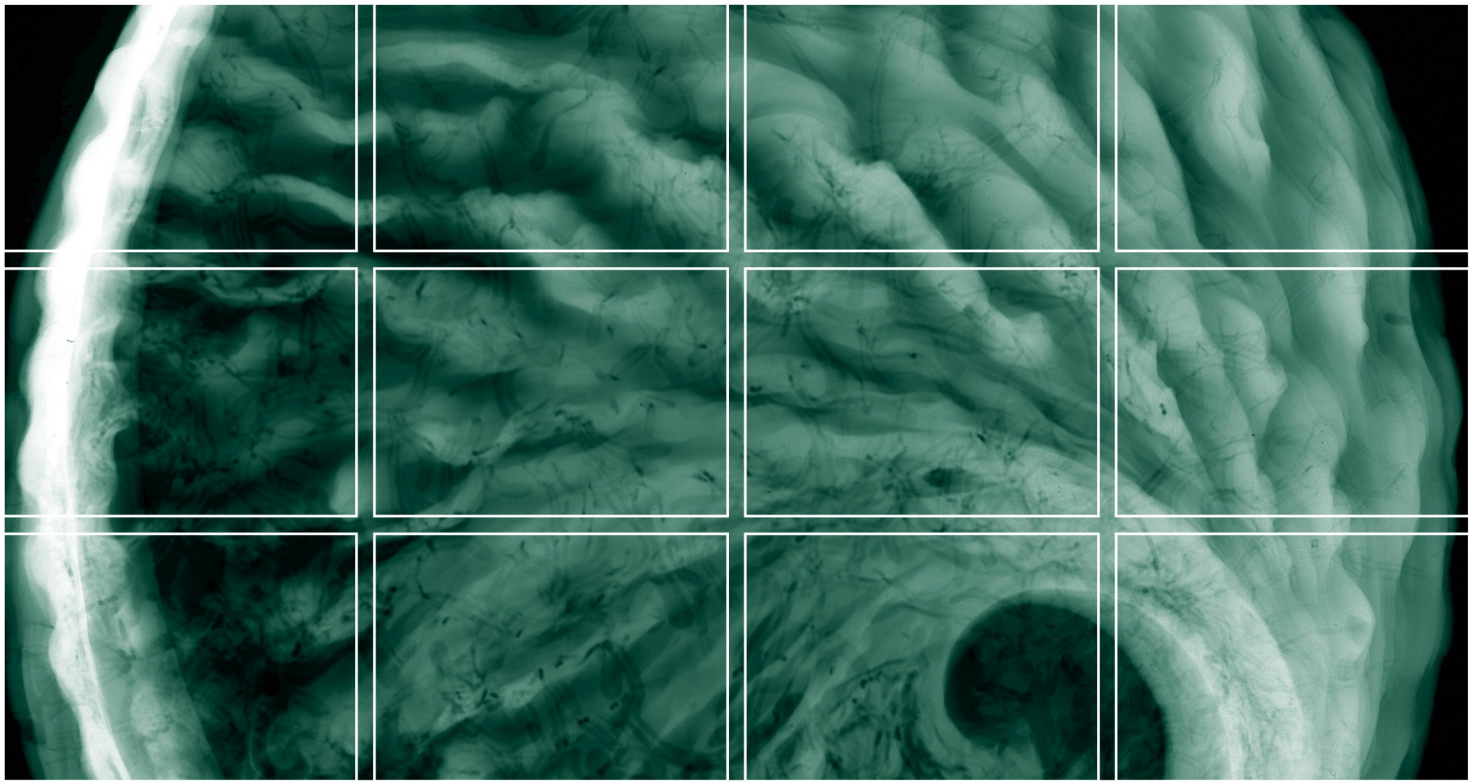


PART B

SURFACE FACILITIES

7 *SURFACE FACILITIES*

This chapter provides a description of the proposed expansion of the surface facilities and operations.

7.1 *PROPOSED SURFACE WORKS UPGRADES*

Coal handling infrastructure will be expanded to cater for the proposed increased volume of ROM Coal and further upgraded to improve operational efficiency and minimise impacts on the environment and local community.

7.1.1 *Coal Processing*

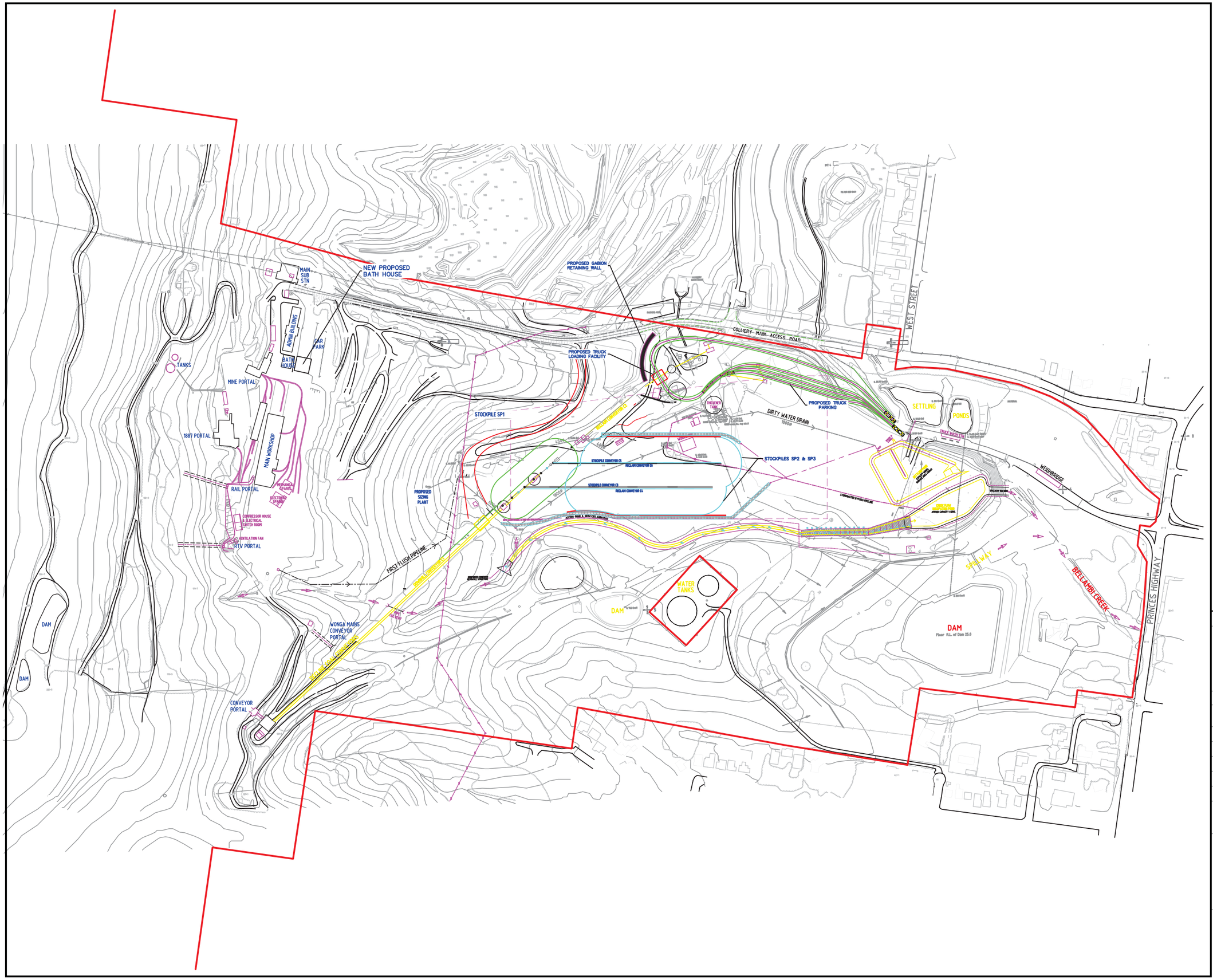
The proposed upgrades have been prepared by JBK Engineering and Mining (JBK) as a as a conceptual design and are described by Olsen (2010). The JBK design plans are provided in *Annex C*. The full Olsen (2010) report *NRE No 1 Colliery Russell Vale Site Stage 2 of Upgrade to Surface Facilities and on-site Traffic Report* is provided in *Annex D*.

New coal handling facilities and surface infrastructure upgrades are illustrated in *Figure 7.1*. Proposed surface works include further upgrading of existing mine infrastructure and services at Russell Vale, including surface conveyors and coal handling infrastructure, coal sizing, screening, and load-out facilities, site noise, dust controls, mine water and stormwater controls and construction and operation of new coal stockpile for run-of-mine (ROM) coal. Essential maintenance and refurbishment of existing ventilation shafts and power and water supply arrangements is also proposed to ensure they comply with current day operational and safety requirements. Further details of surface facility upgrade works and expanded operations are included in *Chapter 3*.

Coal exiting the mine will be screened and sized to a maximum top size of 150mm, before being placed on the stockpile. Upon reclamation and just prior to loading into truck loading facility, the coal will be screened and sized to a maximum of 50mm.

Each sizing and screening facility will be completely enclosed to contain noise and dust emissions. The overall result is less fracturing of coal providing a reduction in the potential for dust generation from the stockpile due to the larger sizing.

Coal will be delivered to the existing stockpile (SP1) via the Wongawilli decline belt (constructed in Stage 1). The existing stockpile has a capacity of 60 000t to 80 000t. Two additional stockpile areas (SP2 and SP3) will be installed east of SP1. Each stockpile will enable up to approximately 140 000t of coal to be stockpiled and reclaimed for loading through a new truck loading facility. The installation of SP2 and SP3 will enable a total stockpiling capacity of approximately 340 000t to 360 000t of coal on site.



Legend

Project Application Area

Figure 7.1

Proposed Surface Facility Upgrade

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE No.1 Colliery Environmental Assessment		
Drawing No:	0079383h_EA_CAD011_R1.cdr		
Date:	07/02/13	Drawing size:	A3
Drawn by:	JD	Reviewed by:	NB
Source:	-		
Scale:	Refer to Scale Bar		

N

0 50 100 150m

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Coal will be delivered to SP2 and SP3 via an overhead conveyor and tripper arrangement. Coal will be reclaimed from the base of SP2 and will be returned to SP1 via a new reclaim conveyor. A retaining wall will be designed and constructed of suitable material to retain the exposed toe of SP2 and SP3 and prevent slumping coal from travelling away from the confined stockpile area. A new access road will be constructed around the southern edge of the stockpile.

The existing reclaim tunnel will be renewed and a new reclaim belt will be installed to replace the existing belt, under SP1. This new belt will be used to deliver coal from the ROM stockpile to a new truck loading facility. When the new reclaim conveyor and the new truck loading facility are installed, the existing infrastructure will be removed.

The new truck loading facility will be installed in close proximity to the current facility with suitable noise management considerations implemented as required. During construction, for a period of up to four months, trucks will be loaded directly from the ROM coal stockpile. Trucks will continue to access the site from the Bellambi Lane and Princes Highway intersection. Upon arrival at site, empty trucks will travel along the Colliery access road then veer to the left and proceed along a new section of road to enter the truck loading and parking area. This area will have provision for trucks to park while awaiting opportunity to load from the truck loading facility. The direction that trucks will pass will be determined to maximise truck loading efficiency.

All surfaces on which trucks park or travel in this area will be sealed to facilitate dust control and water management. A truck wash facility may be used to assist in managing the cleanliness of the trucks entering and/or leaving the site. Trucks that are clean when entering the site and that remain on sealed roads need not be washed however, those, which travel on unsealed or gravel roads, will pass through a truck wash station prior to exiting the site to assist in maintaining their cleanliness.

Trucks will load beneath the bins of the truck loading facility. Loading will be undertaken in batch mode, where each load is weighed to avoid overloading and to record individual truck gross weights. The existing truck weigh bridge will be retained to record all truck weights as a contingency measure as required.

Loaded trucks will travel back onto the mine access road to exit the Colliery. Other mine vehicles using the access road will give way to loaded and empty trucks.

The final design and location of the truck loading facility will be subject to local site constraints and limitations particularly considering site infrastructure and services such as power lines, pipelines and site access constraints.

7.1.2 *Product Transport*

The Project involves an additional 2 Mtpa of ROM coal transport along the existing truck haulage route to the Port Kembla Coal Terminal (PKCT) for loading into ships (see *Figure 2.5*). This will be undertaken in accordance with current approved operating conditions for PCKT in respect of coal from the NRE No.1 Colliery. Trucking hours from NRE No.1 Colliery will be 7.00am to 10.00pm Monday to Friday and 8.00am to 6.00pm on weekends and public holidays, giving 95 hours of coal haulage per week.

Based on average conditions it is expected that approximately 1300 deliveries will be made per week.

The truck fleet is being progressively upgraded and it is proposed that all trucks will have a capacity of 44 tonnes; specially designed trailers with noise dampening to prevent metal on metal impact; and current best practice suspension and braking systems. The aim is to make the trucks quieter, less susceptible to body noise (shake and rattle) and as efficient as current and future technologies will permit. All trucks are now equipped with purpose built covers that enhance containment of the load whilst in transit.

7.2 *WATER MANAGEMENT*

7.2.1 *Potable Water Supply Infrastructure*

Potable water is supplied via a 100mm pipeline from the Sydney Water supply line. Consumption has varied in recent years according to production and employee numbers. An increase in supply from current maximum consumption levels of about 12,000 kilolitres per annum may be available from Sydney Water.

7.2.2 *Process Water*

Expansion of mining operations and the proposed increase in production to 3Mtpa will change water demand and supply at the mine. The total process water demand will increase to 2.3mL/day. Underground demand will decrease slightly due to increased efficiency in mining equipment operation. During initial stages of the Project, demand will exceed supply by up to 1.2mL/day and that water will need to be sourced externally (Beca 2011).

It is proposed to maximise the use of process water and when needed import bulk raw water from local catchment supply under the existing license agreement, using existing infrastructure that is being maintained to meet current standards *(*refer *Chapter 8* and *Annex B).*

7.2.3 *Stormwater and Dirty Mine Water Management*

Russell Vale

Initial improvements to the surface water management system at the Russell Vale site are being conducted and include:

- construction of a new Bellambi Gully Creek channel;
- a new decline conveyor crossing; and
- improved escarpment drainage and stream stabilisation.

Details of further improvements to the surface water management system proposed at the Russell Vale site as part of this Project are summarised below and are provided in *Annex B*. New surface water facility upgrades are illustrated in *Figure 7.1*.

The existing surface water management system at the Russell Vale site will be retained. A new settling pond will be installed downstream of the stockpile area and upstream of the existing roadside ponds (Dam 1 and Dam 2) and Colliery access road.

The new Settling Pond will be incorporated to complement the existing system to collect the dirty stormwater predominantly from around the stockpile area and has an approximate capacity of 6ML.

After entering the new Settling Pond, stormwater will be retained to enable settling of solids. Excess water will then be directed to the existing Settling Ponds (Dams 1 and 2) north of the access road.

Further settling will occur in these ponds during normal operations, and the water from Dams 1 and 2 will be directed to the Thickener Tank for treatment prior to re-use and / or discharge into Bellambi Gully Creek, via LDP2 as required. During heavy storm events, water from Dams 1 and 2 may overflow and be directed into the 62ML SWCD to assist in containing site dirty storm water. After entering SWCD the water will be directed to the Thickener Tank for treatment prior to re-use and / or discharge into Bellambi Gully Creek, via LDP2 as required. Also, during and for a period of 72 hours post a heavy storm event (ie >10mm in 24 hrs) treated water is permitted to be discharged via LPD2 under EPL conditions. During extreme storm events, the SWCD has the potential to discharge directly into Bellambi Gully Creek.

Dirty storm water channels will be constructed immediately north and south of the stockpile boundaries to direct dirty storm water to the new Settling Pond area. An elevated 6.2m wide access road will separate this southern dirty water channel from the new Bellambi Gully Creek channel. The elevation will provide further protection against potential wet coal slumping from the coal stockpile, into the Bellambi Gully Creek channel.

No.4 Shaft

No changes to the existing stormwater management system at No.4 shaft are proposed.

7.2.4 *Sewage*

Russell Vale

Black and grey water from the Russell Vale site is disposed of via connection to Wollongong's reticulated domestic sewage disposal system. No changes to this system are proposed.

No.4 Shaft

The existing waste water system at No.4 Shaft will continue to be used. Regular soil testing and monitoring will be undertaken to determine the condition of the soil and monitor effects of irrigation. An additional irrigation area is available for use if required. This is located on cleared land adjacent to the existing irrigation area (see *Figure 2.2*).

7.3 *OTHER*

7.3.1 *Surface and Underground Power Supply*

In 2009, NRE commissioned Amp control Services NSW to conduct a Power Study of the Colliery to consider the adequacy of the power supply.

The power supply for surface facilities and underground equipment operation is an essential requirement for the project and requires ongoing liaison with Integral Energy and TransGrid to determine suitability.

7.3.2 *Roads and Car Parking*

All mine traffic will enter the site from the Princes Highway and Bellambi Lane intersection and follow the existing single lane access road. The empty coal trucks will merge to the left onto a new dedicated coal dispatch road. All other mine traffic shall continue along the existing mine access road to the site offices further up the escarpment. Mine traffic will be required to give way to coal trucks re-entering the mine access road.

The car park adjacent to the administration building, at the pit top level, will accommodate up to 250 cars. This capacity is driven by the need to accommodate the increased number of employees accessing the mine during the Wonga East series of longwalls. This arrangement is limited to the life of the Wonga East longwalls due to the shorter travelling distance to the mining areas. The Wonga West Longwall panels will be accessed from the existing No.4 Shaft facility.

7.3.3 *Waste*

During construction, any waste rock will be used on site for: general landscaping, road construction and maintenance; and/or utilised specifically to build such features as noise or screening bunds.

During the longer term production phase, all but 1.0 to 1.5% of the ROM coal will be crushed to meet the specific operational requirements of the PKCT.

The oversize waste rock will be blended with any dried silt taken from various settling ponds on the site. This material will be used on site or if the need arises, disposed of at an appropriately licensed facility.

7.3.4 *Rehabilitation*

Details of the final mine rehabilitation and closure plan 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 dealt with.

Progressive rehabilitation of the site will be applied and give priority, particularly in respect to removal of surplus mining equipment, sealing of redundant mine entries and shafts and stabilisation of slopes and embankments. Proposed rehabilitation works are further discussed in *Chapter 16*.

7.4 *CONSTRUCTION*

Construction work associated with the Major Works Project (Stage 2) will where possible be undertaken in tandem with current operations. Proposed upgrades to the trucking facility are likely to commence during the discontinuity of longwall operations. Once the truck loading facility is installed this will allow trucking off site up to a maximum of 3mtpa therefore matching the underground production. Thereafter, the extension/s to the stockpiles will be constructed.

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.

A Construction Environment Management Plan (CEMP) will be developed to manage construction works at the Russell Vale site. The plan will address:

- environmental management including erosion, water, air and noise (further details in *Chapters 8, 9* and *10*);
- traffic management (further details in *Annex D*);
- waste management (further details in *Chapter 15*); and
- management of construction works with continued operation of the site.

A temporary contractor's site and lay down area will be established at various locations on site; however, predominantly the contractor's site will be located north of the existing truck loading facility. The site will be levelled and paved with a layer of road base for all weather use, with appropriate demarcation.

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

8 *SOIL AND WATER*

This chapter provides an assessment of the potential impacts on surface water resources associated with the Russell Vale site and No.4 Shaft. It also addresses issues associated with potential erosion. Measures to manage any adverse impacts are also outlined.

8.1 *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 Gujarat NRE Russell Vale Colliery Major Works Part 3A* is included in *Annex B*.

Coffey Geotechnics Pty Ltd (Coffey) was commissioned by NRE to undertake a geotechnical assessment at the Russell Vale site to support the Stage 1 Preliminary Works Project (Coffey (2010). The major surface works, in particular the Bellambi Gully Creek realignment were considered in the Preliminary Works EAR.

8.2 *EXISTING ENVIRONMENT*

8.2.1 *Russell Vale Site*

Potable water demands at the Russell Vale site are met by town water (Sydney Water) supplied by connection to Wollongong's reticulated water supply. No changes to the potable water supply infrastructure are proposed, although additional water is expected to be required in the early years of mining.

The existing stormwater management system at the Russell Vale site is described in Beca (2011) and Beca (2010) both provided in *Annex B*. A summary is also provided in *Section 2.5*. Wastewater is made up of the following streams:

- process water (or mine water);
- dirty stormwater; and
- sewage – connected to reticulated sewerage management system, no changes are proposed.

Water in excess of site requirements is discharged to Bellambi Gully Creek. NRE currently holds an EPL that allows the discharge of up to 2.5ML/day to Bellambi Gully Creek under dry weather conditions from a single discharge point adjacent to the thickener tank (LDP2). Water quality results from LDP2 are provided in *Table 8.1.*

Table 8.1 Water Quality Bellambi Gully Creek

Analyte	Bellambi Gully Creek [1]	Russell Vale Discharge LDP2	ANZECC [2] Guidelines	Licence Criteria
pH	8.1-9.2	7.1-90	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	-

Analyte	Bellambi Gully Creek [1]	Russell Vale Discharge LDP2	ANZECC [2] Guidelines	Licence Criteria
TP mg/L	0.08-0.30	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).

A schematic diagram of the existing water management system at the Russell Vale site, along with a flow balance are provided in *Figure 2.7.*

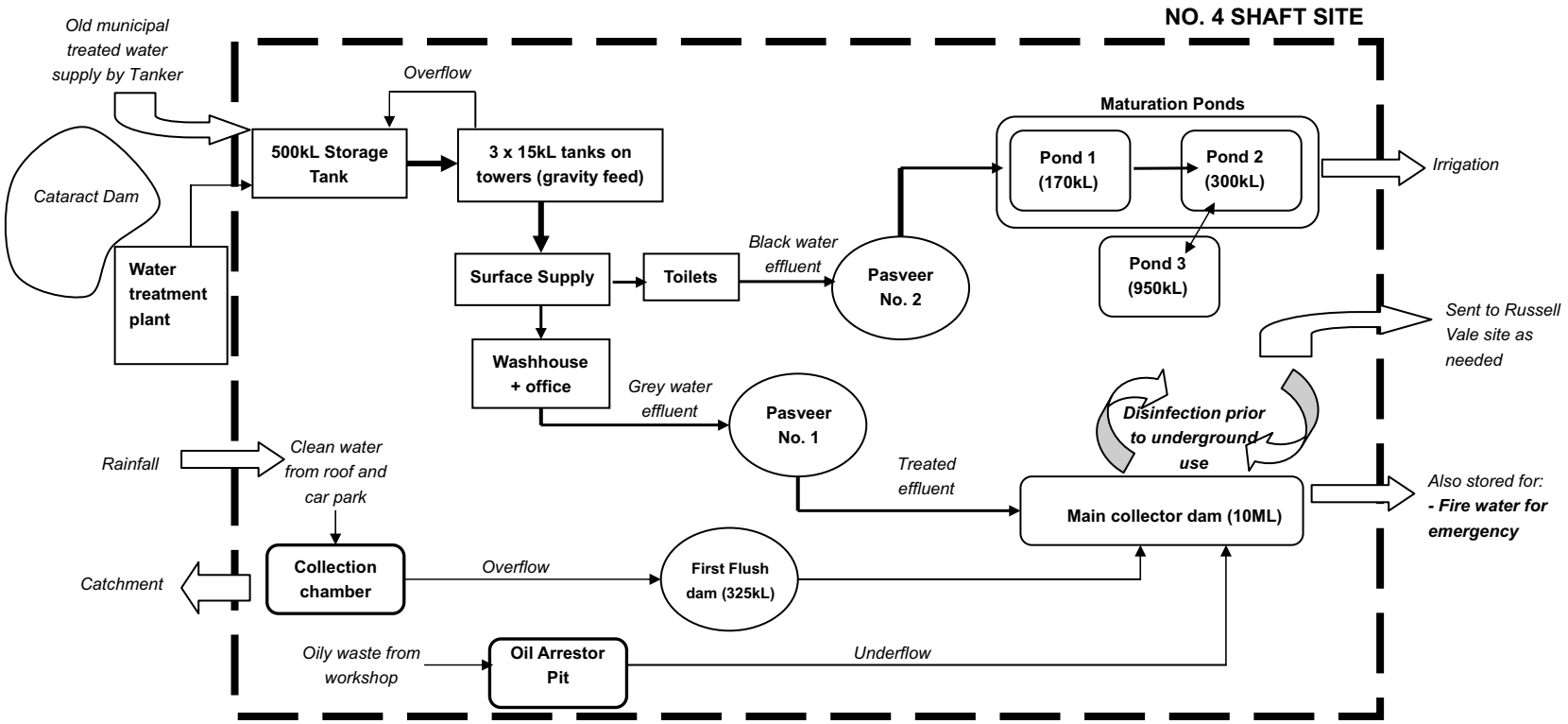
Clean water from the escarpment currently flows through a bypass pipe and into Bellambi Creek East underneath and past the stockpiling and coal loading facility. This by-pass pipe is being replaced with an appropriately designed open channel overland flow diversion and dissipation basin, as part of the Preliminary Works Project.

8.2.2 *No.4 Shaft*

The existing water management systems at No.4 Shaft are described in Beca 2011 provided in *Annex B*. A summary is also provided in *Section 2.5*. Water streams at No.4 Shaft include:

- potable water - transported via water tanker at a rate of approximately three tankers per week;
- raw bulk water - pumped via an existing pipeline from Cataract Dam;
- mine water - collected underground and pumped to the main collector dam. Used for dust suppression underground and emergency fire fighting. In the event that the main collector dam reaches full capacity, the excess mine water is diverted to the Russell Vale site by underground pipe;
- stormwater - flows into a collection chamber prior to discharge into the main collector dam, with any overflow going into the catchment area if required and controlled by a valve;
- oil contaminated water from the work shop is first captured in an oil arrestor pit, with the clean underflow directed into the main collector dam; and
- sewage - grey and black water are treated on site in separate Pasveer facilities;
    - grey water from the bathhouse is treated using Pasveer No. 1 prior to storage in the main collector dam where it is mixed with mine water and stormwater; and
    - black water is treated using Pasveer No. 2, where it is aerated and temporarily stored in maturation ponds, prior to disposal onsite via appropriately sized spray irrigation.

Figure 8.1 shows the current water flow process at No.4 Shaft.



Note: this schematic does not show any valves or pipe sizes

Figure 8.1

Schematic of the Current Water Flow and Management System at No.4 Shaft

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery EAR Post Adequacy 2012 Environmental Assessment	
Drawing No:	0079383s_EA_C003_R0.cdr	
Date:	12/01/2011	Drawing size: A4
Drawn by:	ML	Reviewed by: CA
Source:	Beca (2010)	
Scale:	Not to Scale	

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8.2.3 *Site Stability*

The stability of the site is described by Coffey (2010). 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. The types of landslide that could occur, ranges 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.

8.3 *POTENTIAL IMPACTS*

8.3.1 *Russell Vale Surface Water Management*

The substantial upgrade to the Russell Vale surface water management including a realignment of the Bellambi Gully Creek channel was discussed in the Preliminary Works Project.

8.3.2 *Russell Vale Stormwater Treatment*

Existing Water Treatment Process

Dirty stormwater is mixed with process or mine water and is used on site following removal of suspended solids through automatic dosing of flocculent in thickener tank/s. Total suspended solids (TSS) are reduced to less than the 50mg/L limit in order to comply with criteria in the Environment Protection Licence.

Solids from the thickener tank are returned regularly to Dam 1. The accumulated solids are periodically removed (approximately every three to four months) from the storage dam to maintain the required dam capacity.

Dosing of flocculent is metered and monitored on site using a computer controlled dosing system. Trigger points are built into the system to ensure that 'over-dose' or 'under-dose' of flocculent is managed. Chemical use is kept to a minimum. The chemical dosing system and treatment plant are audited monthly to confirm that the system is operating as designed.

Proposed Water Treatment Process

The existing water treatment process including the thickener tank will be retained to treat combined mine water and dirty stormwater streams prior to reuse or discharge from the site.

A dry and wet basin arrangement with better access for maintenance will be implemented in series with the existing system, to minimise sediment transportation to the SWCD. A stormwater management strategy will be implemented to allow effective control of this system in maintaining a minimum of 30ML spare capacity in the SWCD (or

35ML if only one pump is to operate) at all times, to minimise the chance of a major storm surcharging to Bellambi Gully. This will be achieved by the construction of a new 6ML sediment control dam to catch dirty stormwater flows from the stockpile and other areas. This new dam, together with Dams 1 and 2 will improve dirty stormwater flow attenuation and solids removal. This dam will be managed appropriately to facilitate solids removal and allow ample capacity for storm flow containment providing a buffer capacity for stormwater flows and surplus mine water flows.

The existing discharge point (LDP2) will be retained, albeit with a slightly altered location. Under normal operating conditions, the only discharge will be treated stormwater. The discharge quality and quantity of the treated storm water will meet the current licence conditions and be of similar quality to the background water quality in Bellambi Gully and other creeks in the area.

To enhance operation of the water system it is proposed to establish a solids treatment process facility to divert the solids stream that currently runs from the existing thickener tank into Dam 1, which then feeds back into the thickener tank. The solids stream from the thickener tank will be dewatered and returned to product stockpiles. The thickener sludge will consist of solids removed from the following:

- Russell Vale dirty stormwater;
- a minor drainage stream collecting process water from mining equipment;
- recycled mine water once it has reached a quality that is not adequate for use in mining equipment (as measured by a turbidity meter); and
- future excess mine water.

After treatment, any water that is not able to be reused on site and is within licence quality requirements will be discharged into Bellambi Gully. The Russell Vale dirty stormwater will normally flow through the coarse sedimentation control structure to Dam 1 and Dam 2 prior to treatment and then discharge, bypassing the stormwater control dam. It is intended that the solids treatment will also have the capacity to dewater sludge from Dams 1, 2 and the coarse sedimentation control structure as needed, however the primary purpose of the dewatering is to provide solids treatment for the thickener.

8.3.3 *Process Water Management*

Recent mining operations are focused on the Bulli seam. The proposal to mine the Wongawilli coal seam and to increase production from 1Mtpa to 3Mtpa will alter mine water production rates. The proposal will increase the demand for process water supplied to the underground mining operations and surface facilities. Key uses of process water are:

- five continuous miners at 5.9kL/h each (60% operation);
- one longwall miner at 126kL/h plus 1.7kL/h potable water (60% operation);

- coal stockpile infrastructure at 12.5kL/h; and
- truck washing and dust suppression.

The total demand for process water is anticipated to increase from the current demand of 2.1mL/day to approximately 2.3mL/day.

Process water supply comprises a combination of the following water sources:

- Cataract Dam bulk raw water (for surplus mine water demand);
- clean raw water from Corrimal Springs (approximately 0.1ML/d);
- mine dewatering; and
- potable water (truck washer, some supply to underground equipment and emergency supply).

Groundwater modelling undertaken by Golder Associates (2010) in GeoTerra (2012b) (refer *Annex P*) shows dewatering from mining the Wongawilli seam will vary during the Project. The combined water inflow to the mine from Bulli and Wongawilli seam workings at the end of the Project is estimated to be up to 3.1mL/day. NRE will need to discharge up to 1.1mL/day of water under the existing EPL which allows for discharge of up to 2mL/day (further details are provided in *Annex B*).

A summary of projected water use in the latter stages of the Project is shown in *Figure 8.2*.

At the current production level (approximately 1Mtpa) water demand is approximately 800 litres per ROM tonne. With the increase in production to 3Mtpa the water demand will reduce to approximately 500 litres per ROM tonne.

8.3.4 *Potable Water*

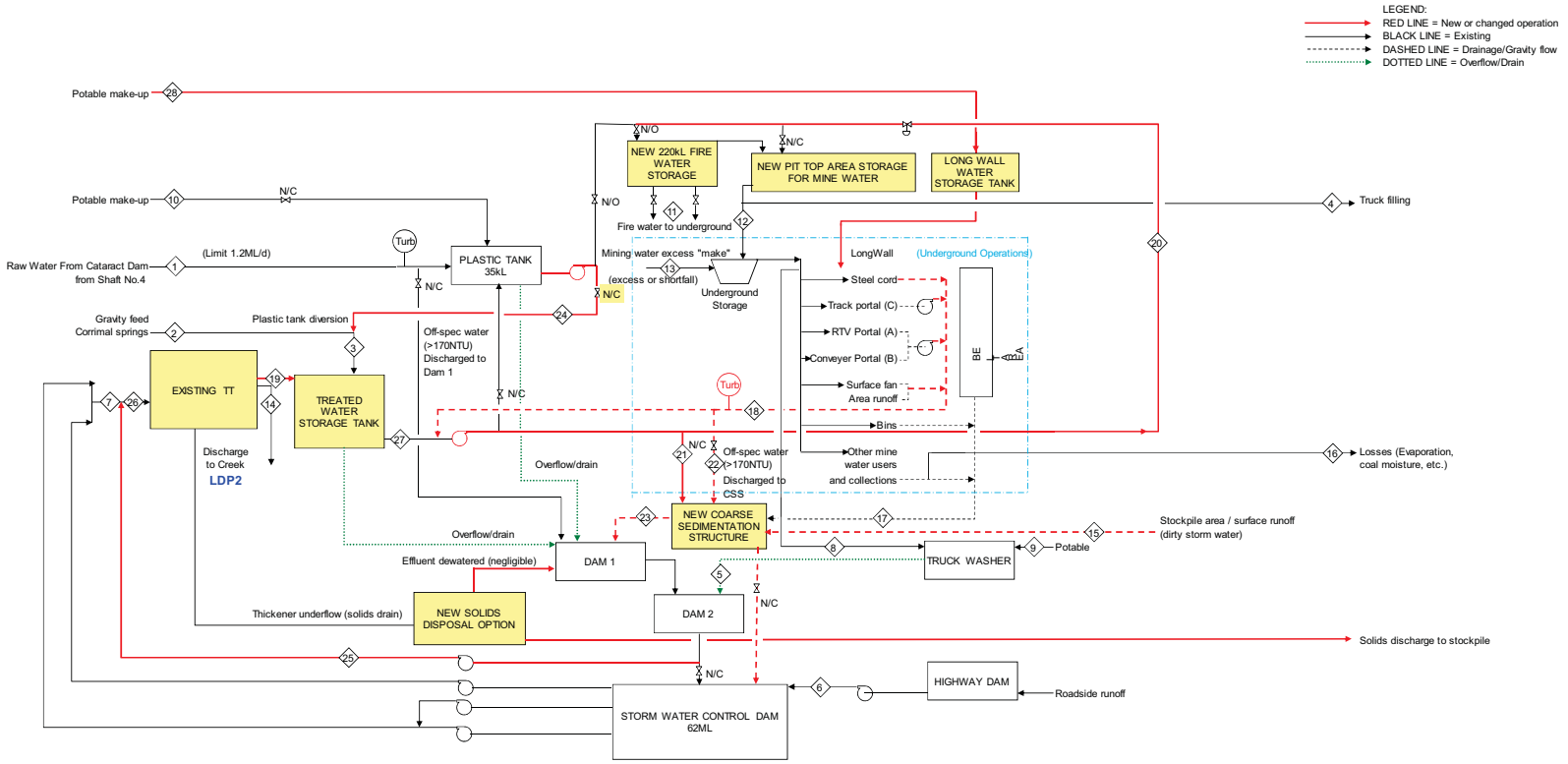
Russell Vale

Potable water supplied by Sydney Water will continue to be used for surface facilities including the administration building, bathhouses, truck washer, workshop and toilets. The expansion of the mine operation will have a minor effect on the volume of potable water used for hygiene and food preparation as the number of people permanently working on site fluctuates.

Currently there are 287 employees at the Russell Vale site. It is anticipated that during mining in Wonga East this will increase up to 310 employees. During mining in Wonga West, personnel will relocate to the No. 4 Shaft, and the number of employees at Russell Vale will drop to 66.

Existing potable water use at the Russell Vale site is 33kL/day. This is expected to increase to 66kL/day due to the increased mining operations. The existing emergency potable water supply from the Brick tank, or its equivalent, to the process water system will be maintained.

PROPOSED BALANCE - SURPLUS WATER SCENARIO



STREAM NUMBER		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
STREAM NAME / PARAMETER		RAW WATER TOP UP (FROM NO. 4 MINE WATER) ***	CORRIMAL SPRINGS	PLASTC TANK AND CORRIMAL WATER DIVERTED TO NEW TANK	TOTAL TRUCK FILLING	TRUCK WASH COLLECT	WATER FROM HIGHWAY DAM	WATER FROM STORM WATER CONTROL DAM	MINE WATER TO TRUCK WASH	POTABLE WATER TO TRUCK WASH**	POTABLE WATER TO MINE USE**	FIRE WATER TO MINE	MINE WATER SUPPLY	MINE WATER "MAKE" IN EXCESS OF DEMAND	TREATED WATER DISCHARGE TO CREEK LDP2	DIRTY STORM WATER - STOCKPILE AREA	SYSTEM WATER LOSSES	BELT AREA DIRTY MINE WATER	DIRTY MINE WATER TO RECYCLE	TREATED WATER TO STORAGE	RECYCLED MINE WATER TO PIT TOP STORAGE	EXCESS MINE WATER TO DIRTY STORM WATER	OFF SPEC MINE WATER TO TREATMENT	RAW WATER AND No.4 SHAFT MINE WATER TO PLASTIC TANK	PLASTIC TANK TO TREATED WATER STORAGE	DIRTY STORM WATER TO TREATMENT	DIRTY STORM WATER TO TREATMENT	TREATED WATER TO PIT TOP STORAGE	POTABLE WATER TO LONG WALL EQUIPMENT CHOCKS
CONTINUOUS OR INTERMITTENT																													
FLOW RATE	MAX ML/day	1.20	0.09	1.29	0.39	0.34	0.00	0.00	0.26	0.09	0.00	0.00	2.30	1.18	**2.04**	0.00	0.11	0.23	2.87	0.00	2.69	1.47	0.00	1.70	1.20	2.04	2.04	1.29	0.02
	MAX m^3/h	50.0	3.6	53.6	16.3	14.3	0.0	0.0	10.8	3.6	0.0	0.0	95.7	49.0	85.2	0.0	4.8	9.6	119.6	0.0	111.9	61.3	0.0	70.8	50.0	85.2	85.2	53.6	1.0
pH	-	8.2	-					9.1		8	8	8.7	8.9																
CHLORIDES	mg/litre	NA	-					NA		21.5	21.5	NA	NA																
SULFATE (SO4)	mg/litre	NA	-					NA		4	4	NA	NA																
CARBONATES (As CaCO3)	mg/litre	10	-					110		46	46	190	190																
APPEARANCE (TURBIDITY)	NTU	5.2	-					570		0.2	0.2	79	85						40										
ELECTRICAL CONDUCTIVITY	µS/cm	110	-					1900		14	14	3700	3000																
TSS	mg/litre	200	-					120				79	24																
TDS	mg/litre	120	-					1200		87	87	2300	2200																
Total phosphorus	mg/litre	0.009	-							0.007	0.007																		
Total nitrogen	mg/litre	0.26	-							0.13	0.13																		

* The highest values are taken from the available Cataract Dam water quality data
** Potable Water Quality Data from Sydney water, Illawarra Water Filtration Plant
*** Potential raw water supply from Cataract dam

Stream 13 - NOTE: A negative flow indicates direction of flow - i.e. absorbed into underground storage. Positive flow indicates flow from underground storage

Figure 8.2

Site Water Balance

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No.1 Colliery Environmental Assessment	
Drawing No:	0079383h_EA_C004_R1.cdr	
Date:	07/02/2013	Drawing size: A4
Drawn by:	JD	Reviewed by: NB
Source:	Beca (2011)	
Scale:	Not to Scale	

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ERM

No. 4 Shaft

Bottled drinking water will continue to be supplied to No.4 Shaft. Other water uses will be sourced from Cataract Dam and treated prior to use in the offices and wash house.

8.3.5 *Waste Water Russell Vale Site*

The process of handling black and grey water at the Russell Vale site will not change. There will be some increases in discharge corresponding to increased potable water use. Sewage will continue to be discharged to the Sydney Water sewerage system.

8.3.6 *No.4 Shaft Water Management*

Currently there are a total of 10 employees at the No. 4 Shaft site. The facilities at Shaft No. 4 are designed to accommodate approximately 1000 persons (Beca, 2011). The number of employees at the No. 4 Shaft site will temporarily increase at the start of mining in Wonga East / Wonga Mains Driveage. It is anticipated there will be up to 111 employees at Shaft No. 4 during this time. As mining progresses to Wonga West there is expected to be 355 employees at No.4 Shaft. There will be no expected modifications to the effluent treatment and disposal facilities at No.4 Shaft, as the system was built to manage the wastewater from 1,000 workers (Beca, 2011).

Black Water

Waste water from the toilet facilities will continue to be treated in Pasveer No. 2 and the maturation ponds. The existing irrigation area for the treated black water is appropriately sized for the average annual disposal of treated effluent, but storage will be required during periods of low evaporation, which occur over winter (Beca, 2011). The existing third maturation pond will be used for such storages. The volume of water stored will vary throughout the year, and will be managed accordingly to be reduced during Summer, thus allowing for less irrigation during Winter.

The existing black water treated disposal system complies with the Department of Environment and Conservation (NSW) October 2004 Environmental Guidelines for the use of Effluent by Irrigation (Beca, 2011).

The irrigation area is managed to prevent runoff beyond the irrigation area. Soil testing will be conducted to determine the existing soil conditions, and to inform any soil conditioning required prior to irrigation. Soil conditions will also be routinely monitored during irrigation activities. To avoid over-irrigation and runoff from the application areas, the irrigation management actions shown in *Table 8.2* will be implemented.

Table 8.2 Irrigation Management Guidelines

Weather condition	Irrigation Condition	Effluent Management
Dry and sunny (<0.25mm/day rainfall)	Check soil moisture and record moisture content.	Cease irrigation when soil is sufficiently moist.
	If moisture content is low, irrigate between 10am-3pm until soil is sufficiently moist.	Record moisture content immediately after irrigation.
Light sparse rain (<5mm/day rainfall)	Check soil moisture and record moisture content.	Cease irrigation when soil is sufficiently moist or when heavy rainfall occurs.

Weather condition	Irrigation Condition	Effluent Management
	If soil is relatively dry, irrigate between 10am-3pm until soil is sufficiently moist.	Record moisture content immediately after irrigation.
Moderate - Heavy rain (>5mm/day rainfall)	No irrigation allowed.	Store effluent in maturation ponds until wet weather ceases.

Source: Beca (2011)

To provide a contingency, and to ensure compliance with OEH guidelines for the management of treated black water, augmentation and improvements to the existing irrigation area are proposed. Current irrigation operations utilise a cleared area that is sufficient and available, however additional irrigation, should it be required, is available to accommodate the disposal of increased treated black water.

Grey Water

Grey water will continue to be treated using Pasveer No1 and then stored in the main collector dam for reuse underground. Disinfection with chlorine will take place immediately prior to normal underground use to minimise potential exposure of workers to pathogens as well as minimise organic smells developed during lengthy periods of stagnancy. Should larger quantities of water be required for emergency purposes, eg fire fighting, the treatment system can be bypassed.

Main Collector Dam

The safe working level of the main collector dam has been reviewed by Beca (2010). Based on the proposed freeboard of 2.0m, the main collector dam has a capacity of approximately 4.5mL for major rainfall event storage. This equates to a 10 year storm event up to the maximum of 72 hour duration, or a 100 year annual recurrence interval (ARI) storm for 24 hour duration.

Mine water will continue to be recycled from underground to the main collector dam, with excess water piped underground for use at the Russell Vale site.

8.3.7 *Bellambi Gully*

This section describes the impacts of water management practices at the Russell Vale site on the quantity and quality of surface water specifically considering the discharge of treated process water and storm water into Bellambi Gully Creek.

The discharges to the environment from the site will not require a change to the existing EPL conditions. The discharges that run into Bellambi Gully Creek continue through the gully to Bellambi Beach. None of the discharges from the mine, via Bellambi Gully Creek, flow into Bellambi Lagoon, or any other lagoon in the area.

Water Quality

The water quality in Bellambi Gully Creek is variable. The gully is a highly disturbed urban creek. Water sample results taken by NRE are shown in *Annex B*. *Table 8.1* provides a comparison between water quality in Bellambi Gully Creek, NRE No. 1 discharge water quality, ANZECC Guidelines and the EPL discharge criteria.

The Bellambi Gully Creek water quality results are reported in *Annex B* and are consistent with the findings reported in *Wollongong Northern Coastal Creeks and Lagoons by WBM 2005,* which investigated the water quality in the region. Background water quality levels for creeks in the Wollongong area have nutrient, pH and TDS levels that exceed ANZECC guidelines.

This is likely to be influenced by the urban nature of the catchments and tidal influence. The area around the gully downstream of the site has been cleared with a small section near Bellambi Beach being returned to a more natural state.

The upper catchment of the Bellambi Gully on the western site of the Princess Highway contains the Russell Vale site, the golf course (former waste disposal area) and areas of urban development. The middle and lower catchment of the Bellambi Gully catchment consists of large areas of urban development including recreational facilities such as public parks, reserves and schools. The gully also runs through or near private property including some light industrial sites.

Nutrient levels in Bellambi Gully are higher than ANZECC freshwater guidelines for lowland rivers, presumably due to urban runoff. Current site discharge concentrations for TP are less than background levels in the creek. Algae growth or other biological growth is more pronounced in stagnant water. Discharging some water through the creek can reduce this stagnation, and the associated algal growth.

Literature review also characterised the water quality in Bellambi Gully by elevated pH, conductivity, Biochemical Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), ammonia, suspended solids, nutrients, copper and zinc. Faecal coliform levels generally exceed the primary recreational contact guidelines. The low macro invertebrate diversity is indicative of an urbanised catchment, water quality problems and/or loss of riparian habitat.

Water quality testing in 1994 (Anthony 1994, for Wollongong City Council (*Annex B*)) indicated that the various tributaries within the catchment were contaminated by pollutants, indicated by high levels of pH, conductivity (possible due to lithology), BOD_5, COD and ammonia, in both dry and wet weather (Anthony 1994 (*Annex B)*). In particular, during wet weather periods, high levels of *E.coli* bacteria were present.

While the water quality at Russell Vale LDP2 sometimes exceeds ANZECC freshwater guidelines for lowland rivers, the water quality at LDP2 is similar to the background water quality in the gully and other creeks in the area.

As Bellambi Gully is a highly disturbed system, 90% trigger values or higher will apply for toxicants, according to the ANZECC 2000 guidelines for freshwater. The exception is mercury which will require 95% protection or higher. Most metal toxicants measured in the Russell Vale discharge stream (LDP2) in 2011 are within the 90% and 95% protection values given (As, Cd, Cr, Mn, Ni, Pb, Zn, Hg). These figures are provided in *Annex B*. Copper is not within the 90%protection level, but is discharged at a lower concentration than the upstream copper reading in Bellambi Gully. Silver and iron are inconclusive, however iron is also discharged at a lower concentration than the last downstream iron readings in Bellambi Gully. The level of silver was too low to read with the equipment used for analysis.

Beca noted that copper, iron, manganese, nickel and zinc readings increase as the gully flows eastwards away from Russell Vale indicating polluters downstream of the site discharge.

Background metal measurements in the Wollongong Northern Coastal Creeks and Lagoons report show that the levels of metals in Bellambi Gully are comparable with, and even less than metals levels in other local creeks in the area.

Water Quantity

The natural flow through Bellambi Gully 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 rainfall events rising rapidly and falling to a trickle for extended periods.

Erosion Potential

The gully catchment is highly urbanised and the flow line is generally well vegetated, although in some areas it is concrete lined. Water discharged by the mine is significantly less than the flows in the gully during high rainfall events. The flow from the mine site is approximately 0.003m^3/s and a 1 in 5 year rainfall event produces a discharge of 17m_3/s from the catchment above the LDP2 (Beca, 2010).

Any potential erosion associated with mine water discharge is insignificant compared with the erosion potential of flows into the gully during heavy rainfall events. In addition, the potential for erosion has been reduced by the proposed Preliminary Works project creek realignment and associated flow dissipation structures.

Management Measures

Stormwater from hard surfaces is diverted into the Storm Water Control Dam (SWCD) via a number of earthen channels and concrete pipes. The water is stored in the SWCD prior to treatment and discharge via controlled valve at LDP2. This practice reduces solids, and holds the water in the dam, reducing flow rates through Bellambi Gully during storms of intensity less than a 1 in 10 year event.

The SWCD is registered with the Dam Safety Committee (DSC). The dam has a controlled gabion lined spillway for events greater than 1 in 10 years.

Flooding Risk

The Bellambi Gully Creek catchment is 427ha and the total creek length is 4.3km (WBM Oceanics Australia for Wollongong City Council, June 2005,). The NRE site is approximately 22.4% (96ha) of the catchment, of this 76ha is uncleared. The gully length is approximately 3km from LDP2 to Bellambi Beach.

Under the terms of the EPL, in wet weather the gully can receive up to 7.2mL/d for not longer than a 72 hour period from the NRE site. The existing capacity of the stormwater control dam is sufficient to contain and successfully manage all 10 year ARI storm events for 72 hours (assuming 50% normal operation level and treating the maximum flow of 300kL/h during a storm event).

The stormwater control dam is a mechanism for the attenuation of stormwater flow in a storm event, and as such assists in reducing the likelihood of any flood risk.

The frequency of high and low flow discharges per year from LDP2 to Bellambi Gully is less than 0.5ML/day for most of the year. The occurrence of discharge events greater than 2.5ML/day has been less than 10 days per year in the years 2007 to 2009.

In general, the flows in Bellambi Gully Creek consist of stormwater run-off in the catchment and treated mine water discharged at LDP2. In dry weather the gully receives on average approximately 0.4 ML/d from LDP2 under existing operations. Following the commencement of longwall mining in the Wongawilli seam, this could be reduced to zero.

8.3.8 *Soils and Erosion*

The soils in the vicinity of the Project are susceptible to erosion. Potential impacts of the Project on soils would be largely restricted to areas where existing surface facility upgrades are proposed, particularly at the Russell Vale site. These impacts may include:

- increased erosion and sediment movement due to clearing, excavation and general exposure of soils during construction of mine infrastructure;
- disturbance of in-situ soil resources within areas not currently disturbed by existing operations;
- alteration of soil structure beneath infrastructure and hardstand areas; and
- alteration of physical and chemical soil properties (eg structure, fertility, permeability and microbial activity) during soil stripping and stockpiling operations (where applicable).

8.4 *MITIGATION MEASURES*

Table 8.3 Mitigation measures and improvements to water management systems.

Water System	Mitigation Measure	Improvement / benefit
Process water treatment at Russell Vale	Implement treatment of solids removed from process water.	Solids will be mechanically dewatered and removed from site providing additional dam storage on site and reducing chance of overflows.
Dirty stormwater treatment	Optimise performance of existing thickener for solids removal from dirty stormwater.	Improve the ease of maintaining the quality of discharged treated water to Bellambi Gully Creek.
Dirty stormwater treatment	Construct a new 6ML storage. dam to collect runoff from stockpile area.	Minimise transport of sediment to the SWCD. Improve storage capacity at SWCD due to reduced solids settling.
Site water use	Water Efficiency audit. Complete a study of water use on site, and determine if less potable water can be used.	Reduce water use. Reduce use of higher quality water.

8.4.1 *Soils and Erosion*

The potential for off-site transport of sediments following excavation or vegetation removal will be managed through the implementation of standard practices established for the mine. Erosion controls will be carried out 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;
  - 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 8.3*); 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.

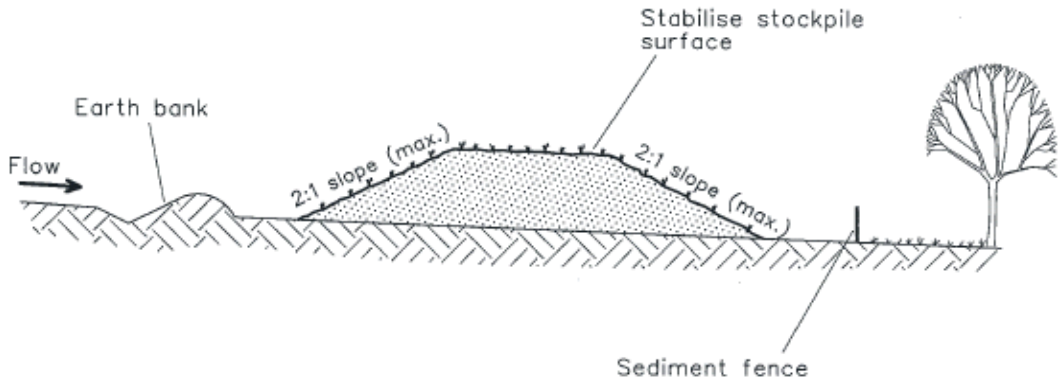

Figure 8.3 Construction of a Stockpile (Source: the 'Blue Book')

8.5 *CONCLUSIONS*

Expansion of mining operations to include the Wongawilli seam will cause fluctuations in mine water flows. At end of Project the water production from mining operations is expected to increase to 3.1mL/day.

At start of mining in the Wongawilli seam, water produced from mining operations will not be enough to meet demand and additional water will need to be provided to supplement the site's water requirements.

It is anticipated that discharge into Bellambi Gully will be in line with current practice, and as such the existing licence will still be applicable for the increased mining operations.

It is proposed that the sludge from the existing thickener tank be diverted from Dam 1. Instead, the sludge will be dewatered. This will improve the efficiency and economy of the treatment processes and the solids output.

9 *ACOUSTICS*

This chapter provides a summary of the acoustic impact assessment including the potential impacts of the Project on the surrounding community. Measures to manage any negative impacts are also outlined.

9.1 *INTRODUCTION*

An acoustic assessment was undertaken for the Project by ERM, addressing construction and operational activities at the Colliery. The key elements considered are:

- pit top/operational noise;
- noise associated with coal haulage;
- vibration; and
- construction noise.

The assessment was undertaken in accordance with the OEH Industrial Noise Policy (EPA, 2000) (INP). Traffic generation on public roads, associated with the Project, is assessed in accordance with the OEH's Environmental Criteria for Road Traffic Noise (EPA, 1999) (ECRTN). Construction noise has been assessed in accordance with the OEH'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 Noise Assessment Major Works Project* presented in *Annex H.*

9.2 *EXISTING ENVIRONMENT*

9.2.1 *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 Corrimal and to the south in Taylor Street, Corrimal. Representative receiver locations were chosen to provide an indication of the extent of potential noise emissions associated with the Project.

Noise monitoring and assessment locations were selected as representative areas for the noise sensitive receivers. Noise sensitive receiver locations are shown on *Figure 9.1* and presented in *Table 9.1.*

Legend

Project Application Area

Receiver Location

Receivers

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 9.1

Sensitive Receivers

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE No.1 Colliery EAR Post Adequacy 2012 Environmental Assessment		
Drawing No:	0079383s_EARPA2012_G029_R0.mxd		
Date:	27/11/2012	Drawing Size:	A4
Drawn By:	SQW	Reviewed By:	NB
Projection:	GDA 1994 MGA Zone 56		
Scale:	Refer to scale bar		

N

0 100 200 300m

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ERM

Table 9.1 Noise Sensitive Receiver Locations

ID	Location	INP Classification	Coordinates (MGA 56)		RL m, AHD
			Easting	Northing	
C1	48 Lyndon St (west) Corrimal	Suburban	305949	6195521	82
C2	48 Lyndon St Corrimal	Suburban	306081	6195570	63
C3	Midgley St Corrimal	Suburban	306558	6195596	37
C4	Bloomfield Avenue Corrimal	Suburban	306322	6195424	45
C5	Taylor Place Corrimal	Suburban	305889	6195417	91
C6	Robson St Corrimal	Suburban	306187	6195291	55
R1	6 Broker St Russell Vale	Suburban	306516	6196055	37
R2	29 West St Russell Vale	Suburban	306470	6196085	39
R3	Moreton St Russell Vale	Suburban	306568	6196087	35
R4	4 Broker St Russell Vale	Suburban	306746	6195951	29

9.2.2 *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 the existing ambient noise environment at the sensitive receiver locations. Sensitive receiver locations were grouped into representative areas and the background (L_{A90}) and amenity (L_{Aeq}) noise levels within the representative areas adjacent to the Russell Vale site were assessed using the results of this monitoring.

A summary of the results of the unattended continuous noise monitoring are provided in *Table 9.2*. Noise data during any periods of rainfall and/or wind speeds in excess of 5m/s (18 km/h) at the microphone were discarded in accordance with INP weather-affected data exclusion methodology.

Table 9.2 Summary of Existing Ambient Background Noise Levels

Representative Area	Description [1]	Rating Background Noise Level (RBL), LA90 dB(A) [2]	LAeq, Period, dB(A) [3]
Moreton St, Russell Vale (R1-R4)	Daytime	38	53
	Evening	34	49
	Night	32	47

Representative Area	Description [1]	Rating Background Noise Level (RBL), LA90 dB(A) [2]	LAeq, Period, dB(A) [3]
Bloomfield Ave, Corrimal (C1-C4)	Daytime	37	53
	Evening	36	53
	Night	32	47
Robson St, Corrimal (C5,C6)	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. The 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. The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Road Traffic Noise Monitoring

Unattended noise monitoring was undertaken to determine existing road traffic noise levels along Bellambi Lane. Noise monitoring, conducted some three months after the opening of the Memorial Drive extension 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 two environmental noise loggers.

The results of the unattended continuous noise monitoring at the two locations on Bellambi Lane are summarised in *Table 9.3*. The summary includes the L_{eq} or the average road traffic noise energy calculated over a fifteen hour period ($L_{eq,15hr}$) and a one hour period ($L_{eq,1hr}$).

Table 9.3 Summary of Existing Road Noise Levels

Location	Leq,15hr dB(A)	Leq1hr Day dB(A)
63 Bellambi Lane[1]	65	67
99 Bellambi Lane[2]	63	64

1. representative of noise levels experienced by receivers in near proximity to road traffic on Bellambi Lane; and
2. representative of noise levels experienced by receivers in far proximity to road traffic on Bellambi Lane.

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 locality. Meteorological conditions of the area are described in *Annex H*.

Under Section 5.2 of the INP, the text under the heading "*Applicability of drainage-flow wind*" states:

"The drainage-flow wind default value should generally be applied where a development is at a higher altitude than a residential receiver, with no intervening higher ground (for example, hills). In these cases, both the specified wind and temperature inversion default values should be used in the noise assessment for receivers at a lower altitude".

The site is partly elevated, however the majority of noise sources are located on lower elevations of the site and there is intervening higher ground between this and the residences to the south therefore conditions are not conducive to drainage flows.

9.3 *PROJECT-SPECIFIC NOISE LEVELS*

9.3.1 *Operational Noise Criteria*

Noise emission design criteria for the Project have been established with reference to the INP. This involved assessment of amenity noise criteria based on land use and the intrusiveness of proposed industrial noise sources. The 'suburban' assessment criteria have been adopted at the potentially affected receivers nearest the proposed development area.

The relevant intrusive and amenity noise criteria and resulting operational Project specific noise levels (PSNL) for the residential receivers surrounding the Russell Vale site, with respect to the background noise monitoring locations, are presented in *Table 9.4*.

Table 9.4 Project-Specific Noise Levels[1]

Receivers	Period [2]	RBL LA90	Intrusive Criteria LAeq, 15min	INP Recommended LAeq	Adjusted [3] Amenity Criteria LAeq, Period	PSNL LAeq,15min
R1-R4	Daytime	38	43	55	55	43
	Evening	34	39	45	45	39
	Night	32	37	40	40	37
C1-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 7.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night 10.00pm to 7.00am. On Sundays and Public Holidays, Daytime 8.00am to 6.00pm; Evening 6.00pm to 10.00pm; Night-time 10.00pm to 8.00am.
3. Recommended LAeq refers to an adjusted amenity criterion which accounts for existing industrial noise. No adjustment made as the receiver locations were not affected by existing industrial noise.

9.3.2 *Sleep Disturbance*

The relevant sleep disturbance criteria for the sensitive receivers adjacent to the Russell Vale site are presented in *Table 9.5*.

Table 9.5 Sleep Disturbance Criteria

Representative Area	Representative Receivers	RBL LA90,15min, dB(A) [1]	Sleep Disturbance Noise Level LA1,1min, dB(A)[1]
Moreton St, Russell Vale	R1, R2, R3, R4	32	47
Bloomfield Ave, Russell Vale	C1, C2, C3, C4	32	47
Robson St, Russell Vale	C5, C6	36	51

1. Night time only.

9.3.3 *Road Traffic Noise Criteria*

Coal haulage trucks exit the site onto Bellambi Lane and travel along Memorial Drive to the Southern Freeway then onto Masters Road and Springhill Road to PKCT.

Due to the recent extension of the Memorial Drive to Bulli, Bellambi Lane is now 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.

Road traffic noise criteria are set out in the Environmental Criteria for Road Traffic Noise (ECRTN, 1999). These criteria are based on the functional categories applied by Roads and Maritime Services (RMS), previously Roads and Traffic Authority (RTA).

The relevant road traffic noise criteria for the roads associated with the proposed operations are provided in *Table 9.6*.

Table 9.6 Road Traffic Noise Criteria

Type of Development	Criteria		Where Criteria are Already Exceeded
	Day 7.00am - 10.00pm	Night 10.00pm - 7.00am	
Memorial Drive	60 dB(A) LAeq,15hr	55 dB(A) LAeq,9hr	Traffic arising from the development should not lead to an increase in existing noise levels of more than 2dB.
Bellambi Lane	60 dB(A) LAeq,1hr	55 dB(A) LAeq,1hr	

9.3.4 *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 9.7*.

Table 9.7 Project Specific Construction Noise Criteria

Representative Area	RBL, LA90,15min, dB(A) [1]	Noise Level LAeq,15min dB(A) [1]
Moreton St, Russell Vale (R1, R2, R3, R4)	38	48
Bloomfield Ave, Russell Vale (C1-C4)	37	47
Robson St, Russell Vale (C5, C6)	39	49

1. Assuming construction is during day time hours only.

9.3.5 *Vibration Criteria*

The acceptable vibration dose values for intermittent vibration at residences during daytime periods are presented in *Table 9.8*.

Table 9.8 Acceptable vibration dose values (VDV) for intermittent vibration (m/s $^{1.75}$)

Location	Daytime (7.00am to 10.00pm)	
	Preferred Value, m/s$^{1.75}$	Maximum Value, m/s$^{1.75}$
Residences	0.20	0.40

9.4 *NOISE MODELLING*

Noise level predictions must take into account all significant noise sources associated with the operation of the proposed coal handling facility. 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. Noise model inputs are detailed in *Annex H*.

The modelling for Stage 2 of the Project has assumed that mitigation measures recommended as part of Stage 1 of the Project are in place. These include mitigation of equipment including the dozer and mine ventilation fan. Noise barriers proposed as part of the preliminary works approval may be replaced with alternate noise attenuation devices or measures in accordance with findings of a noise audit to achieve noise levels predicted in the EAR.

9.4.1 *Operational Modelling Scenarios*

The noise model was run for daytime, evening and night time operations based on peak production. The modelling incorporated the assumptions outlined in *Table 9.9*.

Table 9.9 Peak Operations – Equipment Utilisation and Operating Hours

Equipment	Hours of operation	% of time operating	Comment
1x dozer	7am to 6pm Mon to Fri 8am to 6pm Sat	40% of operational hours	The dozer will be needed to push sized coal into the re-claim points for loading into the trucks via the proposed new truck loading infrastructure
New conveyor	24x7	100%	Enclosed
New sizer	24x7	100%	Enclosed
Trucking facilities	7am to 10pm Mon to Fri	100% of operational hours	26 trucks per hour
	8am to 6pm Sat, Sun & P/hol	100% of operational hours	
ROM stockpile	24x7	100%	Dust suppression spray system

The model presents a worst case, assuming that all acoustically significant plant and equipment operates simultaneously.

9.5 *NOISE ASSESSMENT*

9.5.1 *Operational Noise Levels*

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 (day, evening, night) are presented in *Figure 9.2*.

The single point calculation results for the proposed operational scenarios are presented in *Table 9.10* and are compared to the respective PSNLs.

Table 9.10 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	37	42	36	41	34	37
C2	38	42	37	41	34	37
C3	40	42	39	41	31	37
C4	36	42	35	41	32	37
C5	39	44	38	43	35	40
C6	36	44	36	43	33	40
R1	41	43	**40**	39	31	37
R2	42	43	**41**	39	32	37
R3	40	43	39	39	32	37
R4	41	43	**41**	39	31	37

Note : All levels are dB(A).

Exceedances presented in bold text.

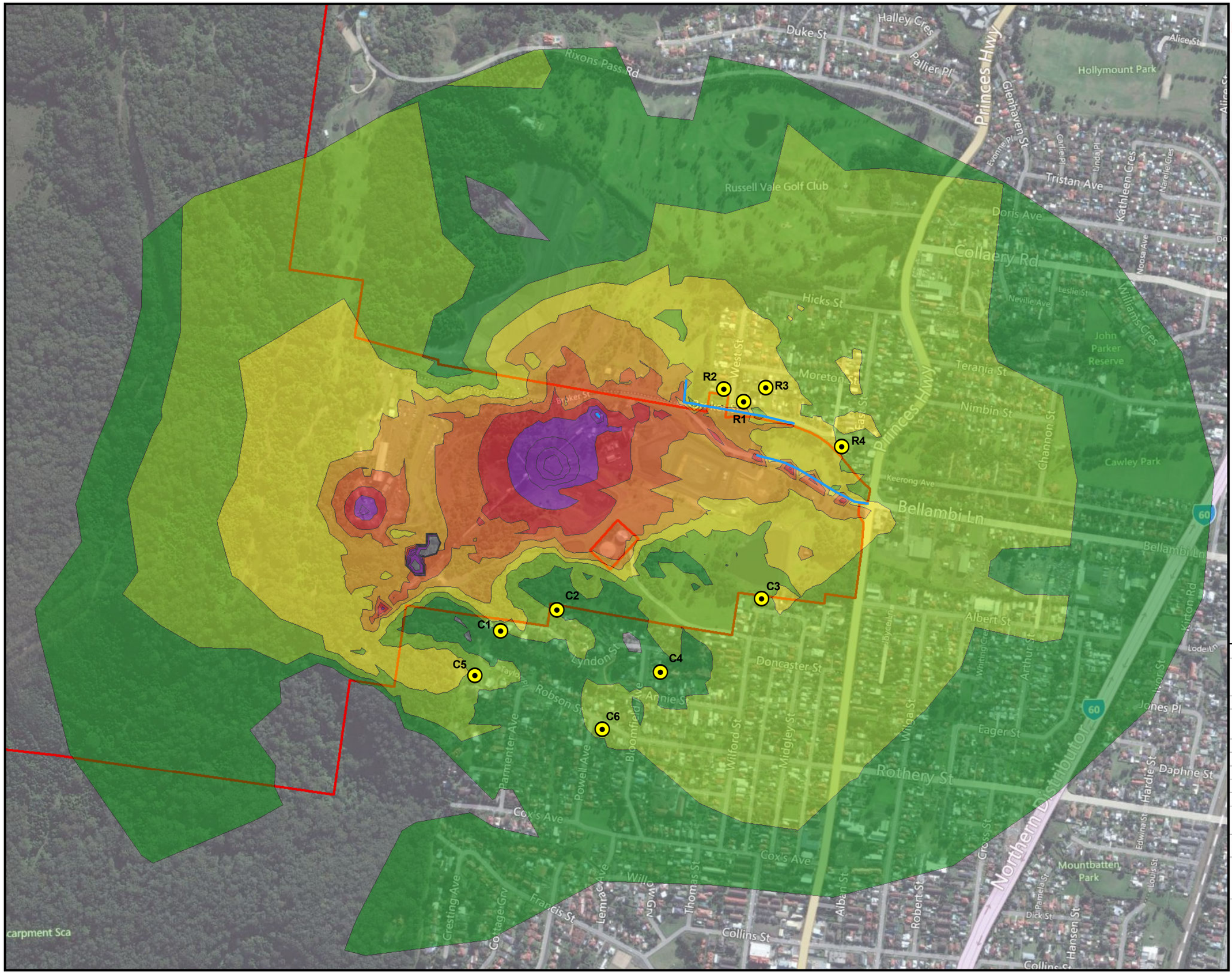

Figure 9.2

Noise Contours for Daytime Peak Operations - Calm Conditions

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE No.1 Colliery EAR Post Adequacy 2012 Noise Assessment		
Drawing No:	0079383s_EARPA2012_G045_R0.mxd		
Date:	27/11/2012	Drawing Size:	A3
Drawn By:	SQW	Reviewed By:	NB
Projection:	GDA 1994 MGA Zone 56		
Scale:	Refer to scale bar		

N

0 90 180 270m

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The results in *Table 9.10* indicate that noise levels from peak operations incorporating noise mitigation measures would comply with relevant PSNLs at all receivers for day and night time periods.

Minor exceedances of less than 2dB(A) are predicted at three receivers during evening periods in Russell Vale.

The noise levels reported are considered to be reasonable and would require validation from attended noise monitoring upon commencement of operations.

9.5.2 *Sleep Disturbance*

Noise levels associated with the Project are predicted to be less than 47dB(A) at all receivers during night time periods, which complies with the sleep disturbance criteria for each representative area.

9.6 *ROAD TRAFFIC NOISE ASSESSMENT*

Unattended noise monitoring was undertaken to determine the contribution of Project-related road traffic noise levels along Bellambi Lane before the commencement of Stage 1 Preliminary Works Project. To quantify the effect of the traffic associated with the Preliminary Works Project, road traffic noise levels were measured on days that trucks were operating and on days that trucks were not operating. Detailed noise modelling has been undertaken to supplement these findings and to:

- consider road traffic noise for residents on Bellambi Lane, Keerong Avenue, Broker Street and other local roads;
- present noise contour maps for current and future scenarios; and
- assess road traffic noise impacts during peak periods.

Projected daily background traffic volumes for the Major Works Project for the year 2019, when operation will increase to 3Mtpa have been estimated by Cardno in the report 'Traffic Impact Assessment – Addendum' (September 2010), and derived from traffic volumes measured on Bellambi Lane during 2010. This is reproduced in *Table 9.11*.

Table 9.11 Projected Daily Background Traffic Volumes

Location	2010		2019	
	AWD	AWE	AWD	AWE
Bellambi Lane	5693	4054	6205	4419

1. AWD is the Average Weekday Daily Traffic (vehicles per day).
2. AWE is the Average Weekend Daily Traffic.

Coal trucks operating in 2019 (3 Mtpa) are projected to generate 512 trips per day. This is an increase of 126% compared to the number of trips projected for Stage 1. The peak coal delivery is predicted to generate 682 trips per day (341 coal truck loads).

This traffic count data (and the sites hours of operation) were used to assess road traffic noise impacts for local residents for the ECRTN daytime (07:00am to 10:00pm) period. No coal trucks are expected to operate during the ECRTN night-time period (10:00pm to 07:00am) and impacts during this period are not considered in the assessment.

The traffic data presented above has been used to calculate 'average' and 'peak' ($L_{Aeq,1\ hour}$) road traffic noise levels associated with 3Mtpa in accordance with the procedures set out in the *Calculation of Road Traffic Noise* (CoRTN, UK DoT, 1988) (refer to *Figure 9.3* and *Figure 9.4*).

The findings of the road traffic noise assessment are summarised as follows:

- predicted 'average' road traffic noise levels ($L_{Aeq,\ 1\text{-}hour}$) from existing and the proposed coal haulage at NRE 1 comply with the relevant daytime road traffic noise criteria at all receivers considered in this assessment;

- predicted 'peak' road traffic noise levels ($L_{Aeq,\ 1\text{-}hour}$) from existing and the proposed coal haulage at NRE 1 comply with the relevant daytime road traffic noise criteria at the majority of receivers considered in this assessment, with the following exceptions:

  - 'peak' road traffic noise levels (LAeq, 1-hour) are expected to increase the existing traffic noise level due to Project-related traffic (future coal haulage) by approximately 2.5 to 3dB(A) at the following receptors:

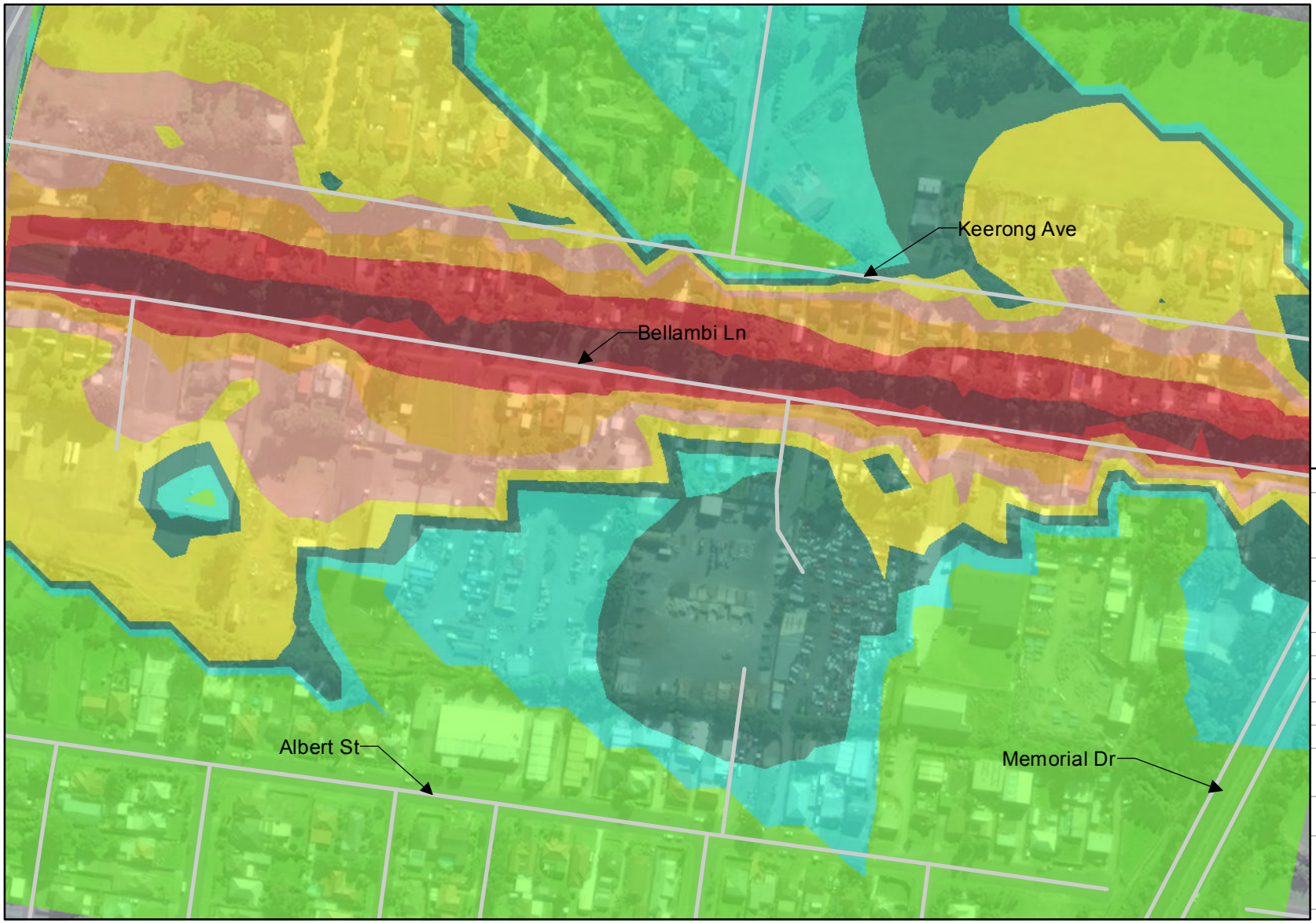
    - 99 Bellambi Lane (99BL); and

    - 109 Bellambi Lane (109BL); and

- the ECRTN states that where the criteria are already exceeded due to existing traffic, then only the change in noise is relevant, and an increase in existing noise levels of more than 2dB is considered significant.

Section 3.5 of the ECRTN states that there may be situations where it is reasonable and necessary to vary the standard time periods applied to the daytime and night time periods. For example there will be instances where the noise levels in an area begin to rise earlier than 7am due to normal early morning activity from the general community. For these situations it is reasonable to consider varying the standard daytime and night time periods to better reflect the actual temporal changes in noise for that location. In these situations, appropriate noise level targets for the 'shoulder periods' may be negotiated with the determining or regulatory authority on a case-by-case basis.

It should be noted that this road traffic assessment has been undertaken, comparing the overall 'average' $L_{Aeq,\ 1\text{-}hour}$ values from long term continuous unattended noise monitoring to predicted 'average' and 'peak' noise levels. 'Average' noise levels are determined to comply with the ECRTN and in actual terms provide the most accurate method by which the magnitude of any impacts may be assessed. The predicted 2.5 to 3dB increase in noise levels at a limited number of locations on Bellambi Lane is based on 'peak' coal haulage only. Conservatively, to predict road traffic noise during the peak period, the assessment considered the busiest coal truck traffic flow over a one hour week day period.



Legend

Local Area Road Network

Noise Contours (dB(A))

- 0 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

Figure 9.3

Average Road Traffic Noise Levels

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE 1 Colliery EAR Post Adequacy 2012 Noise Assessment		
Drawing No:	0079383s_NAFeb2012_G004_R0.mxd		
Date:	27/11/2012	Drawing Size:	A4
Drawn By:	SQW	Reviewed By:	NL
Projection:	GDA 1994 MGA Zone 56		
Scale:	1:3000		

N

0 25 50 75m

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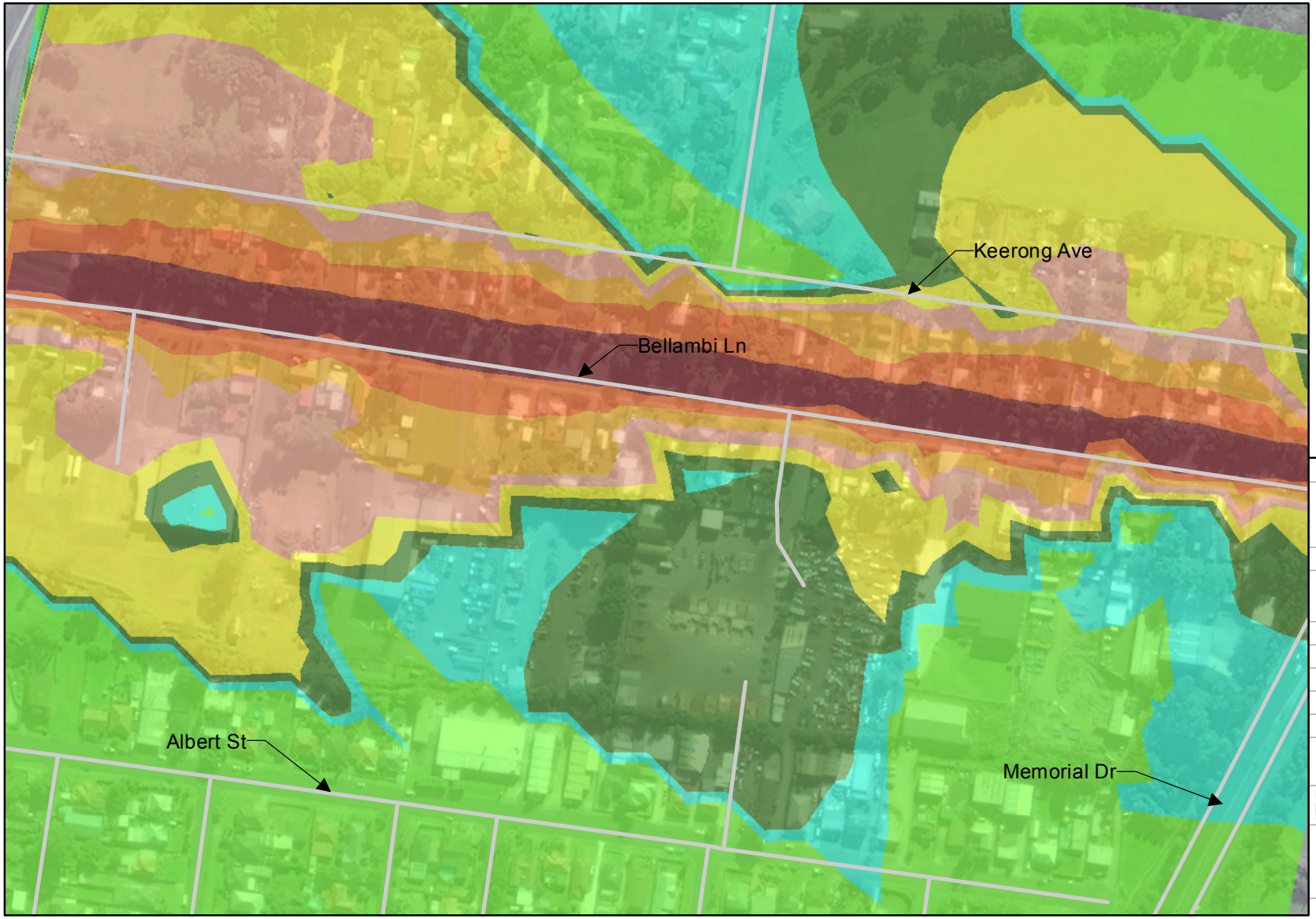

Legend

Local Area Road Network

Noise Contours(dB(A))

- 0 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

Figure 9.4

Peak Road Traffic Noise Levels

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE 1 Colliery EAR Post Adequacy 2012 Noise Assessment		
Drawing No:	0079383s_NAFeb2012_G003_R0.mxd		
Date:	27/11/2012	Drawing Size:	A4
Drawn By:	SQW	Reviewed By:	NL
Projection:	GDA 1994 MGA Zone 56		
Scale:	1:3000		

N

0 25 50 75m

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Existing road traffic noise levels may in fact be higher than those represented by the overall average noise level, and therefore noise levels for peak operations during peak existing traffic periods are not expected to increase the existing road traffic noise by more than 2dB. This is considered a reasonable assumption given the cyclic nature of road traffic in the area, where noise levels increase in the morning peak period, decrease during the middle daytime period and then increase during the evening peak period.

9.6.1 *Cumulative Noise Impact Assessment*

The INP allows assessment of the potential cumulative noise impacts associated with existing and future developments and recommends the following amenity noise levels for all receiver areas: 50dB(A) $L_{Aeq, Day}$, 45dB(A) $L_{Aeq, Eve}$ and 40dB(A) $L_{Aeq, Night}$.

Predicted intrusive noise levels from the Project are below the requirement of 50dB(A) $L_{Aeq, 15min}$ during daytime periods; 45dB(A) $L_{Aeq, 15min}$ during evening periods and 40dB(A) $L_{Aeq, 15min}$ during 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.

9.6.2 *Construction Noise Assessment*

It is anticipated that the construction phase may extend over a period of approximately 36 months.

The single point calculation results for the proposed construction activities are presented in *Table 9.12* and are compared to the respective construction noise criteria.

Table 9.12 Predicted Construction Noise Levels

Representative Area	Predicted Level, LAeq,15min dB(A)	Construction Noise Criteria LAeq,15min dB(A) [1]
R1	47	48
R2	47	48
R3	46	48
R4	48	48
C1	37	47
C2	39	47
C3	42	47
C4	38	47
C5	41	49
C6	38	49

1. Assuming construction is during day time hours only.

The results presented in *Table 9.12* indicate that construction noise levels are predicted to comply with the OEH's construction noise criteria (2009) at all residential receiver locations.

Due to the duration of construction activities, it is recommended that a construction noise management plan be developed. This is discussed in *Section 9.7.2*.

9.6.3 *Vibration Assessment*

The proposed 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 0.2mm/s. This level is considered to represent the human threshold of perception of vibration. As a result vibration impacts associated with truck movements are considered to comply with OEH criteria and are expected to have minimal impact on the community.

9.7 *MANAGEMENT AND MITIGATION MEASURES*

Minor exceedances of less than 2 dB(A) may occur at some receivers during the evening period. Noise levels of this magnitude would generally be indiscernible to the human ear, and effective noise mitigation is likely to be achieved by the implementation of noise management methods outlined below. Achievement of effective noise mitigation would need to be confirmed upon the commencement of operations.

9.7.1 *Operational Noise Management Plan*

An operational Noise Management Plan (NMP) has been developed to specifically address noise impacts associated with the existing operations and will be updated to address potential impacts of 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 an affected residence; and
- noise mitigation measures and operating procedures to ensure compliance with noise goals.

Noise monitoring data from the early stages of Project operations would be utilised to calibrate an operational specific noise model, to refine the potential predicted noise impacts during the worst case scenario.

The ability to monitor noise emissions during Stage 1 where noise levels are predicted to comply with the criteria will enable pro-active noise management methods and suitable noise mitigation methods to be implemented, if required, during the worst case operational scenario.

Operational 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 during periods of maximum production to confirm the acoustic performance of the proposed operations.

The results of the noise monitoring program will be reviewed by the operations manager to assess compliance with the goals and reported in accordance with any requirements of the Project approval or EPL required for the Project under the POEO Act.

9.7.2 *Road Traffic Noise*

At 99 Bellambi Lane and 109 Bellambi Lane road traffic noise levels ($L_{Aeq,\ 1\text{-hour}}$) are expected to increase due to peak Project-related traffic (future coal haulage) by approximately 2.5 to 3dB(A). These results (and potential impacts) do not reflect the majority of the time; noise levels potentially associated with average Project-related traffic are expected to comply.

Accordingly, it is recommended that noise control strategies be considered as part of the *Operational Noise Management Plan* described above, and that road traffic noise monitoring be undertaken as part of the *Operational Noise Monitoring Program* to quantify any increase in noise levels during peak coal haulage periods. The results of this monitoring assessment may then be utilised to determine feasible and reasonable noise control mitigation measures and management strategies that will assist to reduce noise levels to below the relevant ECRTN criteria.

As applying physical traffic noise mitigation measures would be limited in the affected area, it is recommended that the client negotiate directly with the affected community in respect of the timing and frequency of Peak periods of coal haulage. While the measures contained within this section will not necessarily result in meeting the road traffic noise criteria at all times, they will serve to reduce impacts to the surrounding community.

9.7.3 *Construction Noise Management Plan*

A construction NMP will be developed to specifically address potential noise impacts associated with the proposed construction activities at the nearest receivers. All construction works and noise management will be undertaken in accordance with the ICNG.

Construction will occur to Monday to Saturday and all residents will be notified of the start of works. Where feasible, mitigated site equipment will be used to minimise environmental noise emissions.

The NMP will outline methods and procedures to manage the following:

- 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.

The results of the noise monitoring program will be reviewed by the operations manager to assess compliance with the goals and reported in accordance with any requirements of the development consent or Environment Protection Licence required for the Project under the POEO Act.

10 *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 any negative impacts are also outlined.

10.1 *INTRODUCTION*

An air quality assessment was undertaken for the Project by ERM, addressing the impacts that surface infrastructure operations and coal haulage by trucks could have in the local air shed. 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 OEH'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 and makes comparisons with the air quality assessment undertaken for Stage 1 Preliminary Works Project. Further details of the assessment are provided in the *NRE No.1 Colliery Air Quality Assessment* presented in *Annex I.*

The National Environment Protection Measure (Ambient Air Quality) 1998 (NEPM) is a Commonwealth Government initiative which has been adopted by all states which aims to achieve nominated standards of air quality within ten years. This standard is legally binding on all levels of government. Measurement and concentration averaging periods are based on critical exposure times for health impacts and are thus different for various pollutants. The NEPM criterion has been incorporated into the OEH impact assessment criteria and is listed below in *Table 10.1*.

Table 10.1 NEPM (Ambient Air Quality) Standards

Pollutant	Averaging Period	Maximum Concentration	Maximum Allowable Exceedances
Particles as PM_{10}	24 hour	50µg/m^3	5 days in a year
Deposited Dust	Annual	4g/m^2/month	None

The OEH publish impact assessment criteria for air pollutants in their document *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales (revised 2005).* Industry has an obligation to ensure compliance with the requirements specified in this Regulation.

The impact assessment criteria relevant to the Project are presented in *Table 10.2*. These are the criteria, against which the predicted ground level concentrations of pollutants generated by the Project are compared.

Table 10.2 OEH Impact Assessment Criteria

Pollutant	Averaging Period	Concentration
PM_{10}	24 hours	50µg/m^3
	Annual	30µg/m^3
Total Suspended Particulates	Annual	90µg/m^3
Deposited Dust	Annual	2g/m^2/month

Source: *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005).*

Source: *National Environment Protection Measure (Ambient Air) (Amendment 2003).*

These criteria levels include background levels.

10.2 *EXISTING ENVIRONMENT*

10.2.1 *General Meteorological Conditions*

Meteorology plays a major role in determining the location and scale of off-site impacts from 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 OEH located in Wollongong, approximately six kilometres south of the site.

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

10.2.2 *Climate*

Long term climatic data is available from the Bureau of Meteorology (BoM) weather station located, approximately six kilometres south of the site.

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

10.2.3 *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 six kilometres south of the site. The Wollongong station continuously measures PM_{10} concentrations. Daily data for January to December 2011 has been provided by OEH.

To undertake a cumulative assessment of annual PM_{10} ground level concentrations, the annual average of the 24hour Wollongong records have been used. The annual average PM_{10} concentration estimated from this data is 16.4µg/m^3.

A background concentration for TSP has been estimated at 41.9µg/m^3, based on a particle size distribution with PM_{10} being approximately 39.1% of TSP.

Dust Deposition

There is no background dust deposition data (ie 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 10.1*. Data for the period August 2009 to July 2010 is provided in *Table 10.3*. 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.

It can be seen from the data presented in *Table 10.1,* that 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 OEH annual monthly average criterion for insoluble solids of 4g/m^2/month.

10.2.4 *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 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).

The western end of 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 near to 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 10.2.3*).

10.2.5 *Preliminary Works Project*

The air quality assessment for the Preliminary Works Project (MP 10_0046) considered some upgrades to surface facilities but the proposal included minimal changes to the coal handling facilities. The dispersion modelling for Stage 1 also used 'contemporaneous' meteorological and monitoring data for 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. It also allows a comparison between the results of the modelling for Stage 1 and the results of the modelling for Stage 2.

Table 10.3 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.

Legend

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

Figure 10.1

EPL Dust Monitoring SItes

Client:	Gujarat NRE Coking Coal Limited
Project:	NRE No.1 Colliery EAR Post Adequacy 2012 Environmental Assessment
Drawing No:	0079383s_EARPA2012_G031_R0.mxd
Date:	13/11/2012
Drawing size:	A4
Drawn by:	SQW
Reviewed by:	TM
Scale:	Refer to Scale Bar

N

0 50 100 150m

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Table 10.4 presents a summary of the maximum predicted incremental ground level concentrations for the modelled receptor where highest concentrations were predicted in Stage 1.

In addition, modelling for Stage 1 showed that the predicted 24 hour incremental ground level concentrations of PM_{10}, including the background concentration, exceeded the NSW criterion at five sensitive receptors. Most of these events occurred on March 4, when the background concentration was 98% of the criterion level. One sensitive receptor had three additional occurrences greater than the criterion for a total of four, which is less than the allowable five exceedances.

Table 10.4 Maximum Incremental Ground Level Concentrations Stage 1 Preliminary Works Project

Pollutant	Maximum Increment[1]	Background[2]	Cumulative	Criteria[3]	% of Criteria
Sensitive Receptors					
PM_{10} – 24 hour ($\mu g/m^3$)[4]	2.79	49.00	**51.79**	50	**104%**
PM_{10} – 24 hour ($\mu g/m^3$)[5]	19.09	19.10	38.19	50	76%
PM_{10} – Annual ($\mu g/m^3$)	5.04	19.7	24.74	30	82.5%
TSP – Annual ($\mu g/m^3$)	15.7	50.6	66.30	90	73.7%
Dust Deposition – Annual (g/m^2/month)	0.21	-	-	2	10.5%

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.

10.3 *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 and dozer maintenance;
- loading haul trucks;
- using on site haul roads; and
- conveyor transfer of ROM coal from the stockpile to the truck load out.

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 (fully enclosed);
- the screening and sizing plant (fully enclosed);
- underground blasting; and
- emissions from ventilation shafts.

Due to the removal of the excavator, which is a large existing source of emissions, emissions have dropped slightly for Stage 2. 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 large proportion of heavy vehicular traffic along Bellambi Lane and a small proportion along the remaining haul route, the focus has been on Bellambi Lane. Dust generated as a result of the movement of trucks hauling coal along Bellambi Lane could potentially be caused due to 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 potentially 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 picked up by other trucks, vehicles or the wind. NRE has trialled not washing trucks at all, provided they enter the site free from excess solid material and stay on clean hard stand surfaces. This is discussed further in *Section 10.6*.

Dust on Bellambi Lane will be managed as described in *Section 10.6*.

10.4 *DISPERSION MODELLING ASSESSMENT*

10.4.1 *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.*

10.4.2 *Model Receptors*

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

A representative sample of nearby residences was chosen as discrete receptors in the modelling assessment. These receptors were chosen to ensure that all directions were covered. A detailed list of discrete representative receptors is presented in *Table 10.5*.

Table 10.5 Discrete Receptor Locations

Receptor	Description	Coordinates (MGA zone 56)	
		Easting	Northing
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

Receptor	Description	Coordinates (MGA zone 56)	
		Easting	Northing
C4	Bloomfield Ave., Logger 3	306322	6195424
R3	Moreton St., Logger 1	306568	6196087

The location of the receptors is shown in *Figure 10.2*.

10.4.3 *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.

10.5 *IMPACT ASSESSMENT*

10.5.1 *Overview*

The dispersion modelling assessment uses contemporaneous meteorological and monitoring data that both cover the period January-December 2011. 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 10.6 presents a summary of the maximum predicted incremental ground level concentrations for the modelled receptor where highest concentrations were predicted.

Table 10.6 Maximum Incremental Ground Level Concentrations

Pollutant	Maximum Increment[1]	Background[2]	Cumulative	Criteria[3]	% of Criteria
Sensitive Receptors					
PM_{10} – 24 hour ($\mu g/m^3$)[4]	3.46	48.50	**51.96**	50	**104%**
PM_{10} – 24 hour ($\mu g/m^3$)[5]	13.70	14.20	27.90	50	56%
PM_{10} – Annual ($\mu g/m^3$)	2.16	16.4	18.56	30	62%
TSP – Annual ($\mu g/m^3$)	6.1	41.9	48.00	90	53%
Dust Deposition – Annual (g/m^2/month)	0.14	-	-	2	7.0%

1. Maximum increment has been estimated based on dispersion modelling.
2. Background data derived from the OEH Wollongong TEOM monitoring data.
3. Criteria are sourced from DECC (2005) *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.*
4. Predicted concentration on day of maximum background.

   Predicted concentration on day of maximum incremental concentration.

The concentration contours presented in *Figure 10.3* to *Figure 10.5* show that the predicted concentrations are localised and decrease rapidly with distance from the site.

Legend

Project Application Area

Sensitive 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
C4	Bloomfield Ave
R3	Moreton St

Figure 10.2
Sensitive Receptor Locations

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No. 1 Colliery EAR Post Adequacy 2012 Environmental Assessment	
Drawing No:	0079383s_EARPA2012_G041_R1.mxd	
Date:	13/11/2012	Drawing size: A3
Drawn by:	SQW	Reviewed by: TM
Scale:	Refer to Scale Bar	

N

0 50 100 150m

Environmental Resources Management ANZ

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

ERM

Legend

PM10 Concentration (µg/m³)

- 5-10
- 10.1-15
- 15.1-20
- 20.1-25
- >25.1

Sensitive Receptor

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
C4	Bloomfield Ave
R3	Moreton St

Figure 10.3
Concentration Contours – PM10 Maximum 24 hour Average

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No. 1 Colliery EAR Post Adequacy 2012 Environmental Assessment	
Drawing No:	0079383s_EARPA2012_G042_R0.mxd	
Date:	13/11/2012	Drawing size: A3
Drawn by:	SQW	Reviewed by: TM
Scale:	Refer to Scale Bar	

N

0 50 100 150m

Environmental Resources Management ANZ

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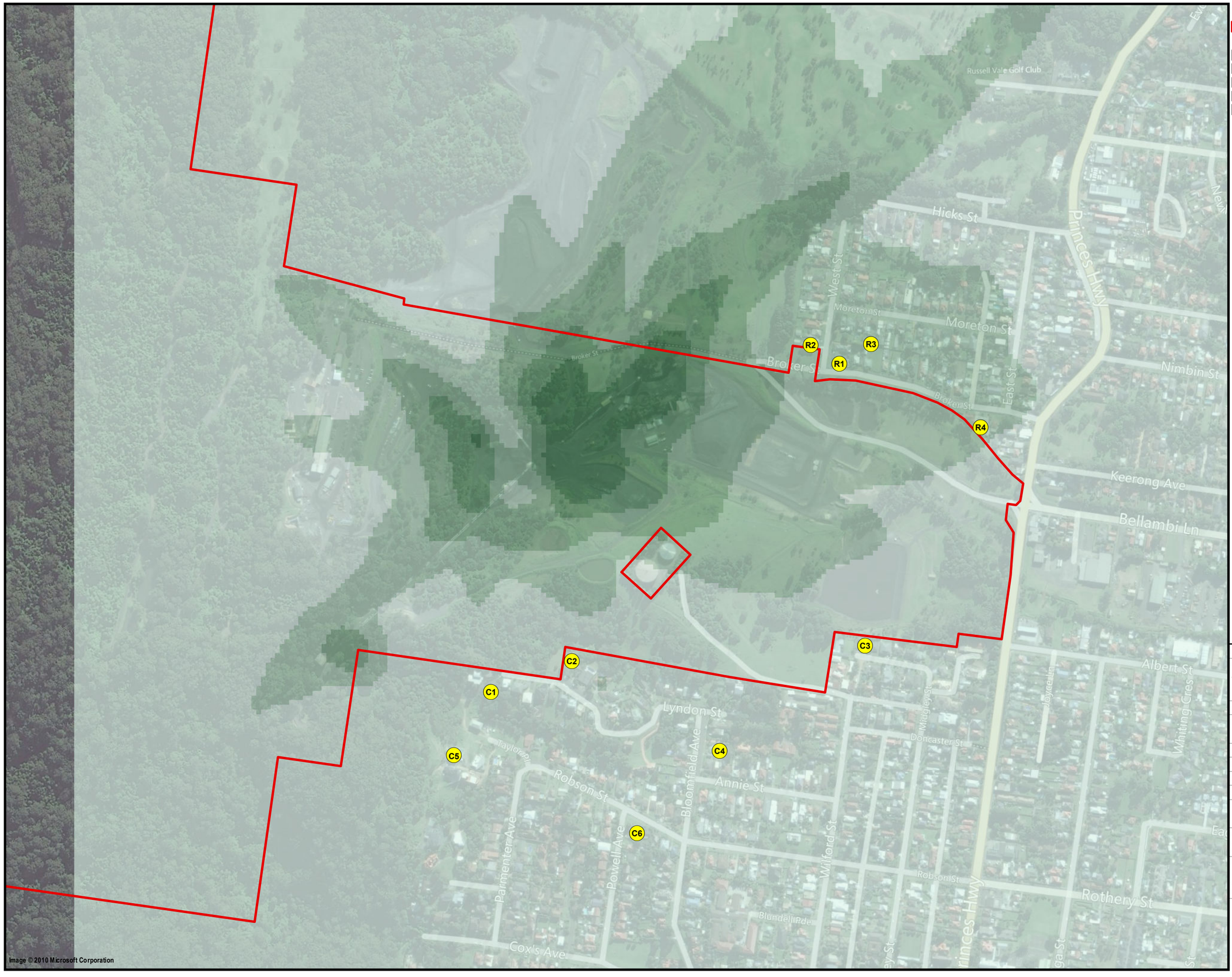
ERM



Legend

Project Application Area

PM10 Concentration (µg/m^3)

- 1-10
- 10.1 - 15
- 15.1 - 20
- 20.1 - 25
- >25.1

Sensitive Receptor

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
C4	Bloomfield Ave
R3	Moreton St

Figure 10.4

Concentration Contours – PM10 Annual Average

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No. 1 Colliery EAR Post Adequacy 2012 Environmental Assesment	
Drawing No:	0079383s_EARPA2012_G043_R0.mxd	
Date:	13/11/2012	Drawing size: A3
Drawn by:	SQW	Reviewed by: TM
Scale:	Refer to Scale Bar	

N

0 50 100 150m

Environmental Resources Management ANZ

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ERM

Legend

- Project Application Area

TSP Concentration (µg/m³)

- 5 - 10
- 10.1 - 15
- 15.1 - 20
- 20.1 - 25
- >25.1

Sensitive Receptor

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
C4	Bloomfield Ave
R3	Moreton St

Figure 10.5

Concentration Contours – TSP Annual Average

Client:	Gujarat NRE Coking Coal Limited	
Project:	NRE No. 1 Colliery EAR Post Adequacy 2012 Environmental Assessment	
Drawing No:	0079383s_EARPA2012_G044_R0.mxd	
Date:	13/11/2012	Drawing size: A3
Drawn by:	SQW	Reviewed by: TM
Scale:	Refer to Scale Bar	

N

0 50 100 150m

Environmental Resources Management ANZ

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ERM

10.5.2 *Short Term (24 Hour Average) Impacts*

PM_{10} – Short term (24 hour) average

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

The PM_{10} cumulative assessment uses monitoring data from Wollongong, which is contemporaneous with the meteorological data used in the dispersion modelling. The highest background recorded at Wollongong (below the NSW criterion) was 48.5µg/m^3, and the maximum increment predicted by the modelling on that day was 3.46µg/m^3 (at Receptor 1), giving a cumulative impact of 51.96µg/m^3, representing 104% of the OEH criteria.

The highest predicted incremental concentration at any sensitive receptor was 13.70µg/m^3 predicted at Receptor 1. The background data recorded at Wollongong on that day was 14.20µg/m^3 and the cumulative impact of 27.90µg/m^3 represents 56% of the relevant criteria.

The NEPM guidance for PM_{10} 24 hour concentrations indicates that the criterion of 50µg/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.

10.5.3 *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 90µg/m^3 at existing sensitive receptors.

The maximum predicted incremental TSP concentration was 6.1µg/m^3. The background level derived from monitoring data at Wollongong for 2011 was 41.0 µg/m^3, and the cumulative impact of 48.0µg/m^3 represents 53% of the criterion.

Particulate Matter Less Than 10 Micron (PM_{10}) – Long Term (Annual) Average

The maximum predicted incremental PM_{10} (annual average) concentration was 2.16µg/m^3 at Receptor 1. The average background recorded at Wollongong for 2011 was 16.4µg/m^3, and the cumulative impact of 18.56µg/m^3 represents 22% 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 0.14g/m^2/month, which represents 7.0% of the incremental criteria.

Due to the lack of available OEH-provided background dust deposition data for the assessment area, a cumulative impact assessment is not possible. Given the nature of the

existing environment, and a lack of neighbouring significant potential dust sources, it is unlikely that cumulative impacts will exceed the cumulative dust assessment criterion annual average of 4g/m^2/month. While historic exceedances have been reported to the EPA, investigations have identified that exceedances were due to vandalism and nearby vegetation clearing. Visual analysis undertaken on samples that exceeded 4g/m2/month confirm that coal dust constituted less than 15%.

10.6 *MANAGEMENT AND MITIGATION*

The facility upgrade has been designed to reduce particulate emissions and the predicted results of this are demonstrated through the comparison of modelling results for Stage 1 and Stage 2 development. Due to the removal of the excavator, which is a large existing source of emissions, emissions have dropped slightly for Stage 2. A number of management measures are already in place at the Colliery 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 will be transported on site using a network of covered conveyors. This results in much lower emissions of dust than using haul trucks to transport coal to the ROM pad.

Materials Storage

Water sprays will be used to minimise dust at Stockpile storage.

Management of Exposed Areas

Exposed areas will consist of one main stockpile area up to a maximum of 2 hectares and the smaller stockpile area (~0.7 hectares). Water sprays will continue to be used on these areas to minimise air borne dust on an as needs basis.

Off-site Transport

Offsite transport will consist of the use of trucks. The trucks will be covered before leaving the site in order to minimize the potential for dust impacts due to product loss through wind erosion. To ensure dust emissions along coal haul routes are effectively managed a truck wash is expected to drop emissions to negligible levels.

NRE No. 1 has also committed to re–enforce the Driver's Code of Conduct, through continuing driver education ('tool box' talks). The code of conduct includes mitigation measures such as mandatory covering of trucks. NRE is also investigating alternative truck washing systems.

A review of management and Mitigation measures against best practice is included in *Table 10.7.*

Table 10.7 Dust Control

Source	Dust Control	Dust Suppression	NRE No. 1 Proposed Controls/Suppression
Whole plant	Enclosures/barriers	-	Various enclosures used for conveyors wherever practicable
Plant equipment (trucks)	Dust proofing	-	Use of covers for trucks and truck washing equipment where required
Enclosure Structures	Regular Maintenance	-	Equipment will be maintained on a regular basis
Conveyors	Side wind guards, covers on high and steep conveyors, belt cleaning, dust collection systems, clean-up program, maintenance of enclosures	Sprays at transfer points to wet dust and particles and prevent liberation, mist/ fog system to increase fall out rates. Belt cleaning sprays in opposite direction to travel.	Conveyors will be covered completely or in part wherever practicable
Stockpiles—discharge	-	Minimizing discharge heights and conveyor speeds, use of rill tower, enclosure of stockpile, atomizing, use of automated weather predicting water sprays to wet stockpile. Drainage often required at stockpile base and foundations.	Water sprays used to minimise dust
Stockpiles—storage	-	Fixed water cannons, or vehicular based sprays for small stockpiles. Drainage often required at stockpile base and foundations.	Water sprays used to minimise dust

1. Source: Best Practice Environmental Management in Mining - Dust Control Australian Government.

10.7 *CONCLUSIONS*

The results of modelling indicate:

- the Project is predicted to comply with the long term OEH air quality impact criteria for PM_{10}, TSP and dust at all receptors for all scenarios;
- the Project is predicted to exceed maximum 24 hour average PM_{10} criterion on one day at one sensitive receptor, which is within the allowable five day exceedance limit; and
- the highest predicted incremental concentration of PM10 (24 hour average) at modelled sensitive receptors was 13.70µg/m3 representing 27.4% of the nominated criteria (50µg/m3).

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 one exceedance of the OEH short term air quality criteria (maximum PM_{10} 24 hour average concentration) of 50µg/m^3 is predicted, it is unlikely that the Project would have a significant impact on local air quality due to the following reasons:

- the Project was not the primary contributor for the exceedance. This predicted cumulative exceedance would largely result from windblown salt, agricultural dust, and other operations in and around the area; and
- 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.

Concentration contours show that the highest impacts are centred around the Russell Vale site, with the predicted concentrations decreasing rapidly beyond the site boundary, with minimal impacts predicted beyond 1km.

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

11 *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.

11.1 *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);
- hydro fluorocarbons (HFCs);
- per fluorocarbons (PFCs); and
- sulphur hexafluoride (SF6).

11.2 *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*.

The emission of greenhouse gases (which include gases such as carbon dioxide and methane) has been linked to climate change. Climate change, as defined by the United Nations Framework Convention on Climate Change (UNFCCC), "*is a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability*".

The UNFCCC is an international agreement setting out the overall framework for intergovernmental efforts to tackle the challenges posed by climate change. The UNFCCC came into effect in 1994 and has been ratified by 195 countries, including Australia. In 1997, at the third Conference of the Parties under the UNFCCC, Australia agreed to adopt the 'Kyoto Protocol'. Due to a complex ratification process, it came into effect in 2005. Australia ratified the Kyoto Protocol in 2008.

In 2011 at the 17th Conference of the Parties under the UNFCCC in Durban, participating countries agreed that there would be a second commitment period of the Kyoto Protocol from 1 January 2013(the details are still to be agreed).

In short, the Kyoto Protocol 'operationalised' the UNFCCC and sets binding emission limitation and reduction targets for industrialised countries (called Annex 1 Parties), including Australia, for the first commitment period (2008 – 2012). Under Kyoto Australia is required to limit emissions to 108% of 1990 emissions. In addition to domestic mitigation actions, the Kyoto Protocol allows Annex 1 Parties to meet their emission reduction commitments through its three 'flexibility mechanisms'; the Clean Development Mechanism (CDM); Joint Implementation (JI); and emissions trading.

According to the Department of Climate Change and Energy Efficiency, Australia remains on track to meet its Kyoto target (DCCEE, 2011). Updated inventory data for 2007-08 and projections data for the remaining four years of the first commitment period confirm that Australia is expected to meet its Kyoto target without needing to purchase international carbon credits (ie from CDM and JI). Australia's emissions are expected to reach an average of 583 Mt CO2-e per annum over 2008-12, which is 107 per cent of 1990 levels.

The Clean Energy Future Plan represents the Australian Government's primary policy approach to reducing emissions of greenhouse gases from Australian Industry. A key aspect of the Clean Energy Future is the Carbon Pricing Mechanism (CPM) which came into effect on 1 July 2012 and will operate as a cap and trade emissions trading scheme. In the first three years, the carbon price will be fixed at $23 per tonne of CO_2-e and, from 1 July 2015 the price will be set by the market.

The Australian Government has made an international pledge to reduce Australia's emissions by 5 to 15 per cent or 25 per cent below 2000 levels by 2020. The 5 per cent target represents Australia's unconditional commitment. Australia's targets of up to 15 per cent and 25 per cent are conditional on the extent of action by others. The Clean Energy Act 2011, which is the basis of Australia's carbon pricing mechanism, sets out Australia's long term emission reduction target of 80% by 2050 against 2000 levels.

Liable companies include those who operate large emitting facilities which generate over 25,000 tonnes of direct CO_2 – e emissions (scope 1 emitters) each year. Most of these companies directly emit greenhouse gases, such as power stations, mines and heavy industry.

The assessment is made by reference to emissions from a 'facility' and not by an individual corporate entity. The CPM will be applied to underground coal mining and will cover fugitive emissions of coal seam methane from the following:

- pre and post gas drainage systems;
- direct discharge from ventilation shafts; and
- delayed discharge from produced coal on stockpiles.

11.2.1 *Direct and Indirect Emissions*

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

The NGA Factors adopt 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; and
- 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 (ie produced by third-party organisations outside of the Project Area).

11.2.2 *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 Colliery, 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 11.1 details the greenhouse gas emission sources included in this assessment.

Table 11.1 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 and 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 11.1* 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 affect emissions associated with these sources.

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

11.3 *METHODOLOGY*

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

- equipment and infrastructure for the extraction, stockpiling, and transportation of ROM coal, will be upgraded;
- increase to coal extraction following expansion of the operations is expected to be up to 3Mtpa;
- operational lifetime of the Project will be 18 years, from 2013 – 2031;
- ROM coal will not be washed prior to transportation and, as such, volumes of coal transported to PKCT will also be up to 3 Mtpa; 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. On average, 19% of the exported ROM coal will be waste.

Table 11.2 details the emission estimates for Scope 1 sources.

Table 11.2 Scope 1 Source Emission Estimates for One Year of Production

Source	Timeframe	Activity Level	Scope 1 Emission Factor	Estimated Emissions (t CO_2-e)
CSG vented during coal extraction	Peak production(1)	3 000 000 t ROM coal mined	0.0105778 (t CO2 Vented/t ROM Coal Extracted) 0.7887487 (t CO2-e Vented from vented CH4/ t ROM Coal Extracted)(2)	2 397 980
CSG vented from coal extraction (post mining)	Peak production	3 000 000 t ROM coal mined	0.014 co2-e/t product (3)	42 000
Diesel Use – On Site Operations	Peak production	1 955 kl	0.0699 - Emission Factor (t CO2-e/GJ)(5)	264(4)
Diesel Use – Construction	1 Year of Construction	39.1 kl.	0.0699 - Emission Factor (t CO2-e/GJ)	105
			Total	**2 44 0349**

1. Given that ROM coal production is expected to be constant, at 3Mtpa, 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. NRE report that 95% of diesel is consumed underground and emissions report to the ventilation system. Given diesel use was reported elsewhere, this figure has been reduced by 95%.

   Scope 1 Diesel fuel combustion emission factor taken from Table 4; '*NGA Factors, June 2009*'.

As highlighted in *Table 11.2,* fugitive release of CSG will represent by far the largest source of Scope 1 emissions from this Project.

Table 11.3 details the emission estimates for Scope 2.

Table 11.3 Scope 2 Source Emission Estimates for One Year of Production

Source	Timeframe	Activity Level	Emission Factor	Estimated Emissions (t CO_2-e/ annum)
Energy from consumption of grid electricity.	Peak production (2015) (1)	134 290.8 MWh/annum (Net Power Consumption)	0.82 (tCO_{2-e} /MWh) (2)	108 104
			Total	**108 104**

1. Energy consumption is expected to be relatively constant throughout the operational lifetime of the Project. However, emissions from electricity consumption are expected to peak in 2015 given that the emissions intensity of grid electricity in NSW is anticipated to reduce incrementally.
2. CO_2 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 11.4 shows the emission estimates for Scope 3 sources.

Table 11.4 Scope 3 Source Emission Estimates for One Year of Production

Source	Consumption	Activity Level/Conversion Factor	Emission Factor	Estimated Emissions (t CO_2/annum)
Road transportation of ROM coal from the site to PKCT.	3Mtpa (1)	14.1km journey. 158 200 truck movements/annum	0.546 l/km (2)	3 286
Shipping transportation of ROM coal from PKCT to India.	3Mtpa	Assumed distance of journey: 12 000km 17 shipping journeys/annum (3)	0.000007 t CO_2 per tonne km (4)	252 000
Use of saleable coal as coking coal for steel manufacturing.	1,571,429 tpa used as coking coal	0.752 Coking Coal Carbon content factor (tC/t fuel) (5)	2.757 (t CO_2-e/t fuel) (6)	4 332 952
Use of saleable coal as thermal coal for power generation.	857,143 tpa used as thermal coal	0.663 Black (Thermal) Coal Carbon content factor (tC/t fuel) (7)	2.43 (t CO_2-e/t fuel) (8)	2 083 714
Indirect emissions for fuel extraction associated with diesel supply.	1,270 kl/annum	48,056.16 (GJ annum)	0.0053 t CO_2-e (9)	260
			Total	**6 672 212**

1. Given that ROM coal production is expected to be constant, at 3Mtpa, 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.

11.3.1 *Summary of Emissions*

Scope 1 direct emissions associated with coal mining activities are estimated at 2 440 349tCO_2-e/annum, representing approximately 26.6% of overall annual emissions from the Project. Nearly all of the Scope 1 emissions are from CSG released during mining.

Scope 2 emissions associated with consumption of grid electricity are estimated to peak at 108 104tCO_2-e/annum in 2015, representing approximately 1% of overall annual emissions.

Scope 3 emissions associated with both transportation and end use of coal will represent 6 672 212tCO_2-e/annum, or approximately 72.5% of total greenhouse gas emissions associated with the Project.

Table 11.5 summarises the total estimated Scope 1, 2 and 3 emissions due to the Project.

Table 11.5 Summary of Greenhouse Gas Emissions for Peak Year 2015

Source	Estimated Total Emissions (t CO_{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	264
Fuel use during construction	105
Total	**2 440 349**
Scope 2	
Energy from consumption of grid electricity.	108 104
Total Scope 1 + 2	**2 548 453**
Scope 3	
Road transport of ROM coal product from site to PKCT	3 286
Shipping transportation of ROM coal product from PKCT to India.	252 000
Use of saleable coal as coking coal for steel manufacturing	4 332 952
Use of saleable coal as thermal coal for power generation	2 083 714
Indirect emissions for fuel extraction associated with diesel supply.	260
Total	**6 672 212**
Cumulative Total for Scopes 1,2 & 3	**9 220 665**

11.4 *IMPACT ASSESSMENT*

NRE expect to mine up to 3Mtpa of coal over the 18 year Project lifetime. Total greenhouse gas emissions for the peak year of operations have been calculated at approximately 9 220 665tCO_2-e, or; as a worst case 165 971 970tCO_2-e aggregated over the lifetime of the Project.

Peak year direct greenhouse gas emissions (Scope 1 and 2) are estimated to be approximately 2 548 453tCO_{2-e}/annum in 2015, meaning that the greenhouse intensity of the Project will equate to approximately 0.85tCO_{2-e} for each tonne of ROM coal material extracted. A worst case estimate of the total direct emissions over the operational lifetime of the Project is 45 872 154tCO_{2-e}.

11.4.1 *Emission Contributions to National and State Inventories*

The relative contribution of emissions from the Project to National and State emissions based on the National inventory for 2009 to 2010 has been assessed and is provided in *Table 11.6*. The National and State inventories include emissions from land use and land use change.

Table 11.6 Emission Contributions to National and State Inventories

	Annual Emissions (Mt CO_{2-e})	**Percentage Contribution**
Project	2.5	100
New South Wales	157.4[1]	1.57
Australia	560.8[1]	0.43

Australian National Greenhouse Gas Accounts –States and Territories Greenhouse Gas Inventories 2009 to 2010 (DCCEEa, 2012).

11.5 *POTENTIAL FOR GAS UTILISATION*

At present the bulk of the Scope 1 greenhouse gas emissions for the Project are fugitive emissions of methane venting from the old workings; however, it is anticipated that as mining in the new areas increases, fugitive emissions will also increase. Fugitive emissions are currently expelled via the mine's fans and ventilation system at low concentrations which make cost effective utilisation difficult.

The nature of the in-situ gas levels and concentrations within the coal as it is mined, are not sufficient to support a standalone gas extraction or gas drainage network that extracts the gas from the coal before it is mined or burns the methane in the mine's ventilation air. Hence, in the immediate and short to midterm period, there exists little to no potential for gas utilisation.

Under current operating conditions for explicit safety reasons, the mine's ventilation system contains methane at concentrations up to 0.2%. Technologies that promote the burning of methane in the ventilation stream require methane concentrations to be above 0.3% and ideally at 1.0%, to operate effectively. Hence the utilisation of this technology is currently not viable or practical and would only become possible should a separate gas drainage extraction system be developed. For obvious safety reasons it is not appropriate to restrict air to the underground workings in an attempt to increase the methane concentration of the ventilation stream.

As mining operations progress to the west with deeper depths of cover, it is predicted that the gas content of the coal will gradually increase. This gradual increase will necessitate installation of a gas drainage system that will extract the gas from the coal prior to mining in order to reduce the in-situ gas levels to prescribed amounts to facilitate safe mining conditions. This can be done using a combination of pre and post mining gas drainage and delivery of product to the surface for utilisation.

Initially the gas (predicted to consist predominantly of methane) quantities will not be sufficient to support gas utilisation via gas engines to generate electricity. Under these conditions the gas will need to be captured into a gas drainage and extraction network with controlled flaring on the surface.

In the long term when gas concentrations and quantities permit, there may be opportunity to feed the gas extracted by the gas drainage network into a series of gas engines, thereby burning the gas and using it to generate electricity. This is the long term aim as it will reduce greenhouse gas emissions and represents a far better utilisation of the gas which is inherently part of the coal. Such works will be subject to a separate approval.

11.6 *MINIMISING ENERGY CONSUMPTION AND GREENHOUSE GAS EMISSIONS*

The Carbon Pricing Mechanism (CPM) came into force in July 2012 and will cover Scope 1 emissions on a facility level. The most significant source of Scope 1 emissions is fugitive emissions from the workings. Strategies to minimise fugitive emissions from the older workings will initially relate to the following:

- refining off current gas and ventilation monitoring and measurement systems to improve data capture;
- sealing of areas of the mine that are currently classed as 'old and waste workings' or large areas of standing pillars;
- rationalising ventilation systems to ventilate only essential roadways and production areas to reduce background emissions to as low as possible;
- eliminating old ventilation circuits as new areas of the mine come on-line to replace these transport and conveyor intake roadways and returns through the older parts of the mine; and
- capturing fugitive emissions and either flaring or using the gas to produce energy.
- longer term reduction strategies include:
- understanding the in-situ gas content of the coal to be mined and de-stressed by the mining process;
- minimising the gas available to enter the mine ventilation as a result of coal production and goaf formation by means of effective gas drainage and piping of gas to the surface;
- sealing active goaf areas as longwall blocks are completed to limit fugitive emissions from these sources and 'tapping' these areas as gas builds up to complement gas drainage capture; and
- investigation of potential gas collection and utilisation systems such as replacing flaring with Ventilation Air Methan (VAM)/gas engine/gas turbine technology. Gas utilisation could include power generation or addition of seam gas to existing natural gas pipelines.

  An assessment of the effectiveness of three mitigation measures to reduce fugitive emissions has been undertaken. The results of the assessment are shown in *Table 11.7.*

Table 11.7 Approximate reduction in fugitive emission due to implementation of mitigation measures

Mitigation Measure	Approximate reduction in fugitive emissions (%)
Goaf sealing	30
Gas drainage and flaring	13
VAM treatment of 30% of methane in mine exhaust ventilation	16
TOTAL	59

Mitigation measures to reduce fugitive emissions will be further assessed by NRE and will include investigating opportunities to capture and/or re-use ventilation gases. Other measures to reduce emissions include:

- the efficiency of all upgraded mobile and fixed equipment will be considered during procurement for fuel-powered equipment. It is anticipated that there will be fuel efficiency gains associated with upgraded equipment;
- the increased scale of the proposed operation will likely enable NRE to achieve greater economies of scale in production and therefore increase production efficiency. Increased efficiency may contribute to further reduction in the greenhouse intensity of the operation beyond what is modelled in this assessment;
- upgrades to internal surface haulage routes will improve efficiency of on-site operations;
- energy audits will be held when practicable to ensure that the Colliery is using current practice techniques to minimise energy use and is operating at optimum energy levels;
- site equipment will be maintained to retain energy efficiency;
- the inventory of emissions developed for this assessment will be maintained; and
- emissions and abatement strategies will be reported annually as part of internal environmental reporting and NGER System obligations.

These greenhouse mitigation and monitoring mechanisms and programs will be used throughout the life of the proposed mining operations.

11.7 *CONCLUSION*

This chapter has provided an assessment of the greenhouse gas impact from activities associated with the Project. The impact assessment has presented estimates of direct emissions, and indirect emissions beyond the operational control of the Project.

In this assessment, total emissions over the lifetime of the Project (direct and indirect) have been calculated as being 165 971 970t CO_2–e. Annual emissions are anticipated to peak in 2015, contributing 9 220 665t CO_2–e to atmosphere from all sources.

Peak year direct greenhouse gases emissions (Scope 1 and 2) are estimated to be approximately 2 548 453t$CO_{2\text{-}e}$/annum in 2015, meaning that the greenhouse intensity of the Project will equate to approximately 0.85t$CO_{2\text{-}e}$ for each tonne of ROM coal material extracted. Total direct emissions (Scope 1 and 2) over the operational lifetime of the Project are estimated at 45 872 154t$CO_{2\text{-}e}$.

Measures identified by the company have the potential to reduce total emissions by at least 59%. These will be progressively used not just to reduce total emissions but to promote safe mining operations. The progressive sealing of old mine areas the use of gas drainage and the burning of the waste gas to generate power are all achievable and practical options that will be used as mining progresses and the gas content of the coal increases.

In calculating the direct emissions profile, it is estimated that the Project will contribute approximately 0.43 per cent of emissions to the Australian annual greenhouse gas emissions total and approximately 1.57 per cent of emissions to the NSW annual total.

This chapter has presented a number of measures that 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.

12 *TRAFFIC*

This chapter quantifies the impacts of the Project on traffic volumes, and road performance. Measures are included to manage identified potential impacts.

12.1 *INTRODUCTION*

NRE commissioned Cardno Eppell Olsen (Cardno) to undertake a traffic assessment for the Project. This chapter sets out the key findings of the assessment. The full report is provided in *Gujarat NRE No.1 Colliery, Environmental Assessment Traffic Impact Assessment* (Cardno 2010a) in *Annex J*. Following the opening of the Northern Distributor Cardno undertook further traffic counts along Bellambi Lane and the Northern Distributor. Assessment of these traffic volumes is provided in *Gujarat NRE No. 1 Mine Traffic Study Addendum Report* (Cardno 2010b) in *Annex J*.

12.2 *EXISTING ENVIRONMENT*

12.2.1 *Operations*

In accordance with PKCT's Project approval, NRE is able transport coal to the coal terminal between the hours of 7:00am and 10:00pm Monday to Friday and 8:00am to 6:00pm on weekends and public holidays. The current coal delivery patterns are as follows:

- deliveries are made between:
  - 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 6:00pm and 10:00pm Monday to Friday and during the day on Sundays;
- the number of trucks in the fleet is 8 to 10, each with an average capacity of approximately 34 tonnes, either articulated vehicles or truck and trailer combinations; and
- an average of approximately 99 loads leaves the Colliery each day. Peak loads are up to 134 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; and
- 55 – 60 mins between 3:00pm – 5:00pm.

12.2.2 *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 respectively . A description of these haulage route units is given in *Table 12.1* (Cardno, 2008). The haul route is shown in *Figure 2.5.*

Table 12.1 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 the Princes Highway, Bellambi Lane is a local road and is the main access to Gujarat NRE No. 1 Colliery at Russell Vale. It is a two-lane undivided road with a signalised intersection at the Princes Highway. Between the Princes Highway and the Northern Distributor, Bellambi Lane is a four-lane undivided road and has a speed limit of 60km/h. It was previously part of the Princes Highway (State Highway No. 1) and a State Road. However, since an extension of the Northern Distributor opened in late 2009, north of Bellambi Lane, it is expected that the Highway No. 1 and State Road classifications will be re-assessed 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 the Princes Highway at Molloy Street. The section of the distributor from North Wollongong to Bellambi Lane is part of Highway No.1 and is a State Road. The section between the Southern (F6) Freeway and North Wollongong is a State Road, classified as Main Road No. 626. It is a dual carriageway with two lanes in each direction with a speed limit of between 80 and 90km/h. Access to the Northern distributor is restricted along its length. There are four signalised intersections and three grade-separated interchanges along the route south of Bellambi Lane.	6.5
Southern Freeway	The Southern Freeway forms part of the arterial route linking Sydney and Wollongong. The NRE haulage route uses part of the Freeway between Mount Ousley Road and Masters Road. This section is predominantly four lanes with a 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 100 km/h (south along the 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

Road	Description	Distance Travelled
Springhill Road	Springhill Road is an arterial road connecting Masters Road and Port Kembla Coal Terminal (Port Kembla Road), 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, however the bulk of the eastern sector is only four 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 few facilities such as a heliport, sewage treatment works, golf course and PKCT. Port Kembla Road is a two-lane undivided road, connecting to Springhill Road at a signalised seagull intersection.	0.6
Source: Cardno (2010)		

12.2.3 *Other On Site Traffic*

In addition to coal trucks there a number of other types of vehicles accessing the Colliery. These include employees, visitors and courier vehicles which are summarised in *Table 12.2*.

The current workforce at the Colliery is approximately 368 with an approximate 40/60 split between Russell Vale and the No. 4 Shaft respectively (see *Chapter 2*). These numbers provide a basis for determining the number of vehicles accessing and leaving the sites during the two hour period surrounding the shift change times (*Table 12.2*). This is based on the assumption that the previous shift leaves the site in the hour following the shift change and the following shift arrives at site during the hour prior to commencement of that shift. General site observations indicate a vehicle occupancy rate of two people per vehicle.

In addition to employee and contractor vehicles, traffic is generated at both Russell Vale and No.4 Shaft by visitors, sales representatives, stores deliveries and equipment dispatch for maintenance and repairs. These visits normally occur Monday to Friday and during daylight hours.

Table 12.2 Typical Existing Vehicle Movements

Site and Time	Employee Vehicles Accessing and Leaving site	Visitors and Sales Representatives	Couriers	Heavy Vehicles
Russell Vale:				
5.30am to 6.30am	30	5	3	1
6.30am to 7.30am	15	10	4	2
1.30pm to 2.30pm	26	5	2	1
2.30pm to 3.30pm	30	5	2	1
9.30pm to 10.30pm	15	0	0	0
10.30pm to 11.30pm	26	0	0	0
Total	**142**	**25**	**22**	**5**

Site and Time	Employee Vehicles Accessing and Leaving site	Visitors and Sales Representatives	Couriers	Heavy Vehicles
No.4 Shaft:				
5.30am to 6.30am	59	5	3	1
6.30am to 7.30am	25	10	4	2
1.30pm to 2.30pm	29	5	4	2
2.30pm to 3.30pm	59	5	0	0
9.30pm to 10.30pm	25	0	0	0
10.30pm to 11.30pm	29	0	0	0
Total	**226**	**25**	**11**	**5**

Source: (Olsen (2010)

12.2.4 *Traffic Volumes*

Table 12.3 shows the historical Annual Average Daily Traffic (AADT) volumes on the existing coal haulage routes.

Table 12.3 AADT Summary Table

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	-

Source: RTA AADT Southern Region (2006) in Cardno (2010)

Cardno undertook a number of traffic counts as part of the PKTC increased receival hours EAR. A summary of average daily traffic volumes is presented in *Table 12.4*.

Table 12.4 Average Daily Traffic Volumes

Name	Location	Year	ADT	AWD	AWE
Bellambi Lane	Bellambi, east of Old Princes Hwy	2008	12 114	12 855	10 262
Northern Distributor	North Wollongong, south of Princes Hwy	2008	21 591	22 840	18 468
Southern Fwy	Mt Ousley, south of Mount Ousley Rd	2007	72 034	75 786	62 655
Southern Fwy	Gwynneville, Gipps Rd overpass	2007	69 034	73 350	58 244

Name	Location	Year	ADT	AWD	AWE
Masters Road	Mt St Thomas, west of Springhill Rd	2007	23 822	26 539	17 028
Springhill Road	Mt St Thomas, north of Masters Rd	March 2008 May 2008	15 301 14 849	16 089 15 928	13 331 12 152

Source: Cardno (2010)

ADT = Average Daily Traffic (vehicles per day).

AWD = Average Weekday Daily Traffic (vehicles per day).

AWE = Average Weekend Daily Traffic (vehicles per day).

In addition peak period traffic counts were undertaken at the Bellambi Lane/Princes Highway and Bellambi Lane/Northern Distributor intersections in May 2009. Following the opening of the Northern Distributor extension in late 2009, further 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 12.5*.

Table 12.5 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)	28,035 (2010 count)

1. Source: Cardno traffic counts (2010b).

12.2.5 *Road Performance and Safety*

Mid-block carriageway performance was assessed to perform well (see *Annex J*) in all sections of the haulage route with the exception of sections of the Southern Freeway which are approaching or, at capacity. However, in those areas where capacity is of most concern, the coal trucks represent only a small proportion of the peak hour directional traffic volumes eg the Southern Freeway where coal trucks are between 0.3-1.0% of total volumes.

All intersections were shown to operate satisfactorily under the current configuration (see *Annex J).*

Road safety audits of the existing haulage routes did not identify any unsafe conditions along the haul route (see *Annex J*).

12.3 *IMPACT ASSESSMENT*

The traffic assessment considers impact of the following:

- increase in road haulage from NRE No.1 Colliery to PKCT;

- background traffic growth; and
- cumulative impacts from existing and proposed developments.

12.3.1 *Future Road Haulage*

NRE proposes to increase its production of coal from 1Mtpa to 3Mtpa. It is expected that approximately 60 000t of ROM coal will be transported from the site during average operation and approximately 80 000t during peak operations, to meet shipping deadlines. In order to achieve this trucking hours are proposed to be maintained in accordance with the PKCT approval to permit 95 hours per week within the following times:

- 15 hours per day Monday to Friday, from 7:00am to 10:00pm; and
- 10 hours per day weekends and public holidays, from 8:00am to 6:00pm.

A summary of the estimated coal truck load deliveries from NRE No.1 Colliery to PKCT for each coal delivery option is presented in *Table 12.6*.

Table 12.6 Summary of estimated coal truck load deliveries

		2009 (current)	2019 (future)	
			Average	Peak
Output	Annual (Mtpa)	1	3	3
	Weekly (tonnes)	20 000	60 000	80 000
Truck Delivery Operation (hours per week)		66	95	95
Truck Haulage Capacity (tonnes)		30 [1]	38	38
	Per year	33 333	78 947	78 947
	Per week	667	1 579	2 105
No. of coal truck loads	Per day - Weekday	113	256	341
	Per day - Saturday	103	194	259
	Per day – Sunday and public holidays	0	105	140

Source: Cardno (2010a).

1. Current average truck load capacities are approximately 34 tonnes. However Cardno used a conservative approach in their assessment using a capacity of 30 tonnes.
2. The total number of traffic movements is twice the number of truck loads

Increasing output from 1Mtpa to 3Mtpa will increase daily coal loads from 113 loads to 256 loads and 341 loads in average and peak periods respectively. This is a daily increase in coal truck movements from 226 to between 512 and 682 movements daily. (A truck movement refers to a one way trip ie 10 loads equates to 20 truck movements).

12.3.2 *Future Background Traffic*

Future traffic scenarios were based on background traffic volumes excluding coal truck traffic along the haul routes. Growth factors were applied to existing background traffic volumes to establish base 2019 background traffic volumes. Then the cumulative impact of other specific development in the area was added to the base volumes.

In determining traffic volume growth rates Cardno (2010a) considered the following:

- the Sydney-Wollongong Corridor Strategy;
- the opening of the Wollongong Northern Distributor Extension (NDE); and
- historical traffic patterns.

Average future daily background traffic volumes are summarised in *Table 12.7*.

Table 12.7 Projected Daily Background Traffic Volumes (with no coal trucks)

Name	2009		2019	
	AWD	**AWE**	**AWD**	**AWE**
Bellambi Lane	5,693 (2010)	4,054 (2010)	6,205	4,419
Northern Distributor	28,035 (2010)	21,525 (2010)	40,651	31,211
Southern Freeway (north)	79 126	65 513	95 467	78 763
Southern Freeway (south)	77 921	61 956	101 062	79 968
Masters Road	26 871	17 505	27 045	17 679
Springhill Road	13 805	16 159	16 159	14 359

Source: Cardno (2010a and 2010b).

AWD = Average Weekday Daily Traffic (vehicles per day).

AWE = Average Weekend Daily Traffic (vehicles per day).

12.3.3 *Total Future Traffic*

Future coal truck movements were estimated at each count location and added to the relevant background traffic volumes. Total traffic volumes include all coal truck movements (from surrounding collieries) to and from PKCT. The estimated traffic volumes for each location are provided in *Table 12.8*.

Table 12.8 Projected 2019 Traffic Volumes

Road Name		Weekday– 7am-10pm		Weekday– 10pm-7am		Saturday – 7am-10pm		Saturday – 10pm-7am	
		Average	Peak	Average	Peak	Average	Peak	Average	Peak
Bellambi Lane	All Vehicles	5 594*	N/A	611	N/A	3 989*	N/A	430	N/A
	Coal Truck movements	516	686	0	0	390	518	0	0
Northern Distributor	All Vehicles	37 129*	N/A	3 522	N/A	29 587*	N/A	2 624	N/A
	Coal Truck movements	516	686	0	0	390	518	0	0
Southern Freeway (north)	All Vehicles	84 955	85 125	11 740	11 740	71 682	71 810	8 125	8 125
	Coal Truck movements	1 018	1 188	152	152	911	1 039	133	133
Southern Freeway (south)	All Vehicles	90 315	90 485	11 970	11 975	72 625	72 753	8 387	8 387
	Coal Trucks movements	1 018	1 188	147	152	911	1 039	133	133
Masters Road	All Vehicles	24 759	24 930	3 451	3 455	15 843	15 971	2 880	2 880
	Coal Trucks movements	1 021	1 192	144	148	911	1 039	133	133
Springhill Road	All Vehicles	15 892	16 063	1 777	1 776	12 879	13 007	2 310	2 310
	Coal Trucks movements	1 272	1 443	238	237	1,173	1 301	211	211

Source: Cardno (2010a).

* Figures updated based on Cardno 2010b. It is assumed that the night time traffic numbers remains as projected in Cardno 2010a.

12.3.4 *Mid-Block Carriageway Level of Service*

An increase in coal production from NRE No.1 Colliery together with a change in operating hours will lead to only minor increases in average weekday mid-block traffic volumes along some road sections both in the AM and PM peak hours. However, an increase in the coal truck traffic does not result in any significant changes to the mid-block operating performance of key route sections. The most notable changes between 2009 and 2019 traffic volumes are expected to occur at the following locations:

- morning peak hour at;
    - Bellambi Lane – 7.1% increase;
    - Springhill Road – 5.4% increase;
- afternoon peak hour;
    - Bellambi Lane – 6.8% increase;
    - Masters Road – 2.0% increase; and
    - Springhill Road – 3.3% increase.

It is noted that if coal truck movements remain as they are currently, the peak hour mid-block levels of service along some road sections will still change as a result of background traffic growth alone.

There are some existing capacity issues along the route, many of which are worsened as a result of increases in background traffic. These issues are not exacerbated by the increases in coal trucks from NRE as a result of increased production and changes to operational hours. These changes have little or no impact on peak hour mid-block level of service along the key routes. Further details are provided in *Annex J.*

12.3.5 *Intersection Performance*

The key intersections along the haulage route including Bellambi Lane/Princes Highway and Bellambi Lane/Northern Distributor were assessed using the SIDRA software package. All intersections were shown to continue to operate at a satisfactory level of service. Further details are provided in *Annex J.*

12.3.6 *Other Site Traffic*

The Project is expected to create an additional 84 jobs at the Site. Shift times are unlikely to change for the Project. It is assumed that employees will drive to work in vehicles with an average occupancy rate of two people per vehicle and arrival times will be concentrated in the two hour period around shift change times (Olsen, 2010). It is anticipated that the volume of visitors and other vehicles at the Colliery will double as a result of the Project as shown in *Table 12.9.* There will not be a significant increase in traffic when spread over shifts, as shown in *Table 12.9.*

Table 12.9 Projected Vehicle Numbers

Site and Time	Employee Vehicles Accessing and Leaving site	Visitors and Sales Representatives	Couriers	Heavy Vehicles
Russell Vale:				
5.30am to 6.30am	32	10	6	2
6.30am to 7.30am	18	20	8	4
1.30pm to 2.30pm	31	10	4	2
2.30pm to 3.30pm	34	10	4	2
9.30pm to 10.30pm	18	0	0	0
10.30pm to 11.30pm	31	0	0	0
Total	**164**	**50**	**22**	**10**
No.4 Shaft:				
5.30am to 6.30am	67	10	6	2
6.30am to 7.30am	29	20	8	4
1.30pm to 2.30pm	33	10	8	4
2.30pm to 3.30pm	67	10	0	0
9.30pm to 10.30pm	29	0	0	0
10.30pm to 11.30pm	33	0	0	0
Total	**258**	**50**	**22**	**10**

12.4 *MITIGATION MEASURES*

The traffic assessment did not identify any significant issues from a road traffic performance perspective. Cardno (2010a) indicates that the proposed heavy vehicle increases are not anticipated to have an impact on the safety of the road network. NRE will continue to implement a driver code of conduct which includes, but is not limited to the following:

- trucking between 7:00am and 10:00pm Monday to Friday and between 8:00am and 6:00pm on weekends;
- obeying legal speed limits and including a self-imposed speed limit of 50km/hr along Bellambi Lane;
- vigilance of drivers regarding separation distances;
- minimising noise where possible;
- avoiding compression braking, particularly on the approach to Port Kembla Rd/Springhill Rd lights when entering or exiting PKCT;
- effectively covering all loads;
- reporting all vehicle faults to the owner; and
- reporting all traffic incidents.

NRE is collaborating with the transport company, to ensure the driver code of conduct is being adhered to. Regular toolbox talks have been implemented to reinforce the importance of adhering to the code. NRE will continue to engage the transport company through regular toolbox talks.

13 *VISUAL AMENITY*

This chapter provides an assessment of impacts of the Project on the visual amenity of the surrounding areas.

13.1 *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 strategic plan as an area of high visual, scenic and landscape quality. The 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 escarpment areas 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 viewpoints located around the Russell Vale site. Management measures to mitigate the identified impacts have been developed and are described in this chapter.

13.2 *EXISTING ENVIRONMENT*

13.2.1 *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 mine site at Russell Vale has existed 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 140m AHD. From the offices, the site extends down slope for about one kilometre to the east toward Bellambi Lane which sits at about 55mAHD. 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. The western side of the site is dominated by the Illawarra Escarpment, the top of which sits at 370m 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 90 m RL, are similar in height to the proposed new stockpile facilities, including conveyors, gantries and trippers. These bins provide a good reference point especially when considering visual impacts from Bellambi Lane.

13.2.2 *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 cannot be view from any publicly accessible locations. There are no proposed works at the No.4 Shaft.

13.3 *METHODOLOGY*

The study area for the visual impact assessment was identified according to topographic features of the landscape and distance from the site. Nine external viewpoints were assessed around the Russell Vale site and were located in the north east, east and south. *Annex K* 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 K*. 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.

13.4 *IMPACT ASSESSMENT*

13.4.1 *Visible Components*

Components of the proposed surface facility upgrades which have the potential to impact on visual amenity include:

- a new ROM stockpile and associated infrastructure; and
- new coal loading facilities.

A new Wongawilli decline conveyor will be constructed, within the footprint of the existing Balgownie conveyor, as part of the Stage 1 project. This conveyor will deliver coal to the new ROM stockpile. The new ROM stockpile and associated infrastructure will be constructed within the footprint of the existing stockpile and have a maximum height of 84m RL. The stackers will be slightly higher at 91m RL.

The new coal loading facility will be located at a lower level than the stockpile and is not expected to be visible from publicly accessible areas. All infrastructure associated with the ROM coal stockpile and coal loading facilities, will be constructed primarily of steel and painted steel sheeting. Colours will be selected to match the surrounding environment.

It is expected that lighting will be required in the vicinity of the ROM stockpile and coal loading areas for safety purposes, to ensure that inspections/maintenance can be carried out during all times of operation.

13.4.2 *Visual Amenity*

The visual impact assessment for each of the nine viewpoints located around the site is summarised in *Table 13.1*. Only one of the nine viewpoints was assessed as having potential views of the proposed surface facilities. *Photograph 13.1* to *13.5* show the views from the surrounding area.

Table 13.1 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		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 and workshop are visible in the background, however coal handling facilities cannot be seen from this location.
4	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.

View point Number	Location with respect to the site	Street Address	RL AHD (m)	Potential View
5	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.
6 and 7		Western end of Broker Street looking south west	61	Residents at this location will have a view of screening trees.
8	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.
9		View west Bellambi lane (halfway between princes Highway and Northern Distributor)	50	From this location motorists and residents would have distant views of the existing Colliery offices and proposed infrastructure.

Photograph 13.1 View point 3 eastern end of Midgley Street looking west north west

Photograph 13.2 View point 4 western end of Midgley Street looking north west into the site

Photograph 13.3 View point 6 western end of Broker Street looking south west

Photograph 13.4 View point 8 looking west from corner Bellambi Lane and Princes Highway

As seen from the photographs presented above and *Table 13.1* 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 is reduced and surface elevations decrease. However, views of the proposed ROM stockpile and coal loading 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.

13.4.3 *View from Bellambi Lane*

Motorists travelling along the Bellambi Lane currently have distant views of the Russell Vale site infrastructure. *Photograph 13.5,* 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. 3D modelling indicates that proposed infrastructure at its highest point, will also be visible from this location, as shown in on *Photograph 13.5*.

The location and final height of the new ROM stockpile infrastructure and coal loading facilities will be consistent with existing infrastructure. 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 13.5 Viewpoint 9 looking west Bellambi Lane

13.4.4 *Lighting Effects*

It is expected that lighting will be required for safety purposes to ensure that inspections/maintenance can be carried out during all times of operation. The areas that will require this lighting will include but not be limited to:

- the decline conveyor;
- stackout tower;
- walkways;
- stockpile stacking infrastructure;
- coal load out buildings; and
- truck loading facilities.

The installation of these lights will use 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.

13.5 *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:

- orientation and location of surface infrastructure components to the western most point of the area, to limit visibility;
- colour of components;
- restriction of the area of disturbance to the minimum practicable;
- the use of areas within the existing infrastructure footprint; 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:

- continued maintenance of site;
- 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*.

13.6 *CONCLUSIONS*

NRE No.1 Colliery is well established in an area historically used for coal mining. Changes to the existing viewscape, resulting from the Project, from publicly accessible viewpoints outside the Colliery, are minor. The management measures presented will ensure that the Project will not significantly impact the visual amenity at any sensitive receiver.

In addition, it is considered that the Project 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 have been limited, through prudent design and placement of infrastructure in an area that is already disturbed and is currently used to support mining activities.

14 *HISTORIC HERITAGE*

This Chapter provides a summary of the potential impacts on historical heritage values of the PAA resulting from the Project. Measures to mitigate these impacts are also provided.

14.1 *INTRODUCTION*

A historic heritage assessment was undertaken for the Project by ERM, addressing operational activities at the colliery. The key elements considered in this assessment are:

- legislative frameworks and heritage registers;
- heritage potential on site; and
- heritage significance.

This chapter sets out the key findings of the assessment. Further details are provided in the full *NRE No.1 Colliery Historic Heritage Assessment* presented in *Annex L.*

14.2 *EXISTING ENVIRONMENT*

14.2.1 *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 within the PAA.

Under *Section 146* of the Heritage Act, the NSW Heritage Council must be notified of any unexpected discoveries of 'relics' during the works

The State Heritage Inventory

The State Heritage Inventory is a database which is maintained by the Heritage Branch of the NSW OEH (Heritage Branch). It includes all heritage items and places identified by local government bodies in NSW, as well as those listed on the State Heritage Register as requiring 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 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 2011

The Wollondilly Local Environmental Plan 2011 (WLEP 2011) lists the 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 (now the NRE No.1 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 mine 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.

14.2.2 *Summary of Heritage Listed Items*

The heritage status of the PAA is summarised in *Table 14.1*. Location of heritage items at the Russell Vale site are shown on *Figure 14.1.*

Table 14.1 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 Local Environmental Plan 2009	Russell Vale site
Cataract Dam	Wollondilly Local Environment Plan 1991 and Wollondilly Local Environment Plan 2009	Centre of PAA between Wonga East and Wonga West
Main portal (S. W. Tunnel 1887)	Illawarra Regional Environment Plan No.1	Russell Vale site west of the existing main work shop
1918 portal for ventilation	Illawarra Regional Environment Plan No.1	Russell Vale site
Signal box	Illawarra Regional Environment Plan No.1	Russell Vale site
Old washery (1960) (now demolished)	Illawarra Regional Environment Plan No.1	Russell Vale site within the stockpile area
Concrete base for ball mill at pit top	Illawarra Regional Environment Plan 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 Regional Environment Plan No.1	Russell Vale site
Former mines office (now demolished)	Illawarra Regional Environment Plan No.1	Russell Vale site
Illawarra Escarpment	Register of National Estate and the NSW National Trust Register	West of the Russell Vale site

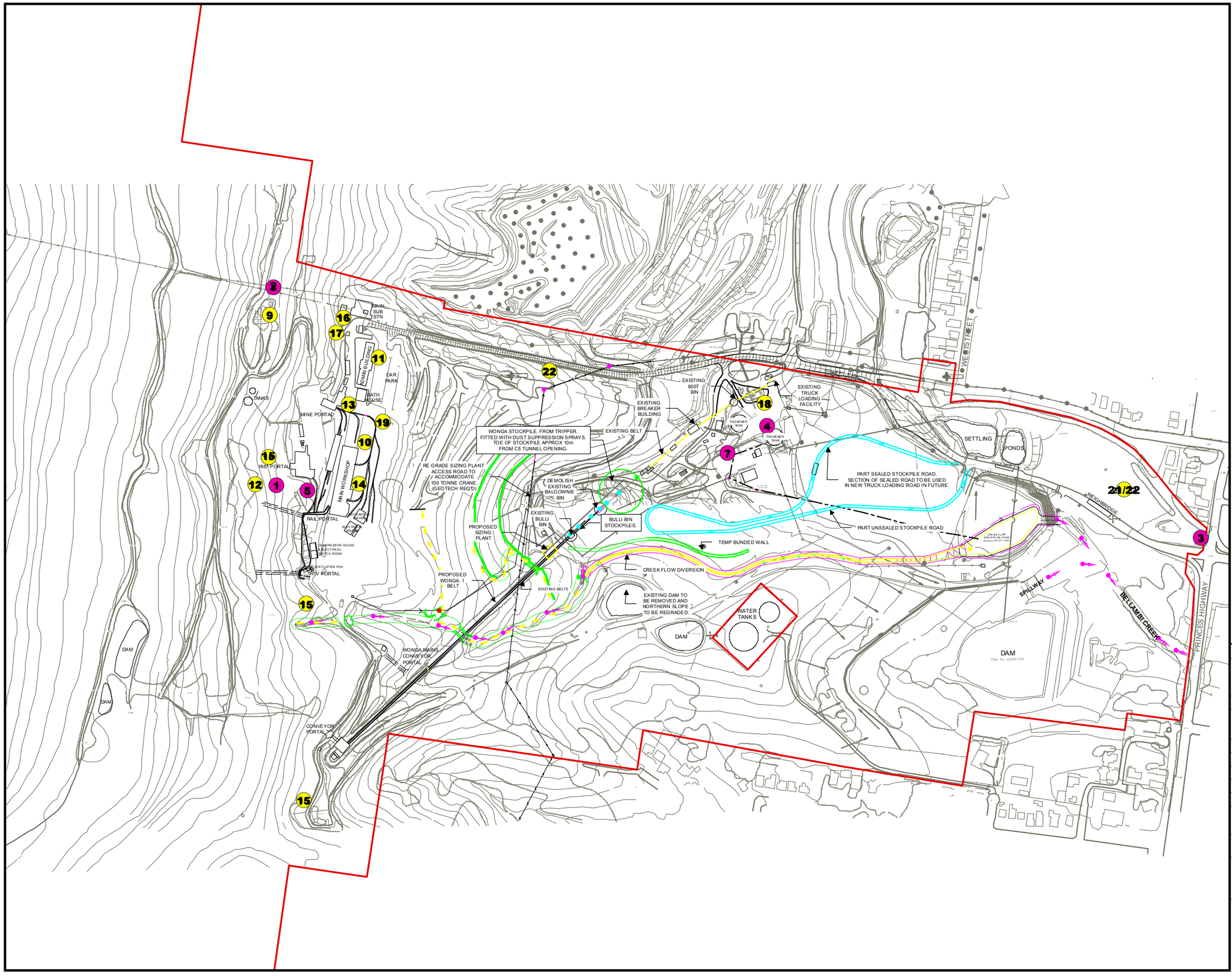
14.2.3 *Items of Significance Identified by Godden Mackay Logan*

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 (see *Table 14.2).*

In 2009 ERM undertook an investigation of the site. No additional items of heritage were identified during this investigation. ERM also assessed the current condition of the items identified by GML (2004). An update of the condition of the site elements as recorded by ERM in 2009 is also provided in *Table 14.2*.



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 14.1

Historic Heritage Items at the Russell Vale site

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE No.1 Colliery EAR Post Adequacy 2012 Environmental Assessment		
Drawing No:	0079383s_EA_GIS028_R1.mxd		
Date:	28/11/2012	Drawing Size:	A3
Drawn By:	SQW	Reviewed By:	TM
Projection:	GDA 1994 MGA Zone 56		
Scale:	Refer to scale bar		

N

0 50 100 150m

Environmental Resources Management ANZ

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

ERM

Table 14.2 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 semicircular 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…* *These buildings appear to be relatively intact and in fair condition."* (GML 2004, p 55)	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
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 observed to have not 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 signal box had been damaged by vandals and fire. This may be in part due to its isolated location near the mine entry gates.
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)	The coal cutter head 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 Princess 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 significance grading. This was intended to demonstrate the degree to which the precincts and elements contributed to the overall heritage value of the site. *Table 14.3* 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 L.*

Table 14.3 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
Workshops 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 materials emplacement areas	Low
Settling dams	Low
Other dams	Low

Item Name	Grading
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).

14.3 *IMPACT ASSESSMENT*

This section identifies the potential positive and negative impacts of the Project upon items with identified heritage values, so that the positive impacts can be enhanced and the negative impacts mitigated. Impacts from both the proposed development and the adaptive re-use have been assessed.

14.3.1 *Positive Impacts and Opportunities*

Aspects of the Project that respect or enhance recognised heritage values are discussed below.

New Development

The new stockpile area and associated infrastructure will be located at the site of the existing stockpile and dismantled washery. This section of the site currently has a strong industrial appearance and historically has been one of the pit top working components. New mining equipment and infrastructure will add a modern layer of mining technology to the site demonstrating the temporal changes in technology whilst enabling the mine to continue operating.

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 beneath Cataract Dam include Wonga Mains. These proposed extraction areas will be developed using the first workings mining method, which results in 'zero' subsidence. As such no subsidence will occur in the vicinity of the Cataract Dam as a result of the Wonga Mains. No secondary extraction will occur beneath Cataract Dam or within a 1km radius of the dam wall. Potential impacts to Cataract Dam are further assessed as part of the subsidence impact assessment for this Project (see *Chapter 18*).

A summary of impacts to heritage items is provided in *Table 14.4*.

Table 14.4 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 Dam	State Heritage Inventory, Wollondilly LEP 1991 and Draft Wollondilly LEP 2009	No. No subsidence will occur beneath the dam.
Main portal (S. W. Tunnel 1887)	Illawarra REP No.1	No. No works proposed in this location.
1918 portal for ventilation	Illawarra REP No.1	No. No works proposed in this location.
Signal box	Illawarra REP No.1	No. 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. 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. No works proposed in this location.
Former mines office (now demolished)	Illawarra REP No.1	NA – no longer present.
Illawarra Escarpment	Register of National Estate and the NSW National Trust Register	No. No works proposed on the escarpment.
Power House Precinct	GML (2004)	No. No works proposed in this location.
Upper Bench Workshops	GML (2004)	No. No works proposed in this location.
Workshop Offices	GML (2004)	No. No works proposed in this location.
Brick Retaining Wall	GML (2004)	No. No works proposed in this location.
Crib Room and First Aid Station	GML (2004)	No. No works proposed in this location.
Store Room	GML (2004)	No. No works proposed in this location.
Closed Adits	GML (2004)	No. No works proposed in this location.
Gibson's Portal	GML (2004)	No. No works proposed in this location.
Sandstone retaining wall	GML (2004)	No. No works proposed in this location.
The Preparation Plant	GML (2004)	No. No works proposed in this location.
Rail Tracks and System	GML (2004)	No. No works proposed in this location.

Item Name	Register	Impact
The Coal Wagon	GML (2004)	No. No works proposed in this location.
Coal Cutter Head	GML (2004)	No. No works proposed in this location.
Remnant Incline Haulage Alignments	GML (2004)	No. No works proposed in this location.
Original Haulage line Vistas	GML (2004)	No. No works proposed in this location.

14.3.2 *Risks to Heritage Values*

Aspects of the Project which could potentially have adverse impacts on heritage significance are described below:

- loss of heritage value caused by a lack of adequate forward planning for items of potential heritage value due to changes in site planning and 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. Therefore 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 severe degradation; and
- changes to the colliery's current phase of life are 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).

14.4 *MITIGATION MEASURES*

The following measures will be put in place to mitigate potential impacts arising from the Project. They are included in the draft statement of commitments for the Project (*Chapter 29*) and will be taken into consideration in a revised Conservation Management Plan (CMP) to be prepared for the Project Area.

- 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 for the discovery of unanticipated 'Relics';

- a photographic recording of the 1887 portal should be undertaken to Heritage Archival Recording standards. Copies of the recording should be lodged with the appropriate Local and State repositories;

- a photographic recording of the site should be undertaken, to Heritage Archival Recording standards, prior to commencement of construction for the Project, to provide a lasting record of the site prior to the new development. Copies of the recording should be 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 its will be donated to a suitable repository. Appropriate repositories will be identified prior to Project works commencing.

15 *WASTE MANAGEMENT*

This chapter identifies waste streams that will be produced by the Project and details procedures to be implemented to manage, minimise, reuse and recycle these waste streams.

15.1 *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 *Chapter 8*.

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's 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.

15.2 *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 15.1* lists the types of waste likely to be produced throughout the construction phase of the Project and ongoing operation of the mine and the management strategy as appropriate. All waste products from the Russell Vale and No.4 shaft sites are managed by the same methods.

15.3 *MINERAL WASTE*

Mineral wastes include all non-coal material extracted through the mining process. No coal washing is undertaken at the colliery and mineral waste is disposed of via the existing coal clearance system. It is estimated that up to 45,000 tonnes of mineral waste will need to be removed from site annually.

ROM coal will be crushed to meet the specific requirements of the Port Kembla Coal Terminal. The waste rock will be blended with dried silt taken from various settling ponds on the site and disposed via the existing coal clearance system.

Table 15.1 Types of wastes produced during ongoing production

Waste type	Predicted Quantity per annum	Management Measure
Waste Rock	45-55 kt/yr	• Disposed of via existing coal clearance system.
Tramp material (includes rags, fibreglass bolts, etc)	25T/yr	• Disposed of using an approved licensed contractor at a licensed facility.
Clean excavated materials	See Colum 3	• Reuse of materials on site. • Where reuse not possible, disposal at an appropriately licensed facility.
Sludge from sediment ponds	See Colum 3	• Re-used 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	100 T	• 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.

15.4 *IMPACT ASSESSMENT*

An increase in waste is expected to be produced during the construction phase of the Project. There will be a small increase in the annual volume of waste currently generated by the operation as a result of the Project. This increase is not expected to impact significantly on current practices. Continued implementation of current waste management practices, as amended to reflect improved technology or practice, will minimise potential adverse impacts resulting from waste generation.

15.5 *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;
- 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.

16 *MINE CLOSURE REHABILITATION*

This chapter provides an overview of the proposed land use following mine closure and the rehabilitation and mine closure strategy for the Project.

16.1 *INTRODUCTION*

NRE has a policy of undertaking progressive rehabilitation of areas of the Colliery that are no longer in use. 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 Environment Protection (E2 and E3). The zonings are illustrated on *Figure 4.1* and this (in conjunction with land ownership) will directly impact upon future rehabilitation strategies both within the life of the Project and in the longer term (following mine closure).

16.1.1 *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 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 approved by DRE.

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 (see Section *16.4.1*); 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 has been developed by DRE. 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.

16.2 *PROJECT 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.

Key considerations in determining the rehabilitation objectives involve consideration of the following:

- *statutory requirements*: this primarily involves undertaking rehabilitation works to specified standards such as sealing mine entries, shafts and the removal of wastes (particularly contaminates) so that work is undertaken in accordance with the appropriate standard, and signed of as complete by the lead regulatory authority;

- *land use/ planning requirements*: these relate to the zoning imposed on the land and both limit and control land use options. At this stage any projected rehabilitation activities can only relate to the current zonings as it is inappropriate to endeavour to predict or pre-empt future zonings; and

- *requirements of the land owners*: while NRE currently has title to entire mine area as well as the mine infrastructures via a current mining lease, it does not hold the freehold title over the entire lease area. As a consequence the final standard and level of rehabilitation must be in line with the requirements of other land owners and any item of infrastructure that is to remain (buildings, dams etc) must be with the consent of the freehold land owner. Similarly, the final land form and standard of re-vegetation must be undertaken to the requirements of the land owner before lease relinquishment occurs.

16.3 *POST MINING LAND USE OPTIONS*

At this stage, the land use options proposed for the various areas of the mining lease mirror the current zonings. In the catchment to the west of the Illawarra Escarpment and Mount Ousley Road, all mining infrastructure will be dismantled and removed. All shafts will be filled to the appropriate standard and any item of infrastructure that remains (building, dam or drain etc.) will be with the consent of the land owner the Sydney Catchment Authority (SCA). This Project is in keeping with current land use and zoning being the harvesting and supply of drinking water for the greater Sydney Metropolitan area.

The current land zoning of the Russell Vale mine site is RU1 being rural primary production. It is proposed that all building and infrastructure will be dismantled and the land reshaped, to ensure the site remains stable and non-polluting in the long term, and is adequately revegetated. However, it should be noted that there may exist the potential for certain buildings dams and other infrastructure to remain on site after mining

operations have been completed. The exact nature of items retained and their ongoing use will be negotiated with the land owner in consultation with Wollongong City Council.

16.4 *GENERAL REHABILITATION METHODS AND PROCEDURES*

16.4.1 *Recent Rehabilitation Action*

Rehabilitation of areas of the Colliery no longer in use has been undertaken in accordance with NRE's rehabilitation policy. Rehabilitation activities recently completed or currently underway include:

- removal of scrap metal and redundant machinery from the pit top and No.4 Shaft;
- removal of unwanted liquid wastes from both the Russell Vale and No.4 Shaft sites;
- removal of over 8500 litres of waste oil from the Russell Vale, No.4 and No.5 Shaft sites;
- demolition of the Washery, including ongoing sale of items of equipment from the Washery such as the 'Delcor' building and contents (ie the fine coal vacuum drying equipment). This building was one of the last main items of infrastructure to be removed from the old Washery site. The only items still remaining are the two belt gantry support towers;
- review of the 2000 Mine Closure Plan covering rehabilitation at Russell Vale to bring it into line with the final Remediation Plan to be defined with the land owner;
- continued monitoring of the condition of the 1887 portal located at the Russell Vale site;
- improvements or maintenance of fencing and other security facilities at the Russell Vale site; and
- progressive sealing, to the required standard, of portals, adits and shafts that are non-essential for egress or ventilation purposes.

16.4.2 *Short Term Rehabilitation*

Progressive rehabilitation of the site will be applied and given priority, particularly in respect to removal of surplus mining equipment, sealing of redundant mine entries and shafts and stabilisation of slopes and embankments. The following activities are proposed in the next 5 years:

Russell Vale Rehabilitation

The following work is proposed in the next five years:

- 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.

Catchment Land Rehabilitation

The following rehabilitation work is planned to be carried out on the Catchment Area during the next five years:

- 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.

16.4.3 ***Rehabilitation for the Life of the Project:***

The Project under consideration has a life of up to 18 years. During this time, there will be the opportunity to undertake rehabilitation works wherever and whenever mine infrastructure become surplus to ongoing needs. It is anticipated that the rehabilitation action outlined below would be undertaken within the next five to eighteen years:

- decommission and remove the Steel Core belt and transfer house;
- decommission and remove the existing Bulli and Balgownie decline belts;
- decommission and fully rehabilitate No.1 & No.2 Shaft sites; and
- decommission and rehabilitate current Balgownie seam entries where and when ventilation and egress requirements permit.

16.4.4 ***Final Rehabilitation and Mine Closure***

While the life of the proposed project is up eighteen years it is identified that considerable resources remain for the life of the mine to be extended beyond 30 years, subject to further applications and approvals. 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 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 are 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 DRE guidelines, current at that time.

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 15.2* details the key items and their rehabilitation potential especially any potential whereby these items can be de-commissioned and rehabilitated within the life of this Project.

Table 16.1 Catchment Rehabilitation Schedule

Item #	Item Description	Comments
1	Shafts Sites 1,& 2	Progressive
	Shafts 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' – earlier de-commissioning where possible within the life of the Project.

'Operational' – currently in use.

Mining Area

The mining area to the west of Russell Vale is controlled and managed by SCA. The majority of this area is native bushland that will not be cleared or modified by the operation and will not require rehabilitation, with the exception of the shaft sites. Any clearance of vegetation would be subject to active rehabilitation via specific management plans developed with the approval of the SCA.

Shaft Sites

It is expected that No.1 and No.2 Shafts will be sealed approximately 10 to 12 years into the operation while No.3, No.4 and No.5 Shafts will be sealed in approximately 30 years' time as they have the potential to be used for the extended mine life. It is proposed that all infrastructure be removed from Shaft sites 1, 2, 3 and 5 and they be managed in accordance with approved and establish revegetation plans. This revegetation plan will be developed in consultation with SCA and consider but not be limited to final landform, seedling selection, planting and weed management.

Possible future land uses for No.4 Shaft site may include:

- remediation back to natural bushland; or

- conversion of facilities to utilise them for other activities ancillary to the mine such as a facility for alternative methods of methane gas capture/management; or

- retaining facilities and conversion for use as 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, Wongawilli and Bulli seams have extensive resources remaining in the area. This site remains as the primary main access for the mine.

Russell Vale Site – Mine Closure

The Russell 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 may continue beyond the current application. Notwithstanding this, it is anticipated that rehabilitation of the Colliery will be done on a progressive basis including the following:

- ongoing maintenance and rehabilitation at the Russell Vale site including removal of all redundant infrastructure such as water pipelines and items of mining equipment no longer required;

- undertake a heritage inventory/ archival recording of the Russell Vale site. This will include an assessment of the 1887 portal;

- staged site rehabilitation at Russell Vale while continuing extraction of the Bulli and Wongawilli seams; this will include rehabilitation of any mine entrances no longer required and remediation of unused areas;

- sealing Russell Vale mine adits at the completion of mining which is anticipated to be required in approximately 30 years' time;

- undertake final rehabilitation of the Russell Vale site and commence staged site development for an alternative use; and

- refine the rehabilitation cost schedule list of items and reassess the costs associated with this schedule.

Table 15.3 details the key items and their rehabilitation potential and also outlines the Russell Vale Rehabilitation Schedule.

Table 16.2 Rehabilitation Schedule

Item #	Item Description	Comments
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

Item #	Item Description	Comments
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 Creek-realignment	Operational
13	Other Structures - requiring care and maintenance that have historical significance	Progressive
14	Third Party Project Management	Progressive

Definitions

'Progressive' - earlier de-commissioning where possible within the life of the project.
'Operational' - currently being utilized.

16.4.5 *Unplanned Mine Closure*

It is envisaged that extraction at the Colliery may continue beyond this current application and accordingly a detailed closure plan has not been developed. Notwithstanding this, a contingency closure plan has been developed that covers the event of 'Sudden (Unplanned) Closure' as raised in ANZMEC Strategic Framework for Mine Closure.

Under this plan, all workings under the Cataract Reservoir have been designed to ensure that they remain stable in perpetuity and that the water body and the dam wall structure are not impacted.

Ongoing contingencies have been developed with the Dams Safety Committee to ensure that suitable seals are installed in the mine and at the Mine entries. Full decommissioning of mine infrastructure in compliance with regulatory standards would be in keeping with the rehabilitation objectives as outline and discussed in *Section 16.2*.

16.5 *CONCEPTUAL LANDFORM DESIGN*

As 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. A plan for rehabilitation of the Russel Vale site would be developed in consultation with the landowner and relevant authorities.

16.6 *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 it is envisaged that operations at NRE No 1 Colliery may extend beyond the life of this current application. 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/or shafts and stabilisation of slopes and embankments.

The mining area to the west of the Russell Vale site is controlled and managed by SCA. The majority of this area is native bushland that will not be disturbed directly by the proposal and will not require rehabilitation, with the exception of the shaft sites upon decommissioning.

Rehabilitation and mine closure objectives for the NRE No.1 Colliery have been developed having regard to previous land use activities, 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 beyond the life of this Project. 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 the 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 DRE guidelines. Possible future land uses for No.4 Shaft site may include:

- remediation back to natural bushland; or
- conversion of facilities to utilise them for other activities ancillary to the mine such as a facility for alternative methods of methane gas capture/management; or
- retaining facilities for use as an administration buildings for SCA or NPWS.

Alternatively, the site may continue to operate as a facility to recover coal, beyond the life of this Project, as the Balgownie, Wongawilli and Bulli seams have extensive resources remaining in the area. This site remains as the primary access for the mine.