core Koala habitat as defined under SEPP 44. The SEPP outlines the following definitions for the determination of Koala habitat:

- *Potential Koala Habitat* - areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component; and

- *Core Koala Habitat* - an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

Eucalyptus haemastoma was the only tree species listed on Schedule 2 of SEPP 44 that was recorded in the V mains area. *E. haemastoma* is a dominant canopy tree in two vegetation communities in the V Mains area: Exposed Sandstone Scribbly Gum Woodland; and Upland Swamp – Fringing Eucalypt Woodland. Searches of the Atlas of NSW Wildlife database returned five records of Koalas from within 10km of the area. Field surveys did not record any observations, scats, tree scratches or vocalisations of the koala in the area

The V Mains area is potential Koala habitat under SEPP 44 of the EP&A Act, given the dominance of *E. haemastoma* in the two vegetation communities mentioned above. The area is not Core Koala Habitat as there is no evidence to indicate the presence of a resident population of Koalas or recent sightings or historical records of a resident population.

Threatened Fauna

A number of threatened fauna species have been previously recorded within 10 kilometres of the V Mains area, with eight species confirmed to occur within the V Mains area. The threatened species recorded were:

- Eastern Pygmy Possum (*Cercartetus nanus*);
- Brown Treecreeper (*Climacteris picumnus victoriae*);
- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Powerful Owl (*Ninox strenua*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Eastern Freetail Bat (*Mormopterus norfolkensis*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

All of these species are listed as vulnerable under the TSC Act and have been assessed further in *Annex L*. None of the species are listed as threatened under the EPBC Act.

16.4.2 309 Panel (T and W Mains)

The 309 Panel is a small area located within the larger Stage 2 study area (see *Figure 16.2*). The 309 Panel was assessed in the desktop and field assessments undertaken by ERM for Stage 2 and by Umwelt (2004).

There is one unnamed 1st order (using the Strahler System of stream ordering) watercourse located on the western edge of the 309 Panel (see *Figure 16.2*). This tributary leads into a 2nd order tributary, and then into Lizard Creek. The terrain of this area is relatively flat, with the closest swamp being located approximately 320m to the west.

Vegetation

Vegetation within the 309 Panel area and surrounds is undisturbed native vegetation, and has been mapped by NPWS (2004) as consisting of two vegetation communities (see *Figure 16.2*). These are:

- *Sandstone Gully Peppermint Forest* - This vegetation community is a tall dry shrubby forest which occurs on sheltered slopes and gullies (NPWS 2004); and

- *Exposed Sandstone Scribbly Gum Woodland* - This vegetation community is the dominant community with the area, consisting of open woodland that occurs on ridges and exposed slopes (NPWS 2004) and was also the dominant community across the V Mains area.

The Umwelt (2004) survey of the T and W Mains found that there is little spatial variation of vegetation across the study area. The dominant canopy species were Scribbly Gum (*Eucalyptus racemosa*) and Red Bloodwood (*Corymbia gummifera*). Other canopy species present included Sydney Peppermint (*Eucalyptus piperita*) and Silvertop Ash (*Eucalyptus sieberi*). The vegetation had a heath understorey, represented by species adapted to sandy soils. A diversity of species was recorded in the shrub layer stratum, including Conesticks (*Petrophile sessilis*), Dagger Hakea (*Hakea teretifolia*), Bushy Needlebush (*Hakea sericea*), Mountain Devils (*Lambertia formosa*), Old Man Banksia (*Banksia serrata*), Hairpin Banksia (*Banksia spinulosa*), Woolly Tea Tree (*Leptospermum lanigerum*), Pine Leaved Geebung (*Persoonia pinifolia*) and Prickly Tea Tree (*Leptospermum juniperinum*). Ground cover diversity was high, with common species including Lesser Flannel Flower (*Actinotus minor)*, Rough Guinea Flower (*Hibbertia aspera*), Tufted Hedgehog Grass (*Echinopogon caespitosus*), and Daisy-leaved Goodenia (*Goodenia bellidifolia*). In drainage lines and low-lying wet soak areas susceptible to becoming waterlogged there was an increase in cyperoid species such as Common Rush (*Juncus usitatus*), Pale Twig Rush (*Baumea acuta*) and Bog Rush (*Schoenus sp.*). The sub-canopy species White Feather Honeymyrtle (*Melaleuca decora*), tolerant of periodic inundation, was more common in these swampy areas. No threatened flora species were recorded during the field survey for this study.

Groundwater Dependent Ecosystems

Groundwater dependent ecosystems in the 309 Panel area include the first order tributary on the western edge of the panel. Umwelt (2004) also recorded wet soak areas with associated vegetation. These areas are also likely to be affected by groundwater fluctuations. There are no swamps mapped within the 309 Panel area.

Threatened Flora Species

No targeted searches were undertaken for threatened flora within the 309 Panel area. However, based on the vegetation present in the area the following species have the potential to occur:

- Woronora Beard-heath (*Leucopogon exolasius*);
- *Epacris purpurascens var. purpurascens*; and
- Prickly Bush-pea (*Pultenaea aristata*).

Endangered Ecological Communities

There are no endangered ecological communities within the 309 Panel area.

Fauna and Fauna Habitat

The 309 Panel area is relatively undisturbed and although small, provides a mosaic of habitat types for native flora and fauna. Forest and woodland areas provide a range of shelter and foraging resources for native fauna, with tree hollows providing nesting and shelter habitat for a range of arboreal mammals and birds. Fallen branches and logs are relatively abundant providing resources for ground-dwelling mammals, birds and reptiles.

In accordance with the EP&A Act, the EA must assess whether the area contains potential or core Koala habitat as defined under SEPP 44. The SEPP outlines the following definitions for the determination of Koala habitat:

- *Potential Koala Habitat* - areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component; and
- *Core Koala Habitat* - an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

Umwelt (2004) recorded *Eucalyptus. racemosa* as the dominant tree species within the T and W mains. However, *E. haemastoma,* a Schedule 2 tree species, is also one of the main tree species in Exposed Sandstone Scribbly Gum Woodland (NPWS 2004). The percentage cover of the preferred feed tree species *E. haemastoma* is not known. However, using the precautionary approach it is assumed that this vegetation community could be classified as Potential Koala Habitat.

No targeted field surveys were undertaken within the 309 Panel area for signs of Koalas. Consequently, there is potential for the area to constitute Core Koala Habitat. However, given the small size of the area and the occurrence of the vegetation community Exposed Sandstone Scribbly Gum Woodland across a wide area on the plateau, if there was a resident Koala population in the immediate area, it would not be reliant solely on the resources of 309 Panel area. In addition, potential impacts from subsidence would not be expected to affect the habitat resources of a resident population of Koalas and it was considered that there was no additional requirement for assessment of impacts to the Koala.

Threatened Fauna

No targeted searches for threatened fauna were undertaken within the 309 Panel area by either ERM or Umwelt (2004). However, a number of threatened fauna species have been previously recorded within 10 kilometres of the area, and a number of species were confirmed to occur within the Stage 2 and V Mains areas. The threatened species recorded within these areas by ERM that also have the potential to occur within the 309 Panel area include:

- Giant Burrowing Frog (*Heleioporus australiacus*);
- Red-crowned Toadlet (*Pseudophryne australis*);
- Eastern Pygmy Possum;
- Brown Treecreeper;
- Gang-gang Cockatoo;
- Powerful Owl;
- Large-footed Myotis (*Myotis macropus*);
- Eastern Bent-wing Bat;
- Eastern False Pipistrelle;
- Eastern Freetail Bat; and
- Greater Broad-nosed Bat.

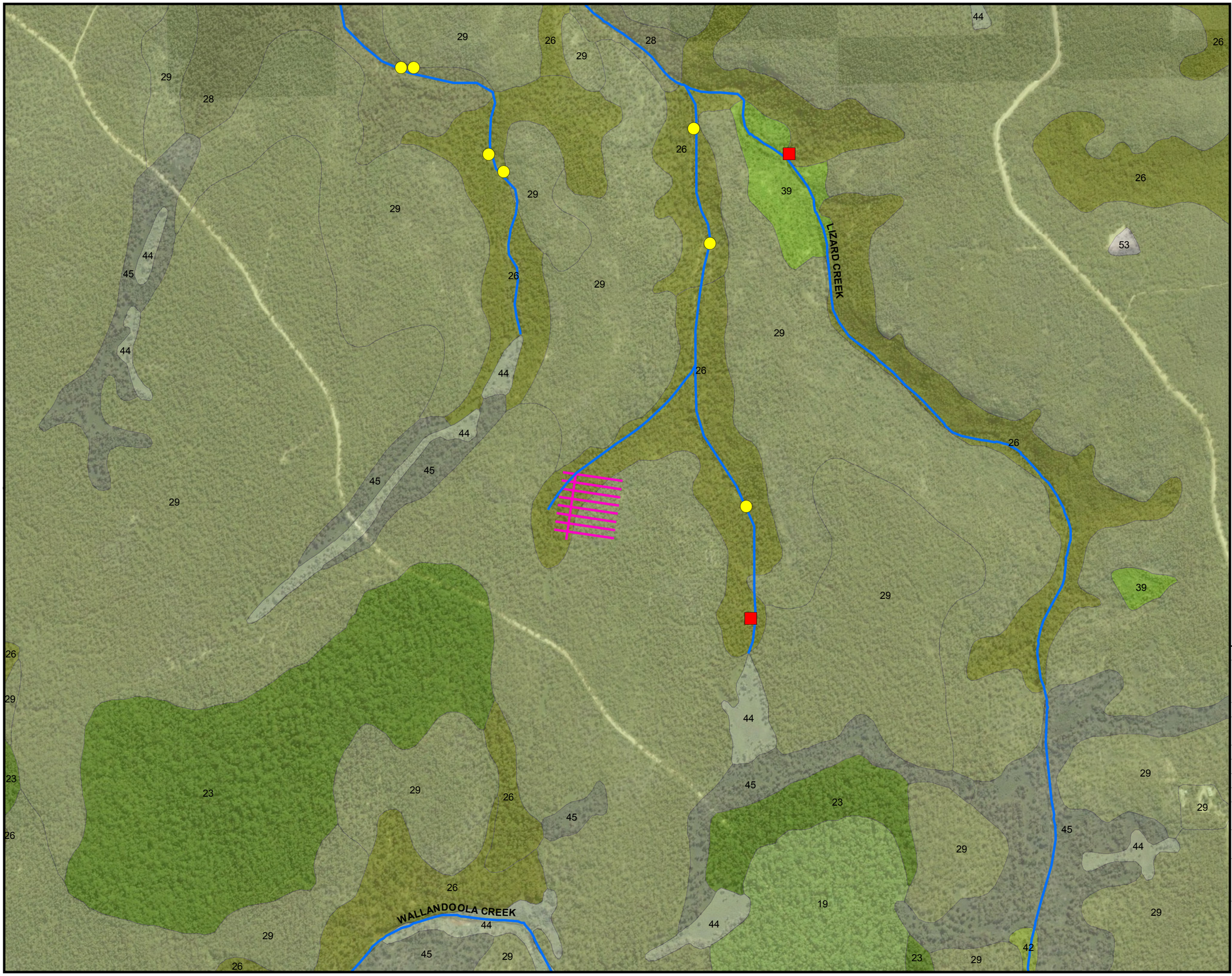
One additional species, the Large-eared Pied Bat (*Chalinolobus dwyeri*) is also expected to occur within the area. All of these threatened species are listed as vulnerable under the TSC Act. The Giant Burrowing Frog and Large-eared Pied Bat are also listed as vulnerable under the EPBC Act.

Giant Burrowing Frog has been previously recorded within two ephemeral drainages of Lizard Creek, within Central Creek and an unnamed tributary within Stage 2. Red-crowned Toadlet has been recorded within Lizard Creek and within one second order ephemeral tributary of Lizard Creek (see *Figure 16.2*). These sites are within 500 m to one kilometre from the 309 Panel and it is therefore considered likely that both species would occur within the first order tributary located on the western extent of the 309 Panel area.

No threatened reptiles have been recorded within the Stage 2 area, although there is potential habitat within that area for the Broad-headed Snake (*Hoplocephalus bungaroides*) and Rosenberg's Goanna (*Varanus rosenbergi*). However habitat elements for these species do not occur within the 309 Panel area and accordingly they are not expected to occur.

Umwelt (2004) recorded a range of habitat niches within the T and W Mains area. Most significant was the presence of hollow bearing trees, providing nesting habitat for a range of arboreal mammals and avifauna. There was a relatively high density of hollows across the site, with hollows most frequently being formed in Scribbly Gums. The large diversity of blossoming flora species provides a significant foraging resource for native birds, as well as for blossom feeding bats. There was minimal habitat for frugivorous fauna. Leaf litter was sparse throughout the study area, likely the result of consumption during bushfire. Similarly, there were few fallen logs present. However, as that study was undertaken in 2004, since that time litter and fallen woody debris is expected to have increased within the area.

Umwelt (2004) recorded numerous large rock platforms throughout the T and W Mains study area, which would provide suitable basking sites for lizards and snakes. Habitat for amphibians was recorded within low lying wet soak areas, and in areas of bushland surrounding the study area where there were small creeks with pool and riffle sequences.



Legend

- 309 Panel
- Waterway

Threatened Species

- Giant Burrowing Frog
- Red-crowned Toadlet

Vegetation Community

- 29 - Exposed Sandstone Scribbly Gum Woodland
- 39 - Rock Plate Heath-Mallee
- 26 - Sandstone Gully Peppermint Forest
- 19 - Transitional Shale Open Blue Gum Forest
- 23 - Transitional Shale Stringybark Forest
- 42 - Upland Swamps: Banksia Thicket
- 45 - Upland Swamps: Fringing Eucalypt Woodland
- 44 - Upland Swamps: Sedgeland-Heath Complex
- 43 - Upland Swamps: Tea-Tree Thicket
- 28 - Western Sandstone Gully Forest
- 53 - Cleared

Source:
The Native Vegetation of the Woronora, O'Hares and Sydney Metropolitan Catchments (NPWS, 2003)

Figure 16.2
Natural Features in the Vicinity of the 309 Panel

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS021_R1.mxd	
Date:	09/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

N

0 100 200 300m

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16.4.3 Russell Vale Site

The Russell Vale site is a developed site with native vegetation and habitats restricted to the perimeters of the site, along the creekline, and within the dams on site.

Vegetation

Vegetation mapping (NPWS 2004) identifies three native vegetation communities within the Russell Vale site:

- Escarpment Blackbutt Forest;
- *Acacia* Scrub; and
- Moist Box Red Gum Foothills Forest.

These communities were confirmed on site, in areas on the western boundaries of the developed areas, and along the creekline. The native vegetation communities along the creekline have also been impacted by weed invasion. Weeds recorded along the creeklines upper reaches included Lantana (*Lantana camara*), Cobbler's Peg (*Bidens pilosa*) and Privet (*Ligustrum sinense*).

Bellambi Gully Creek is piped at several sections within the site, forming barriers to aquatic fauna movements along the creekline corridor, and consequently the creek provides limited habitat for aquatic species. One small pool within the creekline was recorded adjacent to the conveyor belt and this was investigated for frogs. The pool was found to contain clear water, but no tadpoles, frogs, or other aquatic fauna. There are also culverts upstream of the piped section of Bellambi Gully Creek that collect material that gets washed down from the escarpment areas. These were all blocked by debris at the time of the site inspection. These would also form barriers to passage of any aquatic species and amphibians.

Acacia scrub occurs within developed areas of the site, and was found to be a highly disturbed vegetation type with many weed species present (see *Photograph 16.1*).



Photograph 16.1 Acacia Scrub Russell Vale Site

Threatened Species

Potential habitat for the Green and Golden Bell Frog (*Litoria aurea*) was recorded in a number of locations across the Russell Vale site. These are illustrated on *Figure 16.3*. The quality of the habitat was assessed having regard to the key fauna habitat elements required by the species for survival. These are:

- the presence of emergent aquatic vegetation;
- the presence of ground and shrub layers adjacent to the water body for foraging; and
- the presence of areas that can be utilised by the species for access / egress to sheltering sites such as drainage lines, culverts, easements and periodic damp areas.

Table 16.1 summarises the habitat characteristics and condition of each site.



Legend

- Project Application Area
- Corridor
- Waterbodies
- Movement Pathways

Figure 16.3

Green and Golden Bell Frog Habitat, Corridors and Movement Pathways

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS035_R0.mxd	
Date:	30/09/2010	Drawing Size: A3
Drawn By:	NS	Reviewed By: MK
Projection:	GDA 1994 MGA Zone 56	
Scale:	Refer to scale bar	

N

0 100 200 300m

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Table 16.1 ***Green and Golden Bell Frog Habitat within and adjacent to the Russell Vale site.***

Site name	Habitat
Dam 6	Provides good quality habitat with full complement of features required for species survival. (see *Photograph 16.2)*
Pit Top dam	Provides good quality habitat with full complement of features required for species survival
Corrimal Spring	Poor condition habitat due to lack of emergent aquatic vegetation and high levels of disturbance. May provide a marginal corridor to other potential sites including Pit Top dam and Rixon's Pass
Rixon's Pass Dam	Good condition habitat with full complement of features required for species survival. Habitat also provides potential corridors to the Pit Top dam and other habitats present in the eastern part of the Russell Vale site.
Basin No.1	Highly disturbed. Poor condition. Water body may form potential east west corridor.
Basin No.2	Good condition habitat with full complement of features required for species survival. Habitat also provides potential corridors to other habitats.
Northern Pond	Moderate condition habitat. Provides potential corridors to other habitats in the eastern part of the study area.
Don's Dam	Moderate condition habitat. Provides potential corridors to other habitats in the eastern part of the study area.
Stormwater control dam	Good condition habitat. Provides an important movement corridor other habitats in the eastern part of the study area. (see *photograph 16.3)*
Roadside Dam	Moderates condition habitat. Provides an important movement corridor other habitats in the eastern part of the study area

The Green and Golden Bell Frog is listed as endangered under the TSC Act and the EPBC Act. Surveys for the species undertaken by Biosis (2010) in May 2010 and in September 2010, did not detect the species, although an unconfirmed call was recorded at the Pit Top dam. There is a previous record of the species at the Pit Top dam in 1997. The Pit Top dam is located approximately 650 metres to the west of Dam 6.

One other threatened species, Large-footed Myotis, has the potential to forage over the dams of the Russell Vale site. No other threatened species are likely to use the site or rely on the site for resources, although it is likely some migratory species (protected under the EPBC Act) would forage within the dams.



Photograph 16.2 Dam 6 – Green and Golden Bell Frog Habitat



Photograph 16.3 Artificial wetland at the eastern end of the study area

16.5 IMPACT ASSESSMENT

16.5.1 V Mains

Terrestrial Vegetation Communities

Terrestrial vegetation communities not reliant on groundwater have a very low potential for impact from subsidence. Potential impacts to terrestrial communities could include tree tilt or tree fall, localised ponds forming in areas of subsidence or cracking of the ground. The predicted impacts associated with the V Mains area will not result in subsidence within these terrestrial environments. If they were to occur, the impacts would not be considered significant, as the vegetation communities are common in the local area, and any impacts would affect a relatively small area.

Upland Swamps

DECC (2007b) has recognised four large clusters of upland swamps on the plateau areas that are considered to have particular significance in providing large contiguous areas of related habitat. Wallandoola Creek forms one of these important clusters and includes those areas mapped within the V Mains area. The effect of mining-induced surface cracking on upland swamps can be severe, where the swamps are in effect perched water tables dependent on ponded rainfall on top of thin clay or shale floors. Rupturing of these seals is likely where they rest on bare rock rather than deep soil, or where they occur close to cliffs (DECC 2007b). These perched water tables are easily fractured and drained by the tensile strains above an advancing subsidence wave, putting at risk upland swamps and other groundwater dependent ecosystems in its path (DECC 2007b).

Mining of the V Mains area is not expected to crack solid rock (Seedsman Geotechnics 2009), with impacts predicted to be the slight opening of existing sandstone joints. Without cracking of solid rock, there is no potential for loss of surface water and it is highly unlikely that there would be any observable flow-on effects on aquatic habitats, or their biota, within or immediately downstream of the V Mains area (Cardno Ecology Lab 2009). In addition, the depth of the extraction is such that there will be no inter-connected cracks from the seam to the surface (Seedsman Geotechnics 2009), and therefore impacts to groundwater and groundwater dependent ecosystems (swamps) within the area are not expected. Consequently the species that rely on these swamps for habitat such as the Giant Dragonfly (if it occurs there) should not experience significant impacts from subsidence.

Rocky Habitats

The V Mains area contains rocky outcrops that provide potential habitat for the threatened Broad-headed Snake, and other species of reptile.

Seedsman Geotechnics (2009) predicts the strains on the rocky outcrops within the V Mains area to be in the range of +3.3 mm/m to -6.5 mm/m. These levels are not sufficient to cause tensile cracking in solid rock. The tensile strains may cause existing joints to open slightly. In addition, the depth of the extraction is such that there will be no inter-connected cracks from the seam to the surface.

Threatened and Protected Species

The following provides a summary of the findings of Seven-part tests conducted to assess the impacts of the proposal to threatened flora, threatened fauna and endangered ecological communities (*Annex L*).

A number of threatened flora and fauna are considered likely, or moderately likely to occur within the area. However, many of these species are unlikely to be impacted by alterations to habitats as a result of subsidence. Fauna and flora species predicted to be impacted by subsidence in the Southern Coalfields are shown in *Table 16.2* and *Table 16.3* (DECCW 2007b).

In accordance with the DECCW guidelines, a species does not have to be considered as part of the assessment of significance if adequate surveys or studies have been carried out that clearly show that the species:

- does not occur in the study area, or
- will not use on-site habitats on occasion, or
- will not be influenced by off-site impacts of the proposal.

Otherwise all species likely to occur in the study area (based on general species distribution information), and known to use that type of habitat, should be considered.

The fauna species identified as having the potential to be impacted by subsidence (DECCW 2007b) and identified as occurring (or likely to occur) within the V Mains area include:

- Broad-headed Snake;
- Red-crowned Toadlet;
- Rosenberg's Goanna;
- Giant Burrowing Frog;

- Littlejohn's Tree Frog;
- Spotted-tailed Quoll;
- Giant Dragonfly;
- Large-footed Myotis;
- Large-eared Pied Bat; and
- Eastern Bentwing-bat.

No flora species are expected to occur and be impacted by subsidence within the V Mains area. The fauna species were assessed using the seven-part test of significance (see *Annex L*). The results of the seven-part test assessments concluded no significant impacts expected for all species.

The Beautiful Firetail and Southern Emu-Wren could also occur within the V Mains area. However, the impacts to habitat for these species (swamps) are predicted to be zero to minimal and therefore there are no significant impacts expected for these species of regional significance.

EPBC Species

The Giant Burrowing Frog, Littlejohn's Tree Frog and the Large-eared Pied Bat are also listed as vulnerable under the EPBC Act. Given that the 7 part test assessments conclude no significant impacts are expected to any of these species, it was considered that assessments of significance using the EPBC Act guidelines were not necessary.

Table 16.2 Fauna species vulnerable to subsidence (DECC 2007b)

Sensitive Fauna Species	TSC Act	EPBC Act	Habitat in upland swamps	Habitat in creeks or rivers	Habitat on cliffs, rock benches or overhangs
Frogs					
Giant Burrowing Frog *Heleioporus australiacus* #	V	V	**Yes**	**Yes**	No
Green and Golden Bell Frog *Litoria aurea*	E	V	No	**Yes**	No
Littlejohn's Tree Frog *Litoria littlejohni* #	V	V	**Yes**	**Yes**	No
Red-crowned Toadlet *Pseudophryne australis* #	V	-	**Yes**	**Yes**	**Yes**
Stuttering Barred Frog *Mixophyes balbus*	E	V	**No**	**Yes**	**No**
Birds					
Beautiful Firetail *Stagonopleura bella*	-	-	**Yes**	No	No
Black Bittern *Ixobrychus flavicollis* #	V	-	No	**Yes**	No
Eastern Bristlebird *Dasyornis brachypterus* #	E	E	**Yes**	No	No
Ground Parrot *Pezoporus wallicus*	V	-	**Yes**	No	No
Southern Emu Wren *Stipiturus malachurus*	-	-	**Yes**	No	No
Tawny-crowned Honeyeater *Phylidonyris melanops*	-	-	**Yes**	No	No
Turquoise Parrot *Neophema pulchella* #	V	-	**Yes**	No	No
Mammals					
Brush-tailed Rock Wallaby *Petrogale penicillata* #	E	V	No	No	**Yes**
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis* #	V	-	No	No	**Yes**
Eastern Pygmy Possum *Cercartetus nanus* #	V	-	**Yes**	No	No
Large-eared Pied Bat *Chalinolobus dwyeri* #	V	V	No	No	**Yes**
Large-footed Myotis *Myotis macropus* (syn *M.adversus*) #	V	-	No	**Yes**	No
Long-nosed Potoroo *Potorous tridactylus*	V	V	**Yes**	No	No
Platypus *Ornithorhynchus anatinus*	-	-	No	**Yes**	No
Spotted-tailed Quoll *Dasyurus maculatus maculatus*	V	E	No	No	**Yes**
Reptiles					
Broad-headed Snake *Hoplocephalus bungaroides* #	E	V	No	No	**Yes**
Rosenberg's Goanna *Varanus rosenbergi* #	V	-	**Yes**	No	No

Source: DECC (2007b) and DoP (2008)

* 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, # previously recorded within 10km of the V Mains area

Conservation Status: V- vulnerable; E – endangered

Table 16.3 Flora species vulnerable to 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

Source: DECC (2007b) and DoP (2008)

Conservation Status: V- vulnerable; E – endangered

- previously recorded within 10km of the V Mains area.

16.5.2 309 Panel

GeoTerra (2010) states that the maximum proposed subsidence of 400 mm, as well as tensile and compressive strain of 1 mm/m due to pillar extraction of Panel 309 is not anticipated to cause observable adverse impacts Lizard Creek or its tributary in regard to the following:

- flow;
- water quality;
- bed and bank stability;
- pool water levels; or
- seeps, springs or base flow from the headwater upland swamp to Lizard Creek.

In addition, there are no anticipated observable adverse impacts due to subsidence on:

- the headwater upland swamp water levels or water quality in the tributary of Lizard Creek which is located 320 m to the west of the proposed workings;
- regional aquifer or aquitard interconnection;
- groundwater levels in the shallow Hawkesbury Sandstone;
- Hawkesbury Sandstone groundwater quality; or
- inflow of regional groundwater into the proposed workings.

These conclusions were derived from monitoring that has been conducted since August 2006 over the T and W Mains area, within a headwater upland swamp located 320m to the west of Panel 309 and an ephemeral tributary overlying the proposed Panel 309. Ecoengineers (2009) have not observed any geomorphological or geochemical changes due to the maximum 0.15 m of subsidence and tensile / compressive strains of 0.55 and 1.09 mm/m in the tributary overlying the proposed Panel 309 pillar extraction area, which contains monitoring sites C10 (upstream) and C11 (downstream).

No significant trends in pH, electrical conductivity, sulphate or filterable iron, manganese, nickel and zinc were observed over the monitoring period that would indicate effects from subsidence. Monitoring of water levels as well as pH, EC, sulphate and filterable iron, manganese, nickel and zinc, along with monitoring of any soil cracking that may develop, indicates that the upland swamp (320 m west) has shown no adverse observable effects from subsidence during extraction of pillars in the T and W Mains extraction area, as well as no local, shallow fracturing in the Hawkesbury Sandstone.

Impacts from subsidence to the tributary and associated fauna habitats are therefore not expected as a result of the proposed works in the 309 Panel area.

The primary habitat types within the 309 Panel area are terrestrial habitats associated with dry sclerophyll woodland and forest. Impacts to these habitats from subsidence are not expected to result in the loss or reduction of any native species.

Threatened and Protected Species

Threatened flora and fauna are considered to have the potential to occur within the 309 Panel area. However, no threatened flora species were recorded by Umwelt (2004), and many of the species are unlikely to be impacted by alterations to habitats as a result of subsidence (see *Table 16.2* and *Table 16.3*).

In accordance with the DECCW guidelines, a species does not have to be considered as part of the assessment of significance if adequate surveys or studies have been carried out that clearly show that the species:

- does not occur, or
- will not use on-site habitats on occasion, or
- will not be influenced by off-site impacts of the proposal.

Otherwise all species likely to occur in the study area (based on general species distribution information), and known to use that type of habitat, should be considered.

The threatened fauna species identified as occurring (or likely to occur) within the site include:

- Giant Burrowing Frog;
- Red-crowned Toadlet;
- Large-eared Pied Bat (foraging only);

- Eastern Bentwing-bat (foraging only); and
- Large-footed Myotis (foraging only).

Threatened flora species known to occur within the vegetation types that occur within the 309 Panel area are:

- *Leucopogon exolasisus*;
- *Epacris purpurascens* var. *purpurascens*; and
- *Pultenaea aristata*.

The above species were assessed using the seven-part test of significance (see *Annex N*). The results of the seven-part test assessments concluded that the proposal was unlikely to significantly impact on any of the above species.

EPBC Species

Impacts to the Giant Burrowing Frog from the proposal were assessed using the EPBC Act guidelines (see *Annex N*). This assessment found that impacts to an important population as a result of the proposed action were unlikely.

16.5.3 Russell Vale Site

The proposed works within the Bellambi Gully Creek corridor at the Russell Vale site could impact a small area of Moist Box Foothills Redgum Forest. Within the site this vegetation is highly modified through weed invasion and erosion of the creek banks. Proposed works will result in an improvement to the stability of the creekline and there will be no impacts to native flora or fauna or vegetation of significance as a result of works in these areas. Recommended measures to further reduce the potential for impacts to the riparian areas are provided in *Section 16.6*.

The proposed removal of Dam 6 at the Russell Vale site has the potential to impact the Green and Golden Bell Frog and foraging habitat for the Large-footed Myotis. No other threatened flora or fauna are considered to have the potential occur within the Russel Vale site and to be impacted by the proposed works. Assessments of significance under the TSC Act were undertaken for impacts to both species from the proposal. An assessment under the EPBC Act for potential impacts to the Green and Golden Bell Frog was also undertaken.

Surveys for the Green and Golden Bell Frog were undertaken at Dam 6 in May and September 2010. No Green and Golden Bell Frogs were recorded. The survey in May was not undertaken during the appropriate time, however the survey in September was undertaken within the DECC 2009 assessment guidelines. No Green and Golden Bell Frogs were recorded. Given the proximity to previous recorded sites and the presence of suitable habitat features, there is a likelihood of occurrence of the Green and Golden Bell Frog at the Russell Vale site.

The proposed removal of Dam 6 would remove up to 0.19ha of breeding foraging and sheltering habitat and may disrupt the movement of this species between suitable areas of habitat. The removal of habitat from Dam 6 represents 17% of similar habitat available at the Russell Vale site and 0.98% of habitat available in the locality.

The assessments found that, provided the prescribed mitigation measures are implemented, significant impacts to the Green and Golden Bell Frog or the Large-footed Myotis as a result of the works would be unlikely (*Annex N*). However, as a precautionary approach, a referral to the DEWHA for impacts to the Green and Golden Bell Frog will be submitted as part of this proposal.

16.6 MITIGATION MEASURES

16.6.1 Avoidance of Impacts

V Mains and 309 Panel

The project activities at V Mains and 309 Panel are associated with the location of coal resources. There are currently minimal alternatives to the mine plan that result in feasible economic incentives to mining in the V Mains area. However, the pillar extraction mining method has the potential to be modified should subsidence impacts significantly change from what has been predicted. A distinct advantage of the type of mining method (pillar extraction) is that progressive monitoring can be use to limit further extraction, in order to avoid impacts to future extraction areas. The nature and extent of any remediation will be determined by monitoring and direct consultation with relevant government agencies including DECCW and SCA.

Russell Vale Site

The realignment of the Bellambi Gully Creek into an open channel from a pipeline, will require bank stabilisation and removal of Dam 6. Consequently, there can be no avoidance of impacts to Dam 6, without compromising the stability of the bank above the channel. The location of the channel is restricted by existing infrastructure within the site, as well as the location of the natural creekline.

16.6.2 Monitoring and Mitigation Measures

V Mains and 309 Panel

Monitoring of the important habitat areas (such as the upland swamps, creeks and rocky habitats of the V Mains) will occur pre and post mining. Although impacts are not expected, this will enable the detection of any impacts to these habitats in a timely manner, and allow for implementation of targeted remediation measures as required.

Additional fauna surveys in suitable seasons to detect the threatened frogs (V Mains and 309 Panel) and the Giant Dragonfly (V Mains), the species predicted to be most at risk if impacts from subsidence do occur, will be undertaken to obtain population information and distributions, should any of the species be detected. This will also allow for targeted remediation and adaptive management if subsidence does impact important areas for these species.

The nature and extent of any remediation will be determined by monitoring and direct consultation with relevant government agencies including DECCW and SCA. The potential for remediation measures to induce a greater adverse impact over and above that attributable to mine subsidence must be balanced with the potential for natural remediation to occur.

Russell Vale Site

A precautionary approach has been taken and mitigation measures have been recommended by Biosis, which assumes that the Green and Golden Bell Frog could use Dam 6. Biosis concluded that the removal of Dam 6 would be unlikely to have a significant impact on the Green and Golden Bell Frog provided that the following measures are undertaken:

- further targeted surveys will be undertaken between late 2010 and early 2011 (and preferably after rain) across the potential habitats identified and listed in *Table 16.1* to accurately determine the presence of the species and to determine the extent of their utilisation of the study area;

- the enhancement of Dam 5 (which currently contains no suitable habitat elements but is located adjacent to Dam 6) should be undertaken in consultation with DECCW and WCC. This will ensure that the decommissioning of Dam 6 and the subsequent removal of breeding, sheltering and foraging habitat from this location is appropriately mitigated; and

- development of a translocation plan in consultation with DECCW for individual Green and Golden Bell Frogs (if detected) from Dam 6 to Dam 5 to ensure minimal disruption of the species.

Measures to assist in the management of impacts to the riparian areas of Bellambi Gully Creek include:

- demarcation of works area prior to works beginning to avoid impacts to vegetation outside of the works areas;
- appropriate sedimentation controls to be implemented prior to works beginning; and
- weed removal and ongoing management of the area for weed control.

16.7 SUMMARY AND CONCLUSIONS

Based on the assessments, the available subsidence predictions and the avoidance, mitigation and management measures to be implemented for the project, the proposed activities will be unlikely to significantly impact biodiversity values within the study area.

17 ABORIGINAL HERITAGE

This chapter provides an assessment of potential impacts on Aboriginal heritage values of the PAA area resulting from the Project. Measures to mitigate these impacts are also provided.

17.1 INTRODUCTION

An Aboriginal heritage assessment was undertaken by ERM for the surface facilities upgrade at the Russell Vale site. This study looked at the existing conditions on the site. A field survey with Aboriginal community representatives was undertaken to determine if Aboriginal archaeological sites were present or if there was any potential for unidentified sites to be present at the Russell Vale site.

Aboriginal heritage assessment was also undertaken by ERM for the V Mains and 309 Panel mining areas.

The Aboriginal heritage assessment has been undertaken in accordance with the DECCW guidelines for Community Consultation and the National Parks and Wildlife Service (NPWS) guidelines for Aboriginal archaeological assessment.

17.2 COMMUNITY CONSULTATION

Aboriginal consultation is required for any assessment of Aboriginal heritage. The DECCW 'Interim Community Consultation Requirements Guideline' (2005) sets out the process and the complete log of all communications between ERM and local Aboriginal stakeholders is presented in *Annex O*.

Consultation for Field Survey

Letters requesting advice on Aboriginal organisations to consult, and any known heritage issues to be taken into consideration in the area, were emailed on 3 October 2008 to:

- DECCW;
- Registrar, *Aboriginal Land Rights Act 1983* (NSW);
- Illawarra Local Aboriginal Land Council (ILALC); and
- Wollongong City Council.

A local press advertisement requesting local Aboriginal stakeholders interested in being consulted, was run in the Illawarra Mercury newspaper on 10 October 2008. Responses to the advertisement and advice on consultation suggested that five Aboriginal groups were interested in the assessment process. These included:

- Illawarra Local Aboriginal Land Council (ILALC);
- D'harawal Knowledge Holders (DKH);
- Northern Illawarra Aboriginal Collective (NIAC);
- Wodi Wodi Elders Corporation; and
- Kullila Welfare and Housing Aboriginal Corporation.

Each group was provided with a written survey methodology, by post and email, between 6 and 11 November 2008. Comments and fieldwork registration were received from the ILALC, DKH and NIAC. All other stakeholders agreed to the proposed methodology, but did not provide the required information and insurances.

ILALC provided a letter to ERM stating that NIAC are not recognised as representing the Illawarra Aboriginal community, and that NIAC therefore cannot speak on behalf of 'country' and do not represent the views of the local Aboriginal community. The letter is provided in *Annex O*.

NRE representative Dr Chris Harvey was provided with a list of Aboriginal stakeholders and information forwarded by the community groups. Aboriginal group selection and engagement was undertaken by NRE.

Further details of the Aboriginal consultation are provided in *Annex O*.

The field survey aimed to target areas of Aboriginal archaeological potential based upon the initial desktop assessment, particularly within 100 m of any drainage lines and previously recorded sites.

During the surveys, ERM archaeologists discussed the local Aboriginal heritage values and patterning as well as management outcomes, with the community representatives. At the completion of the survey an open discussion was held regarding the future management of the study area. The outcomes of the discussions were agreed upon by all present. The outcomes of this consultation underwrite this heritage assessment.

Copies of the draft final report will be sent to all registered Aboriginal groups and Wollongong Council's Indigenous Heritage Officer and committee for comment and feedback on the content, assessment and recommendations. All comments received from these groups will be appended to this report when received. Any future work relating to the Aboriginal archaeological mitigation should include consultation with the relevant Aboriginal stakeholders.

17.3 ENVIRONMENTAL BACKGROUND

The purpose of this section is to provide the environmental contextual information that was used in developing a predictive model of potential Aboriginal site locations within the mining area. Interactions between people and their surroundings are of integral importance in both the initial formation and the subsequent preservation of the archaeological record. The nature and availability of resources including water, flora and fauna and suitable raw materials for the manufacture of stone tools and other items had (and continues to have) a significant influence over the way in which people use the landscape.

Alterations to the natural environment also impact upon the preservation and integrity of any cultural materials that may have been deposited, whilst current vegetation and erosional regimes affect the visibility and detectability of Aboriginal sites and objects. Environmental context is summarised in *Table 17.1.*

Table 17.1 Summary of environmental context

Feature	Description
Geology	East of the Illawarra Escarpment, the geology of the PAA comprises Permian age Illawarra Coal Measures, underlain by units of the Shoalhaven Group. West of the escarpment, the Permian deposits are overlain by units of the Triassic Narrabeen Group, comprising sandstone, siltstone, claystone, shale and tuffaceous claystone. Further west and extending across the majority of the PAA, these deposits are overlain by Hawkesbury Sandstone.
Landform	The PAA extends from the coastal slopes near Russell Vale, west across the Illawarra escarpment and the Woronora plateau.
Soil	The Russell Vale site is on the Illawarra Escarpment soil landscape, while the majority of the PAA occur west of the escarpment on the Lucas Heights and Maddens Plains soil landscapes (Hazelton and Tille 1990).
Hydrology	The availability of water has significant implications for the range of resources available and the suitability of the area for human occupation. Wallandoola Creek occurs above the V Mains mining area and two unnamed drainage lines which feed into Lizard Creek occur adjacent to the 309 Panel.
Flor a and Fauna	Fertile pockets of clay and shale have allowed rainforests to develop in parts of the PAA. Other vegetation communities include dry and wet sclerophyll forest and swamps. Many native animals also make these areas the home. It has been recorded that local Aboriginal peoples used these plants and animals as part of their economy.

The environmental assessment of the site indicates that the underlying geology presents a context that was favourable for the establishment of Aboriginal sites. Outcrops of sandstone on hill slopes can form overhangs that were favourable camping locations and used as art sites, the aspect of which, often presented views of water resources. The horizontal outcrops of sandstone revealed by water erosion caused by the creeks and tributaries would have provided useful locations to sharpen stone axes and thus lead to the formation of grinding grooves over time.

The numerous water resources in the area, including Wallandoola and Lizard Creeks and their associated swamplands, would have provided habitat for numerous species of fauna and flora which would have been exploited by Aboriginal peoples for food, medicines and implement making.

Within the majority of the PAA (outside of surface lease areas), soils in the area are likely to be relatively deep and undisturbed and only minor disturbance has occurred in relation to the construction of access roads and mining infrastructure. As a result, any archaeological sites are likely to be well preserved.

17.4 ARCHAEOLOGICAL BACKGROUND

17.4.1 Regional Ethno-History

Archaeological studies have confirmed that Aboriginal people have occupied the Australian sub continent for at least 40 000 years (c.f. Allen and O'Connell 2003). This date is frequently challenged with tentative indications that occupation may extend back into the early Pleistocene.

However, such early dates for the Sydney basin and surrounds have not been established. The earliest proven occupation dates in the Illawarra area are around 20 000 BP. Scientifically verified dates have been obtained from rock shelters near the Nepean River (14 700 BP; cited in Attenbrow 2002 and Flood 1999); from sites along the current Shellharbour coast (17 000 BP; cited in Attenbrow 2002 and Flood 1999); a rock shelter on Burrill Lake (20 760 BP; Lampert 1971 cited in Flood 1999), and a date of 17 000 BP has been returned from a shell midden site at Bass Point (Steele 2006).

Late Pleistocene dates, obtained from Holocene 'coastal' locations, represent Aboriginal Pleistocene occupation of hinterland locations (sea levels during the Pleistocene were lower than today, with the sea positioned around 16 km further east).

These early dates confirm a long history of Aboriginal occupation across the Illawarra region. Aboriginal occupation in the region has created an enduring and rich archaeological record; see the discussion relating to the archaeological record below. However, historical records relating to Aboriginal culture, at the time of European colonisation, are limited. Individuals, such as Tench (1793) and Matthews (1901) recorded facets of Aboriginal culture and language; albeit often as a secondary component to their primary research or objectives. Others, such as Tindale (1940; 1974), whilst aiming to record Aboriginal culture, could unfortunately, only record a social system which had been greatly altered during the preceding 150 years. Coupled with the inherent biases of western culture and society, the historical accounts are sometimes incorrect and/or lacking in detail.

However, coupling the available written documents with the archaeological record and oral histories (from descendents of the original inhabitants); allows a picture of Aboriginal society, demography and economy to be developed. The consequential account can be used to assist with interpreting and deciphering Aboriginal sites and their ancient landscape context.

17.4.2 Local Ethno-History

The regional social organisation of the Illawarra Aboriginal groups has been understood from oral histories, early historical accounts and linguistic studies. The tribal group in the Illawarra area, prior to European occupation, was the Wodi Wodi (DEC Undated B; 2005 and Tindale 1974) who spoke a variant of the Dharawal language (*Tharawal* [Mathews 1901:127]). The Dharawal name derives from traditional stories, which tell of the people's arrival in the mouth of Lake Illawarra bringing the Cabbage Tree Palm (Dharawal) with them from the north (DEC Undated B: 5).

Groups of Dharawal inhabiting the Illawarra were probably composed of small units (also referred to in the literature as bands, tribes, clans or named groups), comprising individuals who spoke a similar language. A group may have been composed of one or two adult males and their 'wives' and dependants (McDonald 1992). The groups of people undertook localised social interaction between themselves (such as marriage); whilst numerous groups formed larger units (bands or clans) that gathered resources, traded and held regional gatherings (Attenbrow 2002).

Local Aboriginal population density prior to European settlement is not clearly understood (as for most of Australia) and it is believed that Illawarra local groups were decimated early in European history from introduced diseases (Organ 1997). Official European settlement in the Illawarra began in 1816 once a government land survey had been conducted (DEC 2005). DEC states that 'Dr. Charles Throsby moved cattle into the area in 1815 via the Bulli Pass with the assistance of stockman Joseph Wild and two Aboriginal guides (possibly Bundle and Broughton). The first five land grants for the Illawarra were issued in late December 1817' (2005:14).

Settlement in the Illawarra by Europeans had a profound effect on Aboriginal society and economy. Land grants adjacent to the larger fresh water resources, clearance of forests and the commencement of agriculture would have restricted Aboriginal access to food and land. The introduction of exotic plants and animals resulted in a significant alteration to (and prevention of) traditional land care practices (such as bush burning). This impacted the social, political and cultural balance which existed between the Aboriginal groups. The result was enmities between the Illawarra Dharawal speakers and the Bong Bong, Broughton Creek, Kiama and Shoalhaven Dharawal speakers (DEC 2005:16).

The pattern of pre-European Aboriginal society and economy across the Illawarra is far different from that recorded during the nineteenth century. Aboriginal economy across the Illawarra was split with people referring to themselves as 'fresh water' or 'salt water' people; depending on whether they occupied the coastal areas or plateaus and inland river valleys (DEC Undated B: 5). The mining area is on the plateau. Environmental conditions on the plateau are described on the following pages.

Water, stone, clay, plant and animal resources were the raw materials utilised, collected and mined by the Illawarra Dharawal people. These materials (such as ochre, silcrete and basalt), were traded with neighbouring groups. Water was a key resource, and whilst plentiful within the flatter landscape adjacent to the coast, could be scarce on the higher plateau. To allow habitation within the inland areas, the Dharawal incised sandstone platforms with channels to drain water into carved wells (DEC Undated B: 11).

Resource gathering and patterns of habitation were influenced by the season. Knowledge of food resources influenced the timing for journeys, gatherings and festivals. An intricate knowledge of edible plants, their medicinal uses and practical applications was held by the Dharawal. Artefacts such as spears, shields and canoes were made from timbers, gums and resins. Nuts, feathers, teeth, ochres, animal skins and plant fibres were used to create decorative clothing, cloaks and ornamentation (DEC Undated B: 12).

Extensive use of resources created a visible symbology across a group's landscape (some of which may still remain today). For instance, the Dharawal identified distinct landforms from a distance by the colouring and form of trees (which were sometimes assigned uses by gender); ceremonial areas were defined spatially through carved trees; burials were also marked in such a way. During gatherings, trees were marked to designate camping areas for visiting groups (who may stay for weeks or months) (DEC Undated B: 13). Many uses of natural materials will not have resulted in an archaeological signature, e.g. smoke from leaves was used for communication over long distances; or annual indicators observed in plants or animals told people when they were in season or available. These cultural aspects would have resulted in use of resources, or actions of people, for which there may be a physical record (such as the resulting sites).

17.4.3 Local Archaeological Context

A literature review of the DECCW library (and additional reports held by ERM) was undertaken to understand the broader region's archaeological patterning. This review was targeted to those reports relevant to the PAA. Key word searches were used to find reports for the locality in AHIMS.

The majority of Illawarra heritage studies have concentrated on the coastal and estuarine zones (discussed in Navin Officer 2006). These studies have either been compiled as heritage or impact studies for the development sector or as local studies by an interest group.

Previous archaeological research in the Illawarra area suggests that Aboriginal sites are very common along the coastal plain. More recent research, triggered principally by mining environmental assessments, has started to identify and record Aboriginal sites across the Illawarra's hinterland. Aboriginal sites in this landscape context have been associated with resources, such as food and fresh water.

Archaeological models for Aboriginal Holocene occupation in the Illawarra region have been developed by a number of researchers. Most models suggested ridgelines were used as they provide access routes through the difficult hinterland terrain. Flat areas and saddles were favoured for repeat visits and would have been a focus for occupation activities, possibly resulting in an archaeological signature in these areas.

A brief overview of Aboriginal site types (from the wider recorded pattern in the DECCW's AHIMS) suggests that most Aboriginal sites are lithic sites, rock shelters with art and deposits and grinding grooves. A general connection appears to exist with shallow shelves of sandstone located on the upper reaches of ridgelines, which create small overhangs that were attractive locations to Holocene Aboriginal people.

Of direct relevance to the current assessment (in terms of archaeological content and proximity) are two academic studies (Sefton 1998; McDonald 1994) and five consultants' studies (Saunders 1997, 1998; Biosis 2005, 2007a, 2008a). A further two studies define the observed impacts on Aboriginal heritage sites resulting from longwall mining (Biosis 2007b, 2008b). A review of these reports is provided in *Table 17.2*.

Table 17.2 Previous Studies

Author	Type of archaeological work	Locality	Details of sites recorded
Sefton (1988)	Masters thesis (Unpublished)	Illawarra Escarpment	Focused on data collected by the Illawarra Prehistory group, who between 1970 and 1988 recorded hundreds of Aboriginal shelter sites. Sefton's Study Area comprised 351 km2 from the Illawarra escarpment (east) to the Woronora River (north), Cataract Catchment (south) and Wallandoola River (west). The outcomes of the work were a higher incidence of recorded grinding grooves in the Georges River Basin than the Cataract River Basin; suggesting a higher population density in the former. It was noted that rock engravings were found in the same locations as grinding grooves, although a higher incidence of engravings were noted in coastal locations.
Sefton (1993a)	Aboriginal Heritage Assessment	North of Mount Keira Rd	The Study Area consisted of 600 hectares on the northern side Mt Keira Road. Four sites were noted as occurring in the area: two axe grinding grooves, a shelter with deposit and axe grinding groove, and a shelter with art and axe grinding groove.
Sefton (1993b)	Aboriginal Heritage Assessment	Cordeaux Colliery	The Study Area consisted of 500 hectares mainly on the northern side of Mt Keira Road (with a small part on the southern). Sixteen sites were recorded: seven axe grinding grooves, six shelters with art, two shelters with deposit and one shelter with art and deposit.
McDonald (1994)	PhD Thesis (Published)	The Hawkesbury sandstone formation within the Sydney Basin	Focused on prehistoric rock art across the Sydney region. A number of points relevant to the current Study Area were drawn including: only 7% shelters with art contained deposits; 28% of shelter sites with deposits also contained grinding grooves; the majority of the art is depictive (66%), stencilled (33%) and only two of the sites (from 181) contained rock engravings; around half (41%) of motifs were unidentifiable (because of rock preservation); of the identifiable motifs, 49% were hand stencils or variants therein, 9% were macropods, 7% anthropomorphs, 6% other land animals. The majority of art was created by charcoal (or other dry pigment) stencilling, a few were painted; barely any used both techniques. The overall findings suggested that there was a major variation between the rock art techniques and motif types between the Woronora plateau and the central and northern areas of the Sydney basin.
Navin Officer (1995)	Aboriginal Heritage Assessment	Lake Cataract	The survey area consisted of three subsidence lines on the eastern and western sides of Lake Cataract: 42% of Line 1 was surveyed, as was 88% of Line 2 and 51% of Line 3. No sites were recorded.

Author	Type of archaeological work	Locality	Details of sites recorded
Navin Officer (1999a)	Aboriginal Heritage Assessment	Lake Cataract	The survey area consisted of land on the eastern and western sides of Lake Cataract, with attention focussed on rock exposures along watercourses, and mature trees. Particularly focus was on landform features most at risk of subsidence (sandstone rock shelters, overhangs and platforms). One previously recorded site (a shelter with art) was relocated during the survey. No additional sites were found.
Navin Officer (1999b)	Aboriginal Heritage Assessment	Cordeaux Colliery	Survey of 366 ha on the northern and southern sides of Mount Keira Road, and further south east for a pipeline and borehole. Five previously recorded sites existed in this area (three axe grinding grooves, a shelter with art and an isolated find). Five additional sites were found: three shelters with art and two axe grinding grooves.
Navin Officer (2000)	Aboriginal Heritage Assessment	Cordeaux Colliery	The survey area consisted of land on the western side of Lake Cataract, with attention focussed on rock exposures along watercourses, and mature trees. Twelve recorded sites existed in this area: seven shelters with art; four shelters with art and deposit; and one axe grinding groove site. Two additional sites were recorded: a shelter with art and deposit, and a shelter with art.
Sefton C. 2000	Monitoring study of effects of subsidence to archaeological sites	Woronora plateau	51 overhangs were monitored to determine effects of underground mining. Five showed changes. Four showed evidence of movement (crack or opening) as well as flaking, block fall and cracking of associated surfaces. One had water damage to the rear wall of the cave. There was no indication of deposits being affected by subsidence. It was noted that the main threat to panels containing the art was the effects of cracking or flaking.
Navin Officer (2001a)	Aboriginal Heritage Assessment	Wallandoola Creek	The survey area consisted of land north and east of Wallandoola Creek, with attention focused on rock exposures along watercourses, and mature trees. Particular focus was on landform features most at risk of subsidence (sandstone rock shelters, overhangs and platforms). Four previously recorded sites were within the survey area (two shelters with art, one axe grinding groove site and one shelter with art and deposit and axe grinding grooves). Five additional sites were found (two shelters with art, one shelter with art and deposit, one axe grinding groove site and one isolated find). Ten PADs were also identified.
Navin Officer (2001b)	Aboriginal Heritage Assessment	Cordeaux Colliery	The survey area consisted of land on the western side of Lake Cataract, with attention focused on rock exposures along watercourses, and mature trees. Particularly focus was on landform features most at risk of subsidence (sandstone rock shelters, overhangs and platforms). Two shelters with PADs and one shelter with art were found.
Dallas, M. 2002	Archaeological Test Excavation	Stuart Park	116 stone artefacts recovered from three pits. The site was small and was therefore of low significance as it did not hold the potential to contain a

Author	Type of archaeological work	Locality	Details of sites recorded
			statistically strong sample to gain new information.
Navin Officer (2003)	Aboriginal Heritage Assessment	Cordeaux Colliery	No sites were recorded.
Navin Officer 2006	Aboriginal Heritage Assessment	Mt Ousley	No Aboriginal sites were located during survey. Recommended that Aboriginal groups be invited to monitor.
Steele D. 2006	Aboriginal Heritage Assessment	Wollongong	No new sites identified during survey
Roberts. A 2007	Aboriginal & European Heritage Assessment	Darkes Forest	Two Aboriginal sites identified a scarred tree and an ochre/gypsum quarry with associated artefact scatter and PAD. Minimisation of impact to sites recommended, no disturbance of the PAD and monitoring of the excavation works of the development.
ERM (2009)	Aboriginal Heritage Assessment	V Mains – NRE No.1 Colliery	Four Aboriginal heritage sites were identified through a DECCW) search of the AHIMS) . Two of these sites were able to be relocated during archaeological survey. One site, Wallandoola 2 lies within the subsidence impact zone of the V Mains. This is a rock shelter with grinding grooves and artefacts, considered to have moderate archaeological potential.

17.4.4 Recent Mining Subsidence Impact Assessments

Of direct relevance to the current study are the potential impacts from longwall mining subsidence. A number of key reports, by consultants and the NSW Government, have recently been written on the subject. The following review provides a discussion of longwall mining subsidence. This review will be used to underpin the impact assessment portions of this assessment.

Sefton (2000)

Sefton (2000) prepared a ten year monitoring program assessing the impacts of longwall coal mining in the Southern Coal Fields on sandstone overhang Aboriginal archaeological sites. Sefton inspected and monitored a total of 52 sites, prior to, during and after long wall mining (2000:15). The results of the assessment program (and a principle component analysis using 16 variables) were:

- five of the 52 sites had evidence of impacts resulting from mining (2000: 17-18);
- the impacts from longwall mining could be grouped into four categories: cracking, movement along existing joints/bedding planes, block falls and change to the pattern of water seepage through the rock.

- the components associated with most change were: overhang size (especially length); wetness of the overhang; location near the valley bottom; location above the goaf [that part of a mine from which the mineral has been partially or wholly removed]; and block-fall type shelters;

- no monitored overhang collapsed during the study;

- no monitored overhang less than 50 m^3 has suffered subsidence impacts (irrespective of other risks);

- not all sites larger than 50 m^3 suffer impacts (only five of the 23 large overhang [>50 m^3]suffered an impact);

- the 'over-riding factor which appears to be significant is overhang size where large overhangs are at greater risk' (2000:38); and

- the impacts caused by subsidence were not observed until at least three months post mining.

Biosis (2007b)

Biosis (2007b) reviewed the potential impacts to cultural heritage sites in the Dendrobium Area 2 Subsidence Management Plan (SMP) area. A single Aboriginal site (a sandstone shelter with art, AHIMS# 52-2-2252) was located, which had moderate significance and was to be subject to a number of subsidence related movement impacts. Site 2252 was located two km north of the current study area. The aim of the study was to 'assess the impacts of predicted subsidence on identified heritage sites and recommend management and mitigation measures' (2007b:3).

An assessment of potential impacts to Site 2252 was made. The site was judged to be at some risk because of its large size (>50 m^3), the block fall shelter formation, bedding and jointing planes present, dampness and location directly over a longwall goaf. It was predicted that the site was at some risk from potential impact, because of the compressive and tensile strains were enough to deform the rock and the cliff formation containing the site was in an advanced stage of natural erosion (2007b:32).

Biosis (2008b) provides the results from the assessment, post long wall mining subsidence on Aboriginal Site 2252 undertaken six months post mining.

The results of the assessment showed that the site had suffered some damage attributable to subsidence movement. This damage included: the opening of a pre-existing crack at the base of the back wall; and the down slope slumping of talus and boulders adjacent to the site. Twenty monitoring points were observed; only one of which had changed. The observed change was minor additional opening of a pre-existing crack to a width of 10 mm. Soil cracking and displacement of boulders was observed in the front of the shelter (2008b:7).

17.5 RUSSELL VALE SITE

17.5.1 Study Area

The study area for assessment of the surface facilities upgrade focuses on the Russell Vale site. The Russell Vale site occupies approximately 100 ha east of the Illawarra Escarpment. The Russell Vale site includes the administration offices and coal handling facilities.

17.5.2 AHIMs Data

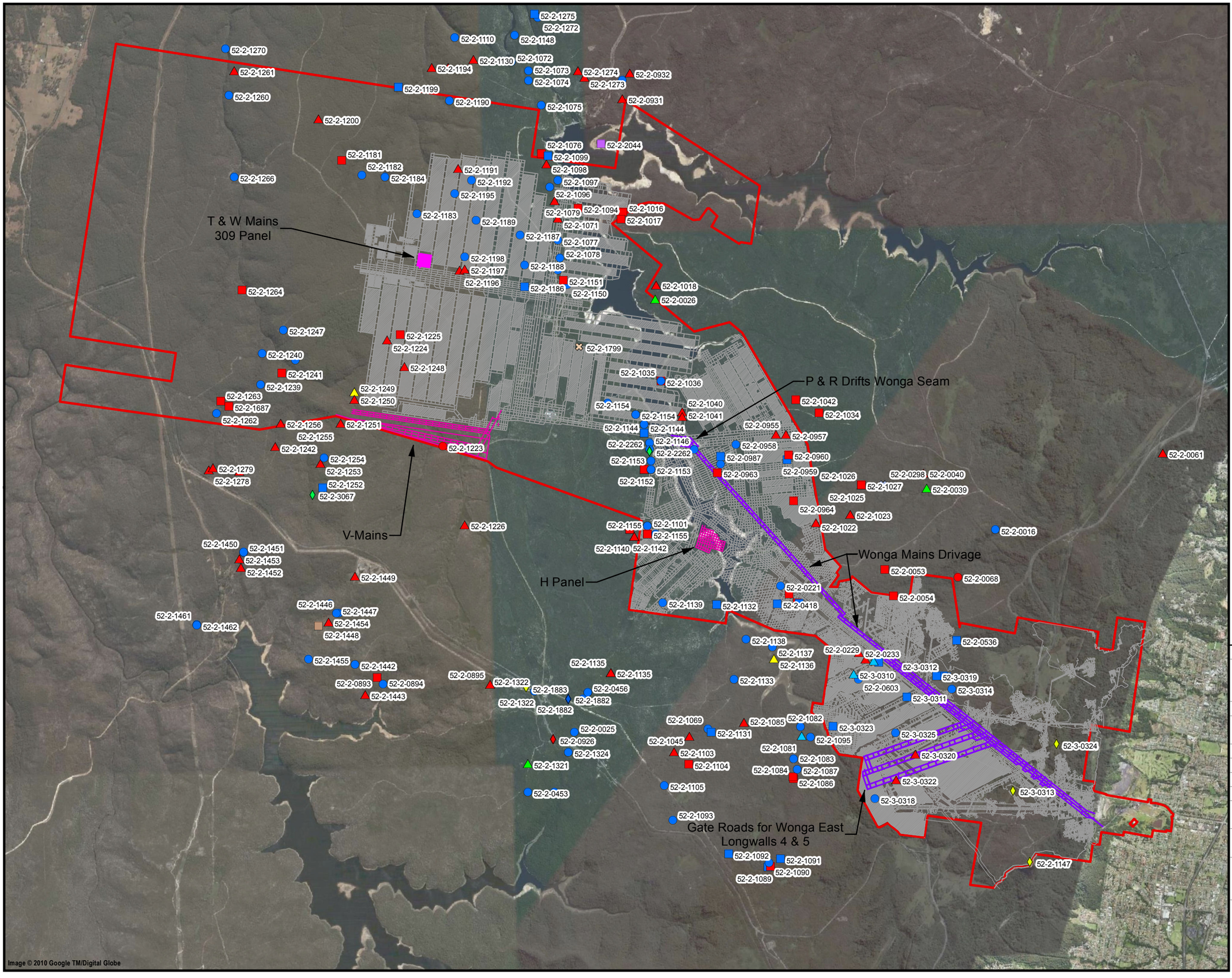
A search of the DECCW Aboriginal Heritage Information Management System (AIHMS) database for an area 12 km by 12 km, with the NRE No.1 Colliery at the centre of the search, was undertaken on 17 October 2008. The search identified 254 recorded Aboriginal sites, the substantial majority of which were shelter sites containing a combination of art, archaeological deposits and grinding groove. No sites were identified at the Russell Vale site (*Figure 17.1*). West of the Russell Vale site on the Woronora Plateau there are three registered sites 52-2-1147, 52-3-0313 and 52-3-0324, all three are open artefact scatters that sit at the top of the slope. Two are recorded as close to a creek.

East of the Russell Vale site there are sites recorded along the coast and these are all predominantly midden sites.

17.5.3 Predictive Model

The Russell Vale site has been extensively modified during the European use and the long history of mining at this location. The Russell Vale site is located on the lower slopes of the Woronora plateau, and as such contains some sandstone features but few areas of sandstone overhangs as found further up in the Woronora Plateau.

Table 17.3 provides a description of the various archaeological site types and the environments where they are generally found. A statement is made on the likely presence of each site type within the Russell Vale site.



Legend

- Project Application Area

AHIMS Site Type

- Axe Grinding Groove
- Axe Grinding Groove, Rock Engraving
- Axe Grinding Groove, Shelter with Art
- Axe Grinding Groove, Shelter with Art, Shelter with Deposit
- Axe Grinding Groove, Shelter with Deposit
- Isolated Find
- Art
- Open Camp Site
- Rock Engraving
- Rock Engraving, Shelter with Art
- Scarred Tree
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Shelter with Art, Shelter with Midden
- Shelter with Art, Shelter with PAD
- Shelter with Deposit

Figure 17.1
AHIMS Search Results

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS003_R1.mxd	
Date:	03/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

N

0 510 1,020 1,530m

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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ERM

Table 17.3 Aboriginal sites commonly found in the local area

Site types	Definitions
Stone artefact scatters	Stone artefact scatters are collections of stone, frequently brought from other areas, which demonstrate evidence for Aboriginal working, use and/or discard of the stone at a single location. Stone artefact concentrations may be associated with any of the site types listed in this table. Where such sites are buried by sediment they may not be noticeable unless exposed by erosion. These sites may be found in any undisturbed landform across the local area, but are most likely to be associated with waterways, flat landforms and ridgeline. It is anticipated that if stone artefact scatters are present they will be found in association with Bellambi Gully Creek.
Isolated finds	Sites consisting of only one identified stone artefact, isolated from any other artefacts or archaeological evidence (and defined by an arbitrary separation distance of 50 m). They are generally indicative of sporadic past Aboriginal use of a location. A distinction should be drawn between isolated finds which are a component of the background distribution and objects such as axes, hammer stones, grinding dishes etc which would have been used repeatedly. These sites may be found in any undisturbed landform across the local area, but are most likely to be associated with waterways, flat landforms and ridgeline. It is anticipated that if isolated stone artefacts are present they will be found in association with the original Bellambi Gully Creek.
Grinding grooves	Grooves resulting from the grinding of stone axes or other implements are found on flat areas of suitable sandstone. They are often located near waterholes or creek beds as water is necessary in the sharpening process. In areas where suitable outcrops of rock were not available, transportable pieces of sandstone were used. These site may be found on open sandstone platforms if they occur near the original Bellambi Gully Creek., if this site type is found it is anticipated that they would be located close to or within original Bellambi Gully Creek.
Shelter sites	Sandstone shelters and overhangs were used by Aboriginal people to provide habitation areas sheltered from the rain and sun. The deposits in such sites are commonly very important because they often contain clearly stratified material in a good state of preservation. The Russell Vale site does not contain areas of stone overhangs and thus it is not expected that this site type will be present.

Site types	Definitions
Quarries	These are areas where stone was obtained for flaked artefacts or ground-edge artefacts, or where ochre was obtained for rock paintings, body decoration or decorating wooden artefacts. There are no known sources of stone tool raw materials located within the study area and thus this site type is not predicted to be present.
Art sites	Aboriginal paintings, drawings and stencils are commonly found where suitable surfaces occur in sandstone shelters and overhangs. These sites are often referred to as rock shelters with painted art. Rock engravings, carvings or peckings are also to be found on sandstone surfaces both in the open and in shelters. These are referred to as rock engraving sites. As there are no overhangs at the Russell Vale site and no large open sandstone platforms it is not expected that this site type will be present within the study area.
Scarred trees	Scarred trees bear the marks of bark and wood removal for utilisation as canoes, shields, boomerangs or containers. It is commonly very difficult to confidently distinguish between Aboriginal scars and natural scars or those made by Europeans. Scars may also originate as 'foot-marks', small pockets cut into the bark of a tree enabling the tree to be climbed. The Russell Vale site has been cleared of original vegetation and there is no chance of scarred trees being present.
Burial sites	Burials may be of isolated individuals, or they may form complex burial grounds. Often associated with other site types such as middens, or mounds. These sites are not expected to be located within the local area .
Stone arrangements, carved trees and ceremonial grounds	These site types are often interrelated. Stone arrangements vary from simple cairns or piles of rocks to more elaborate arrangements; patterns of stone laid out to form circles and other designs, or standing slabs of rock held upright by stones around the base. Carved trees may have intricate geometric or linear patterns or representations of animals carved into their trunks. Ceremonial grounds and graves were often marked by such trees. Bora grounds are a common type of ceremonial site and they are generally associated with initiation ceremonies. They comprise two circles, generally edged with low banks of earth but sometimes of stone, a short distance apart and connected by a path. It cannot be predicted whether these sites will occur.

17.5.4 Fieldwork

Fieldwork was undertaken on 20 April 2010. Two Aboriginal community representatives Peter Falk (DKH) and Richard Campbell (ILALC) accompanied Dr Diana Neuweger (ERM).

Methodology

The field survey looked at the areas to be disturbed by the proposed facility upgrades and the area of the original Bellambi Gully Creek.

A hand held GPS was used to record the tracks walked during fieldwork. *Figure 17.2* shows the survey tracks undertaken. A digital SLR camera was used to record photographs.

Results

There were no Aboriginal archaeological sites recorded during the field survey. The Russell Vale site has been extensively modified and cleared. There were no old growth trees located within the areas to be impacted by the facility upgrades. There were no areas of archaeological potential identified during the field survey. The Aboriginal community did not express any concern that the proposed works will impact on cultural or spiritual sites.

Ground visibility was almost non existent over the entire Russell Vale site. Vegetation growth along the Bellambi Gully Creek was dense and gave very limited visibility. Coal reject has been dumped over parts of the Russell Vale site for road base and provides no visibility of the original ground.



Photograph 17.1 Showing vegetation growth around Bellambi Gully Creek



Legend

- Project Application Area
- Survey Transect

Figure 17.2
GPS Tracks

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS004_R1.mxd	
Date:	03/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

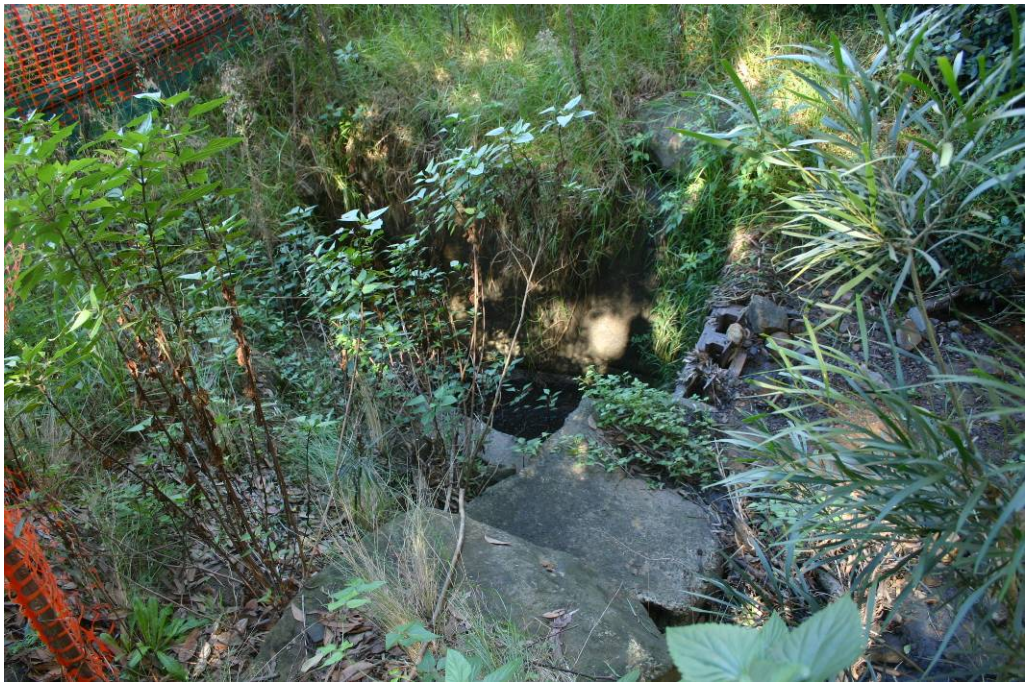
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Photograph 17.2 Concrete culvert via which the open channel of Bellambi Gully Creek is currently directed into the underground pipe.



Photograph 17.3 Coal reject road base



Photograph 17.4 Hillslope in central western area near the ROM Stockpile showing some terracing of the hill slope and past vegetation clearing.



Photograph 17.5 The original creek line crossed the decline conveyor and is currently channelled in a concrete culvert under the conveyor.

The Aboriginal representatives present considered that as the site has been extensively modified, there is no concern that any Aboriginal sites may harmed by the proposed works. The Aboriginal representatives advised that no monitoring of works would be required but that a Management Plan for chance find protocols should be in place prior to works being undertaken.

17.6 MINING AREAS

17.6.1 Study Area

The study area for assessment of the mining focuses on areas with the potential for surface disturbance resulting from mine related subsidence. In accordance with the Southern Coalfields Inquiry, land within 600m of the underground extraction area has been included in the study area. The study area is divided into two geographically separate areas. The V Mains study area and the 309 Panel study area.

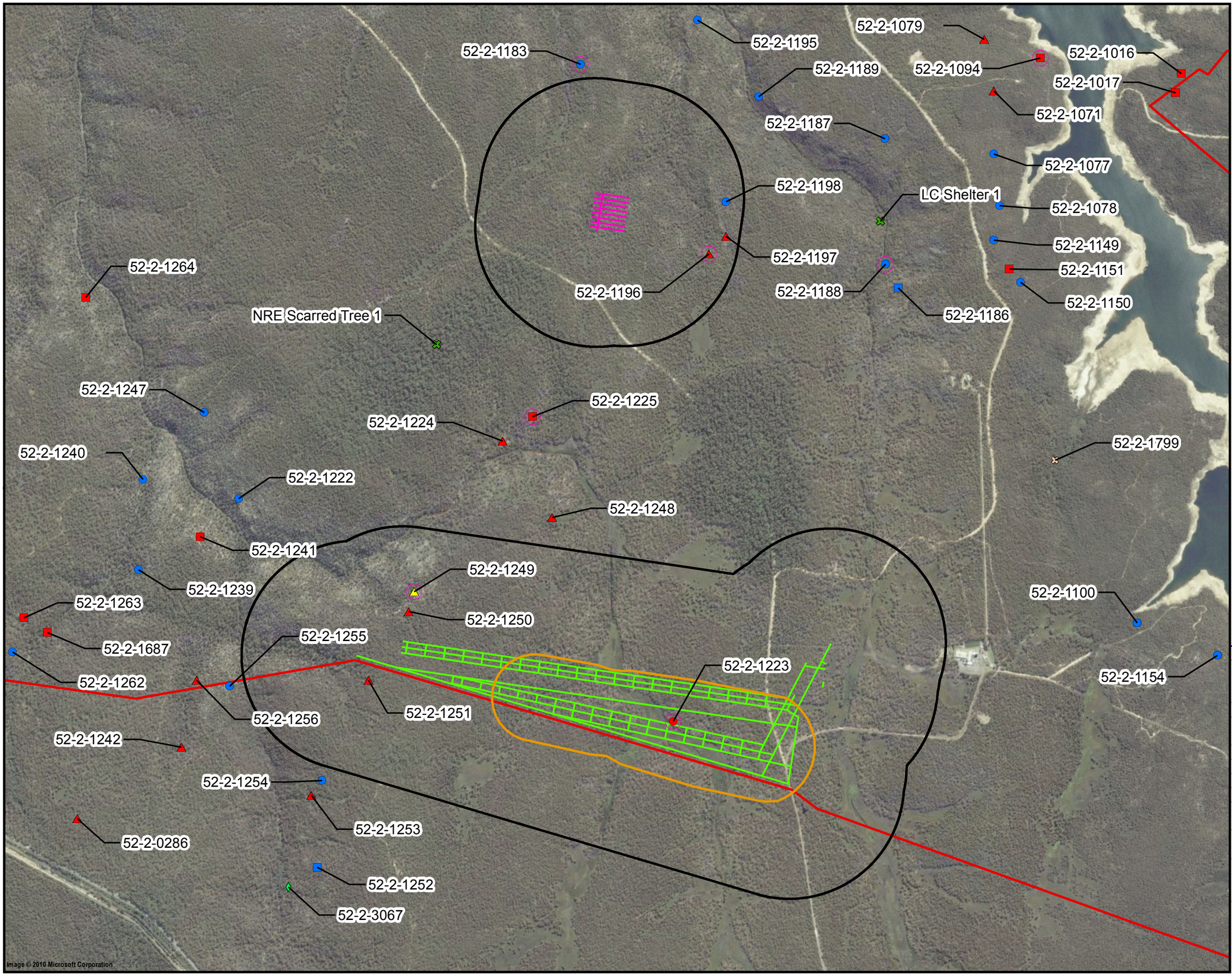
17.6.2 AHIMS Data

A search of the DECCW AHIMS database was undertaken as described in Section *17.5.2*. This search was refined focussing on the V Mains and 309 Panel study areas. Eight recorded Aboriginal sites were identified within the study areas and are listed in *Table 17.4* and shown on *Figure 17.3*.

Table 17.4 AIHMS registered sites within the Study Area

AHIMS Site Id[1,]	AHIMS Site Name	Context	Site Type
Wonga West			
52-2-1183	Lizard Creek Site 14	Enclosed Shelter	Shelter with Art
52-2-1196	Lizard Creek Site 11	Open Site	Axe grinding grooves
52-2-1197	Lizard Creek Site 12	Open Site	Axe grinding grooves
52-2-1198	Lizard Creek Site 13	Enclosed Shelter	Shelter with Art
52-2-1223	Wallandoola Site 2	Enclosed Shelter	Shelter with Deposit, and Axe grinding grooves
52-2-1249	Wallandoola Site 13	Enclosed Shelter	Shelter with Art, and Axe grinding grooves
52-2-1250	Wallandoola Site 14	Open Site	Axe grinding grooves
52-2-1251	Wallandoola Site 15	Open Site	Axe grinding grooves

1. Co-ordinates for sites were estimated off topographical maps by the Illawarra Prehistory Group in the early 1980s. When sites are re-recorded with modern GPS equipment, errors in the original co-ordinates of up to 400 m are not uncommon.



Legend

- Project Application Area
- Study Area
- Potential Subsidence Footprint

Proposed Workings

- T & W Mains - 309 Panel
- V-Mains

- Identified Heritage Site (ERM 2009)
- Relocated AHIMS Site (ERM 2009)

AHIMS Site Type

- Axe Grinding Groove
- Axe Grinding Groove, Shelter with Art
- Axe Grinding Groove, Shelter with Deposit
- Art
- Scarred Tree
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Shelter with Deposit

Figure 17.3

Aboriginal Heritage Items adjacent to the VMains and 309 Panel Areas

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS011_R1.mxd	
Date:	03/09/2010	Drawing size: A3
Drawn by:	NS	Reviewed by: MK
Scale:	Refer to Scale Bar	

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0 170 340 510m

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17.6.3 Predictive model

Table 17.5 provides an overview of the most likely site types which could be found within the 309 Panel and V Mains study area.

Table 17.5 Aboriginal sites commonly found in the local area

Site types	Definitions
Stone artefact concentration	Stone artefact concentrations are collections of stone, frequently brought from other areas, which demonstrate evidence for Aboriginal working, use and/or discard of the stone at a single location. Stone artefact concentrations may be associated with any of the site types listed in the table. Where such sites are buried by sediment they may not be noticeable unless exposed by erosion or disturbed by modern activities. These sites may be found in any landform across the study area, but are most likely to be associated with waterways, flat landforms and ridgeline. It is expected that some stone artefact concentrations will be present.
Isolated finds	Sites consisting of only one identified stone artefact, isolated from any other artefacts or archaeological evidence (and defined by an arbitrary separation distance of 50 m). They are generally indicative of sporadic past Aboriginal use of a location. A distinction should be drawn between isolated finds which are a component of the background distribution and objects such as axes, hammer stones, grinding dishes etc which would have been used repeatedly. These sites could be recorded anywhere within the study area.
Background distribution	Represents the low density of Aboriginal objects that have been discarded but cannot be associated with concentrations of objects. The background distribution is a record of Aboriginal occupation of an area. The density that defines the background scatter needs to be defined through local comparisons. It is recognised that regionally there is a low density count of background objects recorded across the escarpment.
Shelter sites	Sandstone shelters and overhangs were used by Aboriginal people to provide habitation areas sheltered from the rain and sun. The deposits in such sites are commonly very important because they often contain clearly stratified material in a good state of preservation. These sites are expected to be located within the study area.
Grinding grooves	Grooves resulting from the grinding of stone axes or other implements are found on flat areas of suitable sandstone. They are often located near waterholes or creek beds as water is necessary in the sharpening process. In areas where suitable outcrops of rock were not available, transportable pieces of sandstone were used. These sites are expected to be located within the study area.
Quarries	These are areas where stone was obtained for flaked artefacts or ground-edge artefacts, or where ochre was obtained for rock paintings, body decoration or decorating wooden artefacts. These sites have a low chance of being located within the study area, sandstone geology

Site types	Definitions
Art sites	Aboriginal paintings, drawings and stencils are commonly to be found where suitable surfaces occur in sandstone shelters and overhangs. These sites are often referred to as rock shelters with painted art. Rock engravings, carvings or peckings are also to be found on sandstone surfaces both in the open and in shelters. These are referred to as rock engraving sites. These sites are expected to be located within the study area.
Scarred trees	Scarred trees bear the marks of bark and wood removal for utilisation as canoes, shields, boomerangs or containers. It is commonly very difficult to confidently distinguish between Aboriginal scars and natural scars or those made by Europeans. Scars may also originate as 'foot-marks', small pockets cut into the bark of a tree enabling the tree to be climbed. These sites have a moderate chance of being recorded within the study area, but only in areas with old growth trees.
Burial sites	Burials may be of isolated individuals, or they may form complex burial grounds. Often associated with other site types such as middens, or mounds. These sites are not expected to be in the study area.
Stone arrangements, carved trees and ceremonial grounds	These site types are often interrelated. Stone arrangements vary from simple cairns or piles of rocks to more elaborate arrangements; patterns of stone laid out to form circles and other designs, or standing slabs of rock held upright by stones around the base. Carved trees may have intricate geometric or linear patterns or representations of animals carved into their trunks. Ceremonial grounds and graves were often marked by such trees. Bora grounds are a common type of ceremonial site and they are generally associated with initiation ceremonies. They comprise two circles, generally edged with low banks of earth but sometimes of stone, a short distance apart and connected by a path. It cannot be predicted whether these sites will be in the study area.
Resource areas	Resource gathering areas represent landforms that contain a large number of fauna and flora species, which were known Aboriginal resources. Resource areas are frequently associated with permanent water resources, often swamps or marshes, and frequently have recorded sites such as middens nearby. Landforms associated with these sites are often flats with a favourable outlook. These sites are not expected to be in the study area.

17.6.4 Fieldwork

Methodology

The study area was surveyed in two field trips in 2009. The survey methodology was prepared in light of the archaeological background analysis, the guidelines provided by NPWS for Archaeological survey and by the DGRs.

The surveys took the form of a pedestrian survey. Owing to the difficult nature of the terrain and low ground surface visibility in much of the study area, conventional survey transects were not able to be walked. The survey targeted locations of previously recorded archaeological sites, ridgelines, areas associated with sandstone overhangs, large sandstone platforms associated with water and creeklines, where unregistered sites may have been present. Ground surface visibility was variable, however it was generally low, ranging between 0% to 10%.

Previously recorded sites were targeted to determine their current condition. Sites that were relocated were assessed against the original detail on the site cards to determine any changes that may have impacted the sites.

The co-ordinates for previously recorded sites documented by the Illawarra Prehistory Group in the mid 1980s were at the time estimated from topographic maps. This created difficulties in accurately relocating sites in extremely difficult terrain with dense vegetation hindering visibility. A multi-step methodology for relocating these sites was developed and involved:

1. Surveying a 100 m radius around a given co-ordinate in an effort to identify the archaeological site and/or features described in the site card relocation instructions;

2. Identifying key landform features mentioned in site card relocation instructions and possible candidate areas for further inspection; and

3. Surveying natural features such as sandstone overhang ridgelines and sandstone platforms.

This methodology helped to increase the chances of relocating sites, and enabled targeted survey of potential culturally sensitive landforms (overhangs etc) in a systematic fashion.

When heritage sites were identified, they were recorded by the survey team for content, GPS location and digitally photographed.

Results

No new sites were identified within the study area during fieldwork. Four AHIMS registered sites were relocated including 3 rock shelters and one grinding groove site. The correct GPS co-ordinates recorded for site 52-2-1183 place it out side the study area. A summary of the survey results is provided in *Table 17.6*.

Table 17.6 Aboriginal sites relocated and identified during survey

AHIMS Site Number	AHIMS Site Name	AHIMS Site Type
Wonga West		
52-2-1223	Wallandoola Site 2	Shelter with Deposit and Axe grinding groove
52-2-1183[1]	Lizard Creek Site 14	Shelter with Art
52-2-1196	Lizard Creek Site 11	Axe Grinding Grooves
52-2-1249	Wallandoola Site 13	Shelter with Art and axe grinding grooves

1. GPS co-ordinates place this site outside the study area. Assessment of this site has not been undertaken.

Relocated Site Descriptions

52-2-1196 Lizard Creek Site 11

Lizard Creek Site 11 is a grinding groove site composed of three grinding grooves cut into a 24m by 6m sandstone exposure approximately 20 m from a small waterfall. The largest grinding groove measures 380 mm long, 80mm wide and 10 mm deep. Originally recorded by the Illawarra Prehistory group in 1985 the site was revisited again in 1991 and was recorded as being in good condition.



Plate 3 – *52-2-1196 Lizard Creek Site 11* – Rock platform and rock pools where grinding grooves are located. Facing south.



Plate 4 – *52-2-1196 Lizard Creek Site 11* – Three grinding grooves.

52-2-1223 Wallandoola Site 2

Wallandoola Site 2 is a rock shelter facing west over a tributary of Wallandoola Creek. A tree has grown up in front of the shelter and the overhanging rock rests against its trunk. There were reportedly 19 grinding grooves associated with shelter and a deposit of greater than 30 cm depth consisting of grey loamy sand. One red jasper flake and one grey quartzite flake were also recorded at the site. No art was recorded in the shelter.

A follow up condition assessment was undertaken by Sefton (year of assessment not provided). This identified two wombat burrows, fresh fungal growth and chemical weathering. Sefton also speculated that the presence of a 'stone wall' hinted at European occupation.

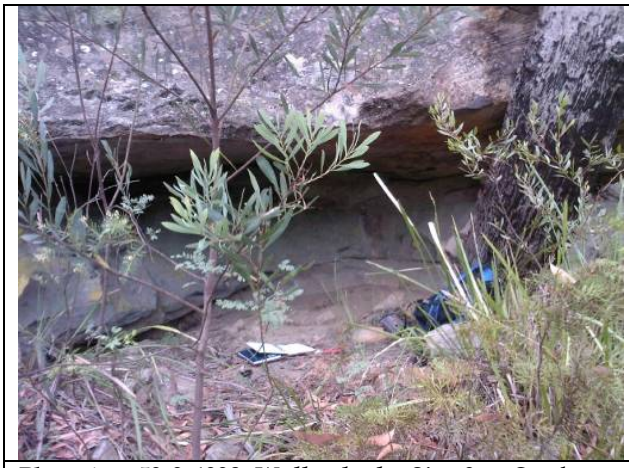


Plate 1 – *52-2-1223 Wallandoola Site 2* – Sandstone overhang.

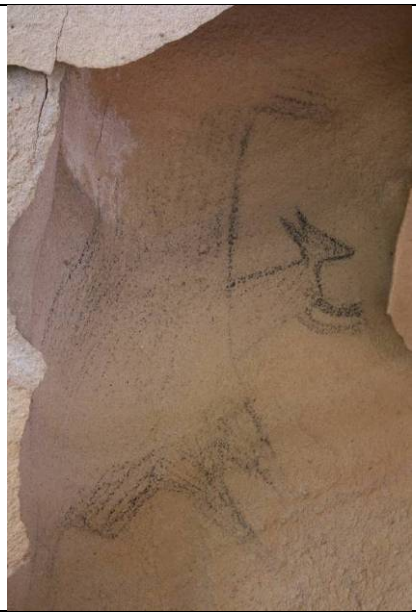


Plate 2 – *52-2-1223 Wallandoola Site 2* – Grinding grooves within the overhang.

52-2-1249 Wallandoola Site 13

Wallandoola Site 13 is a rock overhang formed by a block fall and cavernous weathering. A number of painted images were recorded on the wall of the shelter. The art includes two charcoal outline and infill macropods (one with a joey), 1 profile human figure, 1 charcoal front human figure, three red stencils and three indeterminate charcoal drawings.

Field inspection on February 2009 noted the same features as recorded in the site card. The rock art and condition of the rock shelter are identical to the description and photographs in the site card. The grinding groove was still obvious and the shelter contains a loose sandy deposit that has the potential to be of some depth and to contain archaeological artefacts and indicators of occupation.

	
Plate 5 – *52-2-1249 Wallandoola Site 13* – Sandstone overhang.	**Plate 6 – *52-2-1249 Wallandoola Site 13* –** Charcoal outline of macropod and joey.

Non Relocated Site Descriptions

52-2-1197 Lizard Creek Site 12

Lizard Creek Site 12 is a series of 23 grinding groove located on a 7m by 2m surface of sandstone along a creek bed. There are 10 grooves at the bottom edge of a small pothole and with the remainder located near the edge of 1.5m drop. Originally recorded by the Illawarra Prehistory Group in 1985, the site was revisited in 1991 and recorded as being in good condition.

52-2-1198 Lizard Creek Site 13

Lizard Creek Site 13 is a rock shelter with art, grinding groove and an archaeological deposit. The sandstone overhang is 2 m in length, 3.3m wide and 2.3m in height. The aspect of the shelter is south west and the living area is 12m by 2m. The deposit is brown-grey sandy loam approximately 15 cm in depth. At least 25 stone artefacts of chert, silcrete, jasper and quartz are located on the dripline. There are two indeterminate charcoal drawings. Recorded by the Illawarra Prehistory Group in 1987.

52-2-1250 Wallandoola Site 14

Wallandoola Site 14 is a series of 10 grinding grooves. 5 grooves are located 30 cm back from the ledge in water flow in an area measuring approximately 20m x 3 m. The largest groove measures 360cm x 70cm x 10cm. Another groove is located upstream on edge of water flow, 3 grooves are located a further 12 m upstream, with another 1 found 10 m up from that the final groove located other 36 m further up. The overall area is estimated to be 50m x 40m. The whole area is below a small swamp.

52-2-1251 Wallandoola Site 15

Wallandoola Site 15 is recorded as being an extensive collection of 52 grinding grooves. The axe groove site is upstream from the edge of a 2.5 m high waterfall. 5 grooves are located on the lower edge of the first pothole 1.5 m from the edge; 12 on the lower edge of the second pothole with one other 20 cm west of them. The area is on the creek bed and measures 10 m x 8 m, 3 m upstream another 4 grooves below a pothole with 3 others above at top of the 7 m upstream on an area 10 x 9 m just above another small drop. 13 grooves around a small pothole with a water channel 2 m long x 40 mm wide x 5 mm deep leading from above the pothole with the 13 grooves near the top of this is a short parallel water channel. 10 m south west is an area of sandstone 16m x 4 m, 8 m from the top of the area are 3 grooves, 4 m lower down are 8 more grooves, 2m southwest of this unit are 3 more.

17.6.5 Heritage Significance

Aboriginal heritage sites, objects and places hold value for communities in many different ways. The nature of those heritage values is an important consideration when deciding how to manage a heritage site, object or place and balance competing land-use options.

ERM's approach to the Aboriginal heritage assessment is based upon identifying the key Aboriginal heritage values; values that are likely to be both tangible and intangible. This approach needs to consider the values assessment from the scientific and Aboriginal community perspectives, in accordance with Australian best practice documents.

This assessment focuses upon the scientific significance assessment of the sites observed and recorded during the survey, and the AHIMs sites located within the study area. The Aboriginal community has provided input into the survey and assessment and has been afforded the opportunity to comment on the report (provide in *Annex O*) for a cultural and social significance assessment of the sites recorded.

Archaeological Potential

Archaeological potential relates to the likelihood of discovering an Aboriginal object or site, within a location. Areas with archaeological potential were identified according to the definitions in *Table 17.7*.

Table 17.7 Definitions of Archaeological Potential

Rank	Definition	Example
No potential	Artefacts cannot occur in-situ.	Eroded landforms, reconstructed landscapes, hazardous landscape, developed areas.
Low potential	Artefacts are not normally found in comparable contexts but could occur in low densities making detection unlikely.	Landforms with no specific focus for use, i.e. with no water sources or undifferentiated slopes.
Moderate potential	Artefacts are known to occur in comparable landforms in detectable densities (~1 artefact/m^2) and there is an unknown possibility for detection.	Landforms with an environmental focus which may have seen seasonal visitation.
High potential	Artefacts are consistently found in comparable landforms or similar environmental contexts and thus will certainly be found in any ground breaking works.	Landforms with known environmental focus encouraging repeat visitation to specific locale, i.e. margins of swamp or near high order creeks.

Scientific Significance Assessment

There are six key criteria which may be used to examine the scientific value/significance of a site. These are listed in *Table 17.8*.

Table 17.8 Scientific significance criteria

Criteria	Definition
Rarity	Whether any or all aspects of a site can be considered common or rare within a local, regional or national context.
Representativeness	The comparative rarity of the site when considered and contrasted against other similar sites conserved at the local and/or regional level.
Archaeological landscapes	The study of the cultural sites relating to Aboriginal peoples within the context of their interactions in the wider social and natural environment they inhabited.
Connectedness	Whether the site can be connected to other sites at the local or regional level.
Integrity and condition	Integrity refers to the level of modification a site has been subject to (the cultural and natural formation process) and whether the site could yield intact archaeological deposits. Condition takes into account the state of the material.
Complexity	The demonstrated or potential ability of a site to yield a complex assemblage and/or features.
Archaeological potential	The potential to yield information that will contribute to an understanding of contemporary archaeological interest, or which could be saved for future research potential.

Statement of Heritage Significance

Seven AHIMS listed sites have been identified as occurring within the study areas. A statement of heritage significance for each relocated archaeological site is provided below. *Table 17.9* provides a summary of the scientific and cultural significance assessment for all sites within the study areas.

No significant or moderate changes were observed to the relocated sites during the survey. All relocated sites were in generally the same condition as described on the original site card. It has therefore been assumed that non relocated sites will be in generally the same condition as described on the original site card. The significance and impact assessment for the non relocated sites are therefore based on the information recoded on the AHIMS site cards.

Table 17.9 Summary of Significance Assessment

AHIMS Site Number	Context	Archaeological potential	Scientific significance[1]	Aboriginal social significance[2]
Wong West				
52-2-1196	Open Site	Low	Low	High
52-2-1197	Open Site	None	Low	High
52-2-1198	Enclosed Shelter	High	High	High
52-2-1223	Enclosed Shelter	Moderate	Moderate	High
52-2-1249	Enclosed Shelter	Moderate	High	High
52-2-1250	Open Site	None	Low	High
52-2-1251	Open Site	None	Low	High

1. For non- relocated sites the scientific significance was determined from the condition described in the AHIMs site card.
2. Derived from discussion with local Aboriginal community representatives.

52-2-1196 Lizard Creek Site 11

Grinding groove sites are common within the region, especially in areas with sandstone outcrops and surface water. Lizard Creek Site 11 is not significant in terms of representativeness or rarity. The significance for this site is low.

52-2-1223 Wallandoola 2

Shelter sites in the Illawarra escarpment are not rare. Wallandoola 2 contains deposits and artefacts that were noted on a previous visit to the site. There has been little excavation of rock shelter deposits in the Illawarra and this makes Wallandoola 2 potentially interesting on scientific grounds. A wombat burrow was noted in the cave on the site card and therefore the integrity of the deposit is not expected to be good.

The shelter is in good condition and the grinding grooves illustrate that the rock shelter was occupied in the past. There is a moderate archaeological potential for artefacts to be present in the floor deposits.

Therefore Wallandoola site 2 is of moderate scientific significance.

52-2-1249 Wallandoola 13

NSW rock shelter sites with art are generally rare, although the Illawarra has a large number of these sites that form a complex of site types that not only are scientifically significant but are also spiritually significance to Aboriginal individuals.

The shelter is in good condition and the art is faded but has survived well. There is also the moderate archaeological potential for artefacts to be present in the floor deposits.

Therefore Wallandoola site 13 is of high scientific significance as the floor deposits are not obviously disturbed by animals.

17.6.6 Impact Assessment

NRE commissioned Seedsman Geotechnics Pty Ltd (Seedsman) to prepare a subsidence assessment for the Project. The following impact assessment is based on the predications made by Seedsman (2010). A copy of the full report is provided in *Annex E*.

Consequences and Effects on Aboriginal Sites

Different effects of subsidence have the potential to impact on heritage sites in different ways. Rock shelters may be adversely affected by cracking, movement along joints or bedding planes, by block fall and by water seepage. All these impacts may directly affect the stability of the shelter and consequentially any rock art within.

Impacts arising from valley closure can put additional strain on the cliff tops, which may cause consequential strain on any rock shelters present beneath the upper most landforms. Grinding grooves can be affected by upsidence causing cracking as well as cracking from strain.

Artefact scatters can be indirectly impacted by tilt, causing rain water to run off in differing ways resulting in increased levels of erosion. Artefact scatters are least likely Aboriginal site type to be impacted by mining subsidence. (DoP 2008b).

Predicted Impacts to Sites

All sites within the study area were considered in the Aboriginal heritage assessment. However, only one of these sites is located within the potential subsidence footprint, site 52-2-1223. The impact assessment has focused on this site.

Seedsman (2010) provided an indication of the predicted subsidence, strain and tilt at site 52-2-1223. This information along with the size of the rock shelter and the placement of the site in relation to the goaf (factors identified as relevant by Sefton 2000) have been allocated a scaling in order to quantify potential risk to the affected sites. The scaling is presented in *Table 17.10*.

Table 17.10 Risk factor Scaling

Risk Factor	Risk Level		
	Low	**Medium**	**High**
Subsidence	0-1000mm	1001-2000mm	2001+mm
Tilt (+ or -)	0-9mm/m	10-19mm/m	20+mm/m
Strain (+ or -)	0-9mm/m	10-19mm/m	20+mm/m
Size of Overhang	less 50m³		Over 50m³
Over Goaf	No		Yes

Three levels of risk have been allocated to each risk factor. This information has been applied to determine the impact risk. The results are presented in *Table 17.11*. As there is no precise way to predict actual impact and previous monitoring programs have indicated that only 10% of the recorded sites are likely to be impacted (Sefton 2000), this approach is considered reasonable.

Note that not all factors have been given the same weight. A higher weight has been applied to sites located over the goaf. The matrix used to determine the potential impact risk is presented in *Annex P.*

There are five levels of impact risk:

- high, where impact is likely;
- moderate, where impact is possible;
- low, where impact likelihood is limited;
- very low, where impact is unlikely; and
- negligible, where impacts are not predicted.

A negligible impact risk is the highest level recorded in this assessment.

Table 17.11 Impact Risk

AHIMS Site Number	Relocated	Subsidence (mm)	Final Tilt (mm/m)	Final Strain (mm/m)	Size of overhang	Over Goaf	Impact Risk
52-2-1223	Yes	300 (L)	5 (L)	2(L)	42m³(L)	No (L)	Negligible

1. L = low risk
2. Source: *Seedsman (unpublished)*

17.6.7 Rating the Impact Assessment

In order to rank the level of potential impact, an impact assessment score has been prepared. The impact assessment score combines impact risk (as determined in *Table 17.11*) and the scientific significance of the site.

The following values in *Table 17.2* have been applied:

Table 17.12 Impact Assessment Values

Impact risk	Value	Scientific significance	Value
High	1	High	1
Moderate	2	High/moderate	2
Low	3	Moderate	3
Very low	4	low	4
Negligible	5		

The result for the site is in *Table 17.13*.

Table 17.13 Impact Assessment Score

AHIMS Site Number	Site Type	Impact Risk	Scientific significance	Impact Assessment Score
52-2-1223	Shelter with Deposit, and Axe grinding grooves	Negligible	Moderate	8

Sites with impact assessment scores between 2 and 5 need to be actively managed. As site 52-2-1223 has a score of 8 it will not need to be actively managed.

17.7 MITIGATION MEASURES

17.7.1 Russell Vale

There are no Aboriginal heritage sites or values present within the Russell Vale site, no management for Aboriginal Heritage is required.

A Management Plan for the discovery of suspected Aboriginal objects (chance finds) will be put in place prior to works commencing.

The following provides a chance find protocol in the unlikely event that an artefact or site is found at the Russel Vale site. If a potential Indigenous artefact or site is identified the following actions should be undertaken:

- contact the registered stakeholder groups who participated in fieldwork, Illawarra Local Aboriginal Land Council and the D'harawal Knowledge Holders and have a representative identify if the suspected item is in fact an Aboriginal site or object;
- if the identification is positive, contact a qualified archaeologist to determine record the site or object. The archaeologist in consultation with the registered stakeholder groups should provide management and mitigation measures as necessary, and provide a short report of the investigation to NRE and a copy to DECCW;
- if human skeletal remains are found the following actions should be undertaken;
    - stop works in the immediate area of the remains;
    - the local police contacted, a physical anthropologist or archaeologist contacted;
    - if the remains are determined to be of antiquity and of Indigenous origin contacted the registered stakeholder groups; and
- management and mitigation measures should be drawn up in consultation with the registered stakeholder groups and the archaeologist.

17.7.2 Mining Areas

The impact assessment determined that site 52-2-1223 does not require active management; however the site will be monitored pre and post mining. Monitoring will be undertaken by a qualified archaeologist with the involvement of the Aboriginal community.

18 HISTORIC HERITAGE

This chapter provides an assessment of potential impacts on historical heritage values of the PAA area resulting from the Project. Measures to mitigate these impacts are also provided.

18.1 INTRODUCTION

A historic heritage assessment was undertaken for the Project by ERM, addressing the potential impacts of the Colliery's operational activities and proposed construction works at the Russell Vale site. The key elements considered in this assessment are:

- legislative frameworks and heritage registers;
- heritage potential on site; and
- heritage significance.

18.2 EXISTING ENVIRONMENT

18.2.1 Statutory Framework and Heritage Context

NSW Heritage Act 1977

Non-Indigenous cultural heritage in NSW is protected by the *Heritage Act 1977* (Heritage Act). Heritage items requiring protection under the Heritage Act are listed on the NSW State Heritage Register. A search of the State Heritage Register identified Cataract Dam as a heritage listed item, however it is not within the PAA.

The State Heritage Inventory

The State Heritage Inventory is maintained by the Heritage Branch of the NSW Department of Planning. It includes all heritage items and places identified by local government bodies in NSW. State Heritage Register items require the permission of the Heritage Council, or the Minister, before development with potential to impact upon them can proceed.

Wollongong Local Environmental Plan 2009

The Wollongong Local Environmental Plan 2009 (WLEP 2009) applies to part of the PAA. Schedule 5 of the WLEP 2009 includes South Bulli Colliery (now the NRE No.1 Colliery) as an item of environmental heritage. The Schedule notes that the South Bulli Colliery is an "a*rchaeological site or heritage site with an archaeological component*".

Wollondilly Local Environmental Plan 1991

The Wollondilly Local Environmental Plan 1991 (LEP 1991) lists Cataract Dam as a heritage item under Schedule 1.

Draft Wollondilly Local Environmental Plan 2009

The Draft Wollondilly Local Environmental Plan 2009 (DLEP 2009) also lists Cataract Dam as a heritage item.

Illawarra Regional Environmental Plan No.1

The Illawarra Regional Environmental Plan No.1 (IREP) lists seven items within the South Bulli Colliery, as heritage items under Schedule 1 of the IREP. These items are:

- main portal (S. W. Tunnel 1887);
- 1918 portal for ventilation;
- signal box;
- old washery (1960) (now demolished);
- concrete base for ball mill at pit top (exact location unknown);
- Bellambi Creek Dam (to Collins No 1 and No 2 and on to power house) or Charlesworth's Dam; and
- former mines office (now demolished).

The Register of the National Estate and National and Commonwealth Heritage Lists

From 1 January 2004 the Register of the National Estate (RNE) became a non-statutory list, by way of amendment to the *Environment Protection and Biodiversity Conservation Act 1999*. Whilst listing on the RNE no longer has any formal role in the management of Commonwealth owned heritage places and carries no statutory authority for non-Commonwealth owned heritage places, it is a guide to the significance of particular items.

The Illawarra Escarpment has been identified as an indicative item on the RNE.

National Trust Register

The inclusion of a site on the National Trust Register indicates that it has heritage significance and as such should be protected *to encourage and promote public appreciation, knowledge and enjoyment and of future generations as a valuable resource*. The National Trust Register has no legal status, but is recognised as an authoritative statement on the significance of particular items, and is held in high esteem by the public.

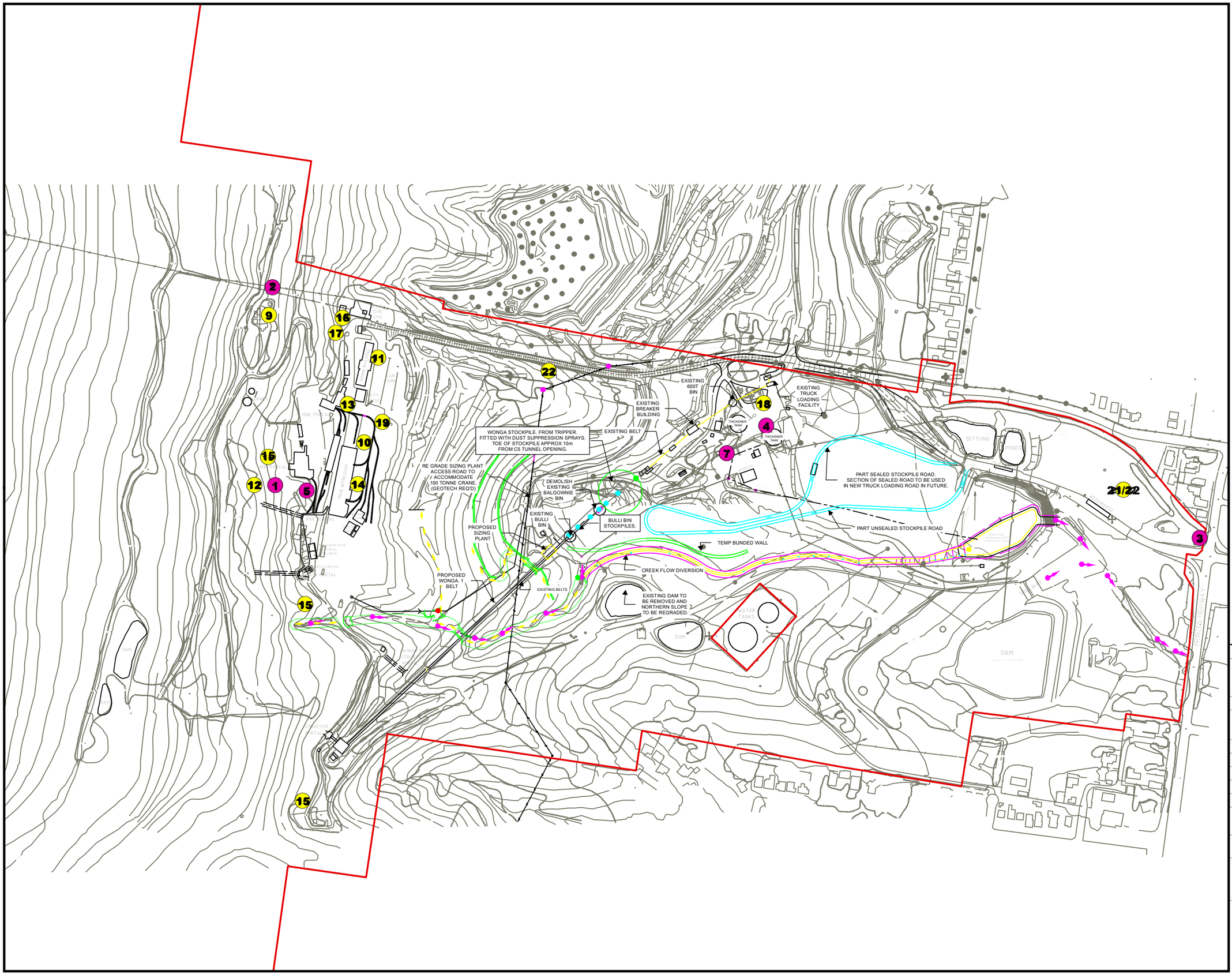
The Illawarra Escarpment has been identified by the NSW National Trust as forming part of the Illawarra Escarpment Conservation Area, which is included on the register.

18.2.2 Summary of Heritage Listed Items

The heritage status of the PAA is summarised in *Table 18.1*. Heritage items at the Russell Vale site are shown on *Figure 18.1*.

Table 18.1 Summary of heritage listed items within the PAA

Item Name	Register	Location within PAA
South Bulli Colliery - "a*rchaeological site or heritage site with an archaeological component"*	Wollongong LEP 2009	Russell Vale site
Cataract Dam	State Heritage Inventory, Wollondilly LEP 1991 and Draft Wollondilly LEP 2009	Centre of PAA between Wonga East and Wonga West
Main portal (S. W. Tunnel 1887)	Illawarra REP No.1	Russell Vale site west of the existing main workshop
1918 portal for ventilation	Illawarra REP No.1	Russell Vale site
Signal box	Illawarra REP No.1	Russell Vale site
Old washery (1960) (now demolished)	Illawarra REP No.1	Russell Vale site within the stockpile area
Concrete base for ball mill at pit top	Illawarra REP No.1	Russell Vale site
Bellambi Creek Dam (to Collins No 1 and No 2 and on to power house) or Charlesworth's Dam;	Illawarra REP No.1	West of Russell Vale site, west of F6 Freeway adjacent to electrical substation (not shown on *Figure 18.1*)
Former mines office (now demolished)	Illawarra REP No.1	Russell Vale site
Illawarra Escarpment	Register of National Estate and the NSW National Trust Register	West of the Russell Vale site



Legend

Project Application Area

Register

GML (2004)

Illawarra REP No.1

Historic Heritage Items

1 Main Portal (S>W>Tunnel 1887)
2 1918 portal for ventilation
3 Signal Boz
4 Old washery (1960) (now demolished)
5 Concrete base for ball mill at pit top
7 Former mines office (now demolished)
9 Power House Precinct
10 Upper Bench Workshops
11 Workshop Offices
12 Brick Retaining Wall
13 Crib Room and First Aid Station
14 Store Room
15 Closed Adits
16 Gibson's Portal
17 Sandstone retaining wall
18 The Preparation Plant
19 Rail Tracks and System
20 The Coal Wagon
21 Coal Cutter Head
22 Remanant Incline Haulage Alignments

Figure 18.1

Historic Heritage Items at the Russell Vale site

Client:	NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Preliminary Works Environmental Assessment	
Drawing No:	0079383s_PW_GIS034_R0.mxd	
Date:	24/09/2010	Drawing Size: A3
Drawn By:	NS	Reviewed By: MK
Projection:	GDA 1994 MGA Zone 56	
Scale:	Refer to scale bar	

N

0 50 100 150m

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.

Environmental Resources Management Australia Pty Ltd

Brisbane, Canberra, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney

ERM

18.2.3 Items of Significance Identified By Godden Mackay Logan

In 2004 Godden Mackay Logan (GML, 2004) prepared a Conservation Management Plan (CMP) with regard to the heritage aspects of the site on behalf of the previous site owners. The CMP was prepared in anticipation of the closure of the Colliery and focused on decommissioning of equipment and provided guidance for future planning and development of the site.

The CMP identified which of the remnant features contributed to the overall heritage significance of the locally listed Colliery.

GML (2004) included a detailed description of many of the buildings, features and views (*Table 18.2).*

In 2009 ERM undertook an investigation of the Russell Vale site. No additional items of heritage were identified during this investigation. ERM also assessed the current condition of the items identified by NRE (2004). An update of the condition of the site elements as recorded by ERM in 2009 is also provided in *Table 18.2*.

Table 18.2 Items of Significance identified by Godden Mackay Logan

Item	GML Description	Changes noted in 2009 by ERM
Power House Precinct	GML (2004) identified the following elements as making up the Power House Precinct: • ventilation fan and flue; • square concrete vents; • small and large iron pipes; • terraced landform; • brick structure to the northeast of the fan with associated pipes; and • two water tanks (GML 2004 32).	At the time of ERM's inspection in 2009, the only change to this precinct was the addition of stormwater management channels to the rear of the ventilation fan housing and flue.
Upper Bench Workshops	GML (2004) described the upper bench workshops as comprising the carpenter and loco shops, the workshop offices, diesel shop and diesel fuel tanks and the remnants of a demolished building. The carpenter and loco shops are located in front of the 1887 portal and are in part supported by the portal brick retaining wall. The single storey steel framed sheds were described as being *disused and dilapidated.* (GML 2004 44).	At the time of ERM's visit in 2009 the sheds were being used for storage. However, there appeared to have been no changes to these structures.
Workshop Offices	The Workshop Offices consist of two small rooms linked by a veranda. These, are located to the rear of the 1887 portal and carpenters workshop. (GML 2004 44).	At the time of ERM's visit in 2009 no changes had been made to this structure
1887 Portal	The 1887 portal is located to the rear of the carpenter shop and loco shop. There are two semi circular arched brick-lined adits. The northern adit is faced with a brick wall portal. and is constructed with brick and topped with a pediment bearing the following inscription '*Built A.D. 1887 South Bulli Mining Co'.* The adit has been partially filled with a concrete brick wall. The southern adit which is described in GML (2004) as having *"a similar façade and arched opening but has no parapet or signage" (*GML 2004 49).	The 1887 portal does not appear to have undergone any significant changes since the Godden McKay Logan (2004) report. ERM observed in 2009 that southern adit has been boarded up with corrugated iron and its original function is not easily observed.
Brick Retaining Wall	GML (2004) noted that the brick retaining wall was approximately 2.5m high and 30m long. It was described as being in poor condition with noticeable cracks and bulging *(*GML 2004, p 49).	ERM saw no changes to the condition of the wall during the site visit of 2009.
Crib Room and First Aid Station	In 2004 these buildings were described by GML (2004) as being *"located on the northern side of the Main Portal…Both are free standing, brick, single-storey buildings with corrugated iron clad gable roofs and both are painted green…*	ERM noted no changes to the condition or fabric of these buildings during the site visit of 2009.

Item	GML Description	Changes noted in 2009 by ERM
	These buildings appear to be relatively intact and in fair condition." (GML 2004, p 55)	
Store Room	Located to the north of the crib room and first aid station, the store room is a small square building with hipped gable roof and sash windows. *(GML 2004, p 55)*	The building had not undergone any alteration since the 2004 GML investigation.
Closed Adits	A number of adits have been closed over the years and while some are marked and easy to detect, others are not (GML 2004, p 57)	ERM did not investigate the location or condition of any closed adits.
Gibson's Portal	In 2004 Gibson's Portal was described by GML as consisting "*of a pair of brick-lined adits…Both Adits feature a rectangular brick façade constructed in English Bond, measuring approximately 5m long and 3.5 m high, with a central three course brick arch …* *These portals appear to be in good condition, though they are affected by soil movement and vegetation growth* (GML 2004, p 59)	The item had not undergone any alteration since the 2004 GML investigation.
Sandstone retaining wall	The sandstone retaining wall runs to the south of Gibson's portal. *the sandstone blocks are roughly hewn and vary in size ….The blocks are bound together with concrete mortar and the top of the wall features a coping course of similar dimensioned stones positioned slightly overlapping the alignment of the wall* (GML 2004, p 59)	The sandstone retaining wall was not observed to have been altered from the time of the 2004 CMP
The Preparation Plant	In 2004 the preparation plant was described by GML "*a large, steel framed structure clad in corrugated-iron sheeting, the multi-dimensional form which follows the configuration of the functional elements within … Walkways throughout the plan circumnavigate installed equipment and are constructed of open mesh steel plates,…* (GML 2004, p 60)	By the time of the 2009 site visit this building had been demolished with the exception of the thickener tanks. As part of the current demolition of the washery a report is being finalised by Nexus (heritage consultants). This report will meet the Development Consent requirements for demolition of the washery. It will include a summary of plans and other documents relating to the washery.
Rail Tracks and System	*The …site contains a network of operational and non-operation rail tracks from various periods. Most of the existing tracks are located in the vicinity of the workshops and the operational adit. Sections of abandoned Rail tracks exist near the 1887 Portal and in various locations around the site.* *The Tracks located on the Upper Bench are associated with the former Carpenters and Loco Shops, established following the closure of the adjacent 1887 Portal. A number of manual point switches are located at the entrance to the sheds and to the south along the Tracks. Additional switches are located on the lower bench associated with current workings at the Main Portal.* *The main access road up the escarpment from the main gates to the Administration Building appears to follow the original skip-haulage line for the mine but no physical evidence of the earlier operations is apparent.* (GML 2004, p67)	There have been no changes to the various networks of rail tracks since 2004 and they remain visible in places especially near to the 1887 adit.

Item	GML Description	Changes noted in 2009 by ERM
Signal Box	The signal box was described as being *"two storeys in height with a gabled roof or corrugated iron, it comprises a single room, weatherboard lined to waist height with glazing above sitting upon a brick walled lower floor level. Restored in 1988 as a Bicentennial project is contains a flour slot lever frame with three levers for signals and wheel-driven winch for moving the points* (GML 2004, p67)	This item was rehabilitated in 1988. There are some original items inside the building. The building has been vandalised by fire on two occasions since 1988. The 2009 inspection undertaken by ERM revealed that the signal box had been damaged by vandals and fire.
The Coal Wagon	The coal wagon is located in the vicinity of the signal box and was also part of the Bicentennial project. It was described as being *"a timber-sided hopper wagon on a steel frame, with four wheels and fixed axles.* (GML 2004, p69)	This item is deteriorating due to vegetation growth and weathering.
Coal Cutter Head	The coal cutter head is located near the coal wagon and is part of a short-wall coal cutter. GML discussed that "*although isolated from its power supply and its transport mechanism and the associated machines, it appears relatively complete"* (GML 2004, p69)	This item has been misidentified in the GML report and is actually a coal loader. The coal loader is subject to weathering and vegetation growth.
Remnant Incline Haulage Alignments	*Of particular interest is the alignment of the incline Haulage route from Gibson's Portals where coal was moved down the escarpment to be loaded from transportation off-site. While there are no remaining tracks associated with this alignment, the route was incorporated into the main access road route and survives as a landscape element. The view lines (to and from the escarpment) associated with the incline haulage alignment and, by association, the front entrance where the coal trucks left the site and crossed the Princes Highway route to Bellambi Jetty. (*GML 2004, p69*)*	The 2009 site inspection revealed no changes to the remnant incline haulage alignments.
Original Haulage line Vistas	*The view lines or vistas looking east from the benched area of the Old portal and Man Portal precincts, across the terraced works area of the site, provide important visual links from the site to other aspects of the colliery operation. In particular, the important visual links are from the 1887 Portals, the Upper Bench Workshops, the Lower Bench Workshop areas over the artificially-terraced benches, the washery precinct and the Incline Haulage route. Beyond the site, the view line continues towards the location of the jetty and is an important and unique visual link between the colliery site and the townships of Russell Vale and Bellambi on the coast (via Broker Street where the rail tracks originally extended to the jetty). This alignment is clearly identified from the colliery escarpment and benched areas. (*GML 2004, p69)	The 2009 site inspection revealed no changes to the original haulage line vistas.

GML (2004) considered the individual site elements at the Colliery and assigned them each a grading in terms of significance. This was intended to demonstrate the degree to which the precincts and elements contributed to the overall heritage value of the site. *Table 18.3* provides a summary of these rankings.

The statements of significance prepared by GML in 2004 for items of moderate, high and exceptional heritage value have been included within *Annex Q*.

Table 18.3 Significance grading of individual site elements

Item Name	Grading
Power House Precinct	Moderate
Administration Precinct	
Administration building	Low
Pathways and landscape	Low
Car park	Low
Old Portal Precinct	
Workshops – lower bench	Moderate
Work shops upper bench	Moderate
1887 Portal	Exceptional
Brick retaining wall	High
The main portal	Low
New bathroom	Low
Crib Room and First Aid Station	High
Storeroom	High
The extraction portal	Low
The main downhill conveyor	Low
Closed adits	Moderate
Gibson's Portal Precinct	
Gibson's Portal	High
Sandstone retaining wall	Moderate
Fan house	Low
Gibson's sublease portal and associated elements	Low
Electrical Substation	Low
Electrical switchroom	Low
The Washery Precinct	
The preparation plant (now demolished)	Moderate
Conveyor system	Low
Storage silos	Low
Truck loader	Low
Coal stockpiles and reject material	
Coal stockpiles	Low
Reject emplacement	Low
Settling dams	Low
Other dams	Low
Rail Tracks, Signal Box and Associated Elements	
Rail tracks and system	High
Signal box	High
Movable heritage Elements	
Coal wagon	High
Coal cutter head	Moderate
Landscape and Vistas	
Remnant Incline Haulage alignments	High
Original haulage line vistas	High

Source: GML (2004)

18.3 IMPACT ASSESSMENT

This Preliminary Works Project is Stage 1 of the proposed upgrade to the infrastructure at the Russell Vale site. Key elements include the replacement of the Balgownie decline conveyor with the new Wongawilli decline conveyor and sizing unit and the construction of the Bellambi Gully Creek bypass channel.

The new Wongawilli decline conveyor and sizing unit will be located within the footprint of the existing decline conveyor. These sections of the site currently have a strong industrial appearance and historically have been one of the pit top working components.

The Bellambi Gully Creek bypass channel will be constructed south of the existing infrastructure within the Russell Vale site.

The proposed surface works are not in the immediate vicinity of the locally listed heritage items. No heritage items are to be demolished to facilitate this Project.

Underground works are not proposed within the vicinity of Cataract Reservoir. The proposal includes Wonga Mains beneath the stored waters and the H Panel. These proposed extraction areas will be developed using the first workings mining method, which results in 'zero' subsidence (*Chapter 8*). As no subsidence will occur in the vicinity of the Cataract Dam, no impacts will result.

A summary of impacts to heritage items is provided in *Table 18.4*.

Table 18.4 Potential impacts to heritage items

Item Name	Register	Impact
South Bulli Colliery - "a*rchaeological site or heritage site with an archaeological component"*	Wollongong LEP 2009	No. Upgrades to the site will be consistent with historical uses.
Cataract Reservoir	State Heritage Inventory, Wollondilly LEP 1991 and Draft Wollondilly LEP 2009	No subsidence is proposed beneath the reservoir.
Main portal (S. W. Tunnel 1887)	Illawarra REP No.1	No works proposed in this location.
1918 portal for ventilation	Illawarra REP No.1	No works proposed in this location.
Signal box	Illawarra REP No.1	No works proposed in this location.
Old washery (1960) (now demolished)	Illawarra REP No.1	NA – no longer present
Concrete base for ball mill at pit top	Illawarra REP No.1	No works proposed in this location.
Bellambi Creek Dam (to Collins No 1 and No 2 and on to power house) or Charlesworth's Dam;	Illawarra REP No.1	No works proposed in this location.
Former mines office (now demolished)	Illawarra REP No.1	NA – no longer present

Item Name	Register	Impact
Illawarra Escarpment	Register of National Estate and the NSW National Trust Register	No works proposed on the escarpment.
Power House Precinct	GML (2004)	No works proposed on the escarpment.
Upper Bench Workshops	GML (2004)	No works proposed on the escarpment.
Workshop Offices	GML (2004)	No works proposed on the escarpment.
Brick Retaining Wall	GML (2004)	No works proposed on the escarpment.
Crib Room and First Aid Station	GML (2004)	No works proposed on the escarpment.
Store Room	GML (2004)	No works proposed on the escarpment.
Closed Adits	GML (2004)	No works proposed on the escarpment.
Gibson's Portal	GML (2004)	No works proposed on the escarpment.
Sandstone retaining wall	GML (2004)	No works proposed on the escarpment.
The Preparation Plant	GML (2004)	No works proposed on the escarpment.
Rail Tracks and System	GML (2004)	No works proposed on the escarpment.
The Coal Wagon	GML (2004)	No works proposed on the escarpment.
Coal Cutter Head	GML (2004)	No works proposed on the escarpment.
Remnant Incline Haulage Alignments	GML (2004)	No works proposed on the escarpment.
Original Haulage line Vistas	GML (2004)	No works proposed on the escarpment.

18.3.1 Risks to Heritage Values

Aspects of the Project which could have adverse impacts on heritage significance are described below:

- loss of heritage value caused by a lack of forward planning or use of out of date heritage policy documents;
- while some buildings and infrastructure on site are locally significant, other elements which have been considered by GML (2004) as contributing to the overall heritage value of the site have not been afforded heritage protection. These buildings or elements could be at risk of demolition or ill-advised alteration;
- loss or damage to items of moveable heritage;

- non-use of potential heritage items could result in these items falling into a state of disrepair; and

- changes to the current phase of the mine's life inadequately recorded prior to the commencement of new work, resulting in an incomplete record of the historical life of the South Bulli Colliery (now NRE No.1 Colliery).

18.4 MITIGATION MEASURES

The following measures are included in the statement of commitments (*Chapter 24*) and will be taken into consideration in a revised Conservation Management Plan (CMP) to be prepared for the Project. Preparation of the CMP as part of the Preliminary Works Project is necessary to ensure that management practices are in place prior to the commencement of site upgrades as part of the Major Development Project (MP 09_0013).

The CMP will include:

- no items identified as having heritage value or contributing to the heritage value of the site, will be demolished as part of this Project;

- a revised CMP will be prepared to reflect the future need of the site as a continuing mine;

- procedures to follow in the event of any unanticipated impacts to heritage structures and for the discovery of unanticipated 'Relics';

- a photographic recording of the 1887 portal and the site in general will be undertaken to Heritage Archival Recording standards and copies lodged with the appropriate Local and State repositories; and

- items of moveable heritage will be retained at their current location onsite and documented including historical photos, plans, maps and records to Heritage Archival Recording standards. A conservator will provide advice regarding the long term storage of the items to maximise their survival. When the item has been appropriately catalogued it will be donated to a suitable repository. Appropriate repositories will be identified prior to Project works commencing.

19 TRAFFIC AND TRANSPORT

This chapter provides an assessment of impacts of the Project on traffic and transport, including off-site trucking impacts. Measures are included to manage identified potential impacts.

19.1 EXISTING ENVIRONMENT

19.1.1 Operations

NRE delivers coal by public road from NRE No. 1 Colliery to PKCT. The characteristics of the current coal delivery patterns are as follows:

- deliveries are made:
  - 7:00am and 6:00pm Monday to Friday;
  - 8:00am and 6:00pm on Saturday;
  - a small amount of trucking occasionally occurs outside these hours, between 6pm and 10pm Monday to Friday and during the day on Sundays;
- number of trucks in the fleet is 8 to 10, each with an average capacity of approximately 34 tonnes; and
- there are an average of approximately 84 loads trucked per delivery day to transport the target output. Peak loads are up to 134 trucks per day;

The average round trip between NRE No. 1 Colliery and PKCT is typically:

- 45 minutes in early mornings;
- 55 – 60 minutes in the morning to 9:30am;
- 45 minutes late morning to early afternoon;
- 55 – 60 mins between 3:00pm – 5:00pm.

Typically coal is transported from the Colliery to PKCT by either articulated vehicles or truck and trailer combinations.

Other Vehicles

The number of visitor and employees vehicles to the Colliery is detailed in *Annex C.* There will be no increase in the number of employee or visitor vehicles at the Colliery and therefore no increases in related traffic. The volume of other delivery vehicles is not predicted to increase, other than during construction.

19.1.2 Coal Haulage Routes

Coal is delivered from NRE No. 1 Colliery to PKCT via Bellambi Lane, Northern Distributor, Southern Freeway, Masters Road, Springhill Road and Port Kembla Road. A description of these haulage route units is given in *Table 19.1* (Cardno, 2008). The haul route is shown in *Figure 2.4.*

Table 19.1 Description of haulage route

Road	Description	Distance Travelled
Bellambi Lane	Bellambi Lane is an east-west road linking NRE No. 1 Colliery, Princes Highway, the Northern Distributor and Bellambi Railway Station. The section used for coal haulage is between the Colliery and Northern Distributor. West of Princes Highway, Bellambi Lane is a local road providing access to Gujarat NRE No. 1 Mine. It is a two-lane undivided road with a signalised intersection at Princes Highway. Between Princes Highway and the Northern Distributor, Bellambi Lane is a four-lane undivided road. It was previously part of the Princes Highway and a State Road. However, since the Northern Distributor extension opened in late 2009, it is expected that the Highway No. 1 and State Road classifications will be moved onto the new road and Bellambi Lane will revert to being a collector road.	0.7
Northern Distributor	The Northern Distributor is an arterial road through Wollongong's northern suburbs, extending from the Southern (F6) Freeway at Gwynneville to Princes Highway at Molloy Street. The section of the distributor from North Wollongong to Bellambi Lane is part of the Princes Highway, although not signed as such. Between the Southern (F6) Freeway and North Wollongong it is a State Road, classified as Main Road No. 626. North of North Wollongong, it is part of Highway No. 1 and is a State Road. It is a dual carriageway with two lanes in each direction. Access to the Northern distributor is restricted along its length. There are four signalised intersections and three grade-separated interchanges along the route.	6.5

Road	Description	Distance Travelled
Southern Freeway	The Southern Freeway forms part of the arterial route linking Sydney and Wollongong. The NRE haulage route use part of the Freeway between Mount Ousley Road and Masters Road. This section is predominantly four lanes with a jersey barrier median. Two additional lanes are provided between Northern Distributor and Princes Highway interchanges. The speed limits are 80km/h (Mount Ousley Road to Gipps Road), 90km/h (Gipps Road to Princes Highway) and 100km/h (south of Princes Highway). Access is restricted along the length of the route.	3.4
Masters Road	Masters Road is an arterial road connecting the Southern Freeway and Springhill Road. It is a state road – classified as Main Road No. 602. It consists of dual carriageways with a total of six lanes with a posted speed limit of 80km/h. Access to Masters Road is restricted to the intersection with Drummond Street.	1.3
Springhill Road	Springhill Road is an arterial road connecting Masters Road and Port Kembla Coal Terminal, as well as being part of the main link from Wollongong to Port Kembla, Warrawong and Shellharbour. It is a State Road – classified as Main Road No. 581. It is a single carriageway with six lanes, with a posted speed limit of 80km/h. Access to Springhill Road is restricted. There are four signalised intersections along the route.	2.2
Port Kembla Road	Port Kembla Road is a State Road – classified Main Road No. 671 – providing access from the arterial road network to Port Kembla Coal Terminal. It functions as a local road due to it only serving a heliport, sewage treatment works, golf course and the port. Port Kembla Road is a two-lane undivided road, connecting to Springhill Road at a signalised seagull intersection.	0.6

19.1.3 Traffic Volumes

Table 19.2 shows the historical Annual Average Daily Traffic (AADT) volumes on the existing coal haulage routes.

Table 19.2 AADT Summary Table[1]

Name	Location	2000	2003	2005	2006
Bellambi Lane	Bellambi, east of Old Princes Hwy	11793	11407	10989	-
Northern Distributor	Towradgi, south of Towradgi Rd	28543	30260	30901	27909
Northern Distributor	Wollongong, south of Old Princes Hwy	43108	38314	-	-
Southern Freeway	Gwynneville, Gipps Rd overpass	58758	68681	72310	68945
Masters Road	Mt St Thomas, west of Springhill Rd	25317	25226	-	-
Springhill Road	Mt St Thomas, north of Masters Rd	35226	31147	35179	-
Springhill Road	Coniston, north of Keira St	16184	15582	16600	-
1. Source: Cardno (unpublished)					

Following the opening of the Northern Distributor extension in late 2009, additional traffic counts were undertaken in September 2010 to understand current traffic volumes on Bellambi Lane and the Northern Distributor. The actual average weekday traffic volumes are displayed in *Table 19.3*.

Table 19.3 ***Average weekday traffic volumes before and after the opening of the extension to the northern distributor.***

Location	Average weekday count prior to opening of the Northern distributor	Average weekday count post opening of the Northern distributor
Bellambi Lane west of Northern Distributor.	14,380 (2009 count)	5693 (2010 count)
Northern Distributor south of Bellambi Lane	22,840 (2008 count)	23,520 (2010 count)

1. Source: Cardno traffic counts (unpublished)

19.2 IMPACT ASSESSMENT

It is estimated that on average there are up to 84 coal truck loads per day with peak loads of 134. This represents an average and peak trip generation of 168 and 268 respectively for total truck journeys per day. At peak, NRE truck trip generation is approximately 4.7% of average weekday traffic volumes on Bellambi Lane.

Given the reduction in overall traffic volumes on Bellambi Lane and the fact that this Project is considered to not propose any changes to the existing transport arrangements and consequent traffic volumes, it is not anticipated that the Project will impact significantly on the capacity of the road system.

19.2.1 Mid-block Carriageway Capacity

Recent analysis by Cardno Eppell Olsen (unpublished) based on September 2010 traffic counts concludes that Bellambi Lane and the Northern Distributor have good mid block performance and operate at a satisfactory level.

The current mid-block carriageway capacity performance of other roads along the haulage route is generally satisfactory except for parts of the Southern Freeway where sections are approaching or exceeding capacity (Cardno, 2008).

It should be noted that where capacity is of most concern along the Southern Freeway the coal trucks represent only a small proportion of the peak hour directional traffic volumes, being 0.3-1.0% of total traffic (Cardno, 2008).

19.2.2 Intersection Operation

The key intersections along the haulage route including Bellambi Lane with the Princes Highway and the Northern Distributor were assessed by Cardno (unpublished) using the SIDRA software package. This modelling was carried out to determine the degree of saturation, average delay (in seconds) and level of service (LoS) at each intersection. All intersections were assessed to perform satisfactorily under the current configuration (Cardno, unpublished).

Recent analysis by Cardno (unpublished) based on September 2010 traffic counts concludes that the Bellambi Lane/Princess Highway and the Bellambi Lane/Northern Distributor intersections operate at a satisfactory level. (Cardno, unpublished)

19.2.3 Road Safety

A road safety audit undertaken by Cardno (unpublished) of the road haulage route from the Colliery to PKCT did not identify any unsafe conditions along the route.

19.3 MITIGATION MEASURES

Although no road or intersection upgrades are required to accommodate the project, NRE proposes to implement a driver code of conduct which includes:

- trucking during PCKT approved hours only i.e. between 7am and 10pm Monday to Friday and between 8am and 6pm on weekends;
- obeying legal speed limits and including a self imposed speed limit of 50km/hr along Bellambi Lane;
- drivers to be vigilant regarding separation distances;
- limit noise where possible;
- avoid compression braking, particularly on the approach to Port Kembla Rd/Springhill Rd lights when entering or exiting PKCT;
- all loads must have an effective cover;
- all trucks to be clean prior to leaving the site;
- report all vehicle faults to the owner; and
- report all traffic incidents.

20 VISUAL AMENITY

This chapter provides an assessment of impacts of the Project on the visual amenity of the surrounding areas.

20.1 INTRODUCTION

This chapter assesses the impact of the proposed works at the Russell Vale site on the visual amenity of the surrounding area which includes, as a back drop, the Illawarra Escarpment. The Illawarra Escarpment is the subject of the *Illawarra Escarpment Strategic Management Plan* (Wollongong City Council, 2008) (referred to as 'the strategic plan') which was prepared to protect the natural and cultural resources of the Illawarra escarpment. Part of the development of the strategic plan was to assess the conservation attributes of the landscape.

The Russell Vale site has been identified in the Plan as an area of high visual, scenic and landscape quality. This site has two of the four main environmental values of the escarpment and foothills identified in the strategic plan being, a landscape support and core escarpment area.

Under the strategic plan 'core' lands should be managed for conservation and become part of an *Environmental Protection Zone – Conservation* with the principle objective to conserve core escarpment and foothills land. 'Landscape support' lands are recommended to become part of the *Environment Protection Zone – Management*. The strategic plan states that the scenic areas of the escarpment should be protected and managed to ensure that impacts are minimised.

This visual impact assessment describes the existing environment and assesses the potential impact of the Project on the visual amenity of the escarpment and the surrounding areas, based on the selection and review of the potential views of the Project from seven view points located around the Russell Vale site. Management measures to mitigate the identified impacts have been developed and are described in this chapter.

20.2 EXISTING ENVIRONMENT

20.2.1 Russell Vale

The topography of the area surrounding the Russell Vale site ranges from the steep slopes and cliff faces of the Illawarra Escarpment, which forms a natural boundary and scenic backdrop to the Illawarra region, to the gently undulating areas from the base of the escarpment heading east towards Bellambi and Russell Vale.

The Russell Vale has existed as a mine for more than 120 years and as such pre-dates the majority of the buildings in the immediate locality. Its location reflects the geology of the area where the coal seam outcrops along the escarpment and the associated lower slopes.

The Russell Vale office site is located on the eastern edge of the Illawarra Escarpment at approximately 140 m AHD. From the offices, the site extends down slope for about one km to the east toward Bellambi Lane which sits at about 55 m AHD. Residential properties are located on gently sloping land to the north east and south of the site and with more residents located to the east on relatively flat land. The western side of the site is dominated by the Illawarra Escarpment, the top of which sits at 370 m to 400 m AHD.

The site is predominantly cleared and re-contoured undulating land with vegetation bordering the north, east and south perimeters. Land surrounding the Russell Vale offices is also vegetated. The central and eastern side of the site currently has some industrial infrastructure including five dams, two tanks, a weighbridge, conveyor, loading station and coal stockpile.

The existing coal bins at approximately 90m RL are similar in height to the proposed conveyor and therefore provide a good reference point, especially when considering visual impacts from Bellambi Lane.

20.2.2 No.4 Shaft

The No.4 Shaft, which has operated as a man, materials and ventilation shaft since 1977, is located above the escarpment on the plateau. This site is not publicly accessible. No.4 Shaft is surrounded by native bushland within the SCA's *Metropolitan Special Area* and can not be viewed from any publicly accessible locations. There are no proposed works at the No.4 Shaft and it has not been included in this assessment.

20.3 METHODOLOGY

The study area for the visual impact assessment was identified according to topographic features of the landscape and distance from the site. Seven external viewpoints were assessed around the Russell Vale site and were located in the north east, east and south. *Annex R* shows the location of each viewpoint.

Photographs were taken and the heights of each view point were recorded. An assessment of the likely visual impacts of the proposed surface works was undertaken by reviewing the height of the proposed works, the potential visibility of the works from each view point and the availability of screening vegetation. 3D modelling done by JBK was used to determine whether the proposed facilities would be visible from each view point. The photo montage prepared by JBK is included in *Annex R*. Lighting effects were also considered.

In addition to the view points, a review of local facilities and recreation areas was undertaken as was the potential impact to users of Bellambi Lane.

20.4 IMPACT ASSESSMENT

20.4.1 Visible Components

Components of the proposed surface facility upgrades which have the potential to impact on visual amenity include:

- a new Wongawilli decline conveyor; and
- a new screening and sizing plant.

The new Wongawilli decline conveyor will be constructed primarily of a steel frame and painted steel sheeting, whose colour will be blended to match the surrounding environment. The trippers on the end of the decline belt will have a final height of 91m RL. The new sizing plant is proposed to be constructed at the end of the decline conveyors before the coal enters the existing Bulli bin. It will be constructed primarily of steel and painted steel sheeting whose colour will be blended to match the surrounding environment. It will have a final height of 91m RL.

20.4.2 Visual Amenity

The visual impact assessment for each of the seven view points located around the site is summarised in *Table 20.1*. *Photograph 20.1, 20.2*, and *20.3* show the some of the views from the surrounding area.

Table 20.1 Summary of impacts

View point Number	Location with respect to the site	Street Address	RL AHD (m)	Potential View
1	Residential area south of the site	Middle of Lyndon Street looking north north west	80	The residences at this elevated location back on to bush land which is likely to obscure views of the site to the north, north west and north east.
2		Eastern end of Lyndon Street looking north	69	The residences at this location back on to bush land which would obscure views of the site to the north, north west and north east.
3	Residential area south east of the site	Western end of Midgley Street looking north west into the site	55	Residences at this location have a view of the existing stormwater control dam. However due to the topography of the landscape no other infrastructure can be seen from this location. Proposed infrastructure will not be visible from this location as it will be within the footprint of existing infrastructure and of a similar height and form.
4		Eastern end of Midgley Street (at the bend) looking west north west	55	Residences at this location have a view across the residences on the northern side of the road. Mine offices are visible in the background however coal handling facilities can not be seen from this location.
5	Residential area east of the site	View west from corner Bellambi Lane and Princes Highway	50	Coal handling facilities are obscured from view by trees. The Russell Vale offices can be seen in the background, screened by trees.
7	Residential area north east of the site	Corner Broker Street and East Street looking south west	54	Residents at this location have a view across the residences on the other side of the road and screening trees in the background. These trees will screen the view of the proposed infrastructure.
8		Western end of Broker Street looking south west	61	Residents at this location will have a view of screening trees.



Photograph 20.1 View point 3 western end of Midgley Street looking north west into the site



Photograph 20.2 *View point 4 eastern end of Midgley Street looking west north west*



Photograph 20.3 View point 8 western end of Broker Street looking south west

As seen from the photographs presented above and *Table 20.1* existing and proposed surface facilities at the Russell Vale site are generally not visible from publicly accessible areas due to screening trees and the elevated topography. Visibility of the site increases in the south east corner as screening vegetation becomes sparser and surface elevations decrease. However views of the proposed surface facilities from these areas are still not possible.

No surface works are proposed on the Illawarra Escarpment. As such, it is considered that the proposal is consistent with the *Illawarra Escarpment Strategic Management Plan, 2008*. That is, the proposal does not impact on the scenic areas of the escarpment and visual impacts on the foothills are limited.

No school/s or public recreation area/s will have views of the Project, due to the local topography and the location of the Russell Vale site.

20.4.3 View from Bellambi Lane

Motorists travelling along the Bellambi lane currently have distant views of the Russell Vale site infrastructure. *Photograph 20.4,* taken looking west from the northern side of Bellambi Lane shows existing infrastructure, including the decline belts and tops of coal bins can be seen from this location.

The location and final height of the new conveyor and sizing unit will be consistent with existing infrastructure. Due to the undulating topography of the surrounding landscape and presence of buffer vegetation, the conveyor will be obscured from view. The conveyor system will appear as typical mine related infrastructure and its colour will be blended to match the surrounding environment. As such, it will be consistent with the majority of the existing structures on the site. Therefore, the viewscape for these receivers would not be significantly impacted.



Photograph 20.4 View west from Bellambi Lane

20.4.4 Lighting Effects

Existing lighting will continue to be required for safety and security and to ensure that inspections and maintenance can be carried out during all times.

These lights will meet the appropriate Australian Standard (*AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting*) and minimise associated stray light to the surrounding environment. As such impacts will be minor.

20.5 MANAGEMENT MEASURES

Given the local topography and vegetation buffers, the proposed works at the Russell Vale site are not expected to have a significant impact on the visual amenity of local receivers.

The visual impact of the proposed works has been mitigated through design including:

- colour of components;
- restriction of the area of disturbance to the minimum practicable;
- the use of areas with existing infrastructure; and
- placement of facilities to minimise disturbance of vegetation.

In addition to these design components, other management measures will be implemented at the Russell Vale site, including:

- progressive rehabilitation as required;
- routine use of low beam on vehicle headlights by all construction and maintenance personnel;
- appropriate use of lighting equipment to limit impacts on sensitive locations. This will be managed through inductions of all construction and operations employees; and
- ensuring lighting is directed away from residences through the use of directional lighting and shielding in accordance with safety regulations, and which complies with *Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting*.

20.6 CONCLUSIONS

NRE No.1 Colliery is well established in an area historically used for coal mining. Changes to the existing viewscape, resulting from the proposal, from publicly accessible view points outside the Colliery, are minor. The management measures presented will ensure that the proposal will not significantly impact the visual amenity at any sensitive receiver.

In addition it is considered that the proposal is consistent with the Illawarra Escarpment Strategic Management Plan, 2008. That is, the proposal does not impact on the scenic areas of the escarpment and visual impacts on the foothills are limited, through prudent design and placement of infrastructure in an area that is already disturbed and is currently used to support mining activities.

21 WASTE

This chapter identifies waste streams that will be produced by the Project and details procedures to be implemented to manage these waste streams.

21.1 EXISTING ENVIRONMENT

A number of wastes are produced as part of the mining process and as a result of the supporting activities, at the Russell Vale and No.4 Shaft sites. These wastes are generally categorised as:

- non-mineral waste;
- mineral waste; and
- wastewater.

Details of waste water management are provided in *Section 2.6*.

Existing waste management measures were reviewed to identify additional measures required as a result of this Project. NRE's waste management strategy is in accordance with the principles of *Waste Avoidance and Resource Recovery Act 2001,* the waste management hierarchy and the provisions of the *Protection of the Environment and Operations Act 1997*. The aims of this in principle, which are supported by NRE, include reducing wastes at source, re-using materials where possible, recycling wastes where practicable, and disposing of wastes appropriately and responsibly.

21.2 NON-MINERAL WASTE MANAGEMENT

Non-mineral waste is generated throughout mining, maintenance and administrative areas. In particular non-mineral waste is generated at the Russell Vale site and No.4 Shaft, maintenance workshops, administrative offices and bathhouse.

Management of non-mineral waste involves the management of general, recyclable, regulated and hazardous wastes. *Table 21.1* lists the types of waste likely to be produced throughout the construction phase of the project and ongoing operation of the mine and the disposal strategy as appropriate. All waste products from the Russell Vale and No.4 shaft sites are managed by the same methods.

21.3 MINERAL WASTE

Mineral wastes include all non-coal material extracted through the mining process. No coal washing is undertaken at the Colliery.

ROM coal will be crushed to meet the specific requirements of the Port Kembla Coal Terminal. The oversize waste rock will be blended with dried silt taken from various settling ponds on the site. It is estimated that up to 30 000 tonnes of waste rock will need to be removed from site annually.

Table 21.1 Types of wastes produced during ongoing production

Waste type	Predicted Quantity per annum	Disposal Method
Waste Rock	30 ktonnes/yr	• Disposed of via existing coal clearance system
Tramp material (includes rags, fibreglass bolts, etc)	5T/yr	• Disposed of using the appropriate and approved licensed contractor.
Clean excavated materials	See Column 3	• Material excavated from the construction of the bypass channel will be stockpiled on site for later use in the Stage 2 project, or in the construction of acoustic bunds. The stockpile will be grassed to stabilise until it can be reused. • Reuse of materials on site • Where reuse not possible, disposal at an appropriately licensed facility
Sludge from sediment ponds	See Column 3	• Reused in product
Green Waste	150T/yr	• Mulched and/or composted and used on site (weeds to be bagged and disposed of at a licensed facility) • Where reuse not possible, disposal at licensed landfill or composting facility
Timber	100T	• Thiess collect and transfer to suitable recycling facilities
Metal, Scrap Steel and Formwork	200T/yr	• Ward's Metals collect and transfer to suitable recycling facilities
Concrete	10T	• Returned to the supplier where possible or reused on site • Where reuse not possible, disposal at an appropriately licensed facility
Recyclables (Cardboard & Paper, Aluminium, Glass, Plastic)	13T	• Returned to the supplier where possible; or • Thiess collect and transfer to suitable recycling facilities
Putrescible waste)	60T	• Thiess collect and transfer to an appropriately licensed facility
Oils	3000 litres	• Temporarily stored on-site prior to removal from site by an appropriately licensed contractor
Lead acid batteries	6	• Temporarily stored on-site prior to removal from site by an appropriately licensed contractor

21.4 IMPACT ASSESSMENT

An increase in waste is expected during construction, particularly the amount of clean excavated material from the bypass channel excavation. Otherwise there will be no change from the annual volume of waste currently generated by the operation as a result of the proposal. Continued implementation of current waste management practices, as amended to reflect improved technology or practice, will minimise potential adverse impacts resulting from waste generation.

21.5 MANAGEMENT AND MITIGATION MEASURES

The following waste management measures will continue on site to prevent adverse impacts resulting from waste generation:

- construction materials will be purchased with the aim of reducing waste products;
- the stockpile of clean excavated material will be seeded with grass to stabilise until it can be reused;
- all waste material will be disposed of in accordance with the provisions of the Protection of the *Environment Operations Act 1997 and the Waste Classification Guidelines* (DECC, 2008);
- waste will be recycled where possible or disposed of at an appropriately licensed waste disposal facility;
- onsite storage and disposal of different categories of waste will be defined prior to construction. A sufficient number of covered storage bins will be provided for waste disposal on site, with separate bins for recyclable and non-recyclable waste; and
- all records will be retained as proof of correct disposal for environmental audit purposes.

22 SOCIO-ECONOMIC

This chapter provides an overview of the demographic and economic indicators for Wollongong and assesses the social and economic impacts of the Project.

22.1 SOCIAL IMPACT ASSESSMENT

22.1.1 Introduction

The communities within the immediate vicinity of the NRE No.1 Colliery are the suburb of Russell Vale to the east, and Corrimal to the south respectively. These communities were originally established by miners and their families and are most likely to experience direct impacts as a result of the project. The nearest residence is located on West Street, directly adjacent to the Russel Vale site.

The wider population centre of Wollongong is most likely to experience both direct and indirect, service demand and socio-economic impacts resulting from the proposal, due to the stronger capacity and availability of social services and networks in this location.

22.1.2 Community Services, Social Infrastructure and Recreation

Major services and social infrastructure are currently concentrated in Corrimal, with limited services available in Russell Vale.

There is a small community hall located in Russell Vale, a pre-school and community parks. Corrimal is a larger suburban area containing a moderate size shopping complex, a community centre, early childhood centre, library, community parks and reserves.

Major health services and facilities are located in the Wollongong town centre. Sporting facilities, clubs and entertainment venues are also provided in Corrimal, Bulli, Woonona and the larger regional centre of Wollongong.

22.1.3 Community Development

Gujarat NRE contributes significant funds to the local community annually through specific community development programmes and charities. Some of the programmes and charities that are supported are listed in *Table 22.1*

Table 22.1 Community development programmes and charities

Greenacres Disability Services	Wollongong Hawks Basketball
St Francis Xavier's Catholic School	Avondale Rugby Club Inc
Rett Syndrome Australian	Bellambi Surf Life Saving Club Inc
St John Vianney's Catholic School	Dapto Swimming Club Inc
Ovarian Cancer Australia	Woonona Soccer Club
Red Shield Appeal	Russell Vale Junior Football
Special Children's Christmas	Woonona Ockies Winter Swimming
Russel vale Public School	East West Ochestra
Light and Hope Clubhouse	Corrimal Rugby League Football
Sydney Utshab Inc	Illawarra District Rugby
Bulli Football Club Limited	Russell Vale Golf Course
Woonona Netball Club	Corrimal Junior Cricket Club
Corrimal Rangers Football Club	Shamrocks Rugby Union Club

NRE has budgeted $0.1m in 2011, and $0.15m annually from 2012 to 2014 for community funding.

22.1.4 Analysis of Impacts

Methodology

The potential for, and magnitude of, impacts resulting from the proposal have been addressed as part of other technical reports presented within this EA.

This section identifies the potential social impacts of the project, their significance, conclusions of technical reports and recommended mitigation measures where appropriate. The definitions of each level of significance are provided in the following *Table 22.2*.

Table 22.2 Impact Significance Definitions

Significance	Definition
Positive	An impact that inherently provides benefits to stakeholders or one that can produce positive effects with proactive management and action.
None to Low	An impact that can be easily addressed by a minor modification to construction or operational techniques (essentially an "opportunity" to proceed at low cost and/or with minimal social impact).
Minor	An impact that can be addressed by modifications to construction or operational techniques, but at an additional cost; and/or likely to be raised as an issue by stakeholders.
Moderate	An impact that can, with some difficulty, be addressed by major (non-standard) modifications to either construction or operational techniques, at a large additional cost; and/or likely to require significant consultation to convince stakeholders that it can be addressed in an acceptable manner.
Major	An impact that has the potential to impose an unacceptably high risk (damage to corporate reputation, compromised social license to operate) unless managed or avoided in an appropriate way. It could involve an unacceptable additional cost or engineering risk; and/or lead to a significant delay to the Project timetable; and/or compromise international standards, country legislation, industry best practice; and/or cause an extreme NGO/ stakeholder reaction.

The significance of impacts has been assessed on the basis of their severity and the likelihood of occurrence, and the sensitivity of receptors to and degree of change caused by the impact (*Table 22.3* and *Table 22.4*).

Table 22.3 Method for Identifying Significant Issues

Criteria Significance Assessment			
Severity	**Low likelihood**	**Moderate likelihood**	**High likelihood**
Low	None-Low	Minor	Minor
Medium	Minor	Moderate	Moderate
High	Moderate	Major	Major

Table 22.4 ***Significance Criteria for Social Impacts***

Severity Criteria				Significance Assessment Criteria			
Duration	**Extent**	**Degree of Change**	**Ability to adapt**	**Severity**	**Low likelihood** (Not heard of in mining sector)	**Moderate likelihood** (Has occurred in similar projects)	**High likelihood** (Has occurred in Australia)
Short-term	Individual/ Household	Inconvenience caused but with no consequence on long-term livelihoods or quality of life	Those affected will be able to adapt to the changes with relative ease, and maintain pre-impact livelihood	Minor	Minor	Minor	Minor
Medium-term	Small number of households	Primary and secondary impacts on livelihood and quality of life	Those affected will be able to adapt to changes, with some difficulty, and maintain pre-impact livelihood, but only with a degree of support	Moderate	Minor	Moderate	Moderate
Long-term/ irreversible	Large part of/full settlement	Widespread and diverse primary and secondary impacts likely to be impossible to reverse or compensate for	Those affected will not be able to adapt to changes and continue to maintain pre-impact livelihood	Major	Moderate	Major	Major

Table 22.5 addresses the potential socio-economic impacts identified, their sources, significance ratings, and mitigation or enhancement measures if required.

Table 22.5 Potential Impacts and Recommended Mitigation Measures

Impact	Source and Description of Impact	Impact Rating Prior to Mitigation/ Enhancement	Recommended Mitigation/Enhancement	Impact Rating after Mitigation
Impacts on social infrastructure and services	Source: Colliery workforce Demand and usage of social infrastructure and services in local and regional area Vulnerability: Capacity of social infrastructure in local and regional area Capacity of health and community services in local and regional area Receptors: Local residents NRE employees and their families Local agencies Local service providers	Minor	Majority of employees will likely be sourced/commute from major urban areas including greater Wollongong, and therefore it is predicted there will be sufficient capacity in the existing local services to accommodate them NRE continue to implement management programmes that contribute to the social and economic aspects of the community – supporting suitable community development programmes	Beneficial

Impact	Source and Description of Impact	Impact Rating Prior to Mitigation/ Enhancement	Recommended Mitigation/Enhancement	Impact Rating after Mitigation
Continued economic activity	Source: Direct employment with project; Indirect and induced employment via demand for local services and infrastructure; and Direct project expenditure in the local and regional area for goods and services. Gain: Job opportunities in local and regional area; Skilled workforce; Opportunity for higher wages; and Demand for a diverse range of skills. Receptors: Local residents who become employees; Broader regional residents who become employees; and Local businesses that provide goods or services to the project.	Moderate	Procure local goods and services Employ local and regional workers	Beneficial

Impact	Source and Description of Impact	Impact Rating Prior to Mitigation/ Enhancement	Recommended Mitigation/Enhancement	Impact Rating after Mitigation
Impacts to property values	Source: Visual Noise Traffic Air quality Vulnerability: Impact and perceived impact on property values Receptors: Local residents Property developers Property owners	Minor	The project is a continuation of existing operations Driver code of conduct Upgraded trucking fleet Additional acoustic bunding Continuation of dust management practices on existing and new stockpiles All urban growth has occurred with the mine operating	Minor
Noise levels	Source: Operational infrastructure and surface facilities including coal load out facility, pit top infrastructure, Road haulage. Vulnerability: Ongoing operational noise, Ongoing haulage noise, Sleep disturbance. Receptors Local residents (particularly those in Russell Vale) Local businesses	Moderate	Construction of a bund wall Noise attenuation and screening on new plant Driver code of conduct Upgraded trucking fleet All urban growth has occurred with the mine operating	Minor/beneficial

Impact	Source and Description of Impact	Impact Rating Prior to Mitigation/ Enhancement	Recommended Mitigation/Enhancement	Impact Rating after Mitigation
Dust levels	Source: Operational infrastructure and surface facilities including coal load out facility, pit top infrastructure, Road haulage Vulnerability: Ongoing dust, Ongoing haulage dust. Receptors Local residents (particularly those in Russell Vale) Local businesses	Moderate	Continuation of dust management practices on existing and new stockpiles New conveyors will be enclosed All urban growth has occurred with the mine operating	Minor
Road haulage levels	Source: Traffic to and from the mine, (employees, visitors, suppliers, deliveries, contractors, maintenance) Road haulage Vulnerability: Ongoing traffic noise Receptors: Road users (Bellambi Lane and Northern Distributor) Local Business	Moderate	The project is a continuation of existing operations Driver code of conduct	Minor

Impact	Source and Description of Impact	Impact Rating Prior to Mitigation/ Enhancement	Recommended Mitigation/Enhancement	Impact Rating after Mitigation
Decease in water quality and containment	Source: Construction works on Bellambi Gully Creek Mine water discharge Vulnerability: Capacity of creek to handle flooding events Water quality impacts down stream Receptors: Local residence (adjacent to Bellambi Gully Creek) Local waterways	Minor	Construction Environmental Management Plans will be put in place Construction of the bypass channel will improve flood management Water quality assessments will inform future upgrades	Beneficial

22.2 *ECONOMIC IMPACT ASSESSMENT*

22.2.1 *Introduction*

The Project will continue to benefit the regional, state and national economies through the extraction, handling and sale of coal. The assessment compares the "without project" situation to the "with project" situation. As the Project would extend existing mining activities, the "without project" situation is defined as the case where the mining activities are not extended and thus the current operation would cease in December 2010. This would lead to mine closure and job losses and to project-related investments not being realised.

Employment for the project will continue at 337 full-time equivalent employees.

22.2.2 *Direct Economic Benefits Due to Project Expenditure*

The 'upstream' economic benefits of the project are accrued where the project expenditure is incurred, at both the regional and national level. The upstream benefits accrue to the local workforce, contractors and suppliers that provide goods and services to the Project.

Expenditure by the Project

A measure of the value of the project to the Australian economy (upstream) is the sum of the net economic benefits of all the transactions that occurred in extracting the coal and bringing it to market (upstream transactions). Direct economic impacts arise from project spending on salaries for employees and purchases of materials, equipment and services from suppliers.

Expenditure of the project includes:

- capital expenditure on materials, equipment, machinery and contractors;
- operational expenditure;
- salaries to employees;
- payments to suppliers of operational inputs and materials; and
- payments to consultants and contractors, including transport providers and Port Kembla Coal Terminal.

The Regional Economy

The impacts on the regional economy depend on the location of the employees, suppliers and contractors. The regional economy in this case is defined as the Wollongong, Shellharbour, Kiama, Wollondilly and Wingecarribee local government areas (LGAs) around the project site where almost all employees reside. Therefore it is estimated that the majority of annual payments to employees, suppliers and contractors will be paid into the regional economy.

Impacts on Household Income

The Project will have a significant direct impact on household income because a large proportion of the direct economic impact relates to salary payments. The majority of impacts on household income will be in the regional economy, as almost all employees reside in the region.

In addition the project will pay fees to suppliers and contactors, a proportion of which will also be transferred as employee compensation. Much of these incomes will in turn be spent in the regional economy. (The indirect impacts on salaries and household income are assessed below).

The Project will also have other direct impacts on the regional economy. These impacts will derive from expenditure on training for apprentices. Such training will help address skill shortages emerging in the mining sector and to improve the employment opportunities of local job-seekers.

In addition, NRE plans to continue it's annual contributions to the community through direct funding of local initiatives (see *Section 22.1.3*)

22.2.3 Indirect Economic Benefits Due To Expenditure

In addition to the direct economic benefits, the Project will also generate indirect economic benefits. Indirect effects are a result of the flow-on effects of income, expenditure and employment of a proposed increase in investment or production. Direct benefits to the economy are multiplied because the initial activity requires the purchase of goods, labour and other services and these purchases in turn generate further flow-on expenditure. The effect diminishes with each round of investment and expenditure until a final increase in the economic benefits can be determined.

22.2.4 Downstream Impacts

The 'downstream' benefits are realised where the coal is used. In this case, the coal is sold to the export market and so downstream benefits that accrue to the Australian economy are limited to the foreign exchange revenues earned.

22.2.5 *Impacts on Government Revenues*

Taxes and royalty payments are an important contribution of the project to government finances and will contribute to further direct and indirect economic impacts in the economy.

These royalty and tax payments can be considered as a payment for the use of public resources (coal), infrastructure and government services. Due to multiplier effects, the total impact on government revenue due to the project will be much greater than the direct impacts alone.

22.3 *EXTERNAL COSTS*

External economic costs and benefits are those costs that are external to the market and thus do not have a direct market value. Externalities include the costs or benefits arising from any environmental and social impacts.

The evaluation of the economic impact due to externalities is beyond the scope of this assessment. The economic costs of subsidence are potentially significant for mining operations. In this case however, the economic costs of subsidence of this project are expected to be minimal. Subsidence is expected to be minimal the mine is mostly located under the Sydney Water catchment which has limited economic assets that could be damaged by subsidence. The Project will be paying a subsidence levy in accordance with government regulations to offset potential subsidence costs. Other significant external costs may include the emission of greenhouse gases (GHGs) (see *Chapter 13*) and the cost of rehabilitating the site (see *Chapter 23*). Site rehabilitation costs will be determined at mine closure.

22.4 *CONCLUSIONS*

The social and economic impacts from the Project occur within an existing operation and therefore are not expected to dramatically change the existing socio-economic environment.

The Project will have the following positive social and economic impacts to the local area including:

- maintaining current employment of 337 employees;
- providing short term employment for approximately 25 contractors during construction;
- continuation of businesses and local spending on goods and services;
- ensuring ongoing employment in the mining sector across NRE operations in the Illawarra;

- significant flow-on effects into the local, regional, state and national economy; and

- maintaining community development and ongoing opportunities for NRE to identify and support community development programmes in the local and regional community.

Potential negative impacts include noise and air quality issues associated traffic and operational infrastructure. However, mitigation measures are proposed including:

- noise attenuation and screening on new plant;

- additional acoustic bunding;

- continuation of dust management practices on existing and new stockpiles;

- driver code of conduct; and

- upgraded trucking fleet.

23 MINE CLOSURE AND REHABILITATION

This chapter provides an overview of the proposed land use following mine closure and the rehabilitation and mine closure strategy for the Project.

23.1 INTRODUCTION

NRE have a policy of undertaking progressive rehabilitation of areas of the Colliery that are no longer in use and where safe operational conditions permit. This chapter sets out the proposed rehabilitation strategy for the mine, taking into consideration relevant strategic land use planning and management policies.

The predominant zonings within the PAA are the Russell Vale site zoned RU1 and the Catchment area zoned for Environment Protection (E2 andE2). The land zonings are illustrated on *Figure 5.1*.

23.1.1 Legislative Requirements

Under the *Mining Act 1992*, environmental protection and rehabilitation are regulated by conditions included in all Mining Leases, including requirements for the submission of a Mining Operations Plan (MOP) and Annual Environmental Management Report (AEMR).

The MOP describes all mining and mining related activities including rehabilitation plans and land use outcomes over the MOP period. Mining operations must not be undertaken other than in accordance with a MOP that has been accepted by IIN.

The AEMR consolidates Government reporting requirements relating to environmental management and rehabilitation of mines including rehabilitation in relation to the MOP undertaken in the last 12 months; and specifying environmental and rehabilitation targets to be achieved over the next 12 months.

Collectively, the MOP and AEMR constitute the *Guidelines to the Mining, Rehabilitation and Environmental Management Process* (MREMP Guidelines) which have been developed by IIN. As Project rehabilitation activities would be undertaken progressively, the MREMP framework would be used throughout the Project life to both plan and track the performance of these activities as they are carried out.

23.1.2 Rehabilitation Objectives

The ANZMEC Strategic Framework for Mine Closure objectives will be applied to all site rehabilitation and planning. The objectives are:

- to enable all stakeholders to have their interests considered during the mine closure process;
- to ensure the process of closure occurs in an orderly, cost-effective and timely manner;
- to ensure the cost of closure is adequately represented in company accounts and that the community is not left with a liability;
- to ensure there is clear accountability, and adequate resources, for the implementation of the closure plan;
- to establish a set of indicators which will demonstrate the successful completion of the closure process; and
- to reach a point where the company has met agreed completion criteria to the satisfaction of the Responsible Authority.

23.2 REHABILITATION AND MINE CLOSURE - RUSSELL VALE SITE

For the life of this Project land use options are primarily limited by the current land zonings and current land use. As per the Wollongong Council LEP the substantive land zoning for the Russell Vale site is RU1 and relates primarily to land east of the Illawarra Escarpment. *Figure 5.1* shows the boundaries of this zoning.

Due to the short life of the project there will be limited rehabilitation work undertaken. At the mine closure stage, when the aim will be to relinquish the mining lease, rehabilitation requirements will follow specific guidelines that apply at the time. Currently these guidelines are reflected in the ANZMEC Strategic Framework for Mine Closure objectives. Proposed rehabilitation of specific features is summarised in *Section 23.2.2*.

23.2.1 Russell Vale Rehabilitation – Life of Project

The following work is proposed during the life of the project:

- remove the F2 and F3 gantries;
- remove the clean coal reclaim tunnel;

- remove the 1.8 metre diameter concrete drainage line when it is replaced with the Bellambi Gully realignment channel;

- reshape the Bellambi Gully drainage line east of the junction of Bellambi Gully and the Stormwater Control Dam spillway;

- remove disused equipment and other scrap metal on the lower development area adjacent to the recently removed coal processing plant; and

- remove the disused conveyor gantry, leading from the Gibson's Tunnel located downhill from the administration building, to the raw coal stockpile.

23.2.2 Russell Vale Rehabilitation – Mine Closure

The majority of current mine infrastructure, particularly the shaft and mine entries (adits) are essential for ventilation, egress and safe operation of the mine. Hence, full and effective rehabilitation of these facilities is only possible as part of mine closure.

Table 23.1 details the key items and their rehabilitation potential.

Table 23.1 Russell Vale Rehabilitation Schedule

	Item #	Item Description	Comments
Russell Vale Site - Zoned RU1	1	Coal Handling and former Coal Preparation Plant	Progressive
	2	Rail Lines and associated loops and spurs	Operational
	3	Main Workshop Area	Operational
	4	Administration Buildings	Operational
	5	Access Roads and Haul Roads	Operational
	6	Sewage/Contaminated Storm Water/Water Treatment Plant	Operational
	7	Hardstand/ Laydown Areas - across the entire site	Operational
	8	Below Surface Infrastructures eg portals	Operational
	9	Lower Development Area - located east of pit top area through to ROM Stockpile area.	Operational
	10	Area Disturbed by Mining ie Pit Top Area	Operational
	11	Dams and Water Holding Structures	Operational
	12	Bellambi Gully - diversion	Operational
	13	Other Structures - requiring care and maintenance that have historical significance	Progressive
	14	Third Party Project Management	Progressive

Definitions

"Progressive" – will be managed in accordance with continuing operations/approvals.

"Operational" - currently being utilized

23.3 REHABILITATION AND MINE CLOSURE - CATCHMENT AREA

Mine infrastructure sites west of the escarpment are located on lease hold land which is within the Metropolitan Catchment Special Area as managed by the SCA. The land zonings and ongoing management of the mine require no changes in respect of land use both for the proposed project, post project and mine closure. The longer term rehabilitation aim is to return these sites to natural bushland with the completion criteria determined by site specific management plans endorsed by SCA.

It should be noted that use of all existing mine infrastructure is essential for the operation of the mine for the life of this Project. This is due to the short life of this project as the potential for the Wonga Main development to replace existing deteriorating mine infrastructure cannot be realised within the life of this Project, hence the de-commissioning and rehabilitation of surplus mine facilities. Thus all shafts, adits and related infrastructure will remain operational for the life of the Project.

23.3.1 Catchment Land Rehabilitation – Life of Project.

The following rehabilitation work is planned to be carried out on the Catchment Area during the life of the Project:

- remove the disused power line that runs between No. 1 shaft and No. 3 shaft; and
- remove a disused diesel storage tank at No. 4 shaft.

23.3.2 Catchment Land Rehabilitation - Mine Closure.

The majority of current mine infrastructure, particularly the shaft and mine entries (adits) are essential for ventilation, egress and safe operation of the mine. Hence, full and effective rehabilitation of these facilities is only possible as part of mine closure.

Table 23.2 details the key items and their rehabilitation potential.

Table 23.2 Catchment Rehabilitation Schedule

Item #	Item Description	Comments
1	Shafts 1,3,4,5 and connecting roads, power lines and surface infrastructure	Operational
2	Main workshop area infrastructure	Operational
3	Admin buildings	Operational
4	Sewerage/Water Treatment Plant	Operational
5	Hardstand/Laydown Areas (across the entire area)	Operational
6	Below surface infrastructure - shaft filling, cap exploration boreholes	Operational/refurb with further assessment
Definitions		
"Progressive" – will be managed in accordance with continuing operations/approvals.		
"Operational" – currently in use		

23.4 GENERAL REHABILITATION METHODS AND PROCEDURES.

23.4.1 Previous and Current Rehabilitation

At the Russell Vale site and Nos. 1, 3 and 4 Shafts rehabilitation over the past 15 – 20 years has included the following activities:

- removal of scrap metal and redundant machinery;
- removal of unwanted liquid wastes;
- removal of the Washery at the Russell Vale site in accordance with approval issued by WCC in December 2004. Only the two gantry towers F2 and F3 and a below ground level coal reclaim tunnel remain to be demolished;
- monitoring of the 1887 archway;
- identifying 26 mine entrances to the Bulli or Balgownie coal seams, located along the escarpment face within the lease area. The majority are now sealed;
- preparation of a Stage 1 Contamination Assessment report in 1997; and
- preparation of a year 2000 Mine Closure Plan.

Post mining land use options will take into consideration inherent land stability and any WCC strategic planning including:

- Wollongong Local Environmental Plan 2009 – in which the Russell Vale site is zoned RU1 Primary Production; and
- Illawarra Escarpment Strategic Management Plan – in which Russell Vale site is proposed to be zoned Core Escarpment Area, Biophysical Support for Core and Landscape Support for Core.

23.4.2 Unplanned Mine Closure

As it is planned to continue extraction at the Colliery for some decades it is premature to develop a detailed closure plan. However, as a contingency a closure plan has been developed that covers the event of "Sudden (Unplanned) Closure" as raised in ANZMEC Strategic Framework for Mine Closure.

All mine entries (adits) and shafts will be sealed in accordance with the appropriate guidelines as provided by IIN. It will be necessary for each mine entry to be treated and assessed according to case specific criteria, conditional upon the terrain that is represented and the physical condition of each portal at the time of closure.

23.5 CONCEPTUAL LANDFORM DESIGN

As the NRE No.1 Colliery is largely underground, landform design will not change upon closure of the mine. All surface infrastructure will be removed unless suitable alternate uses are apparent and endorsed by key stakeholders (in particular buildings, ongoing use of dams, access roads, etc) and it is expected that the landform in all surface lease areas will remain similar to present. Once all surface facilities have been removed from the Russell Vale site, the site will be graded, and seeded with grass to stabilise until approvals for future developments, in accordance with land use zonings, are granted.

23.6 CONCLUSION

The Russel Vale site includes the original parcel of land that has been in continuous use for coal mining since 1887. Plans for the final use of the Russell Vale site have not yet been determined as the life of the mine is considered to be several more decades. However, it is anticipated that rehabilitation of the site will be undertaken progressively. This work will be applied where practicable and given priority, particularly in respect to removal of surplus mining equipment, sealing of any redundant mine entries and shafts and stabilisation of slopes and embankments.

The mining area to the west of Russell Vale is controlled and managed by SCA. A Master Agreement has been entered into with SCA covering mining beneath the Cataract Dam and the Notification Area of the Dam. This agreement covers NRE's obligations and management procedures principally with respect to orderly mine closure and emergency management of water in-rush during mining. The majority of this area is native bushland and will not require rehabilitation, with the exception of the shaft sites.

Rehabilitation and mine closure objectives for the NRE No.1 Colliery have been developed with consideration for previous land uses, existing zoning and the potential to reuse existing structures and materials in the future. A final mine closure plan has not been developed as mining operations are expected to continue for decades to come. However, the details of the final mine closure process are provided in the NRE No.1 Colliery Mining Operations Plan (MOP) (December 2007). The mine closure process will follow the recommended 'Rehabilitation and Mine Closure' guidelines and 'ANZMEC Strategic Framework for Mine Closure' objectives and principles to ensure that all relevant aspects of closure have been addressed.

Upon cessation of mining operations, it would be expected that tenure of the mining and coal leases would be maintained by NRE until such time as lease relinquishment criteria were satisfied. These criteria would be formulated and prescribed in consultation with relevant authorities and stakeholders. As part of the lease relinquishment a report will be prepared and submitted in accordance with the IIN guidelines, current at that time. Possible future land uses for No.4 Shaft site may include:

- remediation back to natural bushland;
- alternative methods for methane gas capture/management; and
- use of the facilities for other purposes such as in-catchment administration buildings for SCA or NPWS.

Alternatively the site may continue to operate as a facility to recover coal for an indefinite number of years as the Balgownie and Wongawilli seams and the Bulli have extensive resources remaining in the area. This site remains as the primary man access for the mine.

24 STATEMENT OF COMMITMENTS

This chapter provides a summary of the major commitments of NRE for the Project.

The following Statement of Commitments has been prepared in accordance with the DGRs and Part 3A of the EP&A Act. These commitments outline the management, mitigation and monitoring measures to be adhered to by NRE throughout the development and operation of the proposed Project to manage potential environmental impacts arising from the proposal and establish contingency plans for any unforseen impacts.

The Draft Statement of Commitments is detailed within *Table 24.1*.

Table 24.1 Draft Statement of Commitments

Outcome	Commitment	Timing
Statutory Requirements		

Compliance with all conditional requirements in all approvals, licences and leases.	• The development will be carried out as outlined in:
	  • this Environmental Assessment Report (EA);
	  • Project Approval;
	  • Environment Protection Licence;
	  • Subsidence Management Plans (SMPs);
	  • Mining Lease(s) conditions;
	  • Controlled Activity Approval; and
	  • any other approvals, licences or leases.
		Continuous and as required

All operations conducted in accordance with all relevant documentation.	• Undertake all activities in accordance with the accepted Mining Operations Plan; environmental procedures; safety management plan and/or site-specific documentation in force at that time.	Continuous and as required
Stakeholder Consultation		
Effective communication/ consultation is undertaken throughout construction and operation of the project.	• NRE will conduct regular community liaison meetings and provide regular updates to the community both during construction and operation of the project.	Prior to construction and at regular intervals of not less than 2 times a year
Subsidence		
Potential adverse impacts from subsidence are managed, monitored and remediated where necessary.	• Implement V Mains SMP as amended by approval conditions.	Prior to mining and on going
	• Continue implementing conditions of T and W Mains as relevant to 309 Panel.	Prior to mining and on going

	• Implement a subsidence monitoring program that will include:
	  • monitoring before, during and after mining;
	  • a set of pre-determined triggers; and
	  • responses and actions that flow from the identification of each trigger.
		Prior to mining and on going

	• Implement mitigation measures for No.8 Fire Trail as detailed in the V Mains SMP:
	  • signs erected to warn motorists of potential subsidence impacts, including a recommended speed limit;
	  • daily inspections (Monday to Friday) during mining under the fire trail;
	  • a pre-approved treatment strategy; and
	  • road rehabilitation if required, including regular regrading of the affected sections of the access road.
		Prior to mining and on going

	• A management plan has been developed for the in consultation with Telstra for management of the optical fibre cable during mining of the T and W Mains. NRE will consult with Telstra to have this plan extended to	Prior to mining and on going

Outcome	Commitment	Timing
	cover the V Mains.	
Soil and Water		
Construction and operations are managed such that adverse impacts to water quality and flows Bellambi Gully Creek and surrounding residents are prevented or minimised.	• Dirty stormwater and mine water will be treated on site prior to discharge.	Continuous and as required
	• Dirty stormwater from hard surfaces will be diverted into the SWCD. Water will be held in the SWCD to reduce solids prior to treatment and then discharging via LDP2.	Continuous and as required
	• The stormwater control dam (SWCD) will be kept at a level that allows 30ML of stormwater to be captured on site, reducing the flow and flood potential downstream.	Continuous and as required
	• Chemicals will be properly stored and bunded. Dosing of flocculent will be metered and monitored on site.	Continuous and as required

	• The underground pipe section of Bellambi Gully Creek will be replaced with a suitably designed and engineered open bypass channel constructed on the southern side of the coal stockpile area. This will include:
	  • a dissipation pond will be constructed at the end of the bypass channel to reduce the energy of flows back into Bellambi Gully Creek;
	  • upgrades to the existing channel including Reno mattresses and Gabion drop structures to reduce the velocity of water flowing down the gully; and
	  • regular maintenance to minimise scouring during major flow events.
		Within 12 months of approval

	• Preparation of a Construction Management Plan that includes the following:
	  • a dry and wet basin arrangement to minimise sediment transportation to the stormwater dam;
	  • works will not take place during heavy rainfall that is likely to contribute to erosion;
	  • undertake stripping of topsoil, if required, immediately before starting bulk earthworks to be use for rehabilitation or revegetation works on site;
	  • suitable areas for any temporary stockpiling of excavated soil (on flat ground) will be clearly identified and delineated before the commencement of works;
	  • ensure stockpiles are:
	  • constructed on the contour at least 2 (preferably 5) metres from hazard areas, particularly likely areas of concentrated water flows or slopes steeper than 10 percent;
	  • stabilised if they are to be in place for more than 10 days. The stockpile of VENM excavated from the construction of the bypass channel will be grassed;
	  • protected from run-on water by installing water diversions upslope; and
	  • installed with sediment filters immediately downslope to protect other lands and waterways from pollution.
		Prior to construction

	• Construction of Bellambi Gully Creek will be undertaken in accordance with engineering plans prepared in general to meet the design parameters outlined in Coffey (2010).	Prior to construction
	• All erosion, sediment control and runoff diversion measures will be established before any excavation begins. These will be left in place throughout works execution and beyond works completion until all surfaces have	During construction

Outcome	Commitment	Timing
	been fully restored and stabilised.	
Surface Water		

Operations are managed such that adverse impacts to catchment surface water are prevented or minimised.	• Implement a monitoring program including:
	  • daily automated monitoring of selected pool water depths upstream, within and downstream of the V Mains area;
	  • Water quality monitoring in Wallandoola and Lizard Creeks;
	  ▪ every 2 months prior to mining;
	  ▪ fortnightly during mining; and
	  ▪ monthly post mining
	  • stream water level, or spot flow monitoring and sampling conducted at all locations on the same day; water depths in the stream monitoring sites should where practical be automatically monitored and photographed during site visits;
	  • potential bedload movement in and downstream of the subsidence area visually monitored during and after significant flow events;
	  • Stream bed/bank stability and vegetation will be visually monitored and photographically recorded prior to, during and post mining
	  • rainfall monitored daily at the mine's weather station for the duration of mining.
		On going during mining

	• An end of panel extraction report will be prepared, which summarises all monitoring over the period. The report will outline any changes in the surface water in the V Mains area.	Post mining
	• Results of the monitoring programmes will be reviewed one year after pillar extraction has been completed and an updated ongoing monitoring and remediation program will be developed in association with IIN, DWE and the SCA.	One year after extraction of each pillar
Groundwater		

Operations are managed such that adverse impacts to local and regional groundwater resources are prevented or minimised.	• Groundwater quality monitoring will be undertaken at P6:
	  • bimonthly prior to mining;
	  • monthly during mining; and
	  • quarterly post mining.
	• Standing water levels will be monitored:
	  • daily prior to mining;
	  • twice daily (automatic) and monthly (manual) during mining; and
	  • quarterly post mining.
	• Mine inflows will be monitored monthly during and post mining.
		On going during mining

	• An end of extraction report will be prepared, which summarises all monitoring over the period. The report will outline any changes in the groundwater.	Post mining
	• Results of the monitoring programs will be reviewed one year after pillar extraction has been completed and an updated ongoing monitoring and remediation program will be developed in association with the IIN,	One year after extraction

Outcome	Commitment	Timing
	NOW and the SCA.	
Air Quality		
Operations are managed to minimise potential adverse impacts to the environment, residences and the community.	• All conveyors will be covered where practical.	Continuous and as required
	• Water sprays will continue to be used to minimise air borne dust on an as needs basis.	Continuous and as required
	• Trucks will be covered before leaving the site.	Continuous and as required
	• Trucks will be clean prior to leaving the site.	Continuous and as required
	• NRE will continue to enforce the Driver's Code of Conduct, through continuing driver education (tool box talks) and regular audits.	Continuous and as required
Greenhouse Gasses		
Manage operations such that greenhouse gas emissions on the environment are minimised.	• Energy audits will be held when practicable to ensure that the mine is using current practice techniques to minimise energy use and is operating at optimum energy levels.	Continuous
	• Site management will ensure that equipment is maintained to retain energy efficiency.	Continuous
	• The inventory of emissions developed for this assessment will be maintained.	Continuous and as required
	• Emissions and abatement strategies will be reported annually as part of internal environmental reporting and National Greenhouse and Energy Reporting System obligations.	Annually
	• NRE will investigate opportunities to capture and/or re-use ventilation gases.	2015 onwards
Acoustics		
Operations are managed to minimise potential adverse impacts on the environment, residences and the community.	• A 3 m high barrier will be constructed to the south of Broker Street across the intersection with West Street (subject to site constraints).	Within 12 months of approval
	• A 3.6 m high barrier will be constructed to north of the internal access road from the weighbridge to the Princes Hwy (subject to site constraints).	Within 12 months of approval
	• The existing Bulli decline conveyor will to be decommissioned and demolished on completion of the new driveage which is likely to start in mid to late 2012.	On competition of the new driveage
	• Attended noise monitoring will be undertaken upon the commencement of operations to confirm predicted minor exceedances which may occur at some receivers.	Following completion of construction works and upon the commencement of operation of new infrastructure.

	• An operational Noise Management Plan (NMP) will be developed to specifically address potential noise impacts associated with the proposed operations at the nearest receivers. The NMP will outline methods and procedures to manage the following:
	  • results of the regular noise monitoring program on-site and within the surrounding area;
	  • response to any complaints or issues raised by the owner of the affected residence;
	  • noise mitigation measures and operating procedures to ensure compliance with noise goals; and
	  • noise monitoring data from the early stages of Project operations will be utilised to calibrate an operational specific noise model, to refine the potential predicted noise impacts during the worst case
		Within 18 months of approval

Outcome	Commitment	Timing
	scenario.	
	• An operational noise monitoring program will be developed to monitor noise emissions from the proposed operations to determine ongoing compliance with PSNLs and to identify any further feasible noise mitigation measures that can be implemented.	Within 18 months of approval
	• The results of the noise monitoring program will be reviewed by the operations manager to assess compliance with the PSNLs and reported in accordance with any requirements of the development approval or EPL.	Ongoing
	• Site equipment to be selected to meet appropriate INP noise goals in accordance with the acoustic design parameters for acoustically significant plant and equipment presented in NRE No.1 Colliery Preliminary Work Acoustic Assessment.	Prior to operation
Construction activities are managed to minimise potential adverse impacts on the environment, residences and the community.	• Construction will be limited to Monday to Friday 7am to 6pm and 8am to 1pm Saturday.	During construction
	• All residents adjacent to the site will be notified of the start of works.	Prior to construction
	• Where feasible, silenced site equipment will be used to minimise environmental noise emissions.	During construction
	• Any complaints regarding environmental noise emissions will be investigated and responded to in an appropriate manner.	During construction
	• All works will be undertaken in accordance with the DECCW's Interim Construction Noise Guideline (2009).	During construction
Aquatic Ecology		
Operations are managed such that adverse impacts to native aquatic habitats are prevented or minimised.	• Observations of aquatic habitats and surveys of aquatic macroinvertebrates will be undertaken at impact and control locations in the headwater swamp regions during and after mining.	During and after mining
	• A survey of aquatic macroinvertebrates (at impact and control locations) will be undertaken if the regular water quality monitoring program detects changes in the depth and quality of the water within Wallandoola Creek and Lizard Creek that are greater than anticipated on the basis of the subsidence predictions.	As required
	• Baseline monitoring will continue.	Continuous
Terrestrial Ecology		
Mining operations are managed such that adverse impacts to native flora and fauna are prevented or minimised.	• Monitoring habitat areas including the upland swamps, creeks and rocky habitats of the V Mains will occur pre and post mining.	Prior to and post mining

	• Additional fauna surveys in suitable seasons will be undertaken to detect the threatened species in the 309 Panel:
	  • Red-crowned Toadlet; and
	  • Giant Burrowing Frog.
		During suitable seasons

	• Fauna surveys will be undertaken to determine if the following species are presenting the V Mains and 309 Panel:
	  • Red-crowned Toadlet;
	  • Giant Burrowing Frog;
	  • Littlejohn's Tree Frog; and
	  • Giant Dragonfly
		During suitable seasons and prior to mining

Outcome	Commitment	Timing
	• If these species are detected, an Environmental Management Plan (EMP) will be developed in consultation with relevant agencies including DECCW and SCA to document contingency plans to mitigate unforseen impacts from mine related subsidence.	
Construction activities at Russell Vale are managed such that adverse impacts to native flora and fauna are prevented or minimised.	• Targeted surveys for the Green and Golden Bell Frog, to be conducted in late 2101 and in early 2011 at all potential habitat locations at the Russell Vale site to determine the presence of the species and the extent of their utilisation (e.g. breeding, foraging, over-winter sites) of the site; and • Should Dam 6 be verified as actual habitat for GGBF, then enhancement of Dam 5 will be undertaken in consultation with DECCW and WCC, to provide suitable breeding, sheltering and foraging habitat; • Preparation of a translocation plan, with the intent of moving individuals (if identified) from Dam 6 to Dam 5.	Before commencement of any work that may potentially affect habitat.

	• Measures that will be implemented to assist in the management of impacts to the riparian areas of Bellambi Gully Creek including the following will be included in an CMP:
	  • demarcation of works area prior to works beginning to avoid impacts to vegetation outside of the works areas;
	  • appropriate sedimentation controls to be implemented prior to works beginning; and
	  • weed removal and ongoing management of the area for weed control.
		Prior to and during construction

Aboriginal Heritage		

Surface works at the Russell Vale site are managed such that adverse impacts to archaeology are minimised	• A Protocol for the discovery of suspected Aboriginal objects (chance finds) will be included in a CMP. The protocol will include:.
	  • contact the registered stakeholder groups who participated in fieldwork, Illawarra Local Aboriginal Land Council and the D'harawal Knowledge Holders and have a representative identify if the suspected item is in fact an Aboriginal site or object;
	  • if the identification is positive, contact a qualified archaeologist to determine record the site or object. The archaeologist in consultation with the registered stakeholder groups should provide management and mitigation measures as necessary, and provide a short report of the investigation to NRE and a copy to DECCW;
	  • if human skeletal remains are found the following actions should be immediately undertaken;
	  • stop works in the immediate area of the remains;
	  • the local police contacted, a physical anthropologist or archaeologist contacted;
	  • if the remains are determined to be of antiquity and of Indigenous origin contacted the registered stakeholder groups; and
	  • management and mitigation measures to be drawn up in consultation with the registered stakeholder groups and the archaeologist.
		Prior to construction

Mining operations are managed such that adverse impacts to Aboriginal	• Site 52-2-1223 will be monitored by a qualified archaeologist and Aboriginal community.	Pre and post mining

Outcome	Commitment	Timing
heritage items are avoided or minimised.		
Non-Aboriginal Heritage		

Operations are managed such that adverse impacts to significant heritage items are avoided or minimised.	• A Conservation Management Plan (CMP) will be prepared for the Project. The CMP will reflect the future need of the site as a continuing mine. The CMP will include:
	  • no items identified as having heritage value or contributing to the heritage value of the site, will be demolished as part of this Project;
	  • a photographic recording of the 1887 portal and the site will be undertaken to Heritage Archival Recording standards. Copies of the recording will be lodged with the appropriate Local and State repositories;
	  • procedures to follow for any unanticipated impacts to heritage structures and for the discovery of unanticipated 'Relics'; and
	  • items of moveable heritage, including historical photos, plans, maps, records and the like will be documented, collated and catalogued records to Heritage Archival Recording standards. A conservator will provide advice regarding the long term storage of the items and an appropriate repository will be identified prior to Project works commencing.
		Within 3 months of project approval
		
		During construction
		
		Within 3 months of project approval
		
		Within 3 months of project approval
		
		Within 3 months of project approval

Traffic and Transport		

Operations are managed to ensure minimal impacts on the local road network.	• NRE will implement a traffic/driver management protocol which includes:
	  • trucking during PCKT approved hours
	  • obeying legal speed limits including a self imposed 50km/hr speed limit along Bellambi Lane;
	  • ensuring drivers are vigilant regarding separation distances;
	  • avoiding compression braking. Compression brakes must not be used on the approach to Port Kembla Rd/Springhill Rd lights when entering or exiting PKCT;
	  • covering all loads;
	  • washing all trucks prior to leaving the site;
	  • reporting all vehicle faults to the owner; and
	  • reporting all traffic incidents.
		Continuous

Visual Amenity		
Construction and design is managed to ensure minimal visual impacts on local residents.	• Colour treatments for surface facility components will be selected to match the surrounding environment.	During design and construction
	• The area of disturbance will be restricted to the minimum practicable.	During design and construction
	• Facilities will be placed to minimise disturbance of vegetation.	During design and construction
Operations are managed to ensure minimal visual impacts on local residents.	• Progressive rehabilitation will be undertaken as required.	Continuous and as required
	• Routine use of low beam on vehicle headlights by all construction and maintenance personnel.	Continuous
	• Appropriate use of lighting equipment to limit impacts on sensitive locations. This will be managed through inductions of all construction and operations employees.	Continuous

Outcome	Commitment	Timing
	• Ensuring lighting is directed away from residences through the use of directional lighting and shielding in accordance with safety regulations, and which complies with Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting.	Continuous
Waste		
Avoidance of unnecessary resource consumption; reuse, reprocessing, recycling and energy recovery wherever possible and, where this is not possible, disposal of wastes in an environmentally responsible manner.	• All construction materials will be purchased with the aim of reducing waste products.	Prior to construction
	• The stockpile of clean excavated material will be seeded with grass to stabilise until it can be reused.	During construction
	• All waste material will be disposed of in accordance with the provisions of the *Protection of the Environment Operations Act 1997* and the Waste Classification Guidelines (DECC, 2008).	Continuous
	• Waste will be recycled where possible or disposed of at an appropriately licensed waste disposal facility.	Continuous
	• Onsite storage and disposal of different categories of waste will be defined prior to construction. A sufficient number of covered storage bins will be provided for waste disposal on site, with separate bins for recyclable and non-recyclable waste.	Prior to construction and ongoing
	• A ll records will be retained as proof of correct disposal for environmental audit purposes.	Continuous
	• At No 4 Shaft, NRE will implement a manual monitoring assessment including visual observation for the presence of ponding of water on the surface of the irrigation area.	Continuous
	• A tertiary treatment system will be installed at No 4 Shaft to reduce pathogens resulting in a 1mg\L chlorine residual after 30 minutes as required under the DEC reuse guidelines.	End of first quarter 2011
Rehabilitation		
Progressive rehabilitation of areas of the Colliery that are no longer in use and where safe operational conditions permit.	• Rehabilitation at the Russell Vale site and within the catchment area to be undertaken in accordance with the Schedules set out in *Tables 23.1* and *23.2*	Continuous

25 CONCLUSION AND JUSTIFICATION

This chapter provides a conclusion justifying the Project taking into account the potential environmental and socio-economic considerations of the Project. It also assesses the Project against the principles of ecologically sustainable development.

25.1 INTRODUCTION

This EA presents findings of an environmental impact assessment for the continuation of mining and ancillary operations at NRE No. 1 Colliery. The Project will enable a continuation of existing operations and carrying out environmental improvement works at the Russell Vale site pending the completion and determination of the Major Project Application (MP 09_0013) for Stage 2.

25.2 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

Ecologically sustainable development (ESD) embraces the multiple objectives of social wellbeing, environmental sustainability, and economic prosperity. The National Strategy for Ecologically Sustainable Development is governed by the Commonwealth Government and provides broad strategic directions and framework for Governments to direct policy and decision-making. The strategy defines ESD as, "*using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased*".

The main theme behind ESD is that future generations should have a natural environment as good as, or better, than the one inherited by this generation. The aim of applying ESD to large resource developments is to ensure long term sustainable outcomes by the integration of profitable business with environmental responsibility, in partnership with the community.

In summary, the four principles of ESD are:

- the precautionary principle;
- social equity, including intergenerational equity;
- conservation of biological diversity and ecological integrity; and
- improved valuation and pricing of environmental resources, including incentive mechanisms.

An analysis of these principles as they relate to the Project follows.

25.2.1 *The Precautionary Principle*

Interpretation

The precautionary principle states that if there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. This principle was developed in response to one of the great difficulties of interpreting scientific data. The scientific method produces results based on confidence limits. These are controlled by the scope of data acquisition, interpretation methods and general understanding of a particular phenomenon within a particular scientific discipline. This has been used as a way of validating a lack of response to a potential threat of serious or irreversible environmental degradation.

In the application of this principle:

- careful application should always be undertaken to avoid serious or irreversible environmental damage; and
- an assessment of consequences of various options should be undertaken in formulating a proposal.

ESD requires that uncertainty and the associated risk level be considered in decision making.

Justification

The environmental consequences of the proposal have been assessed as accurately as possible using appropriate specialists in relevant disciplines. Assessments were undertaken in accordance with the relevant State Government Technical and Policy Guidelines listed in the project DGRs. The assessment process involved computer modelling, field validation, scientific analysis and interpretation of the individual and cumulative environmental impacts of the proposal. This process has enabled the potential impacts of the project to be predicted with a reasonable degree of certainty.

All predictions, however, contain a degree of uncertainty, which reflects the variable nature of the environment. Where there has been uncertainty in the prediction of impacts a conservative approach was adopted to ensure the worst case scenario was used in the assessment of impacts.

The proposal is consistent with the precautionary principle to the extent that all potential threats to the environment have been identified and appropriate mitigation measures have been developed to reduce such impacts. All management procedures form part of the statement of commitments as outlined in *Chapter 24,* and will form part of the approval conditions for this project.

The investigations undertaken during the preparation of this environmental assessment have identified potential impacts with adequate scientific certainty to justify proceeding with the proposed development. The proposal therefore meets the objectives of the precautionary principle of ESD.

25.2.2 Social Equity and Intergenerational Equity

Interpretation

Social equity involves concepts of justice and fairness so that the basic needs of all sectors of society are met and that there is a fair distribution of costs and benefits to improve the wellbeing and welfare of the community, population or society. Social equity does not imply equality but that there should be equal access to opportunities for improved welfare, with a bias towards advantaging the least well-off sectors of society.

Intergenerational Equity refers to the present generation ensuring that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

Justification

It is acknowledged that coal is a finite resource, however the proposal will ensure that the reserve is mined in an efficient manner and that the existing benefits afforded to the community are maintained or enhanced over the project life. The proposal will provide access to approximately 2.2 Mt of additional ROM coal that will supply the international coking coal markets.

Social and economic benefits are expected through the continuation of local employment, the transfer of technical and commercial skills to local industry, positive multiplier effects in the region and ongoing sponsorship and funding for community programmes (see *Chapter 22*).

NRE will ensure that, post-mining, the landform is compatible with those of surrounding lands, and remediation is undertaken in consultation with relevant stakeholders at the time. This is in accordance with the concept of intergenerational equity. Existing geological and mining and operational conditions mean that if the extraction areas are not mined as part of the current NRE No.1 Colliery operations these coal resources will be permanently lost and sterilised.

25.2.3 Conservation of Biological Diversity and Ecological Integrity

Interpretation

Biological diversity refers to the variety of all life forms, including plants, animals and micro-organisms, the genes they contain, and the linkages between them. Biological resources provide food, medicines, fibres and industrial products for current and future generations. They also provide for vital ecological services such as maintaining soil fertility and the supply of clean and fresh water. Maintaining biological diversity safeguards life support functions and can be considered a minimal requirement for intergenerational equity.

Justification

A comprehensive assessment of the likely impacts of the proposal on flora and fauna is detailed in *Chapter 16*.

Significant ecological features identified above and surrounding the 309 Panel include an upland swamp 320m west of the panel. GeoTerra 2010 indicates that the proposed extraction of the 309 Panel will not impact on the water levels or water quality of this swamp. Field studies have also indicated that habitat for threatened flora and threatened fauna species might occur within the vicinity of the 309 Panel. However assessments indicate that the areas of potential habitat will not be impacted by the extraction of 309 Panel (see Annex N).

Upland swamps are located along both Wallandoola Creek and Lizard Creeks. Mining of the V Mains area is not expected to crack solid rock or cause inter-connected cracks from the seam to the surface. Without cracking, there is no potential for loss of surface water or impacts to groundwater. It is therefore highly unlikely that there would be any observable flow-on effects on aquatic habitats, groundwater dependent ecosystems, or their biota.

No flora species are expected to be impacted by subsidence within the V Mains area. The fauna species were assessed using the seven-part test of significance (see *Annex L*). The results of the seven-part test assessments concluded that no significant impacts were expected for all species.

Potential habitat for the endangered Green and Golden Bell Frog (*Litoria aurea*) was recorded within Dam 6 and a swamp at the eastern end of the Russell Vale site. The Large-footed Myotis is also considered to have the potential to forage over the dams of the Russell Vale site. The proposed removal of Dam 6 at the Russell Vale site has the potential to impact the Green and Golden Bell Frog and foraging habitat for the Large-footed Myotis. Provided the prescribed mitigation measures (*Section 16.6*) are implemented, significant impacts to these species would be unlikely.

Commitments made in this report aim to conserve, enhance and manage habitat within the PAA, such that local populations can be maintained and thereby ensuring adherence to the principles of conservation of biological diversity and ecological integrity.

25.2.4 Improved Valuation and Pricing of Environmental Resources

Interpretation

The principle relates to the need to determine proper values for services provided by the natural environment, such as cultural values or the atmosphere's ability to receive gaseous emissions. This would result in intergenerational equity, as improved valuation and pricing of resources is paramount in conserving the natural environment for future generations. This principle's aim is that the environment be considered in the planning and costing of projects, so it is no longer considered a free resource.

Applying standard methods of valuation and pricing to environmental resources is a difficult process. This is largely due to the intangible nature of much of the natural environment. Pollution and future exploitation can be controlled under the polluter pays principle, whereby polluters who degrade the natural environment are responsible and accountable for returning it to its previous condition.

Justification

This environmental assessment examined the environmental consequences of the proposal and has identified a number of management measures for the potential adverse impacts associated with the proposal. These management measures have been included in the statement of commitments. NRE has committed to comprehensive management and monitoring measures to negate or mitigate identified potential adverse impacts arising from the Project Plan. Improved valuation and pricing of resources may include the comprehensive noise, air quality, water quality and groundwater monitoring networks that are or will be established at the Colliery.

The management measures identified in this EA have been developed concurrently with the environmental assessment and have been incorporated directly into the Project design. As such, components of the proposal have been identified to minimise adverse impacts including construction of new bypass channel for improved stormwater management and noise barriers for noise attenuation. The proposal therefore involves a higher initial capital expenditure to ensure a sustainable outcome. The cost of these measures can be used as an indirect indication of the value of environmental resources.

The provision of social and environmental inputs at all levels of study ensures that due consideration of any impacts and their associated costs are given in the assessment of viability and the design of the project. The proposal therefore meets the objectives of the principle of Improved Valuation and Pricing of Environmental Resources.

25.3 CONSIDERATION OF THE CONSISTENCY OF THE PROJECT WITH THE OBJECTIVES OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The DGRs require consideration of the consistency of the Project with the objects of the EP&A Act. Section 5 of the EP&A Act describes the objects of the EP&A Act as follows:

(a) to encourage:

(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,

(ii) the promotion and co-ordination of the orderly and economic use and development of land,

(iii) the protection, provision and co-ordination of communication and utility services,

(iv) the provision of land for public purposes,

(v) the provision and co-ordination of community services and facilities, and

(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

(vii) ecologically sustainable development, and

(viii) the provision and maintenance of affordable housing, and

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

The Project is generally consistent with the objects of the EP&A Act, because it is a Project which:

- has identified measures for the management and conservation of natural resources including water and natural areas for the purpose of promoting the social and economic welfare of the community and a better environment (*Chapters 8-22*);
- promotes the economic use of land through development of the State's mineral resources while maintaining existing land uses (*Chapter 5*);
- incorporates measures to manage potential adverse impacts on the existing communication and utility services in the region that may be affected by subsidence (*Chapter 8*);
- includes measures to minimise potential amenity impacts, such as air and noise emissions, on public land and in the community in the vicinity of the Russell Vale site (*Chapter 12, 14 and 20*);
- would support community services through the ongoing provision of sponsorship and funding to local community programs (*Chapter 22*);
- incorporates a range of measures for the protection of the environment, including the protection of native plants and animals, threatened species, and their habitats (*Chapter 16*);
- incorporates the principles of ESD (*Section 25.2*);
- included consultation with relevant State departments and local councils (*Chapter 6*); and
- has involved the local community through a consultation program (*Chapter 6*) involving the distribution of newsletters and hosting information sessions, where feedback and concerns raise were taken on board.

25.4 CONSISTENCY WITH THE FINDINGS AND RECOMMENDATIONS OF THE SOUTHERN COALFIELD INQUIRY

The SCI recommendations have been considered in the preparation of this EA relevant and are outlined in *Section 5.9*.

25.5 CONCLUSIONS

The EA has been prepared to meet the requirements provided by the Director-General of the Department of Planning and issues raised by the relevant Government authorities and other stakeholders. The assessment has focussed on issues with the potential to impact the environment as identified by the environmental risk assessment undertaken for the Project.

Identification of high risk features was a key preliminary step in the assessment process. Assessments and management measures presented throughout this report have, where appropriate, been tailored according to the level of risk.

The principal risks associated with the proposal are an indirect consequence of subsidence from mining. Assessments of subsidence, surface and groundwater, noise and vibration, air quality, greenhouse gas emissions, ecology, heritage, traffic and transport, waste and socio-economic impacts were undertaken. An overview of key assessment outcomes is provided below.

- Subsidence – has the potential to occur in two mining areas, the V Mains and 309 Panel.
    - Maximum vertical subsidence for the V Mains is predicted to be 1.02m. the predicted strains are in the range of +3.3 mm/m to -6.5 mm/m. These levels are regarded as not sufficient to cause tensile cracking in solid rock (Seedsman, 2010).
    - Maximum vertical subsidence for the extraction of the 309 Panel is predicted to be 400mm.
- Catchment Surface Water – mining in the V Mains or 309 Panel is predicted to result in negligible environmental consequences in Wallandoola Creek, Lizard Creek and their tributaries.
- Groundwater - it is predicted there will be no adverse observable permanent reduction in groundwater levels in the base of the Wallandoola or Lizard Creek valley as a result of the V Mains extraction. Potential subsidence from the extraction of 309 Panel is not expected to result in any observable adverse impacts on groundwater.
- Russell Vale Water - the discharge from the site is not expected to significantly impact the water quality or quantity in Bellambi Gully Creek for the life of the Project.

- Air Quality - the project will not significantly impact on the long term air quality parameters of dust deposition, annual average PM10 and TSP. While a maximum of four exceedances of the DECCW short term air quality criteria are predicted it unlikely that the project would have a significant impact on local air quality.

- Greenhouse Gas - total emissions over the lifetime of the Project (direct and indirect) have been calculated as being 9 400 174 tCO2–e. Annual emissions are anticipated to peak in 2013, contributing 3 147 471 tCO2–e to atmosphere.

- Noise - noise levels from normal operations incorporating noise mitigation measures would comply with relevant PSNLs at most receivers. Minor predicted exceedances will be confirmed though the implementation of a noise monitoring program.

- Aquatic Ecology - predicted subsidence arising from mining in the V Mains area is not expected to have any obvious effects on aquatic habitats or their biota within or immediately downstream of the V Mains area.

- Terrestrial Ecology – subject to the implementation of recommended monitoring measures, it is considered that the proposed activities will be unlikely to significantly impact ecologically sensitive values within the mining or construction areas.

- Aboriginal Heritage – it is considered that no Aboriginal heritage items are predicted to be significantly impacted by the Project.

- Historic Heritage – no items of historic heritage items are predicted to be impacted by the Project.

- Traffic and Transport – the project is not predicted to impact on the safety and performance of the road network along the transport corridor.

- Visual Amenity – changes to the existing viewscape, resulting from the Project, from publicly accessible view points outside the Colliery are minor.

- Waste – continued implementation of current waste management practices, as amended to reflect improved technology or practice, will minimise potential adverse impacts resulting from waste generation.

- Socio-Economic - the social and economic impacts from the Project occur within an existing operation and therefore are not expected to significantly change the existing socio-economic environment.

Assessment results have been presented throughout this report and where key issues have been identified, measures have been proposed negate or mitigate potential impact. These management and monitoring measures are summarised in the statement of commitments for this Project.

The project will provide environmental, social, operational and economic benefits. These include:

- improved management of stormwater on site through construction of the Bellambi Gully Creek channel;

- improved noise attenuation for local residents through the construction of noise barriers;

- continued full time employment for approximately 337 people at the Colliery. In addition, the engagement of varying numbers of contractors and casual employees will continue throughout construction stage of the Project;

- direct positive impact on the local and regional economy through the payment salaries and wages to the staff over the life of the Project and continued contribution and support of local community programs; and

- continued payment of Government taxes and royalties.

Given that the proposal is essentially a continuation of an existing operation, the significant environmental and socio-economic benefits that would result from the project, and the comprehensive management and monitoring measures proposed, it is considered that the project's benefits outweigh the potential adverse impacts associated with the project and therefore, the project is in the best interest of the public.

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ACRONYMS

Acronym	Definition
AEMR	Annual Environmental Management Report
AERMOD	AMS/EPA Regulatory Model
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ANZECC	Australian and New Zealand Environment Conservation Council
AWS	Automatic Weather Station
BoM	Bureau of Meteorology
CCL	Consolidated Coal Lease
CMP	Conservation Management Plan
CPRS	Carbon Pollution Reduction Scheme
CSG	coal seam gas
DCC	Department of Climate Change
DECCW	Department of Environment , Climate Change and Water
DEWHA	Department of Environment, Water, Heritage and the Arts
DGRs	Director-General's requirements
DKH	D'harawal Knowledge Holders
DLEP 2009	*Draft Wollondilly Local Environmental Plan 2009*
DO	Dissolved Oxygen
DoP	Department of Planning
DP	Deposited Plan
DPI	Department of Primary Industries
DSC	Dam Safety Committee
DWCREP	Drinking Water Catchments Regional Environmental Plan No. 1
EA	Environmental Assessment
EAR	Environmental Assessment Report
EC	Electrical Conductivity
ECRTN	Environmental Criteria for Road Traffic Noise
EEC	Endangered Ecological Communities
ENCM	Environmental Noise Control Manual
EPA	Environmental Protection Authority (now DECCW)
EP&A Act	*Environmental planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPIs	Environmental Planning Instruments
EPL	Environmental Protection Licence
ERM	Environmental Resources Management Australia Pty Ltd
EWG	Executive Working Group
GFS	groundwater flow system
GHG	Greenhouse Gas
GIS	Global information system
GJ	Gigajoules
GML	Godden Mackay Logan
GPS	Global positioning system
ICNC	Interim Construction Noise Guidelines
ILALC	Illawarra Local Aboriginal Land Council
IIN	Industry and Investment NSW
INP	*NSW Industrial Noise Policy 2000*
IREP	*Illawarra Regional Environmental Plan No.1*
LDP	Licence Discharge Point
LEPs	Local Environmental Plans
LEP 1991	*Wollondilly Local Environmental Plan 1991*

Acronym	Definition
LGAs	Local Government Areas
ML	Mining lease
MOP	Mining Operation Plan
MP	Major Project
mtpa	Million tonnes per annum
MWh	Megawatt hours
NES	National environmental significance
NEPM	National Environment Protection Measures
NGA	National Greenhouse Accounts
NGER Act	National Greenhouse and Energy Reporting Act 2007
NIA	Northern Illawarra Aboriginal Collective
NMP	Noise Management Plan
NPWS	National Parks and Wildlife Service
NRE	Gujarat NRE Coking Coal Limited
NOW	NSW Office of Water
PAA	Project Application Area
PEA	Preliminary Environmental Assessment
PKCT	Port Kembla Coal Terminal
PM	Particulate matter
POEO Act	*Protection of the Environment and Operations Act 1997*
PRP	Pollution Reduction Programs
PSNL	Project Specific Noise Levels
RBL	Rating Background Noise Level
REPs	Regional Environmental Plans
RL	Reduced level
RMZ	Risk Management Zone
RNE	Register of the National Estate
ROM	Run of Mine
RTA	Roads and Traffic Authority
RVEA	Russell Vale emplacement area
SASPoM	Sydney Catchment Authority Special Areas Strategic Plan of Management 2007
SCA	Sydney Catchment Authority
SCI	Southern Coalfield Inquiry
SEPPs	State Environmental Planning Policies
SEPP MD	State Environmental Planning Policy (Major Development) 2005
SMP	Subsidence Management Plan
SWCD	Stormwater control dam
SWL	Sound Power Levels
tCO2-e	Tonnes of carbon dioxide equivalent
TSC Act	*Threatened Species Conservation Act 1995*
TSP	total suspended particulates
UNFCCC	United Nations Framework Convention on Climate Change
VENM	virgin excavated natural material
WLEP	Wollongong Local Environmental Plan 2009
WM Act	Water Management Act 2000
WWC	Wollongong City Council

DEFINITIONS

Term	Definition
309 Panel	The last panel in the Bulli seam at the eastern end of T and W Mains
Bellambi Gully Creek	Water course that flows through the Russell Vale site
Bellambi Gully Creek bypass channel	New open channel to be constructed to conduct water flowing through Bellambi Gully Creek around the stockpile area.
Coal clearance system	A system used to transfer coal from the working faces to the surface.
Coking coal	Coking coal is coal that can be used in the production of coke which in turn is used in the blast furnace in the production of pig iron. Bottom of Form
Continuous miner	A remote-controlled, tracked, electrically powered coal cutting and loading machine used to form mine roadways and extract coal pillars.
Driveage	A horizontal or inclined heading or roadway in the process of construction. The road way will be used to access a new mining area within the lease.
First workings	Involves the development headings or roadways which will provide access to the coal resource. They are developed using continuous miners with integrated roof and rib bolting rigs. First workings leave the coal pillars intact and the overlying strata fully supported
Gate roads	Access roadways connecting the longwall working face with the main roadways.
Goaf	The space left following extraction of the coal seam where the roof material is allowed to collapse.
H Panel	Small blocks of Bulli Seam coal that lie under and immediately adjacent to the stored water of Cataract Reservoir
No.4 Shaft	Main downcast shaft for men and materials
Main roadways	Roadways that are used as the means of primary access/egress, to supply materials, provide ventilation and enable coal to be conveyed to the surface.
Metropolitan Special Area	An area categorised as Restricted Access under Schedule 1 of the Sydney Water Catchment Management Act 1998. It is managed by the Sydney Catchment Authority.
Mining Lease	Title granted under the Mining Act 1992 that provides rights to mine a coal resource.
P and R Drifts	Connects the Wonga Mains to the Bulli seam
Pillar extraction panel	A continuous miner system of mining whereby coal pillars are systematically extracted.
Portal	Entry point on the Escarpment into the coal seam.
Project Application Area	Area to which this project applies
Relic	Any deposit, artefact, object or material evidence that: (a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and (b) is of State or local heritage significance.
Run-of-mine	Raw coal as mined that has not undergone any screening, crushing or washing.
Shaft	A vertical or inclined excavation used for the purpose of opening or servicing a mine.
Strain	The change in the horizontal distance between two points divided by the original horizontal distance between the points.

Term	Definition
Russell Vale site	Location of main surface infrastructure, including stock pile area, offices etc
Stage 1	Preliminary Works Project – production continuing at current rates of 1mtpa
Stage 2	Major Expansion Project – production increasing to 3mtpa
South Bulli Colliery	Previous name for the NRE No.1 Colliery.
Subsidence	The deformation of the ground mass due to the mining activity, including both vertical and horizontal displacement, tilt, strain and curvature.
Tilt	The difference in subsidence between two points divided by the horizontal distance between the points.
T and W Mains	Recent extraction area west of the 309 Panel.
Upsidence	Relative upward movement, or uplift, created by the horizontal compression and buckling behaviour of the rock strata in the vicinity of a valley floor.
Valley closure	A phenomenon whereby one or both sides of a valley move horizontally towards the valley centreline, due to changed stress conditions beneath the valley and its confining land masses.
Wonga East	The eastern area of the Stage 2 proposed workings
Wonga Mains	Main driveage through the Wongawilli seam
Wonga West	The western area of the Stage 2 proposed workings
V Mains	A block of Bulli Seam coal between earlier longwalls at South Bulli and Cordeaux Collieries

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