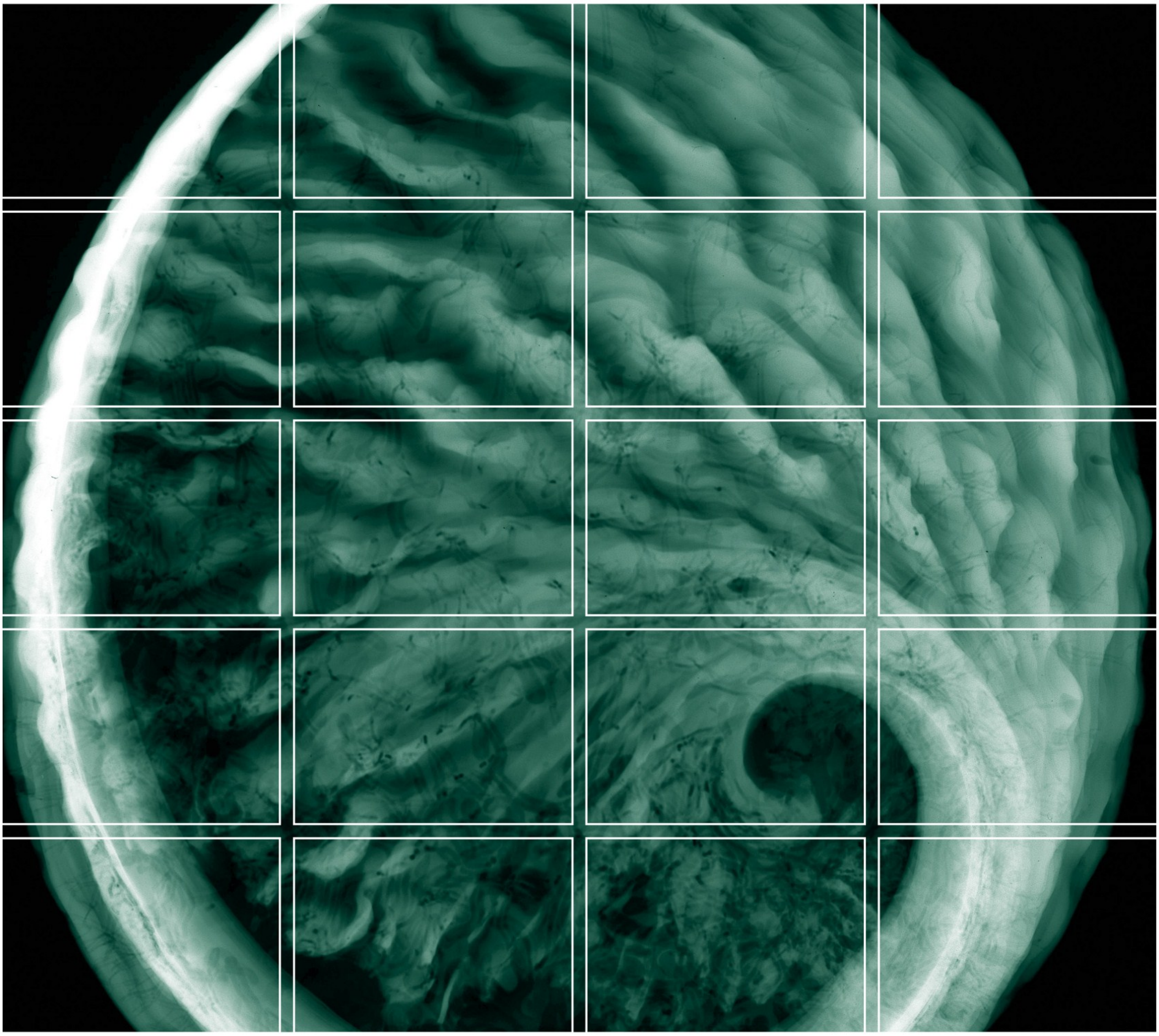

NRE No.1 Colliery Project Application (09_0013)

Environmental Assessment
Volume II– Annexes A to I

Gujarat NRE Coking Coal Pty Ltd

February 2013

0079383

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Annex A

DGR's

NSW GOVERNMENT
Department of Planning

Major Projects Assessment
Mining
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Room 305
23-33 Bridge Street
GPO Box 39
SYDNEY NSW 2001

Our Ref: 9042764-1

Dr Chris Harvey
Gujarat NRE Minerals Ltd
PO BOX 281
FAIRY MEADOW NSW 2519

Dear Dr Harvey

Director-General's Requirements
NRE No. 1 Colliery Project
Application Number: 09_0013

I refer to your re-lodged project application for the NRE No. 1 Colliery Project, received by the Department on 13 August 2009.

I have attached a copy of the Director-General's requirements for the project. These requirements are identical to those issued in respect of your earlier application. They were prepared in consultation with the relevant agencies, and are based on the information you have provided to date. I have also attached a copy of the agencies' comments for your information.

Please note that the Director-General may alter these requirements at any time.

If your proposal is likely to have a significant impact on matters of National Environmental Significance, it will require an approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval is in addition to any approvals required under NSW legislation. It is your responsibility to contact the Department of Environment, Water, Heritage and the Arts in Canberra (6274 1111 or http://www.environment.gov.au) to determine if the proposal requires an approval under the EPBC Act. The Commonwealth Government has accredited the NSW environmental assessment process, so if it is determined that an approval is required under the EPBC Act, please contact the Department immediately as supplementary Director-General's requirements may need to be issued.

I would appreciate it if you would contact the Department at least two weeks before you propose to submit your Environmental Assessment for the project. This will enable the Department to determine the:

- applicable fee (see Division 1A, Part 15 of the *Environmental Planning and Assessment Regulation 2000*); and
- number of copies (hard-copy or CD-ROM) of the Environmental Assessment that will be required for exhibition purposes.

Once it receives the Environmental Assessment, the Department will review it in consultation with the relevant agencies to determine if it adequately addresses the Director-General's requirements, and may require you to revise it prior to public exhibition.

The Department is required to make all the relevant information associated with the project publicly available on its website. Consequently, I would appreciate it if you would ensure that all the documents you subsequently submit to the Department are in a suitable format for the web, and arrange for an electronic version of the Environmental Assessment to be hosted on a suitable website during the exhibition period.

If you have any enquiries about these requirements, please contact Alison O'Reilly on 9228 6339 or Alison.OReilly@planning.nsw.gov.au.

Yours sincerely

18.8.09

Chris Wilson
Executive Director
Major Project Assessment
As delegate for the Director-General

Director-General's Requirements

Section 75F of the *Environmental Planning and Assessment Act 1979*

Application Number	09_0013
Project	The NRE No. 1 Colliery Project, which includes: • augmenting, upgrading and using the existing infrastructure at the mine; • extracting up to 3 million tonnes of run-of-mine coal a year from the Bulli, Balgownie and Wongawilli coal seams for a period of up to 20 years using longwall, pillar extraction and cut and flit mining methods; • transporting run-of-mine coal from the mine by road; and • rehabilitating the site.
Location	Approximately 8 kilometres north of Wollongong
Proponent	Gujarat NRE Minerals Ltd
Date of Issue	18 August 2009
General Requirements	The Environmental Assessment of the project must include: • an executive summary; • a detailed description of the following within the NRE No. 1 Colliery holdings and any associated reject disposal areas: - historical mining operations; - existing and approved mining operations/facilities, including any statutory approvals that apply to these operations/facilities; and - the existing environmental management and monitoring regime; • a detailed description of the project, including the: - need for the project; - alternatives considered, including a justification for the proposed mine plan/s and coal rejects disposal strategy on economic, social and environmental grounds; - likely staging of the project; and - plans of any proposed building works; • a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment; • a detailed assessment of the key issues specified below, and any other significant issues identified in the risk assessment (see above), which includes: - a description of the existing environment, using sufficient baseline data; - an assessment of the potential impacts of all stages of the project, including any cumulative impacts, taking into consideration any relevant guidelines, policies, plans and statutory provisions (see below), and the findings and recommendations of the recent Southern Coalfield inquiry; - a description of the measures that would be implemented to avoid, minimise, mitigate, rehabilitate/remediate, monitor and/or offset the potential impacts of the project, including detailed contingency plans for managing any potentially significant risks to the environment; • a statement of commitments, outlining all the proposed environmental management and monitoring measures; • a conclusion justifying the project on economic, social and environmental grounds, taking into consideration whether the project is consistent with the objects of the *Environmental Planning & Assessment Act 1979*; • a signed statement from the author of the Environmental Assessment, certifying that the information contained within the document is neither false nor misleading.
Key Issues	• **Subsidence** – including: - accurate predictions of the potential subsidence effects of the proposed mine plan/s, and a sensitivity analysis of these predictions; and

	- a detailed assessment of the potential impacts and environmental consequences of these subsidence effects on both the natural and built environment, paying particular attention to significant natural features, Sydney Catchment Authority assets and Mount Ousley Road; • **Soil & Water** – including: - a detailed assessment of the potential impacts of the project on the quantity, quality and long-term integrity of the surface and ground water resources in the project area, paying particular attention to the Upper Nepean River sub-catchment (Metropolitan Special Area), the discharge of mine water and surface runoff into the Bellambi Gully creek and Bellambi Lagoon; - site water balance, including a detailed description of the measures that would be implemented on site to minimise the water use of the project; • **Biodiversity** – including: - accurate estimates of any vegetation clearing or other impacts; - a detailed assessment of the potential impacts of the project on any terrestrial and aquatic threatened species, populations, ecological communities or their habitats; and - a detailed description of the measures that would be implemented to maintain or improve the biodiversity values of the surrounding region in the medium to long term; • **Heritage** – including the potential Aboriginal and non-Aboriginal heritage impacts of the project, both within the surface infrastructure areas and the proposed mining area; • **Noise** – including on-site construction and operational noise and off-site road noise and vibration impacts from the haulage of coal along the coal transport corridor to Port Kembla Coal Terminal; • **Air Quality** – including a consideration of the impacts that surface infrastructure operations and coal haulage by trucks could have in the local air shed and in areas along the coal transport corridor; • **Greenhouse Gas** – including: - a quantitative assessment of the potential scope 1, 2 and 3 greenhouse gas emissions of the project, and qualitative assessment of the potential impacts of these emissions on the environment; - a detailed description of the measures that would be implemented on site to ensure that the project is energy efficient; and - possible alternatives for the use or combustion of methane, rather than direct venting to the atmosphere; • **Transport** - including a detailed assessment of the potential impacts of the project on the safety and performance of the road network, specifically along the coal transport corridor; • **Waste** – including: - estimates of the quantity and nature of the potential waste streams of the project, including details on any waste water management systems; - a detailed description of the measures that would be implemented to minimise, reuse, recycle and dispose of any waste produced on site; • **Hazards** – paying particular attention to public safety; • **Rehabilitation** – including a detailed description of the proposed rehabilitation strategy for the mine, taking into consideration any relevant strategic land use planning or resource management plans or policies; and • **Social & Economic** – including the costs of rehabilitation, remediation and repair.
References	While not exhaustive, the following attachment contains a list of the guidelines, policies, and plans that may be relevant to the environmental assessment of the project.
Consultation	During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups or affected landowners.

	In particular you should consult with the: • Department of Environment, Climate Change and Water; • Department of Industry and Investment; • Sydney Catchment Authority; • Dam Safety Committee; • Mine Subsidence Board; • Roads and Traffic Authority; • Department of Lands; and • Wollongong and Wollondilly Councils. The consultation process, and the issues raised during this process, must be described in the Environmental Assessment.
Deemed refusal period	120 days

Policies, Guidelines & Plans

Aspect	Policy /Methodology
Risk	
	AS/NZS 4360:2004 Risk Management (Standards Australia)
	HB 203: 203:2006 Environmental Risk Management – Principles & Process (Standards Australia)
	Risk Management Handbook for the Mining Industry (DPI)
	Risk Management Policy Framework for Dam Safety (Dam Safety Committee)
Subsidence	
	Guideline for Application for Subsidence Management Approvals (DMR)
Soil and Water	
Soil	Rural Land Capability Mapping (DLWC)
	Agricultural Land Classification (DPI)
	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC & NHMRC)
	National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC)
	Draft Guidelines for the Assessment & Management if Groundwater Contamination (DECC)
	State Environmental Planning Policy No. 55 – Remediation of Land
	Managing Land Contamination – Planning Guidelines SEPP 55 – Remediation of Land (DOP)
Surface Water	National Water Quality Management Strategy: Water quality management - an outline of the policies (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Policies and principles - a reference document (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Implementation guidelines (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC)
	State Water Management Outcomes Plan
	NSW Government Water Quality and River Flow Environmental Objectives (DECC)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC)
	Drinking Water Catchments Regional Environmental Plan No. 1
	Managing Urban Stormwater: Soils & Construction (Landcom)
	Managing Urban Stormwater: Treatment Techniques (DECC)
	Managing Urban Stormwater: Source Control (DECC)
	Floodplain Management Manual (DNR)
	Floodplain Risk Management Guideline (DECC)
	A Rehabilitation Manual for Australian Streams (LWRRDC and CRCCH)
	Technical Guidelines: Bunding & Spill Management (DECC)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Effluent Management (ARMCANZ/ANZECC)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Use of Reclaimed Water (ARMCANZ/ANZECC)
	Environmental Guidelines: Use of Effluent by Irrigation

	Special Areas Strategic Plan of Management 2007
	State Water Management Outcomes Plan
	Environment and Health Protection Guidelines: 'Onsite sewage Management for Single Households', February 1998 (Silver Book)
Groundwater	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	NSW State Groundwater Policy Framework Document (DLWC)
	NSW State Groundwater Quality Protection Policy (DLWC)
	NSW State Groundwater Quantity Management Policy (DLWC) Draft
	NSW State Groundwater Dependent Ecosystems Policy (2002)
	Guidelines for Groundwater Protection in Australia (1995)
	Guidelines for the Assessment and Management of Groundwater Contamination (2007)
Flora and Fauna	
	Draft Guidelines for Threatened Species Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979* (DEC)
	NSW Groundwater Dependent Ecosystem Policy (DLWC)
	Policy & Guidelines - Aquatic Habitat Management and Fish Conservation (NSW Fisheries)
	Policy & Guidelines - Fish Friendly Waterway Crossings (NSW Fisheries)
	State Environmental Planning Policy No. 44 – Koala Habitat Protection
	Draft Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (2004)
	Green Offsets for Sustainable Regional Development: Concept Paper (NSW Government, May 2002)
Heritage	
Aboriginal	Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (DEC)
	Aboriginal Cultural Heritage standards and Guidelines Kit
	Interim Community Consultation Requirements for Applicants
Non- Aboriginal	NSW Heritage Manual (NSW Heritage Office & DUAP)
	The Burra Charter (The Australia ICOMOS charter for places of cultural significance)
	Strategic Management Plan for Historic Coal Mine Sites of the Illawarra 2006
Noise	
	NSW Industrial Noise Policy (DECC)
	Environmental Criteria for Road Traffic Noise (NSW EPA)
	Environmental Noise Control Manual (DECC)
Air Quality	
	Protection of the Environment Operations (Clean Air) Regulation 2002
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC)
Greenhouse Gas	
	AGO Factors and Methods Workbook (AGO)
	Draft Guidelines: Energy and Greenhouse in EIA, NSW Department of Planning, 2002
	The Greenhouse gas Protocol: Corporate Standard, World Council for Sustainable Business Development & World Resources Institute
	National Greenhouse Accounts (NGA) Factors, Australian department of Climate Change, 2008
	Guidelines for Energy Savings Action Plans (DEUS, 2005)

Transport	
	Guide to Traffic Generating Development (RTA)
	Road Design Guide (RTA)
Waste	
	Waste Avoidance and Resource Recovery Strategy 2007 (DECC)
	Environmental Guidelines: Solid Waste Landfills (EPA)
	Environmental Guidelines: Assessment, Classification, and Management of Non-Liquid and Liquid Waste (EPA)
Hazards	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (DUAP)
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis
Rehabilitation	
	Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia)
	Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia)
	Strategic Framework for Mine Closure (ANZMEC)
Social & Economic	
	Draft Economic Evaluation in Environmental Impact Assessment (DOP)
	Techniques for Effective Social Impact Assessment: A Practical Guide (Office of Social Policy, NSW Government Social Policy Directorate)
Strategic Plans	
	Illawarra Regional Strategy (DOP)
	Illawarra Regional Environmental Plan No. 1
	Special Areas Strategic Plan of Management 2007 (SCA & DEC)
	Illawarra Strategic Management Plan
	Illawarra Land Use Review Strategy

Annex B

Water Management

Report

Water Management Report Gujarat NRE No. 1 Colliery Major Works Part 3A

Prepared for Gujarat NRE Coking Coal Limited (NRE) (Client)

By Beca Pty Ltd (Beca)
ABN: 85 004 974 341

7 February 2011

Revision History

Revision Nº	Prepared By	Description	Date
A	Johanna Schortinghuis	Draft For use in 3 A approval submission	2 July 2010
B	Johanna Schortinghuis	Update of draft with additional information	8 July 2010
C	Johanna Schortinghuis	Update of draft with comments from NRE	13 July 2010
D	Deepika Jaduram	Update of draft with comments from site visit and NRE	22 October 2010
E	Dianne Thomas	Incorporate ERM and Gujarat comments	14 November 2010
F	Deepika Jaduram	Final revision incorporating required changes by client and ERM	29 November 2010
G	Dianne Thomas	Revised to include ERM and Olsen comments	13 December 2010
H	Dianne Thomas	Revised to reflect 3.1ML/d water yield from Wongawilli and Bulli not 4.2ML/d. Expand on irrigation reuse at shaft #4 and soil moisture monitoring.	25 January 2011
I	Tiffany Chan	Revised to incorporate ERM comments on executive summary and Figure 10	7 February 2011

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Appendices

1 Executive Summary

Gujarat NRE Coking Coal Limited (NRE) is seeking approval for the expansion of mining operations and upgrade of associated surface facilities at the NRE No. 1 Colliery in the Southern Coalfield. NRE's current mining operations involving the NRE No. 1 Colliery and No. 4 Shaft site are focused on mining the Bulli seam, which is the top most coal seam. The proposed expansion plan is to expand the mining operation into the Wongawilli coal seam, which will have different mine water production rates.

The purpose of this document is to describe current water management practices at NRE's No. 1 Colliery and Shaft No. 4 sites and outline changes to onsite water management that form part of the proposed mine expansion. This report will form part of the Environmental Assessment prepared by ERM under Part 3A of the Environmental Planning and Assessment Act (EP&A Act).

It is anticipated that no alterations to the existing discharge licence will be required as a result of the proposed expansion and upgrade works. Discharge will continue to occur in accordance with current licence conditions, as outlined in Section 3.5. It is anticipated that there will be no significant change in the discharge water quality. Therefore future discharge water quality should continue to be similar to background water quality that is characteristic of creeks in the area. Treatment prior to discharge will consist of solids removal to remove sediments and coal fines.

Expansion of mining operations to include the Wongawilli seam will change the water flows at the mine.

The anticipated total water production from mining operations at the end of this project is shown in table 3. Water make from Bulli and Wongawilli seams will total 3.1ML/d. 1.1ML/d from Bulli and 2.0ML/d from Wongawilli.

It is expected that the total water demand for mining operations will be 4.2 ML/d, which is 2 ML/d above the current water use. Demand is more than the 3.1ML/d estimated to be extracted during mining and will require water from external sources. The preferred source will be bulk raw water from Sydney Catchment Authority.

The existing thickener tank will remain for treatment of the dirty stormwater and mine water. Any treated water that is not reused on site will be discharged into Bellambi Gully. It is proposed that the sludge from the existing thickening tank will be diverted from being re-circulated in the treatment process via Dam 1. Instead the sludge will be dewatered and the solids cake will go to stockpile, with the filtrate water being recycled back into the mine process water system. Dewatering technologies such as a centrifuge or recessed-plate filter press will be investigated further for sludge dewatering at the mine.

The proposed modifications at the Russell Vale and Shaft No. 4 sites include:

- increased water used on site when mining the Wongawilli seams;
- increase water use at Russel Vale and Shaft No. 4 when mining personnel move between the sites;
- new 6ML dam below stockpile at Russell Vale to enhance sediment control;
- improve solids dewatering and disposal.

2 Site Expansion Project Summary

2.1 Project Background

NRE is seeking approval for the expansion of its existing operations and upgrade of associated surface facilities at its' Russell Vale site. This upgrade will have an estimated capital investment value of $250 million. It will include the following activities:

- coal extraction (from the Bulli, Balgownie and Wongawilli seams) ramping up to coal production of up to 3 million tonnes per annum (mpta) with a projected mine life of at least 18 years;
- upgrade of existing mine infrastructure and services at Russell Vale, including surface conveyors and coal handling infrastructure, coal sizing, screening, crushing and load-out facilities, site noise and dust controls and a stockpile for run-of-mine (ROM) coal;
- continued use of No. 4 Shaft for mine access (for men and material), bath house, offices and parking area, there is the potential to relocate to Russel Vale during mining of Wongawilli east;
- essential maintenance and refurbishment of existing ventilation shafts and power and water supply arrangements;
- upgrade of all site water management including mine water and stormwater controls;
- continued road haulage of the unwashed coal to Port Kembla Coal Terminal for shipment to India, using the existing haulage route; and
- progressive site rehabilitation.

Extensive underground mining has been undertaken within the project application area, dating from the late nineteenth century.

NRE's current mining operations involving the Russell Vale and No. 4 Shaft sites are focused on mining the Bulli seam, which is the top most coal seam. The proposed plan is to expand the mining operation into the Wongawilli coal seam, which is lower down in the southern coal seam measures and will have different mine water production from the Bulli seam coal.

Pursuant to provisions of State Environmental Planning Policy – Major Projects 2005, the Project requires approval under Part 3A of the EP&A Act. This report provides water management information for expansion of the coal mining operation of the NRE Colliery at Russel Vale and access Shaft No. 4.

2.2 Operating Environment

NRE No. 1 Colliery Coal mine is located at Russell Vale, which is approximately 8 km north of Wollongong and 70 km south of Sydney, within the local government areas of Wollongong and Wollondilly in the Illawarra region of NSW. The location is shown in Figure 1.

The site includes the Illawarra Escarpment. The escarpment reaches up to 400m AHD elevation and slopes steeply down to the foothills at approximately 30m AHD. The steep slopes of the escarpment are heavily vegetated.

The Russell Vale site is located on the lower slopes and foothills of the escarpment at approximately 140m AHD elevation. The Russell Vale site is bounded by the Princes Highway to the east, residential areas of Russell Vale and Corrimal to the north and south respectively and the Woronora Plateau to the west. The Russell Vale golf course (former waste disposal area) also bounds the site to the north.

The underground lease area lies under the Woronora Plateau west of the escarpment. The surface land of the plateau is covered by native bush land and the Cataract Dam, with perennial creeks, ephemeral tributary streams and upland headwater swamps.

In addition to the Russell Vale site, NRE has surface leases at one access shaft (No. 4 Shaft) and four ventilation shaft sites (No. 1, 2, 3 and 5 Shafts) across the mine operations.

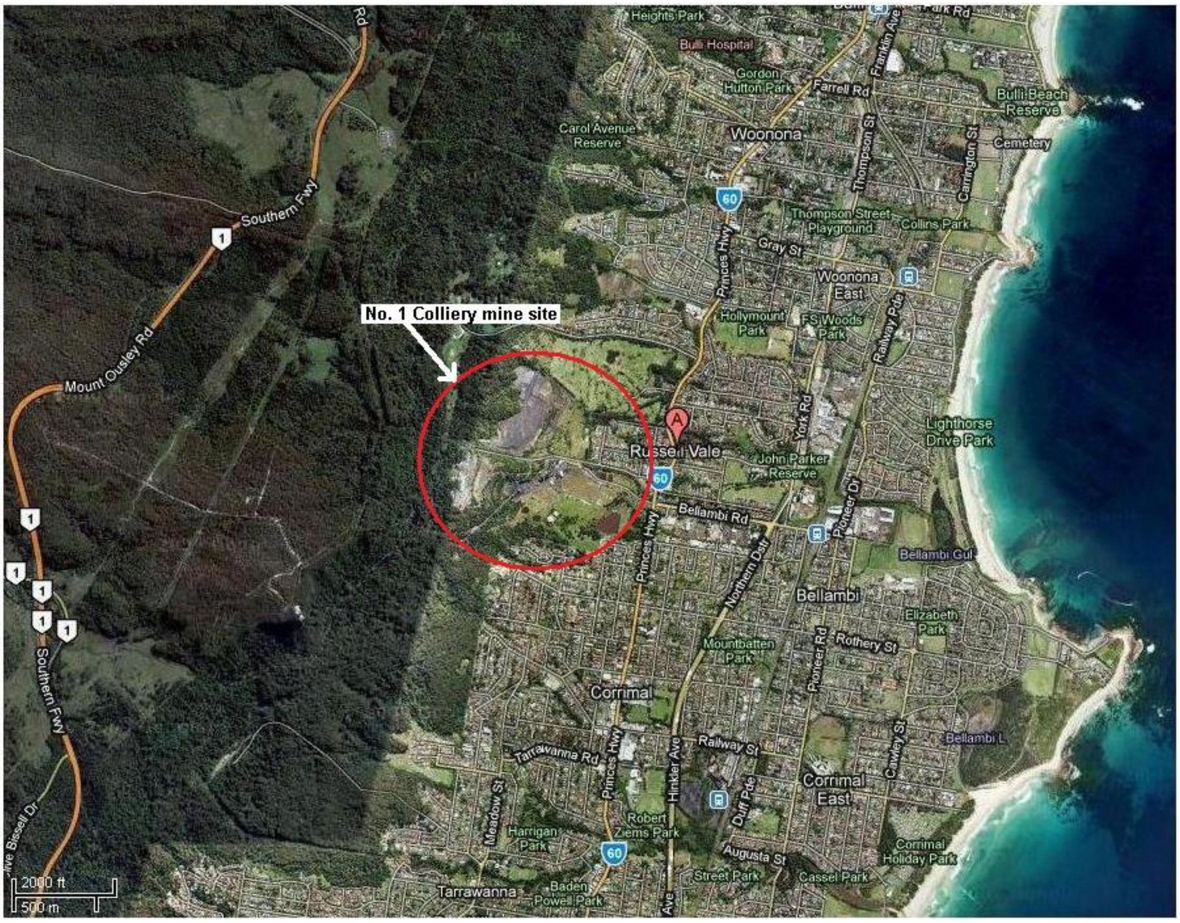


Figure 1 – Location of Gujarat NRE's No. 1 Colliery

3 Description of Existing Water Management System – Russell Vale and No. 4 Shaft

Sections 3.1 to 3.5 describe current water management practices at NRE's surface facilities at Russell Vale. Section 3.6 describes current water management practices at No. 4 Shaft.

The water management system at NRE's No. 1 Colliery mine site at Russell Vale consists of the following components:

- Potable water;
- Waste water;
- Process and mine water;
- Stormwater; and
- Licensed discharge of treated water.

Dirty stormwater management is designed to mitigate a 1 in 10 year storm event. Mine water and dirty stormwater are mixed together in the stormwater control dam and treated together in the thickener. These systems are described in more detail following.

3.1 Potable Water at Russell Vale

Potable water supplied by Sydney Water is primarily used for surface facilities including the administration building, bath houses, truck washer, workshop and toilets, and is generally not used for mining operations.

While infrequently used, there is provision to supply emergency supplies of potable water to the mine process water system. A simplified illustration of the potable water system is shown in figure 2. It should be noted that while there is a potable water connection to the Truck Washer, it predominantly uses process water. Used water is recovered from the truck washer and routed to Dam 2 for reuse onsite, and is not discharged to sewer.

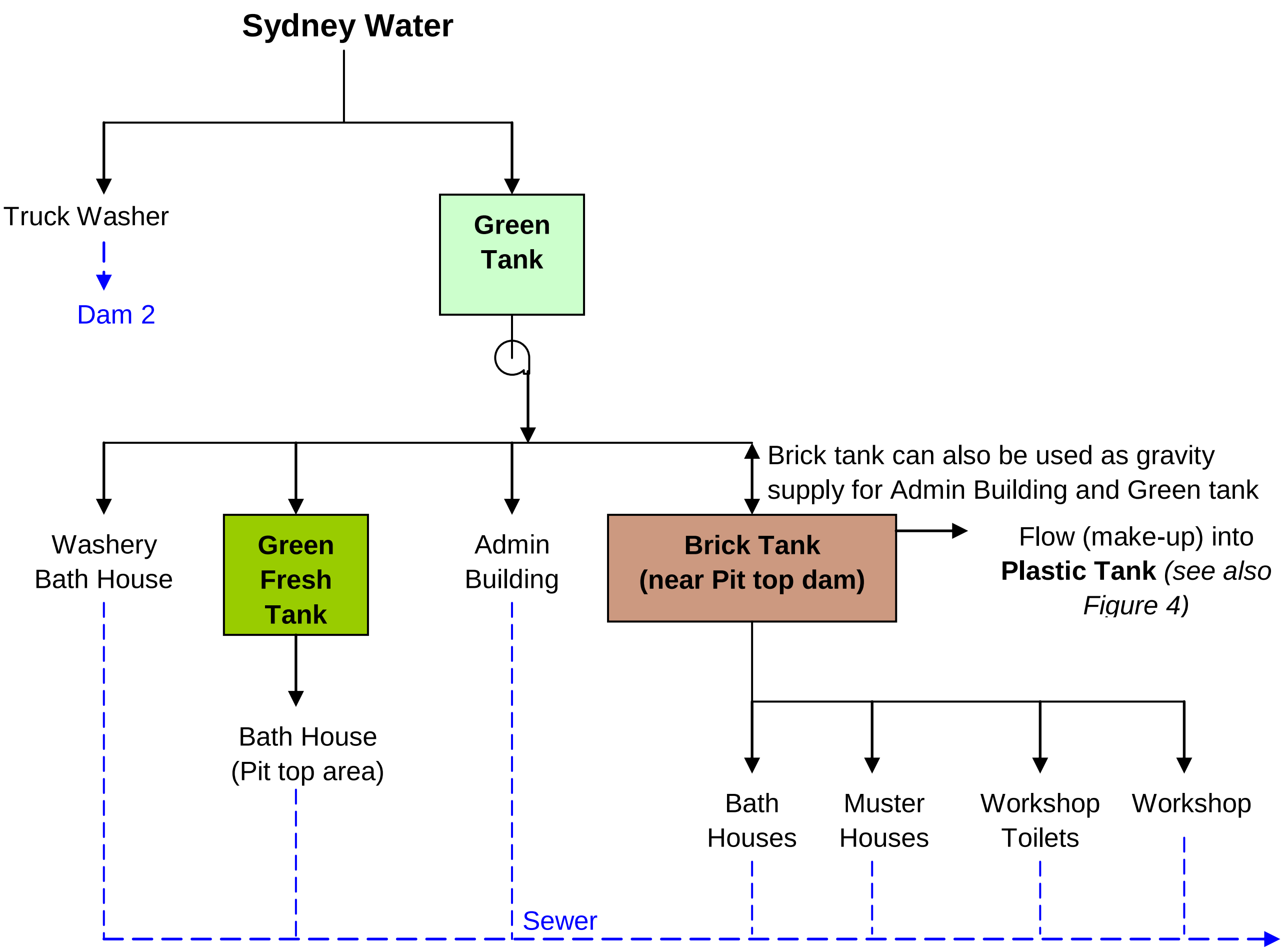


Figure 2 - Schematic of the current potable water supply and sewer discharge for NRE No. 1 Colliery

(blue dotted lines indicate sewer discharge).

3.2 Waste Water at Russell Vale

Black and grey water generated at the Russell Vale site is discharged to the Sydney Water sewerage system, as indicated on Figure 2.

3.3 Process and Mine Water at Russell Vale

3.3.1 Process Water Use

Process water is generally used to supply underground mine workings, fire water, truck filling points for site dust suppression, wash-down and on the stock piles, as illustrated in Figure 3. On average, current daily process water use on site is approximately 2.4 ML/d.

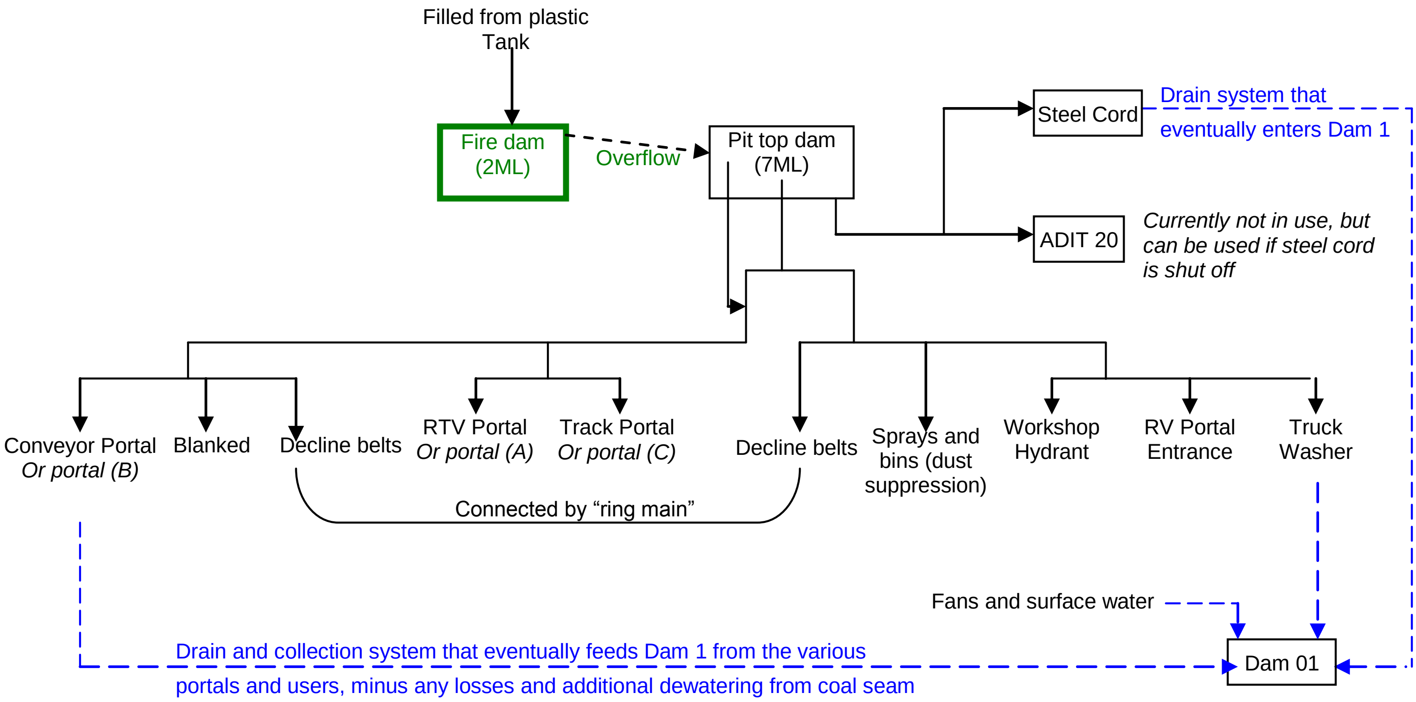


Figure 3 - Schematic of the current process water supply for NRE Russell Vale Colliery

(The black dotted lines denote overflow, and the blue dotted lines denotes 'un-processed' water, which can include used process water and water from the coal seams).

3.3.2 Process Water Supply

Process water supply is made up of a combination of the following water sources, as shown in Figure 4:

- Clean raw water from Corrimal Springs (approximately 0.1 ML/d);
- Mine dewatering water from No. 4 Shaft (also referred to as RV track portal) (approximately 0.5 to 1 ML/d);
- Treated water from the Thickener Tank (approximately 1.7 ML/d); and
- Potable water from the Brick Tank (generally not used)

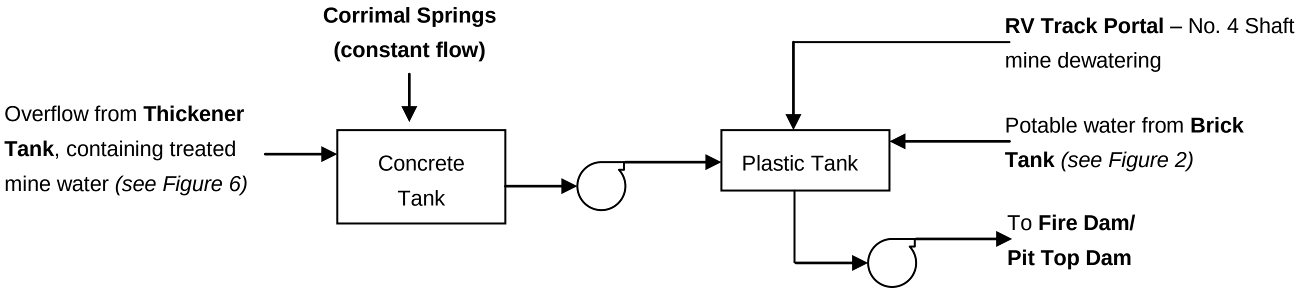


Figure 4 – Schematic of Process Water Supply

Excess water from mine dewatering from No. 4 Shaft (shown as RV track portal in figure 4) is routed to the Plastic Tank when storage dams at the No. 4 shaft site have reached full capacity. This allows excess water to be used onsite for process needs and ultimately treated and discharged, as required, from the Russell Vale site.

Corrimal Springs is a natural spring which flows to the surface within NRE's site. The spring is captured by directing the water flow of approximately 0.1 ML/day to the concrete tank for use on site. This arrangement is understood to have been in place for over 50 years.

Potable water from the Brick Tank can also be routed to the Plastic Tank for process use. Potable water is generally not used to supply process water however may be drawn on during emergencies to allow make-up of the Pit Top Dam.

3.3.3 Process Water Treatment and Discharge

The following used process waters and mine dewatering streams are combined with stormwater runoff from disturbed areas for treatment prior to reuse onsite, or discharge to Bellambi Gully as required:

- Mine dewatering water;
- Waste water from ventilation fan scrubbers;
- Truck wash water; and
- Sludge from the Thickener Tank.

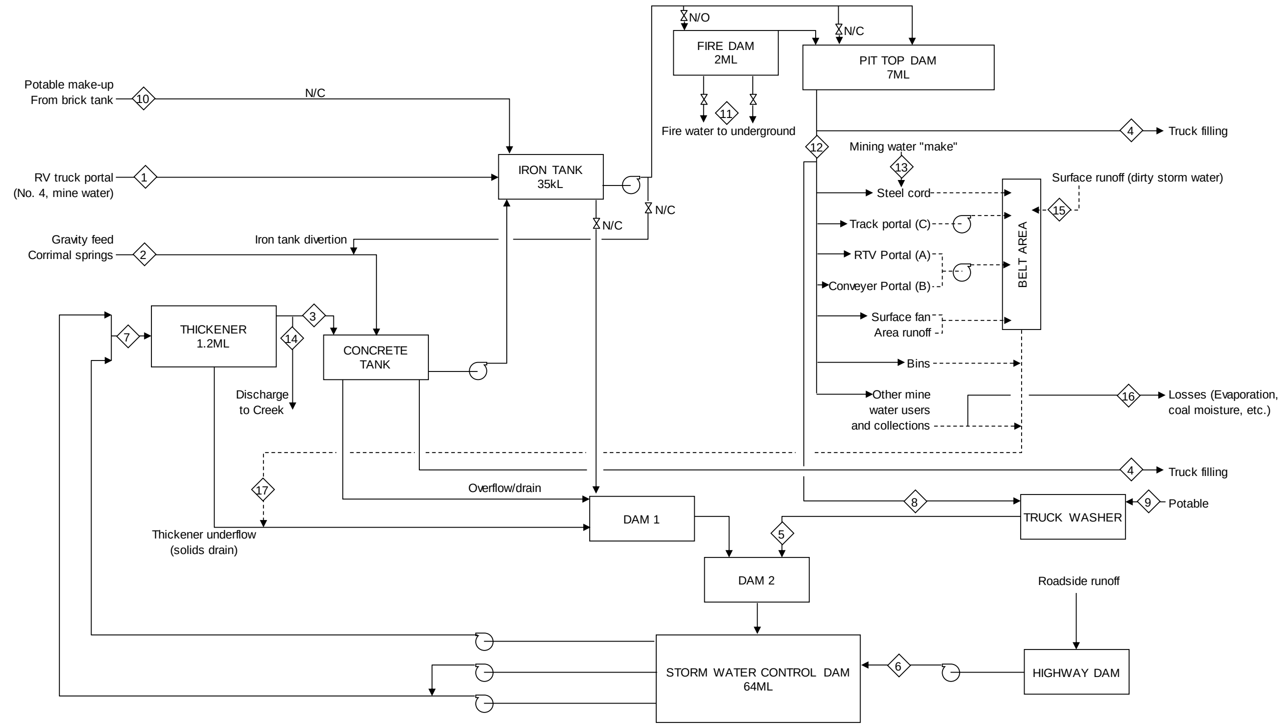
3.3.4 Site Process Water Balance

A summary of water use on site is shown below in Figure 5. This figure combines the various aspects of water on site into an overall flow diagram and flow balance. As limited flow information was available; the balance presented is for the average case only and is based on the following assumptions:

- Supply and recovery of water to and from the mine is not a simple distribution and was therefore simplified to show only the total combined supply (labelled stream 12) and return (stream 17) of water to and from the mine. To account for any future balances, provision was made to allow for additional mine water make-up (stream 13 that could result from mining a wetter seam) as well as any storm water or other surface water drains (stream 15) that might enter the system.
- The balance assumes flows for dry weather conditions. That is no flow from the Highway Dam (stream 6) and dirty storm water (stream 15).

- The balance assumes no flow from potable water make-up (stream 10) and no net “mine water make” or pump out (stream 13) from the mining of roadways in the Wongawilli seam (known as ‘Wonga Mains’). This is consistent with flow meter results communicated that indicate <0.1ML/day.
- The overall balance assumes continuous average normal flows for a 24 hour working day (except for the flows shown for stream 7 that is based on 0, 1 or 2 pumps running to meet the other "continuous stream” flows).
- The balance assumes non-continuous flows are successfully buffered by intermediate holding volumes in dams and tanks.
- The RV track portal pump out provided as a range of 0.5 to 1ML/day (0.5ML/day assumed normal and 1ML/day assumed as maximum for stream 1).
- Corrimal springs make-up (stream 2) rate assumed as 0.1ML/day.
- Thickener Tank overflow (stream 3) estimated from hydraulic difference between Thickener Tank and Concrete Tank with existing piping connection and valve fully open.
- Truck filling (stream 4) estimated from 13kL trucks at 10 trucks per day
- Stock pile (truck filling) and truck wash daily consumption was quoted as 9kL/h. The difference between this and truck filling is assumed to be truck wash (stream 8).
- Potable water to truck wash (stream 9) is assumed to be 25% of the mine water that is supplied to the truck wash.
- Water loss (stream 16) through evaporation, coal moisture, etc. from the system was assumed to be 5% of the water supply to the mine (stream 12).
- The balance of water was assumed to be discharged to the gully (stream 14).

The water balance shows that currently during dry weather conditions approximately 15kL/h of water could be discharged to the gully. This compares favourably with the 20kL/h hour average calculated from actual discharge data for the period July 2008 to June 2009. It is believed that the difference is probably made up of a small amount each for stream 13 (mine water make) and 15 (dirty storm water) respectively that was assumed to be zero for the purposes of this balance.



STREAM NUMBER		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
PARAMETER \ STREAM NAME		RV TRACK PORTAL PUMPOUT	CORRIMAL SPRINGS	CLARIFIER OVERFLOW	TOTAL TRUCK FILLING	TRUCK WASH COLLECT	WATER FROM HIGHWAY DAM	WATER FROM STORM WATER 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"	DISCHARGE TO CREEK	DIRTY STORM WATER	SYSTEM WATER LOSSES	NETT WATER FROM MINE
CONTINUOUS OR INTERMITTENT																		
FLOW RATE NORMAL	m^3/h	20.8	3.6	70.9	5.4	4.5	0.0	150.0	3.6	0.9	0.0	0.0	89.9	0.0	15.4	0.0	4.5	81.8
FLOW RATE NORMAL	ML/day	0.5	0.1	1.7	0.1	0.1	0.0	3.6	0.1	0.0	0.0	0.0	2.2	0.0	0.4	0.0	0.1	2.0
pH	-	8.7						9.1				8.7	8.9		9			
CHLORIDES	mg/litre	NA						NA				NA	NA		NA			
SULFATE (SO4)	mg/litre	NA						NA				NA	NA		NA			
CARBONATES (As CaCO3)	mg/litre	130						110				190	190		110			
APPEARANCE (TURBIDITY)	NTU	110						570				79	85		27			
ELECTRICAL CONDUCTIVITY	µS/cm	3700						1900				3700	3000		2100			
TSS	mg/litre	29						120				79	24		27			
TDS	mg/litre	2300						1200				2300	2200		1300			

Figure 5- Current Russell Vale flow diagram and balance summary

3.4 Stormwater at Russell Vale

Stormwater generated onsite is segregated into two streams, clean and dirty. Dirty stormwater consists of runoff from catchments that contain disturbed areas such as the coal stockpile area, unsealed roads and other disturbed mine areas. Clean stormwater consists of rainfall runoff from vegetated and clean hardstand areas where the risk of stormwater contamination is low.

3.4.1 Clean Stormwater

Clean stormwater catchments primarily consist of naturally vegetated escarpment. Clean stormwater is also generated from some operational areas that do not include stockpiling and haulage of coal. Clean rainfall runoff is collected in clean stormwater pipelines and transported across the site around and underneath the existing stockpile area to the western-most point of the site where it is discharged to Bellambi Gully.

The stormwater drainage system including description of stormwater sub-catchments is described in the "Gujarat NRE Stormwater Hydrology Review" (Beca, 2010) which is included in Appendix A of this report. The diversions described in the Hydrology report have been proposed and are subject to separate approval. These diversions will attenuate storm flow across the site, reducing the peak flow during storm events. The diversions will also reduce the chance of blockages and uncontrolled flows as the pipe flows are being replaced with channels, which are easier to inspect and maintain. These were covered in the previous NRE Part 3A submission to the Department of Planning (DoP) (No: 10 0046).

3.4.2 Dirty Storm Water

Dirty stormwater consists of runoff from disturbed catchments and includes:

- Runoff from unsealed surfaces;
- Run off from the ROM coal stockpile area;
- Roadside water runoff from the Highway dam; and
- First flush from the hardstand area in front of the portals.

Dirty stormwater is combined with mine dewatering water and used process water and in Dams 1 and Dam 2, prior to being routed to the 64ML Storm Water Control Dam (SWCD), as illustrated Figure 6, where it is stored prior to treatment for reuse or discharge from site. Dam 1 and Dam 2 provide holding volume to aid solids settling prior to discharge to the SWCD.

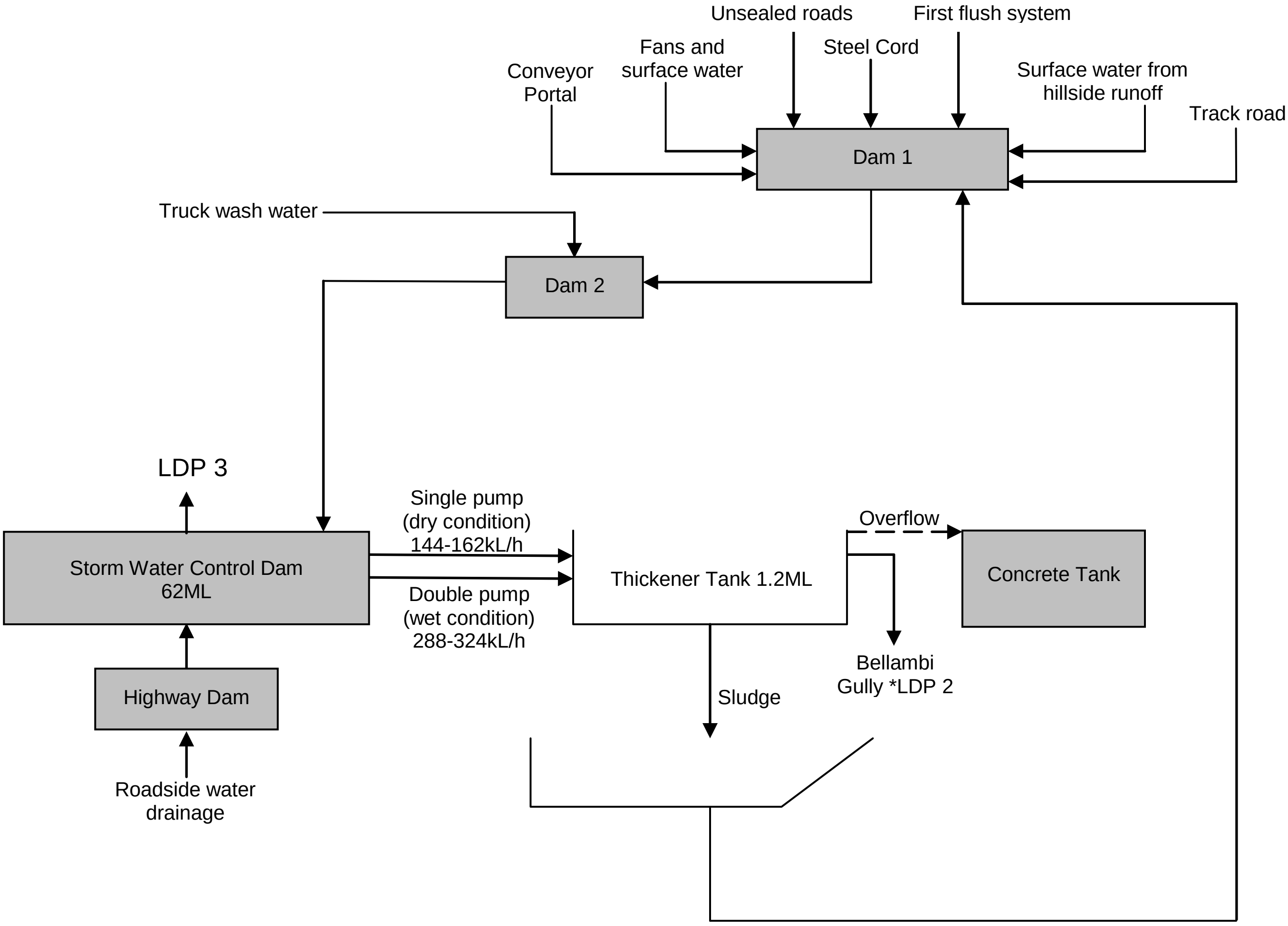


Figure 6 – Schematic of the current dirty stormwater flows and storages

From the SWCD, water is pumped to the Thickener Tank where suspended solids are removed with addition of flocculent/coagulant. Treated water from the Thickener Tank then flows either to:

- The concrete tank to be pumped via the plastic tank to the Fire Dam and Pit Top Dam for use as fire water and process water; or
- Licensed discharge point 2 (LDP 2) into Bellambi Gully under Environmental Protection Licence (EPL) 12040.

Solids from the Thickener Tank are returned to Dam 1. Accumulated solids are periodically removed (approximately every 3 to 4 months) from storage dams to maintain the required dam capacity.

The level of the SWCD is maintained with at least 30ML available volume to allow sufficient free capacity to contain stormwater flows resulting from a 10 year annual recurrence interval (ARI) storm event.

3.5 Environmental Protection Licence

NRE currently holds an Environmental Protection Licence (EPL12040) for operations at the NRE No. 1 Colliery. With regard to discharges to water, the EPL defines three licensed discharge points from the site (1, 2 and 3) and applicable concentration and volume limits.

Licence discharge point 1 (LDP1) consists of underground drainage from coal stockpile and forested area, and is located outside the lease area to the north of the main mine operations in the Russell Vale emplacement area. LDP1 is located at the concrete weir on the energy dissipater in Rath's Gully. The licence allows 50kL/day to be discharged from LDP1. No concentration limits apply to LDP1.

Licence discharge point 2 (LDP2) permits discharge of treated stormwater runoff and mine water from the Russell Vale site to Bellambi Gully. The discharge point is located downstream of the Thickener Tank at a pipe outlet. The licence requires water discharged from LDP2 to comply with the water quality limits shown in Table 1.

Table 1- Environmental Protection Licence Concentration Limits for LDP2

Pollutant	Units	100^{th} Percentile Concentration Limit
Oil and Grease	mg/L	10
pH	pH units	6.5 – 9.2
Total Suspended Solids	mg/L	50

The licence allows discharge of 2.5ML/day from LDP2 under dry weather conditions. The licence makes provision for wet weather under Section L4.2 Note 2: “For 72 hours following wet weather conditions, water may be discharged in excess of 2,500kL/day from Point 2, in order to allow the dam level to be quickly reduced to a safe level provided all practical measures are taken to minimise additional pollution caused by the wet weather.”

NRE monitors effluent discharged from LDP2 in accordance with licence requirements and submits a performance report and compliance statement to the Department of Environment, Climate Change and Water quarterly and annually. The 2009 annual report and compliance statement is provided in Appendix D.

It should be noted that reuse of process and mine water within the mining operation is the preferred and primary destination for water collected in the SWCD in order to minimise use of potable water onsite, and that discharge via LDP2 to Bellambi Gully is considered a secondary option.

Licence discharge point 3 (LDP3) refers to discharge of water that seeps through the dam wall immediately downstream of the SWCD. The SWCD is registered with the Dam Safety Committee (DSC), and the dam wall is designed to be permeable and slowly filter and discharge water. No volume or concentration limits apply to LDP3.

3.5.1 Water Quality Management Measures

Prior to discharge water is treated in the thickener (clarifier) on site. TSS is reduced to less than 50mg/L under the operating licence.

Chemicals are stored in accordance with Australian Standard requirements. Dosing of flocculent is metered and monitored on site using a computer controlled dosing system. Trigger points are built in to 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 system is operating as designed. *Info Tronix* completed the September 2010 audit.

3.6 Water Management at Shaft No. 4

There are five shafts within the Project area, four are exclusively ventilation shafts (1, 2, 3 and 5) and one shaft (Shaft No. 4) is for man, materials and ventilation.

Shaft No. 4 and associated facilities are located on the surface lease approximately 10 km northwest of the Russell Vale Site and surrounded by native bushland within the Sydney Catchment Authority Metropolitan Special Area. Site facilities at Shaft No. 4 include winder, offices, bath-house, stores, workshop, car parking, water management facility, sewage treatment plant, electrical substation and explosives magazine. Currently there are a total of 225 employees at the No. 4 Shaft site, spread over 3 shifts. Facilities at Shaft No. 4 are designed to accommodate far in excess of these personnel figures (approximately 1000 persons).

Proposed water management at Shaft No. 4 is described below and illustrated in Figure 7.

Potable water for drinking will continue to be supplied to the site using bottled drinking water. Other water uses will be sourced from Cataract Dam and treated prior to use in the offices and wash house.

As there is no Sydney Water sewage connection at the No. 4 Shaft site, black and grey water is treated onsite prior to disposal or reuse. Grey water refers to the wastewater generated from bath houses and general surface cleaning and is treated in a Pasveer wastewater treatment facility (referred to as Pasveer No. 1). Black water, consisting of sewage from toilets, urinals and hand basins is treated in a separate Pasveer wastewater treatment facility (referred to as Pasveer No. 2). Treated grey water is stored in the main collector dam prior to disinfection and use underground. Treated black water is disposed of via spray irrigation on site.

Oily water from the workshop enters the oil arrestor pit where grease and oil is trapped. From here the clean underflow water is transferred to the main collector dam for reuse.

Storm water generated onsite enters a collection chamber prior to release to the catchment, with overflow from this chamber directed to the first flush dam (which mainly collects storm water run-off from the car park) and to the main collector dam.

Process water supply for underground process use and fire fighting is provided from the main collector dam. Surplus process water flows to Russell Vale via underground pipes and pumps. Process water stored in the main collector dam consists of:

- Underground workings dewatering;
- Treated water from the workshop oil arrestor pit;
- Treated grey water from Pasveer No. 1;
- Excess stormwater that overflows from the stormwater collection chamber.

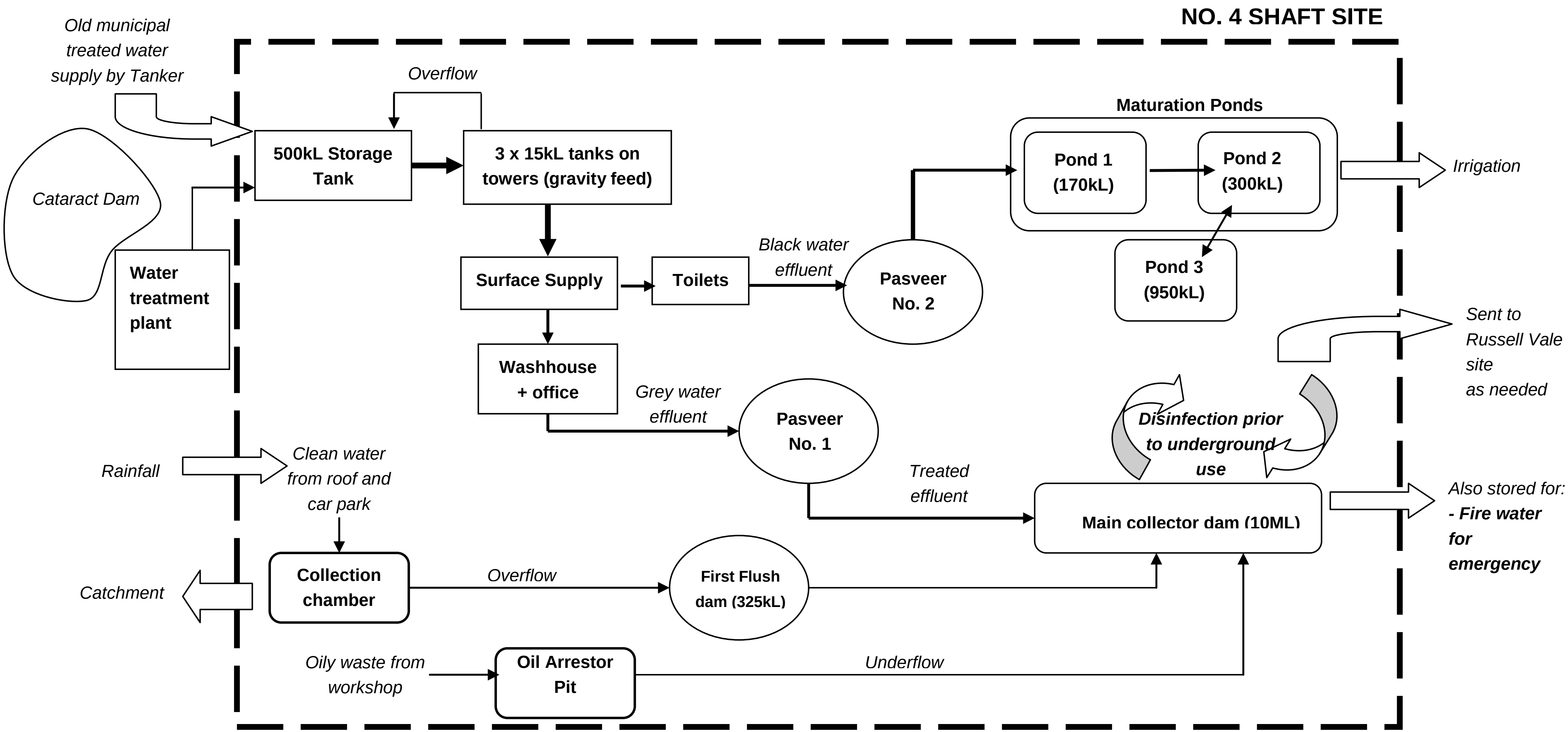


Figure 7- Schematic of the water flow and management system at Shaft No. 4

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

3.6.1 Cataract Dam Water Treatment

As noted above non-drinking water for use in the main building is sourced from Cataract Dam. Bottled water is supplied for drinking purposes.

The water quality from Cataract Dam is generally in accordance with the Australian Drinking Water Guidelines except for pathogens. Pathogens need to be removed using a disinfection process to protect the health of people washing in this water. Cataract Dam water occasionally has high levels of turbidity, which can compromise the effectiveness of disinfection.

In order to cater for these characteristics of the source water, additional treatment measures are implemented to protect worker health. Water treatment consists of:

- Filtration of the raw water supply to remove solids; and
- Disinfection to kill pathogens.

3.6.2 Black water

Waste water from the toilet facilities will continue to be treated in the No. 2 Pasveer ditch and maturation ponds. Following stabilisation in the maturation ponds, the water is then used to irrigate a grassed area on site with an approximate total utilisation area of 0.25 ha.

As shown in figure 7, there are two maturation ponds in series with a total storage capacity of 470kL. The third 950kL pond is for wet weather storage. 30 days storage is required in the maturation ponds for treatment. 30 days storage is 222kL. This leaves 248kL in the second maturation pond and 950kL in the third pond for wet weather storage. Treated effluent needs to be stored during periods of low evaporation, which occur over winter. The volume of water stored in the second and third ponds will vary over the year, with the volume stored reduced over summer to allow less irrigation over winter. Appendix D demonstrates how pond 2 and pond 3 volumes will increase over winter.

Appendix D shows the irrigation calculations for Shaft #4. At 7.4kL per day production, there is162 days or 5.3 months storage in the working volumes of ponds 2 & 3. This provides significant contingency on the 740kL storage required under average conditions. If long term rain patterns change and additional effluent disposal is required, there is room on the site for additional irrigation areas.

During periods of unusually prolonged precipitation and low evaporation, if the ponds approach a full capacity, treated effluent should be tankered offsite to prevent overflow from these storages. This should be commenced at about 96% capacity – which allows 5 days additional storage in pond 3. Following discussion with NRE personnel, this is understood to have happened only three times in the past 30 years.

The existing treated black water system complies with the Department of Environment and Conservation (NSW) October 2004 Environmental Guidelines for the use of Effluent by Irrigation. The guidelines suggest that for municipal re-use, irrigating on open space, parks, as dust suppression, and on construction/mine sites, the level of treatment should be secondary treatment with pathogen removal. Pathogen removal can be either disinfection or detention. The guideline also stipulates irrigation should be undertaken when there is no public access to the irrigated area. At the Shaft No. 4 site there is secondary treatment in the Pasveer channel, pathogen reduction in the maturation ponds and the area has no human access during irrigation. The area is only accessed to monitor the irrigation system and maintain the grass.

Regular soil testing and monitoring will be undertaken for black water irrigation to determine the condition of the soil, and monitor any effects over time of black water for use in irrigation.

It is preferred to continue to use the spray irrigation system as this enhances evaporation and increases the volume of water that can be disposed on site.

The irrigation area is managed to prevent effluent runoff beyond the irrigation area. Effluent will be stored in the third maturation pond during periods of low evaporation or high precipitation.

Soil testing will be conducted to determine the existing soil conditions, and to inform any soil conditioning to be made prior to irrigation. Soil conditions will also be routinely monitored during irrigation activities. To assist with any potential of over-irrigation and/or runoff from the application areas to the Sydney catchment land the irrigation management actions shown in Table 2 below will be implemented.

Table 2 – Irrigation Management Guidelines

Weather condition	Irrigation Condition	Effluent Management
Dry and sunny (<0.25mm/day rainfall)	Check soil moisture and record moisture content **If moisture content is low**, irrigate between 10am-3pm until soil is sufficiently moist	Cease irrigation when soil is sufficiently moist Record moisture content immediately after irrigation
Light sparse rain (<5mm/day rainfall)	Check soil moisture and record moisture content* **If soil is relatively dry**, irrigate between 10am-3pm until soil is sufficiently moist	Cease irrigation when soil is sufficiently moist or when heavy rainfall occurs Record moisture content immediately after irrigation
Moderate - Heavy rain (>5mm/day rainfall)	No irrigation allowed	Store effluent in maturation ponds until wet weather ceases

Scheduled irrigation events should be monitored on a weekly basis, as appropriate, for a number of parameters, such as:

- the weather condition
- visible condition of the lawn
- soil moisture content via soil moisture indicator probe
- the time taken for that particular irrigation event

Soil moisture can be measured with a probe. Soil moisture probes are proprietary units that measure the availability of moisture in the soil by either measuring the water pressure across a ceramic (commonly ceramic units are used) probe, or by using an electrical conductivity meter to measure when water forms a contact across the probe. Alternatively, a visual inspection by digging a small hole in the root zone will quickly determine if the soil is water logged. Other indicators are water appearing on the surface when you walk across it. Over irrigation is unusual, as it is difficult to maintain an over irrigated lawn.

Water conservation practices will help to minimise the volumes of black water generated. It is proposed that a water audit and conservation plan should be done in order to achieve this.

To provide additional contingency, and to ensure compliance with DEC guidelines for the management of treated black water, augmentation and improvements to the existing irrigation area are proposed. The existing irrigation area is cleared land located within the current lease. Current irrigation operations do not fully utilise this cleared area, providing scope for increased irrigation should it be required. The area can also be fenced. The irrigation area is visually monitored during irrigation. It drains to the main collector dam in the unlikely event of over irrigation.

3.6.3 Grey Water

Grey water (non-toilet wastewater from the surface) will continue to be treated in the No. 1 Pasveer ditch 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. Any potentially larger quantities of water use required for emergency purposes, i.e. fire fighting, can bypass the treatment system and use the untreated grey water.

3.6.4 Main collector dam

The safe working level of the main collector dam has been reviewed (Water management for shaft No. 4, Beca, 2010). Based on the proposed freeboard of 2.0m depth, the main collector dam can allow approximately 4.5ML capacity for major rainfall event storage. This equates to a 10 year storm event up to the maximum of 72 hour duration, and 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 disposed underground to Russell Vale.

4 Description of modifications to Water Management System

As described previously, current mining operations at the NRE No. 1 Colliery mine site are focused on mining coal from the Bulli Seam and it is now proposed to mine the Wongawilli coal seam. The layers for these seams are shown in figure 8 below. The Wongawilli seam will have different water production rates compared with the Bulli Seam. Therefore, a revision to the current water management system for the NRE No. 1 Colliery is proposed.

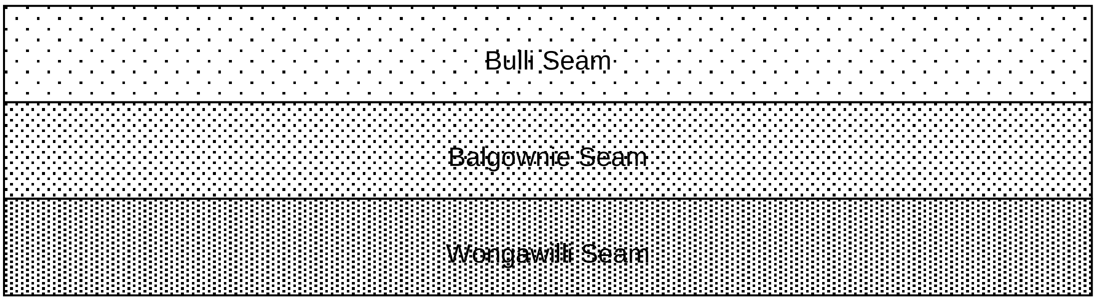


Figure 8 – Schematic showing layers of coal seams in the Russell Vale area.

In addition, several opportunities for improvement and to create efficiencies in the current water management system have been identified for inclusion in the development proposal. This section describes the changes proposed to the current water management system.

4.1 Potable Water at Russell Vale

The expansion of the mining operation may require additional water to be supplied to the site at times when the seam is dry and mining equipment water needs are not met by water collected on site. Potable water supplied by Sydney Water will continue to be used for surface facilities including the administration building, bath houses, truck washer, workshop and toilets. If additional water is required for mining operations, the preference is to negotiate provision of raw bulk water from the Sydney Catchment Authority, otherwise potable water will need to be drawn from the Sydney Water supply.

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 143 employees at the Russell Vale site. It is anticipated that during mining of the Wongawilli seam this will increase to 310 employees. During mining of the Wongawilli west seam, personnel will relocate to the No. 4 Shaft site, and the number of expected employees at Russell Vale will drop to 66.

Existing potable water use at Russell Vale is 33 kL/day. This is expected to increase to 66 kL/day due to the increased mining operations. The existing provision for emergency potable supply from the potable water tank (Brick Tank) to the process water system will be maintained.

4.2 Waste Water at Russell Vale

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 as described in the previous section. Sewage will continue to be discharged to the Sydney Water sewerage system.

4.3 Process and Mine Water

The sections below describe proposed changes and improvements to the process and mine water system as a result of the proposed development.

4.3.1 Process Water Use

Key future process water uses will continue to consist of underground mine workings, fire water, dust suppression and wash-down.

It is anticipated that the future mining operation will increase the demand for process water supplied to the underground mining operations and equipment. Key uses for process water at the Gujarat NRE No. 1 Colliery over the life of the project are:

- 5 Continuous Miners 5.9kL/h each
- Long Wall Equipment 126kL/h
- Coal Stockpile infrastructure 12.5kL/h

In addition, above ground process water uses are truck washing and dust suppression. Demand for these above ground uses are anticipated to increase in line with mine production to approximately 27kL/hr. Trucks operate on average 9 hours a day.

This results in a total requirement of approximately 4.2ML/day of process water supply to operations at NRE Russell Vale Colliery.

4.3.2 Process Water Supply

Process water supply is made up of a combination of the following water sources, as shown in Figure 9:

- Cataract Dam (for surplus mine water demand);
- Clean raw water from Corrimal Springs (approximately 0.1ML/d);
- Mine dewatering; and
- Potable water (Truck Washer and Emergency Supply)

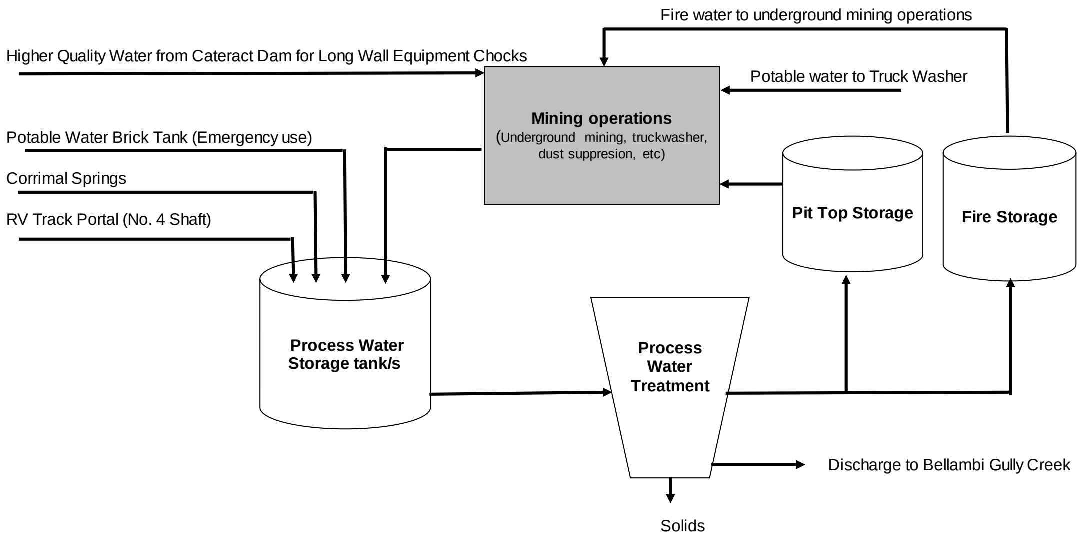


Figure 9 – Schematic of Future Process Water Supply Sources

Mine Dewatering

Groundwater modelling conducted for NRE (Golder Associates 2010) shows water make from future dewatering from mining the Wongawilli seams will be less than mine water make from the Bulli seam under current operations. Golder Modelling indicates that inflow into the proposed Wongawilli Seam workings at the end of project are as shown in Table 3 below.

Table 3 – Model-Generated Inflow Rates (ML/d)*

	Current Bulli Seam Workings	Last phase of mining Wongawilli Seam Workings	Last phase of mining Wongawilli and Bulli Seam Workings
Wonga East	0.2	1.2	1.4
Wonga West	0.9	0.8	1.7

*This table was taken from a report by Golder Associates 2010

NRE estimates derived from modelling outcomes show the annualised daily water inflow rate will be approximately 3.1ML/day at the end of project. This groundwater inflow will be less than process water demand and will result in no mine water discharge from site during dry weather conditions. There will however, be a need to buy between 2.0 – 4.2ML/d of water from Sydney Water or Sydney Catchment authority during the life of this project.

Expected mine water quality is shown in Table 4.

Table 4 - Expected Water Quality from Wongawilli Seam

Parameter	Units	Expected Water Quality
pH	pH units	8.9
Electrical Conductivity (EC)	µS/cm	2910
Total Dissolved Solids	mg/L	1780
Alkalinity (as $CaCO_3$)	mg/L	1520
Total Suspended Solids (TSS)	mg/L	902
Turbidity	NTU	1240
Total Kjeldahl Nitrogen	mg/L	8.4
Total Phosphorus	mg/L	0.27

Long Wall Equipment Process Water Supply to Chocks

Water for use in the new Long Wall Equipment Chocks must satisfy a higher quality standard than the general process water quality suitable for other process water uses. The recommended water quality for supply to the Long Wall Equipment Chocks in Table 5 has been supplied by the manufacturer Joy Mining Equipment.

Table 5 - Underground product water specification (for mining operations)

Parameter	Units	Required Water Quality
pH	pH units	6.5 -8.0
Chloride (Cl^-)	mg/L	<220
Sulfate (SO_4^{2-})	mg/L	<400
Carbonates (as $CaCO_3$)	mg/L	0-250
Appearance		Clear
Electrical Conductivity (EC)	µS/cm	800
Total Suspended Solids (TSS)	mg/L	0

The process water treatment system is designed to remove solids from the water stream and does not include any processing step to treat salinity, alkalinity and pH. The expected process water quality will not achieve this water quality standard and increases the risk of scaling and corrosion of the Long Wall equipment.

For this reason 1.7kL/hr will be sourced from a higher quality water source from Cataract Dam to protect the Long Wall Equipment Chocks against scaling and corrosion. Cataract Dam Water quality is described below in table 6.

Table 6 - Cataract Dam Water Quality

Parameter	Unit	Average water quality
pH	pH unit	7.4
Total Dissolved Solids (TDS)	mg/l	71
Conductivity	µS/cm	98
Carbonate	mg/l	<2
Total Suspended Solids (TSS)	mg/l	20
Turbidity	TNU	2.4

4.3.3 Process Water Treatment

The existing water treatment process including the thickener will be retained to treat combined mine water and dirty stormwater streams. No change is treatment of these water streams is proposed. NRE confirm that the current infrastructure has adequate capacity to treat future predicted flows.

4.4 Storm Water at Russell Vale

4.4.1 Clean Storm Water

Although the impervious area and associated flow rates will be unchanged as result of the expansion of the mining operation, NRE has identified an opportunity to improve stormwater management and control, through engineering upgrades and realignment of the clean storm water flow paths on the site.

Changes will be made to improve the management of water from steep Bellambi Gully areas of the site that have experienced significant erosion. This work will aim at reducing the velocity of water flowing down the gully. The longer channel runs and storage in the newly constructed dissipation dam, prior to discharge, significantly reduces potential energy and hence erosion potential. The drawings in Appendix A describe the proposed changes that include a realignment of a major section of the stormwater drainage line on the site.

The replacement of piped drainage with channel drainage reduces the risk of uncontrolled flows across the site. These uncontrolled flows are associated with blocked drainage pipes. NRE will take appropriate actions to ensure drains are effective with regular maintenance of the channels.

The implementation of this re-aligned channel will minimise the likelihood of potential downstream impacts, such as those from the 1998 floods occurring in the future and has been assessed under the preliminary works EA report submitted to DoP (No:10 0046). The minimisation of potential downstream impacts will be achieved through both the maintenance and upgrade of existing diversions and flow paths (such as those in the upper sub-catchments) and the proposed implementation of open channels and diversions around NRE's proposed stockpile area.

The existing and proposed channel re-alignment and drains will be lined as shown in the "Gujarat NRE Stormwater Hydrology Review" (Beca 2010) and after any further geotechnical advice as required. The channels will be maintained regularly to minimise scouring during major flow events. This will consist of regular inspection and repair of all reno mattress areas, and all shotcrete areas are to be inspected for undermining and eddies, which could lead to erosion if left unaddressed.

4.4.2 Dirty Storm Water

The existing water treatment facility the Thickener Tank will be retained for treatment of dirty storm water prior to reuse or discharge from site.

A dry and wet basin arrangement with better access for maintenance will be implemented to minimise sediment transportation to the SWCD which must maintain a minimum of 30ML spare capacity (or 35ML if only one pump is to operate) at all times to minimise the chance of a major storm surcharging to Bellambi Gully.

The dry and wet basin will be a new 6ML sediment control dam to catch flows from the stockpile area. This new dam will improve stormwater flow attenuation and solids removal. This dam will be kept dry most of the time to facilitate solids removal, and allow ample capacity for storm flow containment.

The existing discharge point will remain unchanged. 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.

The purpose of the provision for discharge into Bellambi Gully is to cope with storm events, specifically to empty the stormwater control dam after a major event to provide buffer capacity for future mine and stormwater flows into the dam. The discharge is treated water, and is surplus to the water that can be re-used in mining operations.

4.4.3 Treatment of Solids

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 Thickener Tank into Dam 1, which then feeds back into the Thickener Tank. It is proposed that the solids stream from the thickener tank will be dewatered and returned to product stockpiles.

A number of dewatering technologies are available for this purpose. The following dewatering options were identified:

- Vacuum filter;
- Belt-filter press;
- Recessed-plate filter press;
- Centrifuge;

A multi-criteria assessment (MCA) was undertaken, based on the following aspects:

- Footprint space requirement
- Operability requirements
- Energy requirements
- 25% solids possible
- Continuous or batch operation
- Suitability for coal fines

This MCA is described in table 7 below.

Table 7 - Evaluation of Dewatering Technologies

Technology	Footprint Space Req.	Operability Req.	Energy Req.	25% solids possible	Continuous or batch operation	Suitability for coal fines
Vacuum Filter	Small	Med	Med	Yes	Continuous	No
Belt-Filter	Small	Low	Med	Yes	Continuous	Yes
Recessed-plate filter press	Small	Low	Low	Yes	Batch	Yes
Centrifuges	Small	Med	Med	Yes	Continuous	Yes

Operability considerations included the following items:

- Lubrication and repair of mechanical components
- Cleaning requirements – flushing
- Chemical dosing and monitoring requirements
- Cloth/media/filter changes
- The number of mechanical components

In determining the level of energy requirement the following aspects were considered:

- Power requirements
- Pump requirements (VSD requirements)
- Electrical controls
- Whether the technology is fully or partially automated
- Running time

All the technologies considered can be used for the application of treating water with coal fines. Most of the technologies have the potential to produce sludge cake with low water content.

Vacuum filters would not be suitable for an application with coal fines, as they rely on the use of filter material in a vessel, which would not be effective.

The belt filter is similar to the recessed filter, in that they both engage mechanical processes but the belt filter solids produced are not as dry as those produced by the recessed-plate filter press.

The centrifuge engages a different type of capture mechanism where there is no direct positive action to trap solids in the chamber. Instead it relies on chemical dosing and decanting action to draw solids away.

The following two options will be investigated further for dewatering the sludge stream from the existing thickening tank that treats the storm water and process water from the mine:

- Recessed –plate filter press
- Centrifuge

Recessed-plate filter press dewatering is a batch process; however this can be automated using a PLC. This technology is able to produce good quality dry solids, without the use of additive chemicals. Solids in the sludge stream are mechanically compacted, providing for a forgiving dewatering process.

Centrifuge dewatering, on the other hand, is a continuous operation that relies on decanting action to compact the solids. This requires very sensitive chemical dosing to achieve the desired dewatered solids moisture content. Because of this an interim receptacle will be necessary to ensure the chemical dosing is accurate. It is possible that the filtrate will need further treatment if it is to be re-used and/or discharged to the environment, depending on the effect the chemicals have on the water quality. Filtrate water from the dewatering process is likely to be re-circulated or pumped. A particular water quality will need to be maintained to ensure safety to people and the environment, and also to protect mechanical seals (preventing accelerated maintenance as a result of poor water quality affecting pump seals etc.)

Generally mechanical dewatering processes will be selected by first bench testing with the specific vendors' equipment. Analyses, solid content and characteristics of the solids stream from the current operation will be required to progress selection of the preferred treatment option, which will be subject to analyses and vendor bench scale testing.

As part of the evaluation criteria cost comparisons will need to be made (both capital and operational expenditure) to determine the most cost–efficient and economical technology for this particular application. Costs are generally relative to the volume (more specifically the weight) being processed by the technology, therefore consideration should be made as to the filtrate and solids quality desired from this process.

Consideration will also need to be made to the capacity requirements, which will include determining the rate at which the dewatering will take place and the frequency of such activity.

4.5 Site Water Balance

A summary of water use on site for the future development is shown below in Figure 10. This figure combines the various aspects of water on site into an overall flow diagram and flow balance. Changes in the flow due to the future development are included in this balance. The balance presented is for the average case only. The following information and assumptions were used and/or made to arrive at the balance presented in Figure 10:

- Higher quality water for the Chocks of the Long Wall Equipment will be provided by using raw water sourced from the Cataract Dam. The demand for higher quality water is estimated on 1.7kL/h (41kL/day).
- Alternative uses for water discharged were not included in the diagram and balance presented in Figure 5. I.e. water is only treated to meet water quality conditions for one of 2 destination or end uses. These include:
  - Treated dirty storm water discharged to Bellambi Gully at the existing discharge point (LDP2) meeting the current licence conditions.
  - Treated process water reused in mining operations or discharged to Bellambi Gully at a future discharge point subject to future permit conditions.
- It is planned that solids from the dirty storm water and process water primary solid removal process will be combined for further treatment and concentration of the solids.

In addition to the general assumptions above, the specific assumptions that are in line with the balance presented in Figure 10, together with some additional information and specific assumptions related to the future operation are presented below:

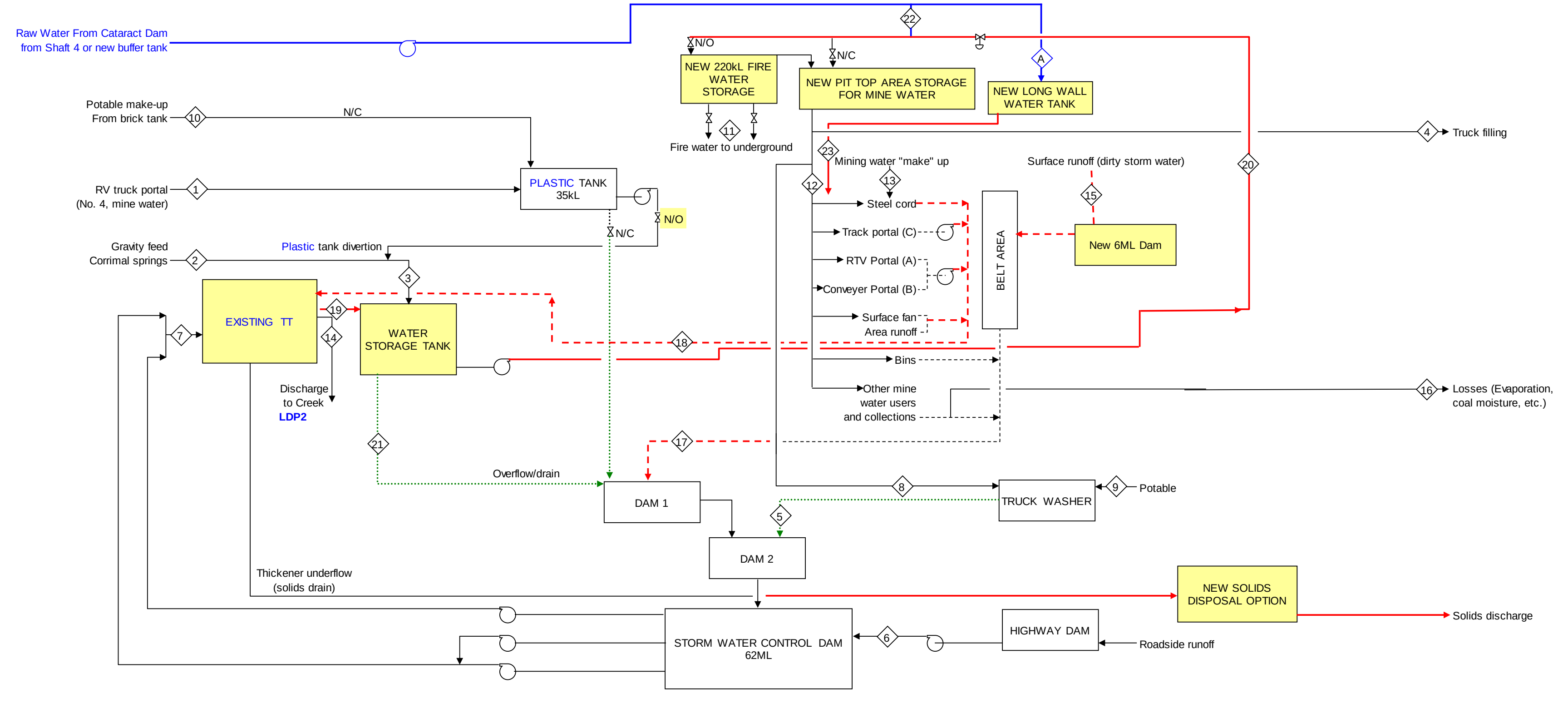
- The balance presented is for the maximum estimated case for dry weather conditions.
- The balance assumes flows for dry weather conditions, i.e. no flow from the Highway Dam (stream 6) and dirty surface run off (stream 15)
- The balance assumes no flow from potable water make-up (stream 10)
- 4.2 ML/day (stream 12) is water supplied underground for dust suppression and equipment operation
- The overall balance assumes continuous average normal flows for a 24 hour working day for the Process Water System. The Dirty Storm Water System is based on 0, 1 or 2 pumps running to keep the Storm Water Control Dam under the 50% full level to meet the required storage capacity for a 10 year average recurrence interval (ARI) rain event.
- The balance assumes non-continuous flows are successfully buffered by intermediate holding volumes in dams and tanks.
- RV track portal pump out provided as a range of 0.5 to 1ML/day (0.5ML/day assumed normal and 1ML/day assumed as maximum for stream 1).
- Corrimal springs make-up (stream 2) rate assumed as 1L/s (3.6m^3/hr.)
- Truck filling (stream 4) estimated assuming 30 trucks per day with capacity of 13kL for dust suppression.
- Stock pile dust suppression (truck filling) and truck wash daily consumption was quoted as 27kL/h. The difference between this and the truck filling is assumed to be truck wash (stream 8).
- Potable water to truck wash (stream 9) is assumed to be 25% of the process water that is supplied to the truck wash.
- Water loss (stream 16) through evaporation, coal moisture, etc. from the system was assumed to be 5% of the water supply to the mine operations (stream 12).
- 10% of the water supplied to mine operations is assumed to be not recoverable or collectable to the new mine water storage tank/s and that this will be routed (as part of stream 17) through existing drains to Dam 1.
- The solid side of balance is not included (initially assumed negligible in the overall balance).
- The balance of water was assumed to be discharged to the gully (stream 14).

The future flow diagram and balance is presented in Figure 10. New or changed processing steps are highlighted in yellow and new or changed lines are shown in red. The diagram does not show all detailed processing steps and equipment within the relevant blocks.

4.6 Shaft No. 4 changes

The number of employees at the No. 4 Shaft site will fluctuate when the new work commences. Some employees will move from the Shaft No. 4 site to the Russell Vale site at the start of mining the Wonga east seam. It is anticipated there will be 111 employees at Shaft No. 4 during this time. They will progressively move back to Shaft no. 4 as the mining progresses to the Wonga west seam, where there is expected to be up to 355 employees. There is not expected to be any modifications to the facilities at Shaft No. 4, as these were originally designed for a larger number of people working at this site (approximately 1000 persons).

The third maturation pond will be used as a wet weather storage facility for treated black water. This 950kL storage will be drawn down over summer and other periods of high evaporation. The volume stored will be allowed to build up during periods of low evaporation. The irrigation area will be monitored as described earlier. The existing irrigation area is currently underutilised. This provides available irrigation area for periods of peak load, and if additional space is required for effluent disposal during wet weather.



STREAM NUMBER		1	2	3	4	5	6	7	8	9	10	11
STREAM NAME / PARAMETER		RV TRACK PORTAL PUMPOUT ***	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
CONTINUOUS OR INTERMITTENT												
FLOW RATE MAX	ML/day	1.0	0.1	1.1	0.4	0.3	0.1	0.0	0.3	0.09	0.0	0.0
FLOW RATE MAX	m^3/h	41.7	3.6	45.3	16.3	14.3	6.0	0.0	10.8	3.6	0.0	0.0
pH	-	8.2	-					9.1		8	8	8.7
CHLORIDES	mg/litre	NA	-					NA		21.5	21.5	NA
SULFATE (SO4)	mg/litre	NA	-					NA		4	4	NA
CARBONATES (As CaCO3)	mg/litre	10	-					110		46	46	190
APPEARANCE (TURBIDITY)	NTU	5.2	-					570		0.2	0.2	79
ELECTRICAL CONDUCTIVITY	µS/cm	110	-					1900		14	14	3700
TSS	mg/litre	200	-					120				79
TDS	mg/litre	120	-					1200		87	87	2300
Total phosphorus	mg/litre	0.009	-							0.007	0.007	
Total nitrogen	mg/litre	0.26	-							0.13	0.13	

STREAM NUMBER		12	13	14	15	16	17	18	19	20	21	22	23	A
STREAM NAME / PARAMETER		MINE WATER SUPPLY	MINE WATER "MAKE" UP	TREATED DIRTY STORM WATER DISCHARGE TO CREEK LDP2	DIRTY STORM WATER	SYSTEM WATER LOSSES	MINE WATER NOT TO TREATMENT	MINE WATER TO TREATMENT	TREATED WATER TO STORAGE	TREATED WATER TO STORAGE	TREATED MINE WATER OVERFLOW TO DAM	TOP UP WATER	RAW WATER TO LONG WALL CHOCKS*	RAW WATER TO LONG WALL STORAGE TANK*
CONTINUOUS OR INTERMITTENT														
FLOW RATE MAX	ML/day	4.2	0.00	0.0	0.0	0.3	0.6	3.1	3.1	4.8	0.0	0.0	0.041	0.041
FLOW RATE MAX	m^3/h	175.0	0.00	0.0	0.0	12.5	25.0	129.2	129.2	200.0	0.0	0.0	1.7	1.7
pH	-	8.9		9				8.99					8.2	8.2
CHLORIDES	mg/litre	NA		NA										
SULFATE (SO4)	mg/litre	NA		NA										
CARBONATES (As CaCO3)	mg/litre	190		110			1520	1520					10	10
APPEARANCE (TURBIDITY)	NTU	85		27			1240	1240					5.2	5.2
ELECTRICAL CONDUCTIVITY	µS/cm	3000		2100			2910	2910			110		110	110
TSS	mg/litre	24		27			902	902					200	200
TDS	mg/litre	2200		1300			1780	1780					120	120
Total phosphorus	mg/litre						0.27	0.27					0.009	0.009
Total nitrogen	mg/litre						(8.4 Nkjd)	(8.4 Nkjd)					0.26	0.26

* 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

#DIV/0! #DIV/0!

Figure 10 Water uses at NRE No. 1 Colliery at end of project

Note information is approximate only and will be confirmed when production commences.

4.7 Environmental Protection Licence

No alterations to the existing conditions for discharge from LDP2 are anticipated to be required as a result of the proposed expansion and upgrade works. LDP2 will continue to act as the discharge point from the Russell Vale site for treated stormwater, and discharge will occur in accordance with current licence conditions.

5 Assessment of potential Impacts on receiving water

This section describes the impacts of water management practices at NRE No. 1 Colliery on the quantity and quality of surface water in the project area, specifically considering the discharge of treated process water and storm water into Bellambi Gully. 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 continue through the gully to the outlet at the sea as shown in figure 11. None of the discharges from the mine flow into Bellambi Lagoon, or any other lagoon in the area.

Figure 11 - Flow path of Bellambi Gully

5.1 Water Quality

The water quality in Bellambi Gully is variable. The gully is a disturbed urban creek. Water sample results taken by NRE are shown in Appendix C. Water quality from Wollongong Council samples for Bellambi Gully and other local creeks are provided in Table 9.

Table 8 provides a comparison between water quality in Bellambi Gully, NRE No. 1 discharge water quality, ANZECC Guidelines and NRE EPL.

Table 8 - Water Quality Comparison

Analyte	Units	Russell Vale Discharge LDP2***	EPL 12040 Concentration Limits LDP2	Bellambi Gully*	ANZECC** Guidelines
pH	pH unit	7.1-9	6.5-9.2	8.1-9.2	6.5-8(9)
Oil & Grease	mg/L	<0.1	10	<0.1	NS
Total Dissolved Solids	mg/L	1100-1900	NS	1220-1900	125-2200
Total Kjeldahl Nitrogen	mg/L	0.4-1.1	NS	0.4-0.9	0.5
Total Phosphorus	mg/L	0.03-0.12	NS	0.08-0.3	0.05
Total Suspended Solids (TSS)	mg/L	13-27	50	1-52	NS

*from Wollongong Northern Coastal Creeks and Lagoons report by WBM January 2006 and NRE testing
** Australian and New Zealand Environment Conservation Council's Guidelines for Fresh and Marine Water Quality, lowland rivers (ANZECC)
*** for more details see appendices B & C
NS: Not Specified

The Bellambi Gully water quality results are consistent with the findings reported in "Wollongong Northern Coastal Creeks and lagoons by WBM 2005" which investigated the water quality in the region. Water quality from Wollongong Council samples for Bellambi Gully and other local creeks are provided in Table 9.

Table 9 - Water Quality in the Region (from "Wollongong Northern Coastal Creeks and Lagoons by WBM 2005)

Pollutant	Flanagan's Creek	Collins Creek	Bellambi Gully	ANZECC* guideline
pH	6.6-8.4	7.5-8.6	7-9	6.5-8
Total Dissolved Solids (TDS)	400-288	1000	1000-7000	125-2200
TKN mg/L	0.1 – 0.55	0.2 – 1.6	0.2-0.9	0.5
TP mg/L	0-0.11	0.1-1.5	0.02-0.3	0.05

*Australian New Zealand Environment Conservation Council 2000 marine and freshwater guidelines for lowland rivers

Table 9 demonstrates that 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 catchment and tidal influence. The area around the gully downstream of the EPL 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 Gujarat NRE No. 1 Colliery, the golf course (former waste disposal area) and areas of urban development. The middle and lower catchment of the Bellambi Gully catchment consist of large areas of urban developments including recreational facilities such as public parks, reserves and schools. The Gully also runs through or near private property including some light industrial units.

Nutrient levels in Bellambi Gully are higher than ANZECC freshwater guidelines for lowland rivers in the creek presumably due to urban runoff. Current 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, BOD_5, 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) indicated that the various tributaries within the catchment were contaminated by pollutants, indicated by high levels of pH, conductivity (possible due to lithology), Biochemical Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD) and ammonia, in both dry and wet weather (Anthony 1994). In particular, during wet weather periods, high levels of *E.Coli* bacteria.

Both Table 8 and Table 9 show that the water quality at Russell Vale LDP2 sometimes exceeds ANZECC freshwater guidelines for lowland rivers. However these tables also indicate the water quality at the Russel Vale LDP2 is similar to the background water quality in the gully and other creeks in the area.

5.2 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.

5.2.1 Erosion Potential

There is the potential for the erosion of Bellambi Gully as a result of discharge into the gully. The gully is highly urbanised and vegetated (in some areas it is concrete lined). Water discharged by the mine will be a significantly smaller flow when compared with the flows in the gully during high rainfall events. The flow from the mine site is approximately $0.003 m^3/s$. The 1 in 5 year rainfall event produces a discharge of $17 m^3/s$ from the catchment above the EPL discharge point (LDP2). Therefore the $0.003 m^3/s$ discharged from the mine is inconsequential in comparison to the $17 m^3/s$ discharged from the catchment above the mine's LDP2. Any potential erosion associated with mine water discharge is insignificant compared with the erosion potential of flows into the gully during heavy rainfall events.

5.2.2 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 reduces solids, but also holds the water in the dam, reducing flow rates through Bellambi Gully during storms of intensity less than 1 in 10 year event.

The SWCD is kept at a level that allows flow attenuation prior to discharge to environment. This reduces erosion potential by reducing the peak flow during storm events up to 1 in 10 year events.

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.

5.3 Flooding Risk

Wollongong has a warm temperate climate. The relatively high rainfall in the region and steep topography creates many small high velocity waterways including the Bellambi Gully. The Bellambi Gully 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 the Bellambi Gully, of this 76ha is uncleared.

Downstream of NRE's LDP2, the Gully comprises either culverts under main transport structures and roads, or disturbed creek bed, through urban areas. Bellambi Gully flows from LDP2, under the Princes Highway, past several industrial premises, under the northern distributer, through residential streets, under the railway line, through Holy Spirit High School grounds, and then flows out into the ocean. The gully length is approximately 3km from LDP2 to Bellambi Beach.

In general, the flows in the Bellambi Gully consist of storm water run-off in the catchment and the discharge of treated mine water at the licence discharge point (LDP2). In dry weather the gully receives on average approximately 0.4 ML/d from the NRE site under existing operations. After the upgrades to the site, this will be zero.

In wet weather the gully could receive up to maximum 7.2 ML/d for not longer than a 72 hour period from the NRE site under the existing licence. The existing capacity of the stormwater control dam is sufficient to contain and successfully manage all 10 year ARI storm event 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.

Figure 12 shows the frequency of high and low flow discharges per year from LDP2 to Bellambi Gully. It is demonstrated in figure 12 that the discharge is less than 0.5ML/day for most of the year. The occurrence of discharge events greater then 2.5ML/day has been less than 10 days per year in the years 2007 to 2009.

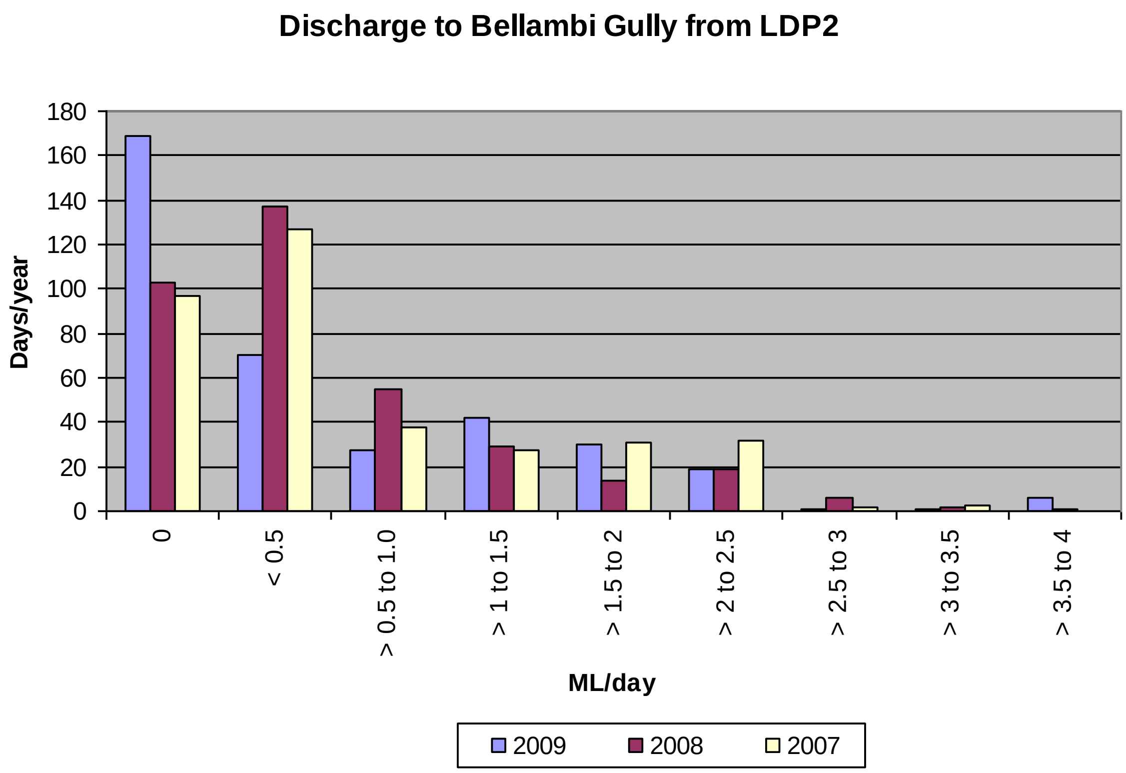


Figure 12 – discharge volume date from NRE to Bellambi Gully

The wall of the storm water control dam is designed to be permeable and slowly filter and discharge water. The flow rate through the dam wall is monitored by NRE, although not as a licence requirement. The dam wall seepage is collected and measured using a V-notch weir. The average instantaneous flow rate is 0.42L/s.

A preliminary study of the Bellambi Gully catchment has confirmed that the existing concrete culvert (2.4m wide x 1.5m high) at the Princes Highway is inadequate for a 10 year ARI event. During such an event it is likely backwaters would accumulate until they spill over the Princes Highway. It would seem that the culvert is undersized and this may contribute to the flooding potential risk upstream of the Princess Highway.

The proposed changes to mining operations at the Gujarat NRE No. 1 Colliery will not add to flooding potential. Diversions proposed under separate approval will reduce energy in the stormwater and the management of the SWCD attenuates flows smaller than a 1 in 10 year event.

6 Mitigation Measures

NRE propose a number of mitigation measures to improve water management at the NRE No. 1 site, these are presented in table 10 below.

Table 10 – Mitigation Measures and Summary Improvements to Water Management Systems

Water system	Mitigation Measure	Improvement / benefit
Process water treatment at Russell Vale	Investigate treatment of solids removed from process water	• Solids will be mechanically dewatered and removed form 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 quality of discharged effluent to Bellambi Gully
Dirty stormwater treatment	Construct a new 6ML storage dam to collect runoff from stockpile area.	• Minimise transport of sediment to the Storm Water Control Dam • 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 water can be used.	• Reduce water use • Reduce use of higher quality water

7 Conclusion

Expansion of mining operations to include the Wongawilli seam in addition to the Bulli seam will increase the mine water flows at the Gujarat NRE No. 1 Colliery. It is predicted that there will not be sufficient quantities of water inflow to the mine to meet increased process water demand.

At the end of project the water production from mining operations is expected to be 3.1ML/day, which is 1.1ML/d less than demand.

At start of mining Wongawilli seams, water produced from mining operations will be less than at the end of mining and additional water will need to be provided to supplement the site's water requirements.

The main change to surface water management is the construction of a 6ML dam to collect run off from the new stockpile.

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 thickening tank be diverted from Dam 1. Instead the sludge will be dewatered and the solids cake will be added to the ROM coal product, if appropriate, with the overflow water being recycled back into the mine process water system. This will improve the efficiency and economy of the treatment processes and the solids output.

Appendix A

Gujarat NRE Stormwater Hydrology Review and Stormwater Diversion Drawings

Report

Gujarat NRE Stormwater Hydrology Review

Edited for Part 3A submission

Prepared for Gujarat NRE (Client)

By Beca Pty Ltd (Beca)
ABN: 85 004 974 341

19th October 2010

Revision History

Revision Nº	Prepared By	Description	Date
A	Paul Irwin	Preliminary Draft – For Information	30/09/2009
B	Paul Irwin	Preliminary Draft 2 – For Information	02/10/2009
C	Paul Irwin	Issued for Information	15/10/2009
D	Paul Irwin	Final Issue	25/11/2009
E	Dianne Thomas	Edited for Part 3 Approval for use by ERM.	26/05/2010
F	Paul Irwin	Update Methodology	08/09/2010
G	Paul Irwin	Update Basin Information	19/10/2010

Document Acceptance

Action	Name	Signed	Date
Prepared by	Paul Irwin		19.10.10
Reviewed by	Dianne Thomas		19.10.10
Approved by	Dianne Thomas		19.10.10
on behalf of	Beca Pty Ltd		

Introduction

During 1998 the Illawarra experienced a major storm event which caused considerable flooding throughout the region. Review of the rainfall data for this event taken from the Russel Vale catchment confirms that this storm was a statistical 100 year average recurrence interval (ARI) event when compared to BoM statistical models.

Although the mine operators at the time had in place a number of diversion drains, settlement and piped stormwater systems, these proved inadequate due mostly to maintenance, inadequate design, and lack of redundancy factors of safety. This resulted in large quantities of escarpment runoff water diverting through the existing coal stockpile.

As this coal stockpile drained to the dirty water treatment and collection system, this system was overwhelmed and resulted in black water and coal washing down the Bellambi Creek and through a number of private properties causing considerable damage.

This study will attempt to review and address these existing inadequacies as well as propose new measures to minimise the likelihood of future failures.

Stormwater Methodology

As the mine upgrade is primarily to underground activities and to a limited extent the surface areas, it’s expected that the proposed mine upgrade will not result in a significant change in impervious areas when compared to the existing site. This study therefore is intended to calculate the flowrates and flowpaths of the existing catchments to Bellambi Creek with the aim of producing a stormwater management concept to form the basis of future detailed design.

As stated above, the primary cause of the failure of the stormwater management system in the past (i.e. the 1998 storms) was due to blockages and diversion of the primary clean water through the dirty water and coal stockpile areas. This was primarily a result of inadequate sizing of diversion drains, poor maintenance, and insufficient erosion protection. The intention of this study is therefore to provide a concept for the management of this stormwater coming from the upper catchments reducing the risk of this situation reoccurring into the future.

The guide for the collection, storage, and treatment of dirty water within the site is primarily through the application of recommendations outlined in both Managing Urban Stormwater: soils and construction volume 1 (Landcom 2004) and Managing Urban Stormwater: soils and construction volume 2E mines and quarries (Dept. Of Environment and Change 2008). As per these outlines the primary focus of the concept is that clean upper catchment flows should be diverted around the operational area “dirty water” flows to minimise the required dirty water treatment volume. Further consideration was also given to flooding studies and additional literature where relevant and as appropriate.

It should be noted that the intention of the concept is to provide a solution which will significantly reduce the possibility of blockage and diversion of the clean water flow through the dirty water areas and propose minimum basin and treatment area for the dirty water collected from operational areas on site. This concept will therefore maintain the existing flowrates generated by the subject site to Bellambi Creek via the existing RTA culvert under the Princes Highway. The concept will propose options for the reduction in potential blockages due to debris on the Russell Vale site, which would have contributed heavily to the downstream flooding. However, it will not reduce the flowrate or propose options for any upgrades and/or maintenance that may be required downstream of the site not owned by or in the control of Gujarat NRE.

Each of the catchments has been modelled using an ILSAX hydrological model within the DRAINS application using the latest Bureau of Meteorology IFD data for the subject site.

The ILSAX storage parameters used were 1mm of storage for both paved and supplementary areas, and 5mm of storage for pervious areas. A soil type 3 was selected as clays are present in the upper escarpment. This will be conservative for the middle and lower catchments which are freer draining fill.

Rainfall data used as per the BoM IFD information was:

- 2yr1hr 47.22
- 2yr12hr 11.43
- 2yr72hr 4.51
- 50yr1hr 107.86
- 50yr12hr 28.25
- 50yr72hr 9.58
- G 0.00
- F2 4.28
- F50 15.81

Storms modelled for the purposes of the preliminary design of channels and pipes were the 5, 10, and 100 year frequency events (Q5, Q10, Q100 respectively).

Storm durations modelled within each Annual Recurrence Interval (ARI) were 5min, 10min, 20min, 30min, 45min, 1hr, 1.5hr, 2hr, 3hr, 4.5hr, and 6hr with the Dirty Water storage basin being assessed up to a 72 hour duration 10yr ARI event.

Based on these flows, site observations, and survey information Hec-Ras channel models and DRAINS piped flow models have been produced for the preliminary design of the proposed stormwater treatments.

Catchments

Catchment Zones

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

Upper Catchments – This zone is characterized by predominantly natural escarpment and steep heavily vegetated slopes with thick undergrowth. The Upper Catchments include a number of small dams for use within the mines and also a number of unsealed access roads and fire trails.

This catchment zone is considered to be 100% clean water with no coal stockpiling or conveyor activities within any of its subcatchments.

Middle Catchments – This zone includes the workshop, offices, a number of existing and proposed portals, and a network of access roads between the stockpile and the Upper

Catchments. It is characterized by steep batters of both natural slopes and mine tailing material and with the exception of Subcatchment M7 will not be exposed to coal stockpiling, conveyor operations, or hauling in the proposed mine upgrade.

The catchment M1 is also used to store plant and materials and has both a sealed and gravel surface which although not used for the storage or transportation of coal has the potential for light contamination during initial runoff.

Lower Catchments – This zone is dominated by the coal stockpile and haul areas, truck loading facility and settlement basins. It is also the location of the clean water discharge point to Bellambi Creek.

Sub-Catchments

Each of the above zones has then been broken down into sub-catchments based on their location within the overall catchment plan and their dirty water or clean water characteristics.

As stated above, each of these sub-catchments have been reviewed, modelled, and recommendations made based on preliminary plans and information provided in meetings with the client.

Note: All flow rates and areas are for individual subcatchments and not a cumulative total and are subject to change upon final design and detail following Part 3A approval.

Subcatchment U1

10.69ha

100% pervious

Clean Water (CW) catchment.

Q5: $2.83m^3/s$

Q10: $3.58m^3/s$

Q100: $6.39m^3/s$

This sub-catchment is a natural escarpment catchment which is dominated by heavy trees and undergrowth with a number of unsealed access roads and fire trails. The sub-catchment also includes two open dams which are used for underground water supply, these dams do not collect or store water from the natural catchment and are instead fed by pump from the lower catchments. As the dams do not intercept a larger catchment than their own surface area they are not at risk of overtopping during a major event provided adequate freeboard is maintained.

The current catchment drains by sheet flow in a general easterly direction and in minor events will be contained within the unsealed access road swale drains. Which eventually discharge into the existing southern stormwater channel. However the capacity of these roads to contain major events is limited and will result in overtopping of these flows down the catchment grade and through M7 (which is a Dirty Water catchment).

In order to ensure that all major storm events reach the stormwater channel a diversion drain is required to be constructed along grade. The grade of this channel should be kept to a minimum to limit scouring and generally following the contour of the catchment from south to north.

A Hec-Ras channel flow model was constructed assuming a trapezoidal channel and the flow rates up to and including the Q100 flow indicated above. In order to limit the impact of minor land slips, local settlement, obstructions and poor maintenance a freeboard of at least 500mm should be allowed for in the sizing of this channel.

The length of the channel will be approximately 170m and a longitudinal grade of 2% has been assumed to limit velocities and scour.

Based on the above parameters a trapezoidal channel of base width 2.0m (minimum) and minimum depth 1.5m with 1:2 side slopes is required. It is not advisable to reduce this width or depth along the length of the channel as it is possible (though unlikely) that a majority of the flow rate will enter the channel at its southern extent in the event that a roadside drain fails towards the southern extent of the catchment.

This approximate channel location and details have been shown in the sketch plans provided.

Subcatchment U2

9.76ha

100% pervious

Clean Water (CW) catchment.

Q5:	2.50m3/s
Q10:	3.13m3/s
Q100:	5.66m3/s

As with U1, this subcatchment is a natural escarpment catchment which is dominated by heavy trees and undergrowth with a number of unsealed access roads and fire trails.

The current catchment drains by sheet flow in a general easterly direction until intercepted by the access road which then discharges to an existing diversion drain. In the event that the roadside swales are breached and water continues east, this diversion drain is intended to direct flows to the southern stormwater channel.

The capacity of this existing diversion drain upon inspection was reduced due to very dense undergrowth which had choked up the channel. Upon clearing of this channel it was also apparent that local settlement and land slip had reduced the cross section of this drain in several locations.

The channel was then surveyed and a Hec-Ras model of the existing drain was produced. The Hec-Ras model makes the assumption that in future events the channel will remain clear of undergrowth and lantana through regular maintenance.

The Hec-Ras analysis of the existing diversion drain has concluded that in its current maintained form there is insufficient capacity between chainages 140 and 304 to contain a 100yr ARI event which would result in overtopping of this drain to M1 and subsequently lead to erosion of the drain and an increase of flows to M1.

The cause of this section of channels insufficient capacity was due to a combination of insufficient cross section due to slump and design and a very flat longitudinal grade.

This section of the diversion drain therefore requires upgrading to achieve a consistent grade from Ch140 to Ch304 which matches in with existing at each extent. Due to the change in elevation along this length of 164m a longitudinal grade of 2.75% is required to minimise upstream and downstream alterations.

An alternative Hec-Ras model of the diversion drain, including the upgraded trapezoidal section was then created. Based on the above parameters a trapezoidal channel of base width 2.0m (minimum) and minimum depth 1.25m with 1:2 side slopes is required at a minimum slope of 2.75%.

This channel location and preliminary details have been included in the sketch plans provided.

Subcatchment U3

8.63ha

100% pervious

Clean Water (CW) catchment.

Q5: 2.21m3/s

Q10: 2.77m3/s

Q100: 5.00m3/s

As with U1 and U2, this subcatchment is a natural escarpment catchment which is dominated by heavy trees and undergrowth with a number of unsealed access roads and fire trails.

The southern section of the catchment drains by sheet flow in a general easterly direction until intercepted by the access road, this is then channelled in the roadside drainage to the north and into an existing diversion drain. This diversion drain has been maintained by the mine operator and in the event of failure drains to subcatchment U4.

The capacity of this existing diversion drain on the steep grades is adequate for major events and historically discharges to the northern valley/channel system on the adjacent lot.

As this catchment historically discharges into the adjacent northern valley it does not form part of the stormwater model for the Russel Vale site. This channel should be regularly maintained and free from obstructions, weeds, lantana, and undergrowth to ensure its continued capacity. Emphasis should also be placed on the maintenance of the existing access road in the southern portion of this site to ensure that the swales and cross fall are even and free from obstructions.

Subcatchment U4

0.50ha

100% pervious

Clean Water (CW) catchment.

Q5: 0.226m3/s

Q10: 0.274m3/s

Q100: 0.459m3/s

This subcatchment is located east of the U3 catchment and is the site of the original electrical power station of the mine. The power station is no longer in use and there are no significant structures or impervious areas within the catchment to increase runoff intensity. The natural soil in this location is comprised of a high percentage of ash and fine silty materials and is therefore highly prone to erosion.

As with subcatchment U3 this subcatchment historically drains to the north via an existing diversion drain which has recently been maintained by the mine operator. This diversion drain has been oversized to allow for redundancy of the U3 diversion drain in the event of failure. The capacity of this existing diversion drain on the steep grades would be adequate for major events.

As this catchment historically discharges into the adjacent northern valley it does not form part of the stormwater model for the Russel Vale site. This channel should be regularly maintained and free from obstructions, weeds, lantana, and undergrowth to ensure its continued capacity. As with U3 emphasis should also be placed on the maintenance of the existing access road in the southern portion of this site to ensure that the swales and cross fall are even and free from obstructions.

Subcatchment U5

0.4ha

100% pervious

Clean Water (CW) catchment.

Q5: 0.189m3/s

Q10: 0.237m3/s

Q100: 0.367m3/s

As with U3, this subcatchment is a natural escarpment catchment which is dominated by heavy trees and undergrowth with a section of unsealed access roads and fire trails. This is adjacent to the M2 subcatchment which comprises of the mine office building, carpark and substation.

As with subcatchment U3 this subcatchment historically drains to the north via an existing diversion drain which is required to be upgraded and maintained by the mine operator. This diversion drain is the last line of diversions to the northern catchment before the substation and so a concrete diversion channel is proposed to ensure that major storm events will not cause damage to the mines power supply.

A Hec-Ras model of the proposed channel upgrade has been prepared assuming a rectangular section using concrete culverts. A conservative catchment area of 1ha was assumed to allow for redundancy of the U4 catchment diversion drain. This has resulted in a design section of 1m wide by 0.5m depth with a factor of safety of 2 on the existing grade.

As this catchment historically discharges into the adjacent northern valley it does not form part of the stormwater model for the Russel Vale site. This channel should be regularly maintained and free from obstructions to ensure its continued capacity. Emphasis should also be placed on the maintenance of the existing access road in the southern portion of this site to ensure that the swales and cross fall are even and free from obstructions.

Subcatchment M1

1.89ha

55% Pervious

45% Paved

First Flush (FF) catchment.

Q5:	1.89m3/s
Q10:	2.28m3/s
Q100:	3.92m3/s
DW:	0.02m3/s maximum flow

Subcatchment M1 is characterised by both a section of natural escarpment slopes located below the U2 and U3 catchment and also the workshop and mine portal area. Although the workshop and mine portal area (and surrounding roads) are not proposed for the stockpiling or haul of coal, due to the presence of plant and machinery for service (or entry/exit to the pit) on the hardstand areas there is potential for minor contaminants to be on the surface within this area.

Due to the potential for contaminants the existing M1 catchment drains to a piped stormwater pit system with restricted first flush outflow. The existing first flush system includes at the pit invert a 100mm diameter pipe and 200mm high weir. The first flush of stormwater which falls on the paved component of the M1 catchment is diverted down this line to the Dirty Water drainage system. As the flow rate within this catchment increases during a major event the water level increases until it spills over the 200mm high weir and enters the 225mm diameter Clean Water pipe which discharges east to the southern stormwater channel. In a major storm event, with 1m of head the maximum flow rate of the Dirty Water first flush pipe is 0.02m3/s.

In a major event this 225mm diameter pipes capacity is exceeded and water is then directed overland to the primary stormwater channel at the base of the U1/U2 catchment where it then drains to the M3 subcatchment.

It is also important to construct a crest perpendicular to the access road to subcatchment M3 which will prevent overland flows from spilling down this road. Additional flows down this road would increase the flow rate in the southern channel of M3 which although it has the capacity would generate potential erosion to the M3 access road due to steep grades. The location of this crest has been shown on sketch SK5.

The U1 and U2 catchments drain to the M1 subcatchment via the southern stormwater channel. The eastern extent of this channel (to the west of the culvert crossing location) is heavily eroded due to steep grades and the high erodability of the coal seam in this location. In order to minimise future erosion a number of options have been considered:

Sprayed Concrete (‘shotcrete’) Lining – This method provides a relatively smooth and high capacity channel lining which is not prone to blockage. However, the subgrade in this location consists of a highly erodible natural soil which, through the action of eddies in cracked sections has a tendency to become undermined in high velocity flow areas. It is therefore not an ideal long term solution in a high velocity/flow location.

Gabion Basket – The construction of a stepped gabion basket channel is a good solution hydraulically as it has considerable energy dissipation characteristics and low maintenance. Disadvantages to gabion basket construction are the considerable earthworks required to install a stepped basket structure with benching, batters, and footing systems requiring substantial remodelling of the hillside.

Reno Mattress – The installation of a reno mattress (underlain with geofabric) is an alternative to gabion baskets. Instead of a stepped basket structure on a solid foundation the channel can instead be smoothed out and lined with a geofabric which is then covered in a layer of large crushed rock under a heavy duty galvanised steel mattress (size of rocks to be dependant on flow velocity and to be determined at detailed design stage). Reno mattresses have the added advantage of the ability to conform to the shape of the channel more naturally. Disadvantages of reno mattresses are that they are not as tolerant to the action of vertical cascading water (such as that on a waterfall or vertical drop) and still require regular maintenance.

For the lining of this section of channel it is recommended that a reno mattress be installed to the entire length of the eroded channel section. In addition to this the existing trash rack structure is to be maintained and cleaned out regularly.

Subcatchment M2

1.28ha

34% Pervious

66% Paved

Clean Water (CW) catchment.

Q5: 0.528m3/s

Q10: 0.625m3/s

Q100: 0.995m3/s

This subcatchment consists of the office building, and carparking facilities as well as a small section of natural catchment to the west. Sheet flows and concentrated flows from the small section of natural catchment are captured above ground and directed via piped stormwater to the M8 Catchment.

There is no mine operations in this section of the subject site and so it is assumed that all surface runoff will be considered as clean water. There is potential for some sediment load to come from the carpark area, this water will bypass the energy dissipater at the base of the stormwater channel, but in all low flows will pass through the lower existing weirs and ponds n Bellambi Creek before exiting the site which will allow for any light sediments to be removed, however it is therefore recommended that consideration be given to providing a bitumen sprayed seal to the carpark.

The M2 catchment drains overland in all events to its north eastern corner due to bunding along its eastern carpark edge. A number of options were considered, including regrading of the north eastern extent of this catchment to drain to the M3 catchment and then through to the southern channel. This option was rejected as it unnecessarily increased the flow through the M3 catchment with no net benefit. An alternative option of extending the proposed piped stormwater from M8 to the eastern extent of M2 would provide a safe and efficient passage of runoff and provide a failsafe overland flowpath (in the unlikely event of blockage) down the access road kerb and gutter.

Subcatchment M3

3.31ha

100% Pervious

Clean Water (CW) catchment.

Q5:	0.734m3/s
Q10:	0.923m3/s
Q100:	1.73m3/s

This subcatchment consists of an existing steep man made batter and set down area for materials, items of plant, and deliveries as well as an access road which links this area to the workshop area. The set down area and batters are free from coal and the mine operators have confirmed that there will be no dirty plant left in this area (dirty plant will be confined to the M1 catchment which has a first flush system).

Surface runoff from the northern extent of M3 collects along its access road which runs generally at a minimum longitudinal grade of 1.75%. Based on a basic check of capacity (manning's flow model) this longitudinal grade and an assumed crossfall of a minimum 3% and a 1m wide 250mm deep swale the roadway has capacity to contain a Q100 event (half of total catchment flow was assumed for northern half of catchment). Despite this, it is recommended that a minimum 0.5m bund be maintained along the length of this access road to ensure that obstructions within the flowpath (such as a poorly located piece of plant) do not result in water cascading to M5.

Beyond the roadway stormwater then enters a piped culvert which discharges to a broad channel. The capacity of this pipe is critical and its blocking would result in an increase of flows into M5. Based on a manning's calculations this pipe should be a minimum of 650mm diameter and at a grade of not less than 2% to withstand the Q100 flow however due to the unpredictable nature of the materials being set down in this area there is potential for blockage of this pipe from floating debris (such as packaging or wooden pallets).

It is therefore advisable regardless of pipe capacity to maintain the existing piped culvert, but also provide a failsafe overland flowpath between the roadway and the broad channel. This can be achieved by constructing a higher crest in the access road to M5.

The southern portion of the M3 subcatchment then drains to a broad channel which is approximately 9m wide at its narrowest point. This channel is bunded to the east to prevent flows from entering the M5 catchment. The substantial cross section of this channel has more than adequate capacity for the Q100 event. In addition to its capacity the broad base of this channel provides a low flow filtration of sediments and runoff from this catchment and set down area.

The M3 catchment then drains to the southern stormwater channel which contains flows from the U1, U2, and M1 catchments. This section of the southern stormwater channel is highly eroded due to steep grades and the previous relocation of this channel along a ridgeline. As with the western portion of the southern stormwater channel in M1, it is recommended that a reno mattress be employed in this location to the entire length of this channel between the M1 and M5 catchments.

The junction with the M3 channel flows currently requires a vertical drop of 3-4m which is causing considerable additional erosion at this node. For reasons discussed in M1 above, it is recommended that a gabion drop structure be constructed at this node to ensure that no further erosion occurs. The sizing and detail of this drop structure will be determined at detailed design stage.

Beyond the spillway to the southern stormwater channel subcatchment then passes under the proposed conveyor crossing. This crossing was the site of a key failure in the 1998 storms in which debris caused blockage in the piped crossing and diverted the majority of the upper catchment flows. In order to minimise the risk of future major events overtopping this crossing it is recommended that an open channel or culvert structure be employed.

The option of an open gabion lined channel and concrete box culvert was assessed, however as this crossing will include a road overpass as well as the dirty water pipeline passing underneath minimising cross section whilst maximising flow is a priority. For this reason a box culvert was employed. The combined catchment flow rate through this section of the southern stormwater channel are below, and a minimum longitudinal grade of 10% has been assumed:

Q5: 7.69m3/s

Q10: 9.66m3/s

Q100: 17.3m3/s

In order to convey the above flow rates with a 0.5m freeboard in the Q100 event a minimum cross section of approximately 2.5m wide by 1.75m deep is recommended as per the sketches, this will allow for approximately 0.5m of freeboard above the Q100 water level. In addition to this it is recommended that the adjacent downstream ridgeline be extended to the roadside and the road and adjacent area to the south be graded towards the south. This regrading and extension of the ridgeline will provide a redundancy in the event of blockage of the culvert where water will re-enter the southern stormwater channel rather than continue down the belt decline towards the dirty water channel.

Subcatchment M4

0.30ha

100% Pervious

Clean Water (CW) catchment.

Q5:	0.149m3/s
Q10:	0.181m3/s
Q100:	0.300m3/s

This is a small component of heavily vegetated natural slope adjacent to the M7 conveyor portal catchment.

This catchment will be experiencing reduced flows with the collection of the M7 Dirty Water and drains to the M5 catchment. There are no works proposed for this catchment.

Subcatchment M5

1.98ha

100% Pervious

Clean Water (CW) catchment.

Q5:	0.874m3/s
Q10:	1.10m3/s
Q100:	1.98m3/s

This subcatchment consists entirely of steep man made batters and access roads. As with M3 the access roads are not proposed to be used for the haul of coal and all slopes are vegetated with grass. All stormwater on M5 is collected and channelled along its eastern extent. This channel is directly adjacent to the steep batter of the M6 subcatchment and so it is important that this stormwater is contained during a major event.

The M5 stormwater channel is very flat at its northern extent and increases gradually to a grade of approximately 6%. In order to effectively transport stormwater this area should be regraded to a minimum of 1% and a trapezoidal cross section of approximately 0.5m depth, 1m base, and 1:4 batters be provided. In addition to this a bund should be constructed and maintained along the eastern edge of this subcatchment adjacent to the batter slope of M6 to minimise the possibility of overland flow down this batter which could lead to erosion.

The entry to the proposed diversion drain is located adjacent to the steep batter of the M6 subcatchment. This batter is of concern due to geotechnical considerations and therefore it is important that flows are efficiently transported away. For this reason it is recommended that the proposed M5 channel be shotcreted to minimise infiltration of flows to the batter.

In addition to shotcreting of the channel, stabilisation and seeding of the steep batter slope should be undertaken to minimise the likelihood of any surface erosion in future rainfall events.

Subcatchment M6

1.36ha

100% Pervious

Clean Water (CW) catchment.

Q5:	0.368m3/s
Q10:	0.470m3/s
Q100:	0.818m3/s

This subcatchment, as with M5 is characterised by steep man made batters and an access road. M6 is also directly adjacent to the coal stockpile catchment L2 and is the final Clean Water catchment on the southern stormwater channel before the entry to the diversion drain. M6 carries overland flow via a channel along its eastern extent adjacent to the batter to L2. The average longitudinal grade of the M6 channel is to be regraded to a minimum of 1% and in order to contain the Q100 flow a swale of approximately 0.5m depth with 1:4 batters is recommended. As with M5 it is also recommended that a bund be constructed and maintained adjacent to the eastern extent of this subcatchment in order to minimise the possibility of diversion of flows down the steep batter.

At its southern extent the flows from the M6 subcatchment join with those of the M5 catchment and then pass under the conveyor to the southern stormwater channel. This combined flow of 2.798m3/s in the Q100 event is to be constructed at a minimum grade of 5%. A Hec-Ras model of the proposed channel has resulted in a rectangular box culvert channel of approximate base width 1.5m wide by 1.0m deep which will provide a 0.5m depth of freeboard above the Q100 limit (i.e. factor of safety of 2).

As with subcatchment M3, the road adjacent to the culvert crossing is recommended to be regraded towards the southern stormwater channel to provide a redundancy overland flowpath to the southern stormwater channel in the event of blockage of the box culvert.

As with M5, this diversion drain is located adjacent to the steep batter of the L2 subcatchment. This batter is of concern due to geotechnical considerations and therefore it is important that flows are efficiently transported away. For this reason it is recommended that the channel be shotcreted to minimise infiltration of flows to the batter. In addition to shotcreeting of the channel, stabilisation and seeding of the steep batter slope should be undertaken to minimise the likelihood of any surface erosion in future rainfall events.

Subcatchment M7

1.73ha

100% Pervious

Dirty Water (DW) catchment.

Q5: 0.654m3/s

Q10: 0.778m3/s

Q100: 1.290m3/s

The M7 subcatchment is located at the southern extent of the subject site and is the location of the conveyor portal outlet from underground operations. Although conveyor design is placing emphasis on the clean transportation of coal from the portal to the stockpile, as a precaution this area has been assumed as Dirty Water to minimise the impact of localised coal spills and dust from the conveyor systems and maintenance.

Dirty Water runoff from this catchment is to be graded towards and along the access road (which is to be sealed) and directed to a piped stormwater system which will carry the Dirty Water down to the stockpile area and sediment basins. By piping this water we can ensure that it will remain separate from the clean water system.

Subcatchment M8

1.78ha

95% Pervious

5% Paved

Clean Water (CW) catchment.

Q5: 0.473m3/s

Q10: 0.615m3/s

Q100: 1.09m3/s

The M8 subcatchment runs along the northern extent of the subject site adjacent to the access road. The subcatchment is characterised by a long narrow natural ridge and a sealed roadway. The roadway is not proposed to be used for the haul of coal and is primarily an access for the office and U3 catchment. The existing stormwater which runs off the road and the ridge enters a road side swale which is heavily eroded and in need of maintenance or replacement.

As all water entering this catchment is free from coal it is to be considered Clean Water and is proposed to be collected via a piped stormwater system which will transport the water through the L2 subcatchment into an existing section of the Clean Water diversion pipeline which is to remain (east of stockpile).

As the natural soil in this location is that of a ridgeline and also passes through a naturally exposed coal seam it is highly erodible and showing considerable scour in many locations. This scouring is also resulting in degradation of the pavement edge adjacent to this drain. As discussed with the mine operators, it is advised that this section of drainage be piped underground and the road regraded towards a kerb and gutter system with kerb inlet pits at a maximum of 50m spacing.

The alternative of kerb and gutter is an open swale with grated surface inlet pits, however to address the issue of scouring the swale would require shotcrete treatment and regular maintenance to inspect for undercutting and erosion of the shotcrete.

Kerb and gutter adjacent to the pavement also provides a solid edge for pavement which will minimise erosion and degradation of this edge from the action of vehicles and prolong the life of the pavement.

Subcatchment L1

4.84ha

100% Pervious

Clean Water (CW) catchment.

Q5:	0.738m3/s
Q10:	0.951m3/s
Q100:	1.940m3/s

This catchment consists of the ridge and slope immediately adjacent to the clean water diversion channel which runs past the proposed stockpile area.

A number of options have been considered for the diversion of stormwater around the stockpile site, with emphasis being placed on the requirement for the channel to remain at a higher level than the adjacent stockpile area. The reason for this was to ensure that even in the event of heavy rainfall occurring during a full stockpile (i.e. during a rare shipping delay) the slumped stockpile would not be able to spill into the clean water diversion drain.

In addition to the elevation requirement an existing dam on the ridge adjacent to this drain is strongly recommended by the geotechnical engineer to be removed and the slope regraded to ensure that slope stability in major rainfall events (minimising the chance of land slip obstructing channel). Three channel alignment options were proposed to the mine operators including expected regraded contours of slope which are presented in sketch SK6. The option of a channel commencing at elevation RL65 has been selected as a conservative option in the absence of a final design for the stockpiles however it is recommended that the slope stability of this area be of particular attention to the detailed design of this channel on the hillside.

Design requirements of the client for this section of channel are that it needs to be wide enough to drive up and maintain (min 2.5m wide) be resistant to erosion, and be able to convey the 1:100 year storm event with a safety margin of 0.5m freeboard.

Options investigated included a gabion lined trapezoidal channel, grass lined channel, concrete box culvert, and earth channel with shotcrete coating. Grades considered ranged from 1% minimum to a 5% maximum.

Due to the requirement to maintain a level above the stockpile (which at the time of writing has not been finalised) and also to minimise velocities in the channel, a maximum grade of 1% was decided upon adjacent to the stockpile and the option of a concrete box culvert for minor storm flow was chosen. The proposed design will incorporate a concrete box culvert section of approximate dimensions 2.5m wide by 1.2m high which has capacity to deal with a 10year ARI event, this box culvert then opens to a trapezoidal channel of 1m depth which provides capacity for a 100year ARI storm with a freeboard of 0.5m. This structure is recommended to be constructed into the newly regraded slope which will minimise the likelihood of failure (rather than a cut/fill balanced bund arrangement. A detail of this preliminary cross section option can be seen on sketch SK4.

As the length of this channel is approximately 530m and the elevation change between its extents is approximately 25m in the conservative option chosen (in the absence of stockpile elevations) a 1% grade is not appropriate for the entire length of the site. For this reason it is suggested that the channel be steepened to a maximum of 5% grade beyond the stockpile and if compatible with the stockpile the main channel grade increased to 2%. This will reduce the required section of the channel but will substantially increase flow velocities. If it is assumed that 180m of channel is to be constructed at 5% grade, with the remaining 350m at 1% there will need to be a total of 12.5m in vertical drop structures along the length of the channel, or alternatively at 2% for the length of the stockpile a vertical drop of 9m.

Subcatchment L2

12.07ha

90% Pervious

10% Paved

Dirty Water (DW) catchment.

Q5: 2.84m3/s

Q10: 3.52m3/s

Q100: 6.51m3/s

This catchment consists primarily of the coal stockpile, truck loading bay, and surrounding dirty areas. It is the primary generator of dirty water within the site and the final catchment before entry of dirty water to the sediment basins.

Stormwater collected from this catchment as well as stormwater collected from the M7 and M1 (first flush) catchments is directed via a piped stormwater system to the proposed sediment basins. The sizing and location of this piped system will be detailed in construction issue drawings and is dependent heavily on the location, elevation, and size of proposed stockpiles and infrastructure on site.

The proposed sediment collection system will allow for settlement of fine and coarse sediments through two basins of combined surface area of up to 8500m2 at a minimum depth of 0.5m (i.e. providing a minimum of 4250m3). This preliminary design is based on the requirement of approximately 300m3/ha of storage and using the Soils and Construction Handbook Volume 1 (Blue Book). Basins should be constructed such that easy draining and access is available to the mine operators for clearing and maintenance. Due to the dispersive nature of the sediments, following coarse settlement the dirty water will then pass through to the storage dam for further treatment.

The existing 62ML storage dam is to continue to be used for storage of dirty water for treatment prior to discharge to the creek or reuse on site. Sizing and assessment of this basin has been based on hydrographs for the base of this catchment and the requirement to contain all storms up to and including a 10yr ARI event. The facility has the ability to pump out of this dam at between 150-300kl/hr via two pumps which are fed to clarifiers which treat the dirty water prior to reuse or discharge to the creek during storm events.

The total capacity of this basin is highly dependent on its level of silts and fines which were not fully captured in settlement basins 1 & 2 (due to the nature of the low density of coal fines suspending in water for extended periods).

In order for the mine to ensure that all storms up to a 10year event can be contained/treated within the site, a minimum of 30ML of capacity should be maintained within the basin at all times. This is assuming a pump rate of 300kL/hr; an increase to 35ML capacity is required if pumping at 150kl/hr is only available. It is important that pumping be available in the dam at all times as spare capacity in a dry spell can easily be used up in the weeks leading to a major storm.

The above storage capacity is well in excess of the requirements of the Soils and Construction, Volume 2E Mines and Quarries guideline, which specifies that for sites with highly dispersive soils and an operation life greater than 3 years that a storage for the 90th percentile 5 day rainfall event be allowed for. Based on Table 6.3a of Volume 1 of this guide 60.8mm of rainfall over the combined dirty water catchment area of 19.92ha is required; this equates to a minimum storage of 12.11ML, well below the minimum 30ML capacity proposed.

Channel Treatments

The southern drainage channel is characterised by a steep grade and in a number of areas appears to contain highly erodible soils and coal seams. This appears to have been a major contributor to a number of the blockages experienced during the 1998 event where large rocks, plants, and debris were washed downstream until they lodged in pipes or culverts.

Due purely to the grade and velocities within the varying soil conditions it is recommended that further detailed geotechnical assessment be undertaken following the Part 3A approval and prior to detailed civil design along the length of the southern stormwater channel. The purpose of this investigation will be to determine which areas of the channel are stable (and possibly on bedrock) and only require maintenance and which areas require reno mattress reinforcement.

Based on investigations following our own site inspection it is recommended that a reno mattress or gabion be placed in at least the following areas:

- Subcatchment M1 – (Reno mattress) Directly west of culvert crossing extending beyond coal seams and highly eroded steep channel section.
- Subcatchment M1 – (Gabion basket drop structure) Directly east of culvert crossing where channel drops into M3 subcatchment.
- Subcatchment M3 – (Gabion basket drop structure) Southern extent of M3 channel at junction of southern stormwater channel.
- Subcatchment M3 – (Reno mattress) Approximately 50m adjacent to culvert crossing of conveyor road.
- Subcatchment M5 – (Gabion basket drop structure) Directly downstream of conveyor road culvert crossing.
- Subcatchment M5 – (Reno mattress) M5 to M6 connection swale.
- Subcatchment M6 – (Reno mattress) Approximately 50m adjacent to headwall inlet to stockpile diversion channel.
- Subcatchment M6 – (gabion basket drop structure) Southern extent of M6 channel at junction of southern stormwater channel.

It should be reinforced that if we are to ensure that in the event of a major storm the only way to minimise any potential blockage of the channel is to ensure that the entire southern channel be stabilised. If areas other than those above are considered geotechnically stable it is still advised that these areas be cleared of large rocks and vegetation, trimmed, compacted and stabilised with either shotcrete or preferably a reno mattress.

Maintenance

The above recommended treatments should be regularly inspected (at least annually) to ensure that all gabions, reno mattresses, shotcrete, and banks are free from slumps and damage. This should include inspection of any damage to the basket of rock mattresses and gabions and if required repair of damaged sections. Shotcrete in particular should be checked for holes or damage in the flowpath of the creek as their presence can often lead to the undermining of the channel through the action of piping and eddies which will eventually lead to the failure of the channel, for this reason reno mattress (underlain with geofabric) is preferred as it will conform to slips and settlement more dynamically than rigid shotcrete.

In addition to the above treated sections of channel, all open grass lined channels and batters should be kept free from trees, heavy weeds (such as lantana) and any blockages (branches, rocks, etc.).

Bellambi Creek and Princes Hwy Culvert Crossing

Following diversion of clean water around the stockpile and dirty areas this water then enters Bellambi Creek at the eastern extent of the site where it continues east combined with additional lower catchment flows before passing under the Princes Highway via an existing concrete Culvert of dimensions 2.4m wide by 1.5m high. It is important to note that the proposed stormwater concept will not alter the flowrate of stormwater to this lower catchment, however due to the treatment of the flowpath around the site the likelihood of blockages in this catchment will be significantly reduced.

A preliminary study of this catchment has confirmed that the existing culvert is inadequate for even a Q10 event during which backwaters would accumulate until they spill over the Princes Highway. From site observations, it is not clear whether the low point of this road crossing is located at the culvert crossing and visibly appears to be further north. This would result in flood waters potentially flowing through the adjacent workshop and business before re-entering Bellambi Creek due to a man made bund adjacent to the creek (possibly as a reaction to flooding in the 1998 event).

In order to reduce this risk the RTA should consider the upgrading of the existing culvert crossing, as well as regrading to ensure that waters quickly divert back to the creek. The existing Bellambi Creek east of the Princes Highway culvert crossing should be maintained by the relevant authority to be free from heavy undergrowth and weeds to ensure that this does not contribute to blockage of the culvert (resulting in overtopping of the Princes Highway).

In addition to this, it is recommended that the mine operators clear all obstructions from the Bellambi creek west of the Princes Highway culvert such as undergrowth, trees in invert and banks, weeds and crossings to minimise the chance of blockage to the existing culvert. The flowpath of the existing Bellambi Creek west of the Princes Highway is also currently inhibited by an existing small piped culvert crossing which serves as an access for the mine operators to the south eastern portion of the site. It is recommended that this crossing be removed and a low level causeway crossing be erected instead. This would have the dual benefit of slowing velocities in minor flow events, whilst not causing a major obstruction in a major event. Although flooding of this area will not affect mine operations, this areas maintenance should minimise future flooding possibilities from minor storms.

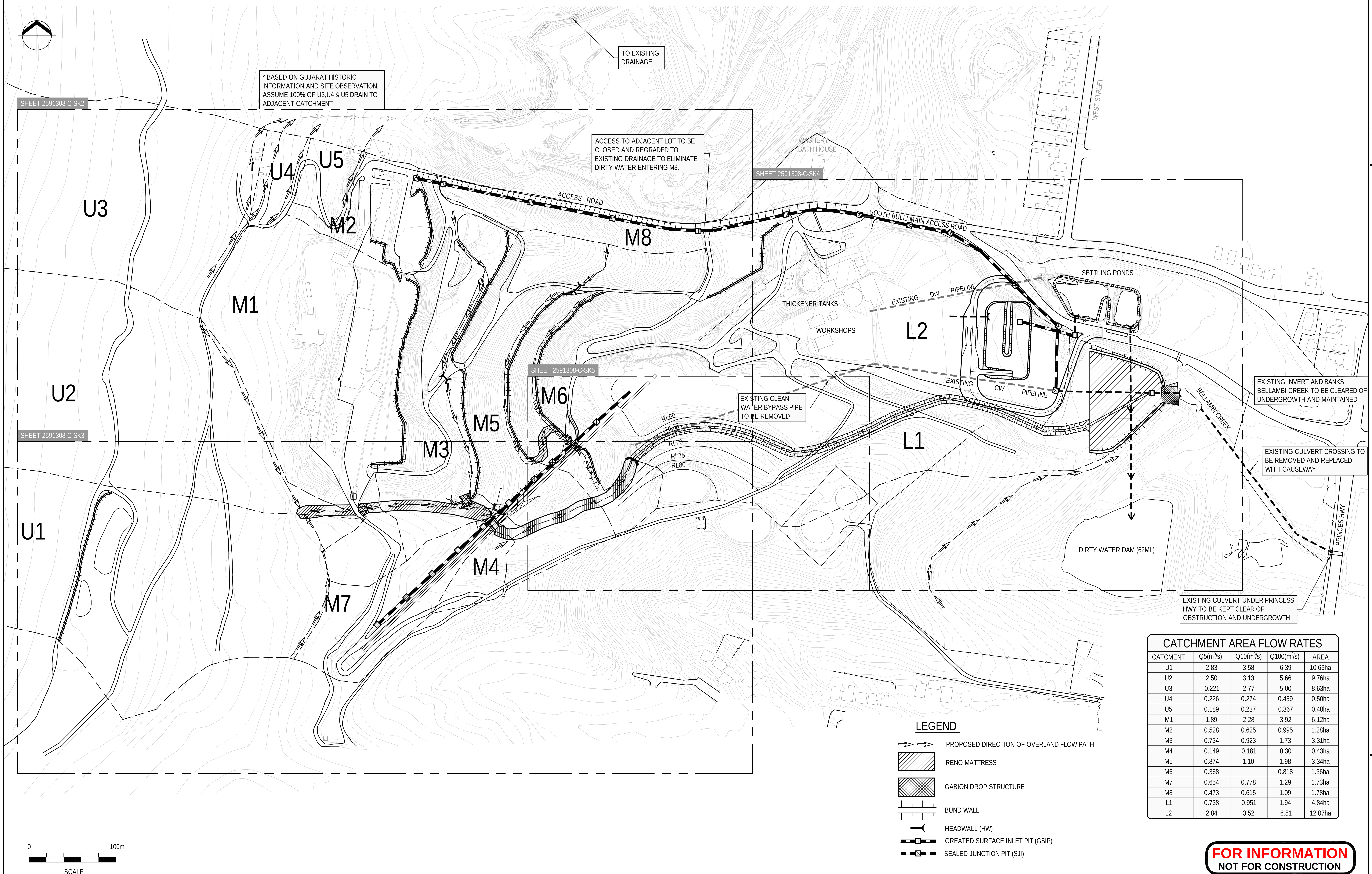
Conclusion

Although there is no increase in impervious area or flow intensities across the site, this is an opportunity to improve stormwater performance in a major event. In accordance with the recommendations of *Managing Urban Stormwater: soils and construction volumes 1 and 2E*; the stormwater concept proposes a number of measures which will minimise the likelihood of a failure such as 1998 occurring in the future, through both the maintenance and upgrade of existing diversions and flowpaths (such as those in the upper subcatchments) and the recommendation of open channels and diversions around the stockpile area with settlement basins, scour protection, and clearing of undergrowth.

It should also be noted that downstream of the site there are issues that may result in substantial impacts on the community due to flooding. These are the road culvert under the Princes Highway giving rise to a potential choke point and also the state of the Bellambi Creek East of the Princes Highway that has been significantly altered, with the potential to restrict the flow of water along its length.

It is recommended that the existing and proposed diversion channels and drains be lined as recommended above in consultation with geotechnical advice and maintained regularly to minimise scouring during major flow events. All reno mattress areas should be regularly inspected and repaired where necessary, and all shotcrete areas are to be inspected for undermining and eddies which could lead to erosion if left unaddressed.

Appendix 1) – Hydrology Review Sketches



CATCHMENT AREA FLOW RATES

CATCMENT	Q5(m^3/s)	Q10(m^3/s)	Q100(m^3/s)	AREA
U1	2.83	3.58	6.39	10.69ha
U2	2.50	3.13	5.66	9.76ha
U3	0.221	2.77	5.00	8.63ha
U4	0.226	0.274	0.459	0.50ha
U5	0.189	0.237	0.367	0.40ha
M1	1.89	2.28	3.92	6.12ha
M2	0.528	0.625	0.995	1.28ha
M3	0.734	0.923	1.73	3.31ha
M4	0.149	0.181	0.30	0.43ha
M5	0.874	1.10	1.98	3.34ha
M6	0.368		0.818	1.36ha
M7	0.654	0.778	1.29	1.73ha
M8	0.473	0.615	1.09	1.78ha
L1	0.738	0.951	1.94	4.84ha
L2	2.84	3.52	6.51	12.07ha

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
B	CONCEPT DESIGN - NOT FOR CONSTRUCTION	AS	SM		8/10/09
A	CONCEPT DESIGN - ISSUED FOR REVIEW	AS	SM		23/7/09

Drawing Originator: Beca

Original Scale (A1) 1:2000	Design	PI	23/7/09
	Drawn	AS	23/7/09
Reduced Scale (A3) 1:4000	Dsg Verifier	SM	29/9/09
	Dwg Check		

Approved For Construction*
Date
* Refer to Revision 1 for Original Signature

Client: GUJARAT NRE

Project: GUJARAT NRE No. 1 HYDROLOGICAL INVESTIGATION

Title: GENERAL SITE LAYOUT WITH CATCHMENT AREAS & FLOW RATES

Discipline: CIVIL

Drawing No. 2591308-C-SK1 Rev. B

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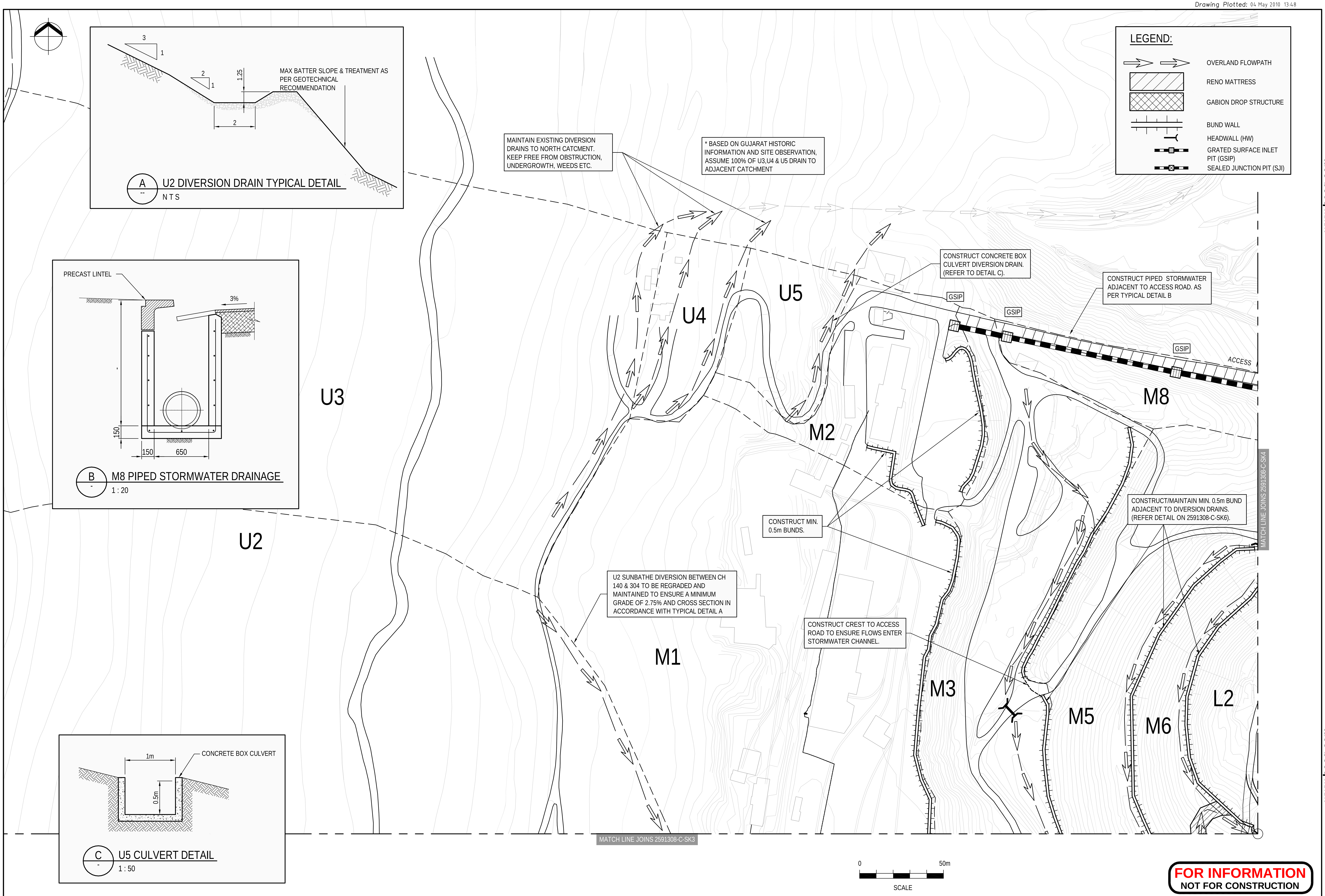
Document No. 2591308-C-SK1.dwg



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No.	Revision	By	Chk	Appd	Date
B	CONCEPT DESIGN - NOT FOR CONSTRUCTION	AS	SM		8/10/09
A	CONCEPT DESIGN - ISSUED FOR REVIEW	SK	SM		23/7/09

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Reduced Scale (A3) 1:2000	Drawn	SK	23/7/09	
	Dsg Verifier	SM	29/9/09	
	Dwg Check			Date

* Refer to Revision 1 for Original Signature

Client: GUJARAT NRE

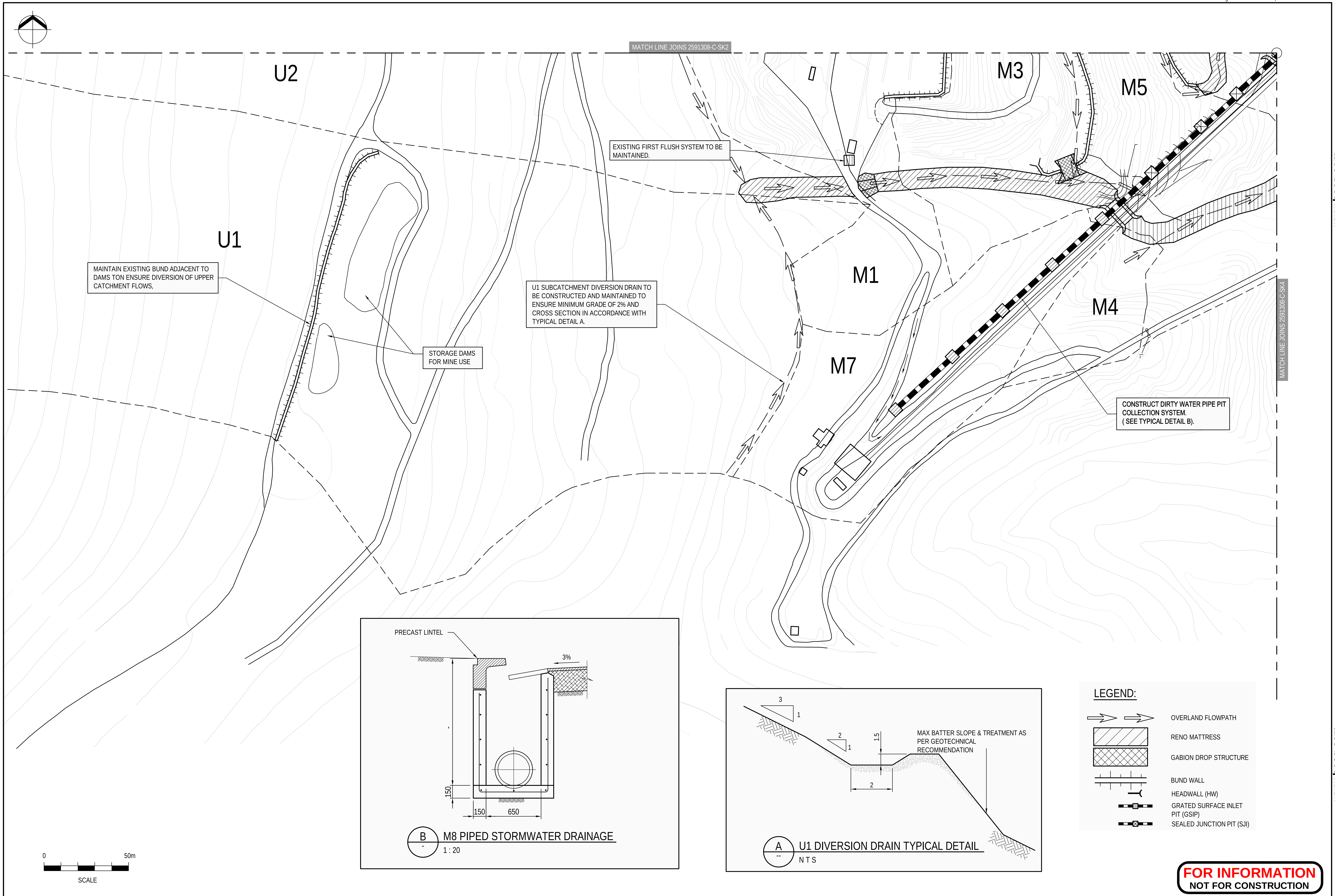
Project: GUJARAT NRE No. 1 HYDROLOGICAL INVESTIGATION

Title: SITE LAYOUT DETAIL 1 OF 4 - NORTH WEST

Discipline: CIVIL

Drawing No. 2591308-C-SK2 Rev. B

Drawing Plotted: 04 May 2010 13:48



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No.	Revision	By	Chk	Appd	Date
B	CONCEPT DESIGN - NOT FOR CONSTRUCTION	AS	SM		8/10/09
A	CONCEPT DESIGN - ISSUED FOR REVIEW	SK	SM		23/7/09

Drawing Originator: Beca

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	Drawn	SK	23/7/09
Reduced Scale (A3) 1:2000	Dsg Verifier	SM	29/9/09
	Dwg Check		

Approved For Construction*

Date

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Client: GUJARAT NRE

Project: GUJARAT NRE No. 1 HYDROLOGICAL INVESTIGATION

Title: SITE LAYOUT DETAIL 2 OF 4 - SOUTH WEST

Discipline: CIVIL

Drawing No. 2591308-C-SK3

Rev. B

Document No. 2591308-C-SK3.dwg

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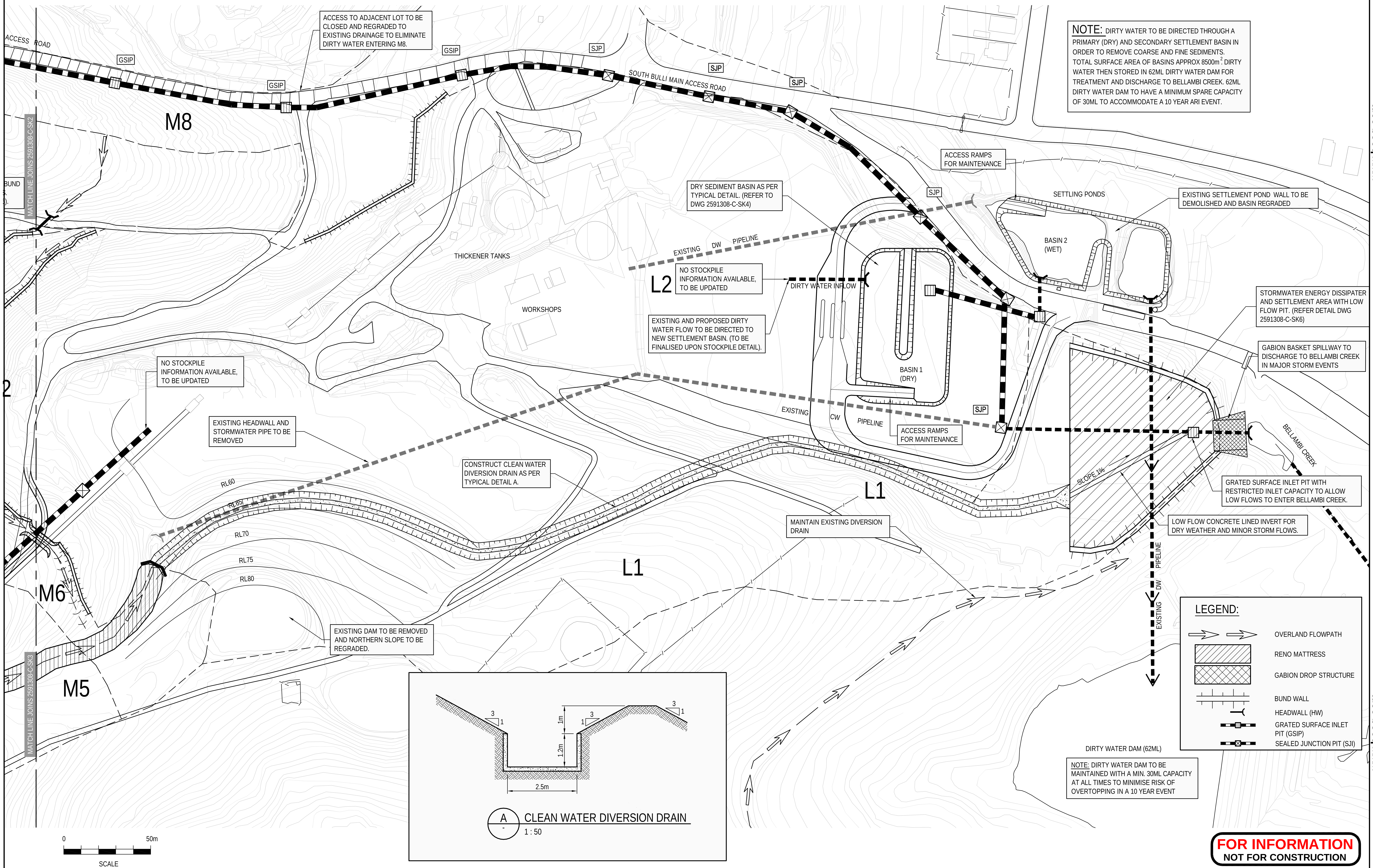
Drawing Plotted: 04 May 2010 13:49



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No.	Revision	By	Chk	Appd	Date
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A	CONCEPT DESIGN - ISSUED FOR REVIEW	SK	SM		23/7/09

Drawing Originator: Beca

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	Drawn	SK	23/7/09
Reduced Scale (A3) 1:2000	Dsg Verifier	SM	29/9/09
	Dwg Check		Date

Approved For Construction*
* Refer to Revision 1 for Original Signature

Client: GUJARAT NRE

Project: GUJARAT NRE No. 1 HYDROLOGICAL INVESTIGATION

Title: SITE LAYOUT DETAIL 3 OF 4 - EAST

Discipline: CIVIL

Drawing No.: 2591308-C-SK4 Rev. B

Document No. 2591308-C-SK4.dwg

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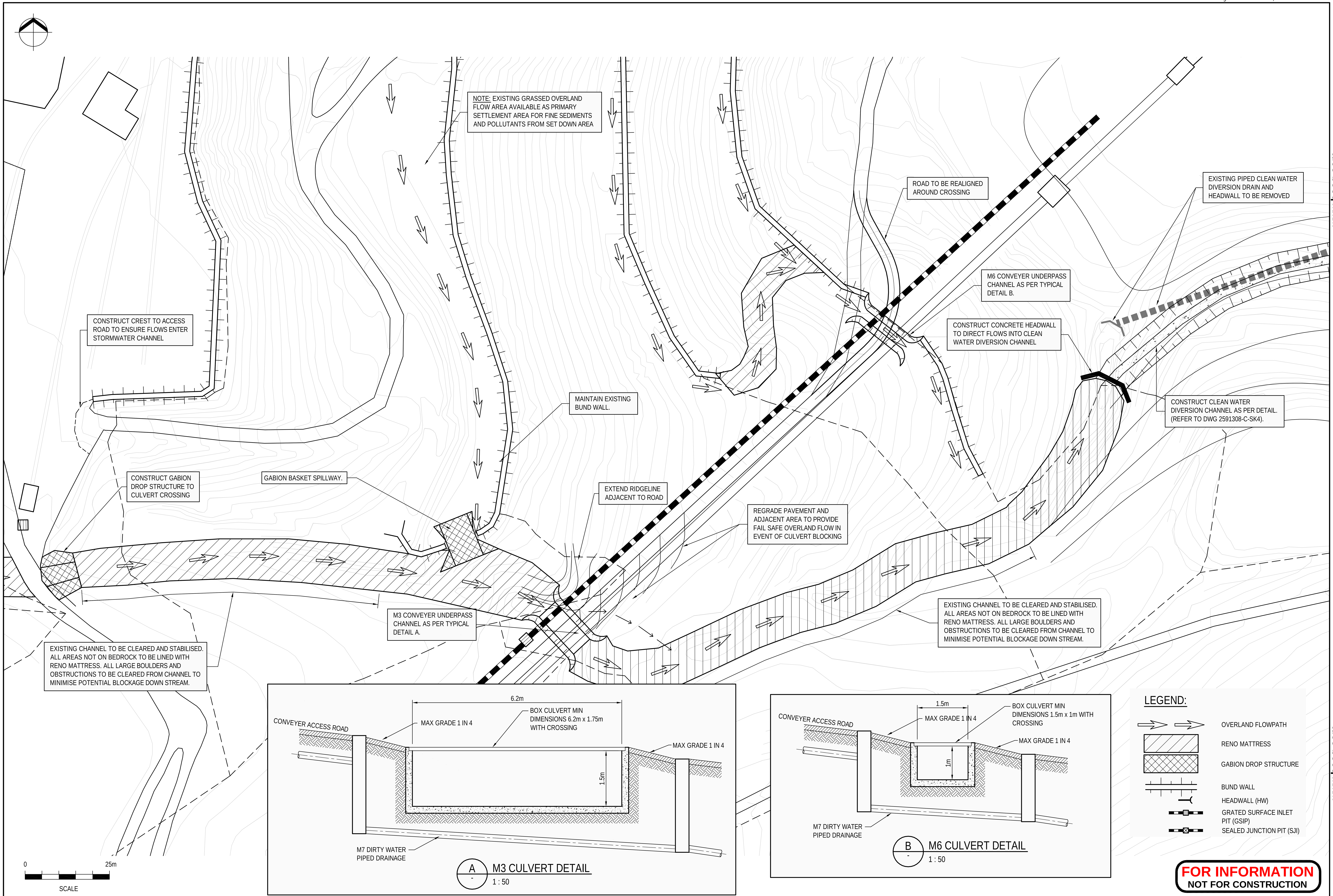
Drawing Plotted: 04 May 2010 13:49



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Reduced Scale (A3) 1:1000	Drawn	SK	23/7/09
	Dsg Verifier	SM	29/9/09
	Dwg Check		

Approved For Construction*

Date

* Refer to Revision 1 for Original Signature

Client: GUJARAT NRE

Project: GUJARAT NRE No. 1 HYDROLOGICAL INVESTIGATION

Title: SITE LAYOUT DETAIL 4 OF 4 - CLEAN WATER CHANNEL

Discipline: CIVIL

Drawing No. 2591308-C-SK5

Rev. B

Document No. 2591308-C-SK5.dwg

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	Drawn	SK	23/7/09
Reduced Scale (A3) 1:1000	Dsg Verifier	SM	29/9/09
	Dwg Check		

Approved For Construction*

Date

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Client: GUJARAT NRE

Project: GUJARAT NRE No. 1 HYDROLOGICAL INVESTIGATION

Title: PROPOSED DAM WALL REGRADE AND CHANNEL OPTIONS

Discipline: CIVIL

Drawing No.: 2591308-C-SK6

Rev.: B

Document No. 2591308-C-SK6.dwg

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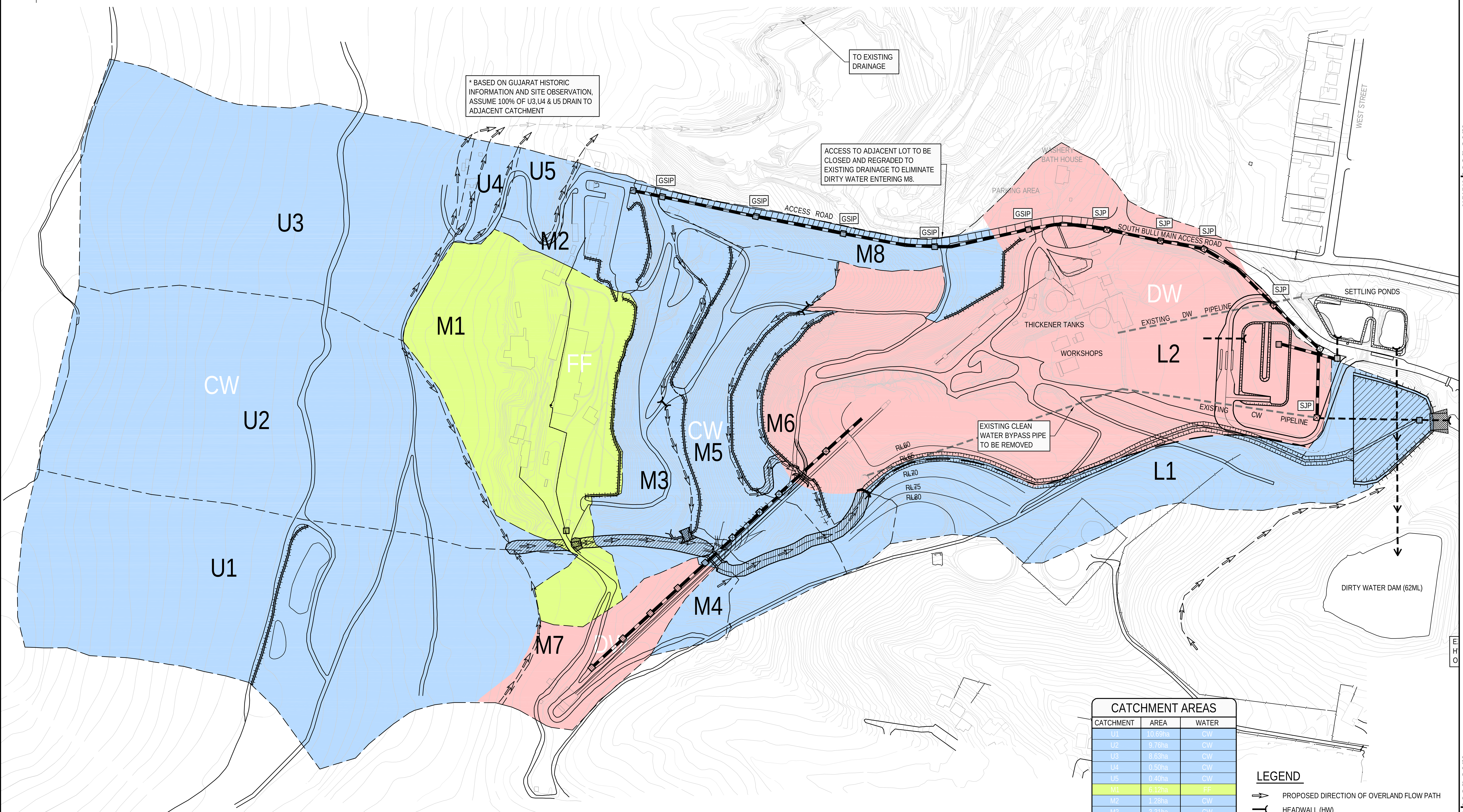

CATCHMENT AREAS

CATCHMENT	AREA	WATER
U1	10.69ha	CW
U2	9.76ha	CW
U3	8.63ha	CW
U4	0.50ha	CW
U5	0.40ha	CW
M1	6.12ha	FF
M2	1.28ha	CW
M3	3.31ha	CW
M4	0.43ha	CW
M5	3.34ha	CW
M6	1.36ha	CW
M7	1.73ha	DW
M8	1.12ha	CW
M9	0.66ha	CW
L1	4.84ha	CW
L2	12.07ha	DW

LEGEND

- PROPOSED DIRECTION OF OVERLAND FLOW PATH
- HEADWALL (HW)
- GRATED SURFACE INLET PIT (GSIP)
- SEALED JUNCTION PIT (SJI)
- FF FIRST FLUSH
- CW CLEAN WATER
- DW DIRTY WATER

0 1000m
SCALE

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Reduced Scale (A3) 1:4000	Dsg Verifier	SM	29/9/09	
	Dwg Check			Date
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Client: GUJARAT NRE

Project: GUJARAT No. 1 HYDROLOGICAL INVESTIGATION

Title: SITE LAYOUT CLEAN/DIRTY WATER REGIONS

Discipline: CIVIL

Drawing No. 2591308-C-SK7 Rev. B

E H O

Document No. 2591308-C-SK7.dwg

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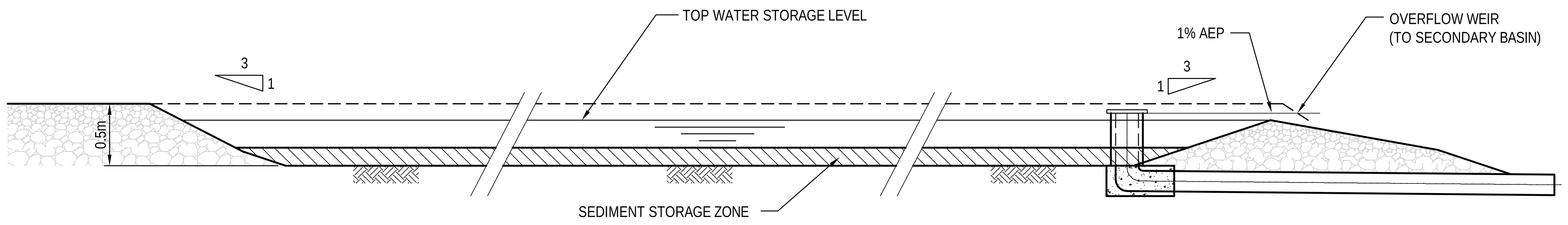
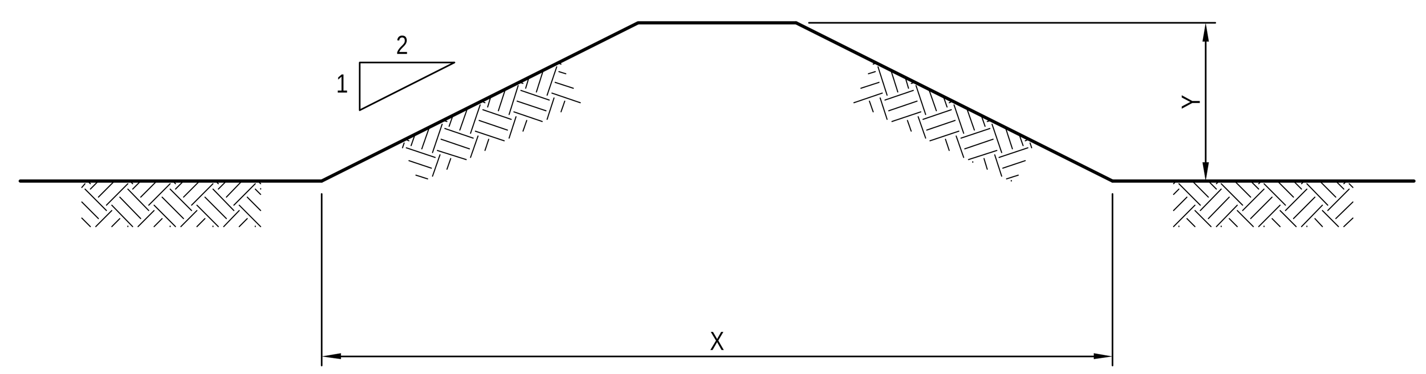
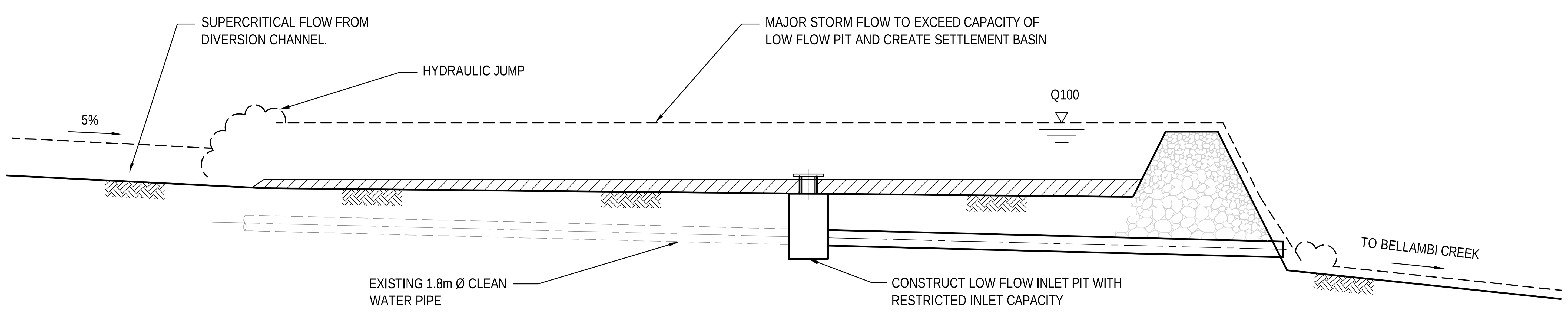


1 TYPICAL SECTION DETAIL - DRY SEDIMENT POND
NTS



3 DETAIL - TYPICAL EARTH BUND
1 : 20



2 CLEAN WATER SETTLEMENT BASIN
NTS

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Drawing Originator: Beca

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Reduced Scale (A3) 1:40	Dsg Verifier	SM	29/9/09	
	Dwg Check			Date
	* Refer to Revision 1 for Original Signature			

Client: GUJARAT NRE

Project: GUJARAT NRE No. 1 HYDROLOGICAL INVESTIGATION

Title: DETAILS SHEET

Discipline: CIVIL

Drawing No. 2591308-C-SK8 Rev. B

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Appendix B

Bellambi Gully Water Quality Samples

Appendix B

Table B1 - Water Quality samples of the discharge into Bellambi Creek (from Post-Thickener Tank line); note: oil and grease is not monitored.

Parameters	Units	Sample (23/01/09)	Sample (18/02/09)	Sample (04/03/09)	Sample (01/04/09)	ANZECC Guidelines, unless specified	Comments
Alkalinity	Mg $CaCO_3$/L	790	650	700	950	**NA**	
Ammonia	mg/L	<0.02	<0.02	<0.02	<0.02	**0.9**	95% protection level
Bicarbonate	Mg $CaCO_3$/L	700	540			**NA**	
BOD5	mg O_2/L		5	<2	<2	**<15**	Lowland River discharge
Carbonate as CaCO3	mg/L	91	110			**NA**	See *Alkalinity* comments
COD	mg/L		28	32	24	**<40**	Lowland River discharge
Conductivity	µS/cm	1600	1600	1600	2100	**125-2000**	Lowland River discharge
Enterococcus	cfu/100mL		130	2000	60	**NA**	
pH	pH units	8.8	9	9	9	**6.5-9.2**	**EPL licence requirement**
Thermo tolerant coliforms	cfu/100mL		300	2800	80	**<0.02** **100**	Lowland river discharge Low effect on livestock drinking water
Total coliforms	cfu/100mL		10000	2500	400	**NA**	Microbial growth evident
Total dissolved solids	mg/L	750	890	870	1300		
Total organic carbon	mg/L	6	6	6	11	**NA**	
Total phosphorus	mg/L	0.03	0.03	0.03	0.05	**0.025**	Lowland river discharge
Total suspended Solids	mg/L	13	20	22	27	**<50**	**EPL licence requirement**
Turbidity	NTU		26	33	27	**1-20**	Assumed for lakes and reservoirs category
Hardness	mg/L			40	42	**20-100**	Fouling potential >350mg $CaCO_3$/L
UV Transmissivity @ 254nm					51		

Table B2 – V Notch Weir at Storm Water Control Dam

Analyte	Units	22/1/2010	2/10/2010
pH	pH	7.1	7.74
Conductivity	µS/cm @ 25°C	1700	1200
Oil and Grease	mg/L	-	-
TSS	mg/L	2	164
Turbidity	NTU	-	1010
TKN	mg N/L	0.4	-
TP	mg/L	0.07	-

Appendix C

NRE Russell Vale Bellambi Gully Creek Water Quality Samples

Table C1 – Bellambi Gully Creek at Gladstone Street Russel Vale

Analyte	Units	22/1/2010	3/04/2010	13/4/2010
pH	pH	8.1	8.49	8.97
Conductivity	µS/cm @ 25°C	1900	1240	1360
Oil and Grease	mg/L	<0.1	-	-
TSS	mg/L	23	12	2
Turbidity	NTU	-	66.3	11.1
TKN	mg N/L	0.9	0.5	0.5
TP	mg/L	0.13	0.08	0.09

Table C2 – Bellambi Gully Creek at West-side of Culvert at Princess Highway Russel Vale

Analyte	Units	22/1/2010	3/04/2010	13/4/2010
pH	pH	8.8	8.58	7.32
Conductivity	µS/cm @ 25°C	1800	1220	1510
Oil and Grease	mg/L	<0.1	-	-
TSS	mg/L	6	26	10
Turbidity	NTU	-	152	34.2
TKN	mg N/L	0.9	0.4	0.5
TP	mg/L	0.08	0.08	0.09

Table C3 – Bellambi Gully Creek – water upstream of LDP 2 Russel Vale

Analyte	Units	3/04/2010	13/4/2010
pH	pH	8.46	8.79
Conductivity	µS/cm @ 25°C	1060	1160
Oil and Grease	mg/L	-	-
TSS	mg/L	4	2
Turbidity	NTU	21.3	6.4
TKN	mg N/L	0.4	0.4
TP	mg/L	0.04	0.04

Table C4 – Water discharge to Bellambi Gully Creek at LDP2 Russel Vale

Analyte	Units	22/1/2010	23/02/2010	3/03/2010	4/09/2010
pH	pH	9.1	8.6	8.77	9.03
Conductivity	µS/cm @ 25°C	1900	1100	1240	1280
Oil and Grease	mg/L	<0.1	<5	<10	<5
TSS	mg/L	21	9	16	8
Turbidity	NTU	39	33.3	26.4	19.2
TKN	mg N/L	1.1	0.4	0.4	0.4
TP	mg/L	0.12	0.11	0.07	0.21

Appendix D

Irrigation calculations for treated Blackwater effluent disposal at Shaft #4

The following table shows irrigation rates for treated Blackwater at Shaft #4.

Month	Days	Effluent (m3)	Rainfall (mm)	Rainfall (m3)	Pan Evaporation (mm)	Crop Factor (Pasture)	Evapotranspiration (mm)	Volume of evaporation (m3)	Percolation (m3)	Available for Irrigation (m3)	Storage change for each month
Jan	31	229.4	67.1	301.95	175	0.7	122.5	551.25	67.5	316.8	0
Feb	28	207.2	68.5	308.25	175	0.7	122.5	551.25	67.5	310.5	0
Mar	31	229.4	67.2	302.4	125	0.7	87.5	393.75	67.5	158.85	70.55
Apr	30	222	47.4	213.3	100	0.6	60	270	67.5	124.2	97.8
May	31	229.4	32	144	80	0.5	40	180	67.5	103.5	125.9
Jun	30	222	34.8	156.6	80	0.45	36	162	67.5	72.9	149.1
Jul	31	229.4	26.1	117.45	60	0.4	24	108	67.5	58.05	171.35
Aug	31	229.4	25.1	112.95	80	0.45	36	162	67.5	116.55	112.85
Sep	30	222	37.1	166.95	125	0.55	68.75	309.375	67.5	209.925	12.075
Oct	31	229.4	49.8	224.1	150	0.65	97.5	438.75	67.5	282.15	0
Nov	30	222	55.5	249.75	175	0.7	122.5	551.25	67.5	369	0
Dec	31	229.4	53.2	239.4	200	0.7	140	630	67.5	458.1	0
TOTAL		**2701**		**2537.1**				**4307.625**	**810**	**2580.525**	**739.625**

Notes:

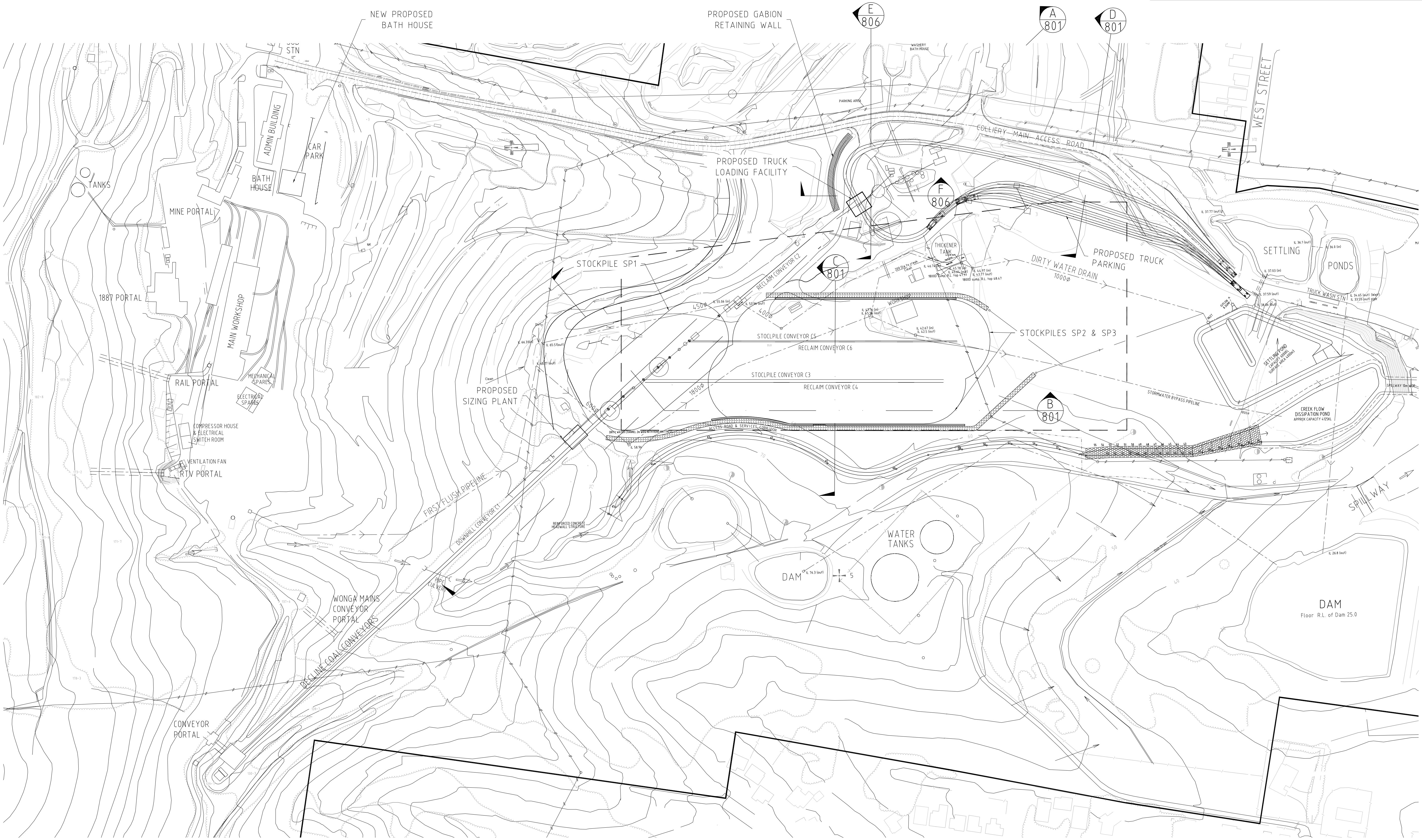
Effluent flow rate is based on a daily generation of 7.4kL/d black water
Rainfall (mm), averaged for Picton, NSW, available from the Bureau of Meteorology website
Pan evaporation (mm) estimated from the Bureau of Meteorology, http://www.bom.gov.au/jsp/ncc/climate_averages/evaporation/index.jsp
Crop factor, assumed for pasture using the DEC 2003 guidelines
Evapotranspiration (mm), calculated by multiplying pan evaporation with crop factor
Evapotranspiration (m^3), converted by multiplying with the available irrigation area (4,500m^2)
Percolation (m^3), 15mm per month, in accordance with DEC guidelines (4,500m^2)
Available for Irrigation (m^3), the amount of effluent that can be irrigated, determined by the equation: evaporation + percolation – rainfall
Storage at start of month (m^3), the amount of excess effluent that must be stored per year.

Available storage is approximately 1,200kL. Irrigation rates can be increased by increasing area under irrigation. During prolonged wet weather, treated effluent can be trucked offsite.

Annex C

Surface Layout and Building Plans

REFERENCE DRAWINGS	DRG. No.
LONG SECTION AND SECTION VIEWS	282801
MUD MAP	282802



REV	DATE	REVISIONS	DRN	APP	REV	DATE	REVISIONS	DRN	APP
E	21/05/2010	REVISED TRUCK PATH AND PARKING	MJD						
D	14/04/2010	REVISED REVISION	MJD						
C	06/04/2010	REVISED SCREENING BLD,ACCESS & EGRESS ROAD	MJD						
B	24/03/2010	REVISED ACCESS ROAD AND TRUCK LOADING FACILITY	MJD		G	09/07/10	UPPER BENCH WITH NEW BATH HOUSE ADDED	JAH	DS
A	22/03/2010	ISSUED FOR REVIEW	GKL	-	F	21/06/10	POWER LINE ADDED	JAH	DS

AS 1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

	NAME	DATE
DESIGN	GKL	MAR 10
DRAWN	GKL	MAR 10
CHECKED	XXX	XXX
APPROVED	XXX	XXX
SCALE	1 : 1500	

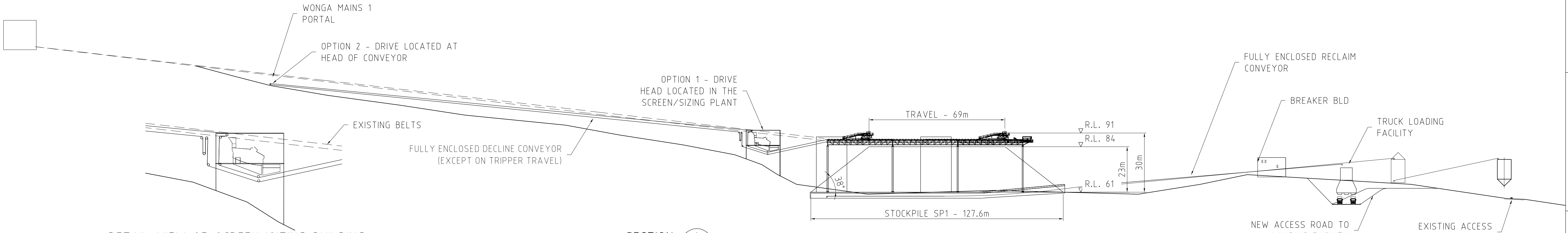
JBK Engineering & Mining
Ph. 02 4271 6424 Fax. 02 4272 6424
Workshop: 6 Investigator Drive UNANDERRA
P.O. Box 1184 UNANDERRA DELIVERY CENTRE UNANDERRA NSW 2526

GUJARAT NRE COKING COAL Ltd

No. 1 COLLIERY RUSSELL VALE
PROPOSED UPGRADE
300KT STOCKPILE PROJECT – PLAN

ISSUE: PROPOSAL
DWG. SIZE: A1
JBK DWG No.: 282800
REVISION: G

REFERENCE DRAWINGS	DRG. No.
PLAN VIEW	282800
MUD MAP	282802



DETAIL VIEW OF SCREEN/SIZING BUILDING
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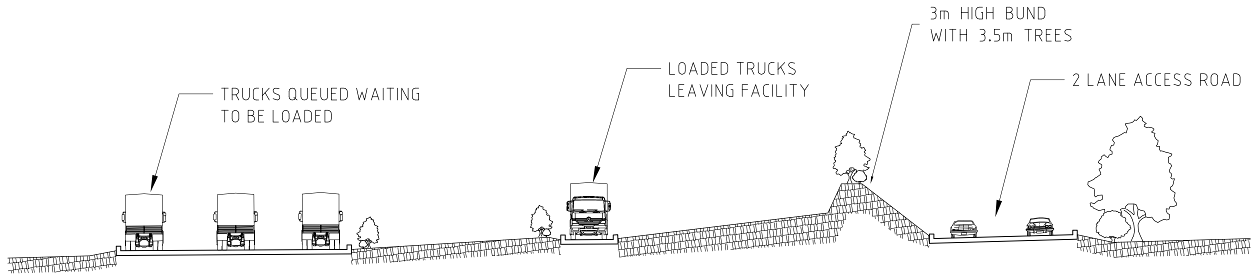
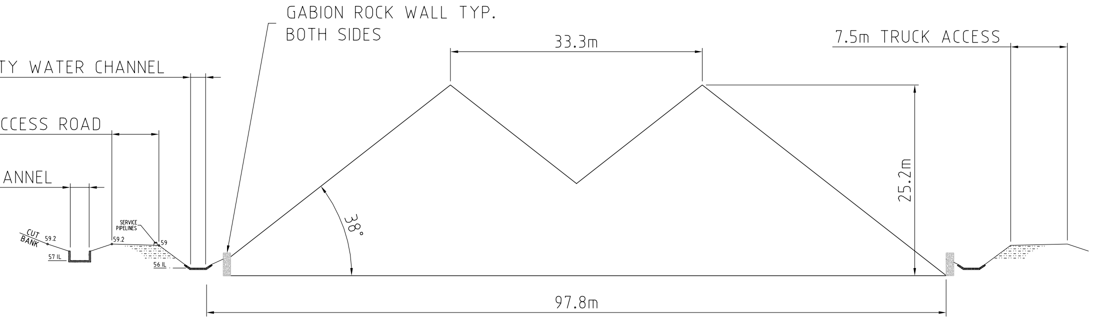
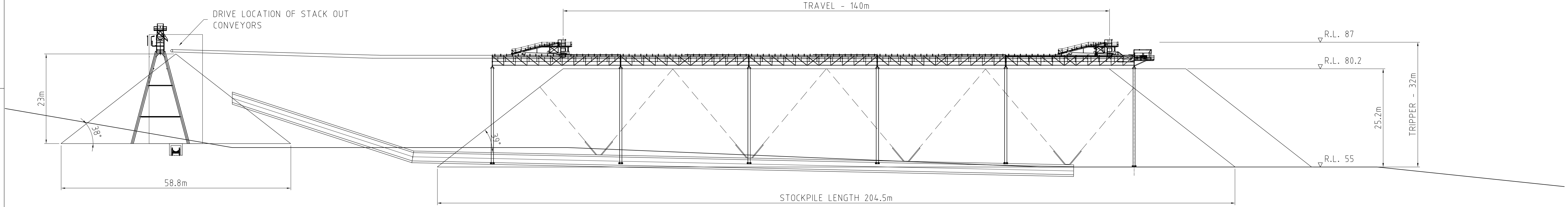
SECTION A 00 LONG SECTION OF DECLINE BELT AND STOCKPILE 1
SCALE 1 : 1000



SECTION D 00 SECTION VIEW OF NEW TRUCK ACCESS & EGRESS ROAD
SCALE 1 : 500



SECTION C 00 SECTION VIEW OF STACKOUT STOCKPILES 2 & 3
SCALE 1 : 500



TRUE SECTION VIEW OF STOCKPILE 1

SECTION B 00 LONG SECTION OF PROPOSED STACKOUT STOCKPILES 2 & 3
SCALE 1 : 500

REV	DATE	REVISIONS	DRN	APP	REV	DATE	REVISIONS	DRN	APP
E	21/05/2010	REVISED TRUCK PATH AND PARKING.	MJD						
D	06/04/10	REVISED SCREENING BLD, TRUCK ACCESS & EGRESS	MJD						
C	28/03/10	REVISED LOCATION OF SCREENING BLD	MJD						
B	24/03/10	REVISED LOCATION OF TRUCK LOADING	MJD						
A	22/03/10	ISSUED FOR REVIEW	GKL	-	-	-	-	-	-

AS 1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

	NAME	DATE
DESIGN	GKL	MAR '10
DRAWN	GKL	MAR '10
CHECKED	XXX	XXX
APPROVED	XXX	XXX
SCALE	1 : 1000	

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GUJARAT NRE COKING COAL Ltd
No. 1 COLLIERY RUSSELL VALE
PROPOSED UPGRADE
300KT STOCKPILE PROJECT – LONG SECTIONS

ISSUE: PROPOSAL
DWG. SIZE: A1
JBK DWG No. 282801
REVISION: E

REFERENCE DRAWINGS	DRG. No.
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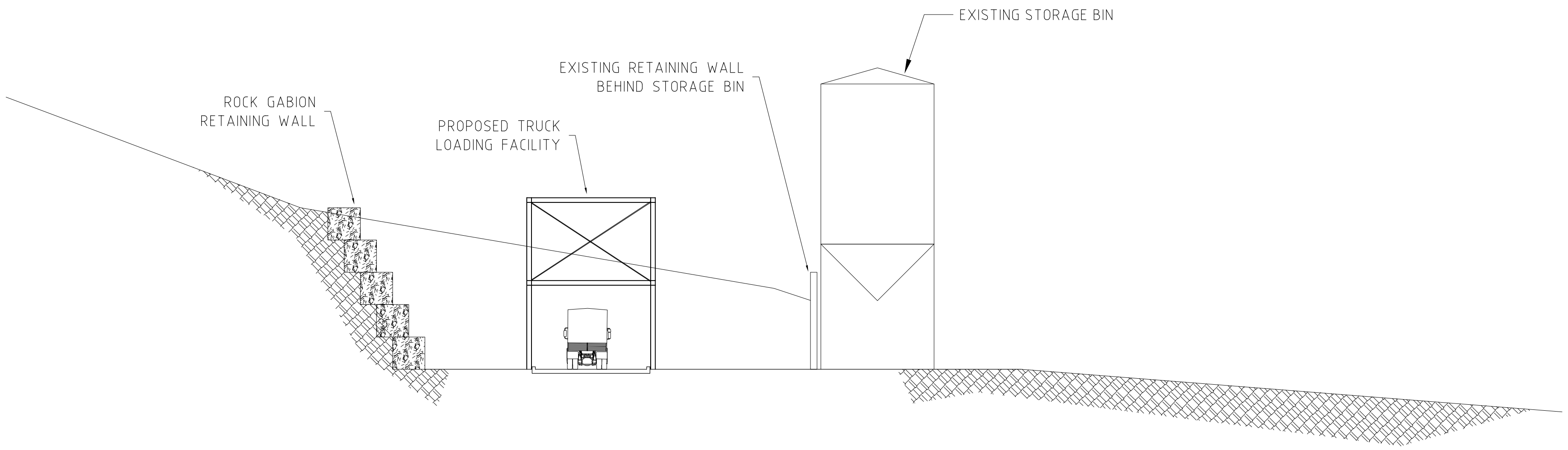
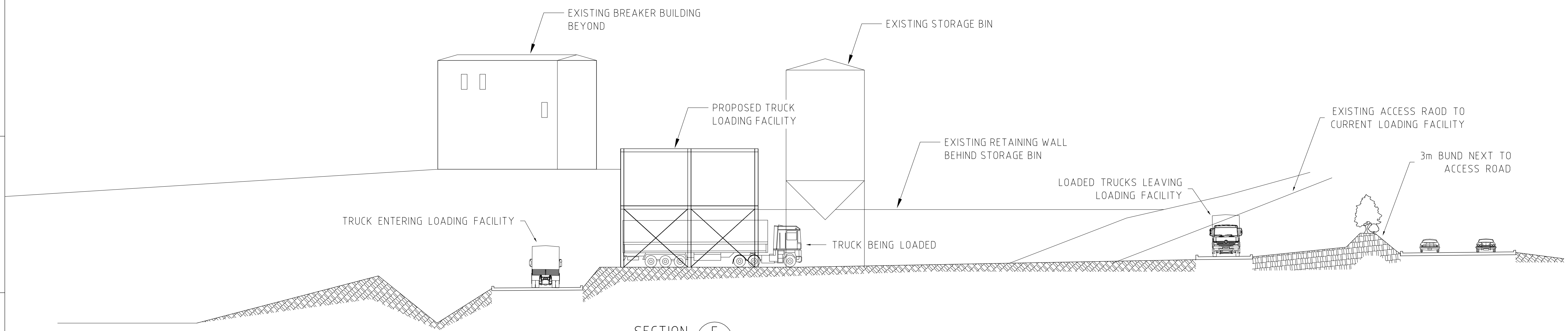
MUD MAP	282802



SECTION F/00 SCALE 1 : 200 SECTION VIEW OF LOADING FACILITY AND ROAD



SECTION E/00 SCALE 1 : 200 SECTION THROUGH ROADS AND LOADING FACILITY

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A	24/5/10	ISSUED FOR REVIEW	MJD	-	-	-	-	-	-

AS 1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

	NAME	DATE
DESIGN	GKL	MAY '10
DRAWN	MJD	MAY '10
CHECKED	XXX	XXX
APPROVED	XXX	XXX
SCALE	1 : 200	

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GUJARAT NRE COKING COAL Ltd

No. 1 COLLIERY RUSSELL VALE
PROPOSED UPGRADE
300KT STOCKPILE PROJECT – SECTIONS E & F

ISSUE: PROPOSAL
DWG. SIZE: A1
JBK DWG No.: 282806
REVISION: A

Annex D

On Site Traffic

Olsen Environmental Consulting Pty Limited

FINAL

NRE No 1 Colliery
Russell Vale Site

Stage 2 of Upgrade to Surface Facilities And On-site Traffic Report

December 2010

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OEC File Reference: P84/2308

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APPENDICES

1. INTRODUCTION

Gujarat NRE Coking Coal Limited (NRE) own and operate the NRE No. 1 Colliery at Russell Vale and propose to upgrade the colliery. The colliery upgrade includes a reorganisation of the surface infrastructure, services and facilities at Russell Vale.

The upgrade will occur in a staged process with a Preliminary Stage (Stage 1) providing a transition to the Final Upgraded Stage (Stage 2). This report describes the surface facilities and on-site traffic arrangements for Stage 2.

Olsen Environmental Consulting Pty Ltd (OEC) prepared a previous report which describes the surface facilities and on-site traffic arrangements for Stage 1 of the project (Surface Facilities and On-site Traffic Preliminary Works Part 3A, 26th May 2010) (**OEC 2010A**). This previous report is included as Appendix A and contains details of the surface facilities and traffic arrangements existing prior to Stages 1 and 2 of the proposed development. It establishes a basis for impact assessment.

NRE are required to obtain a valid development approval for the colliery in accordance with the ***Environmental Planning and Assessment Act 1979*** (**EP&A Act**). This requires the preparation of an Environmental Assessment under the provisions of Part 3A of the **EP&A Act.** NRE have commissioned Environmental Resources Management (ERM) to prepare this Environmental Assessment.

In April 2009 NRE commissioned Olsen Consulting Group Pty Ltd (OCG) to provide the following services:

- Provide specific input into some components of the No. 1 Colliery Upgrade. These components include developing a storm water control and management system and developing a site traffic arrangement that addressed heavy, mining and light vehicle routes;

- Undertake a detailed survey of the existing facility at Russell Vale;

- Provide assistance to the Environmental Manager (Don Jephcott) to co-ordinate assessments relating to geotechnical, hydrological and water treatment systems for the Russell Vale Site. These studies would provide the information necessary to determine general design and to locate components of the surface upgrade project. The design would be undertaken to a stage that ensures the proposed facilities are able to be built as described and located appropriately. The general design does not include detailed construction design; and

- To develop site plans incorporating the outcomes of the various component projects and studies. These plans will eventually be used in describing the proposed project within the Part 3A Environmental Assessment being prepared by ERM.

Other consultant groups have been involved in determining the layout of the upgraded surface facilities at NRE No. 1 Colliery. These include:

- ERM has been commissioned to prepare the Part 3A Environmental Assessment. They have also been commissioned to conduct additional assessments such as noise, dust and visual for the Environmental Assessment;

- The engineering consultancy Beca was commissioned to provide expert hydrological advice for the design of the surface layout and water management;

- Ellton Conveyors (Ellton) was engaged to design a conceptual conveyor/stockpile system. This was the central component of the overall layout design. The Ellton proposal became an option for the project and was later rejected;

- JBK Engineering and Mining was subsequently commissioned to provide an alternative conveyor/stockpile system. Their design became the adopted design for the project;

- Coffey Geosciences Pty Ltd was commissioned to undertake geotechnical studies for the project; and

- Cardno Eppell Olsen was commissioned to prepare an off-site Traffic Study.

In April 2010 NRE commissioned OEC to prepare two reports on the surface facilities and on-site traffic proposals to describe both Stages of the developments proposed for the No 1 Colliery at Russell Vale. This is the second of those two reports and it addresses Stage 2.

2. EXISTING SITE ARRANGEMENTS

2.1. OPERATIONS HISTORY

Gujarat NRE Coking Coal Limited is the holder of Consolidated Coal Lease No 745 (CCL 745), which includes the surface at No.1 Colliery Russell Vale and ML 1575. CCL 745 covers approximately 6,001 ha and ML 1575 covers approximately 544 ha. The total area held under lease is therefore approximately 6545 ha of which 750 ha is freehold land. The balance is Crown Land located within the Cataract Dam catchment which is under the control of the Sydney Catchment Authority (SCA).

The colliery includes 5 surface sites near Wollongong on the escarpment and in the catchment near to the dam. This report focuses on the original site at Russell Vale, which has been operating continuously since 1887. In the mid 1970's a vertical shaft (No. 4 Shaft) was established for men and materials access to the workings about 15 km west of the escarpment and the facilities at Russell Vale. This area comprises offices, workshop, bathhouse, store and winder. There are four other shafts, including the No.1, No.3 and No.5 which are all ventilation shafts and the No.2 Shaft which has been decommissioned.

2.2. MINE OWNERSHIP

Gujarat NRE Australia Pty Ltd (GNAL) purchased the colliery in December 2004. GNAL was a private company with its major shareholder an Indian public company and India's largest independent metallurgical coke producer, Gujarat NRE Coke Limited (GNCL). GNAL has subsequently gained its own listing on the stock exchange and changed its name to Gujarat NRE Coking Coal Limited (GNCCL).

2.3. PROPOSED AND FUTURE OPERATIONS

Since taking over operation of the Mine, GNCCL has been sequentially implementing a Mine Plan during the following three broad development periods:

Development Period 1 (2007 – 2008)

- Continued mining in remnant Bulli blocks;
- Developed three new entries into the Wongawilli Seam at Russell Vale;
- Conducted pre-feasibility study for longwall mining in the Wongawilli Seam; and
- Conducted pre-feasibility study for longwall mining in the Bulli Seam.

Development Period 2 (2008 – 2010)

- Develop new main access headings in the Wongawilli Seam towards No.5 Shaft;
- Connect Wongawilli roadways to No.1 Shaft;
- Form stone drifts from the Bulli to the Wongawilli Seam; and
- Conduct feasibility study for longwall mining in the Wongawilli Seam.

Development Period 3 (2010 and beyond)

- Develop longwall gateroads in the Wongawilli Seam underneath extracted Bulli longwalls;
- Form Wongawilli partial extraction panels between No.1 and No.5 Shafts;
- Undertake Bulli Pillar extraction in V Mains;
- Commence Wongawilli longwall operations;
- Main heading development V Mains and Western longwall blocks;
- Recover coal from some existing roadways and commence development of new roadways heading towards the Western reserves of CCL 745; and
- Commence longwall operations in the Western Bulli reserves.

The implementation of all activities that constitute the proposed Mine Plan has been and will continue to be subject to feasibility studies on commercial viability and necessary stakeholder approvals and stakeholder endorsements.

The activities listed in the first three dot points of Development Period 3 (2010 and beyond) will be undertaken during implementation of the work described in the Preliminary Works Environmental Assessment (Project Stage 1).

A separate application for Stage 1, the Preliminary Works project (MP_0046), was submitted to the Department of Planning in June 2010. Stage 1 involves the continuing operation of the Colliery.

The activities listed in dot points 4 and 5 of Development Period 3 (2010 and beyond) will be undertaken during implementation of the work described in the Expansion Major Works Environmental Assessment (Project Stage 2). Stage 2 involves increased activity at the Colliery.

The activities described in dot points 6 and 7 of Development Period 3 (2010 and beyond) will be undertaken at some future time and will be subject to assessment and approval at that time.

2.4. EXISTING SURFACE INFRASTRUCTURE

The existing Russell Vale Site arrangements are fully discussed in **OEC 2010A** (Appendix A of this report) and **Figure 1** in Appendix A shows the location of surface facilities and roads. The modifications and additions proposed for Stage 1 of the development of the colliery have been, or will be, implemented prior to the implementation of Stage 2. **OEC 2010A** also contains a description of Stage 1 development proposals and **Figures 3 and 4** of the same report provide plan view and cross sectional views of the proposals.

The mining leases area can be split into landuse areas that are identified as follows:

- Russell Vale Site; and
- SCA Catchment Including the No. 4 Shaft Site.

2.4.1. Russell Vale Site

Following implementation of Stage 1 of the proposed development, this site will support the following infrastructure:

- The pit top which provides storage for most of the mining materials;
- The main administration building and bathhouse facilities;
- Two older portals. One, identified as the Mine Portal on **Figure 1** of **OEC 2010A** (Appendix A of this report), operates as a track road which gives men and materials access to the mine. The other, identified as the Conveyor Portal is where a belt road conveys coal to the surface;
- The 3 new main access headings (Wonga Mains) in Wongawilli Seam, which have recently been constructed. They are identified as the RTV Portal (A Heading), the Wonga Mains Conveyor Portal (B Heading) and Rail Portal (Heading C) on **Figure 1** in **OEC 2010A**;
- Two decline conveyors which transport Bulli Seam coal and Wongawilli Seam coal separately being fed by a vibrating feeder to the ROM coal stockpile. However, as part of NRE's strategy and site improvements the second conveyor is expected to be decommissioned by late 2012 to early 2013;
- A ROM stockpile and reclaim tunnel;
- The breaker building and conveyor that delivers coal to the road truck loading facility;
- A truck access road that runs to the public road system at the intersection of Bellambi Lane and the Princes Highway. Trucks are weighed and washed before leaving the site; and
- A water management facility that uses a Storm Water Control Dam (SWCD) to store water which is then treated to assist in the removal of solids prior to discharge via a Licence Discharge Point (LDP2) in accordance with EPL 12040.

2.4.2. SCA Catchment Including No. 4 Shaft Site

CCL 745 extends for approximately 20 km to the west of the Russell Vale Site beneath and in some places on the surface of SCA Catchment land. There are five shaft sites identified as No.1 Shaft to No. 5 Shaft located west of the Illawarra Escarpment.

No. 4 Shaft is an operating downcast shaft and there are other facilities located at this site that include:

- Administration Office;
- Bath house originally designed for 1000 people;
- Car park area;
- Water management facility.
- Electrical sub-station;
- Small workshop;
- Materials store; and
- Explosives magazine.

2.5. WATER MANAGEMENT

Section 3 of the Beca Report, "Water Management Report Gujarat NRE No. 1 Colliery Major Works Part 3A" (**Beca 2010**) contains a detailed description of current water management arrangements at Russell Vale.

2.5.1. Russell Vale Site

Fresh water for the Russell Vale Site is supplied from the Sydney Water reticulated supply. Up to 500 kL per day of mine discharge water can be recycled into the surface water reticulation system. The recycled water is used for a wide range of purposes including dust suppression, truck washing and road cleaning.

Site toilet and bathroom wastes are disposed of via the normal domestic sewage disposal system operated by Sydney Water.

The Storm Water Control Dam (SWCD) is identified as the Dam on **Figure 1** of **OEC 2010A** and is the main facility for controlling ‘dirty’ surface runoff water on the site. Excess water is treated prior to being discharged to Bellambi Gully Creek in accordance with EPA license quality and quantity criteria and general conditions (EPL 12040). The water collected in the SWCD is primarily ‘dirty’ storm water run-off that comes from disturbed areas such as the stockpile areas and unsealed roads around the coal handling facilities, including the belt decline system. This water undergoes primary settling in both concrete and earthen dams prior to entering the SWCD.

Water is drawn from the SWCD via a floating suction and pumped into the water treatment facility adjacent to the truck loading area. Coagulant is added to the water as it enters the water treatment facility. This coagulant dosing is controlled and occurs just prior to the water entering a mixing chamber, which thoroughly mixes the coagulant and water. The mix is then delivered into a large thickener where settling of sediment occurs.

After settling in the thickener, clarified water overflows into a launder and then to a pipe that discharges to Bellambi Gully Creek. The inflow and outflow water quality is monitored using turbidity meters. Dosing of the coagulant is automatically controlled in response to the monitoring results. Discharge quantity is also monitored and automatically controlled.

In principle, wherever possible, dirty water is collected and directed into the SWCD. All water is collected from areas such as the coal handling facilities at the portals, ROM stockpile, reclaim tunnel, breaker building, former clean coal stockpile area and truck loading and tarping sections. In addition, both sealed and unsealed perimeter roads are drained such that contaminated rain water and wash down water is collected. Finally, all clean storm water is directed into Bellambi Gully Creek.

2.5.2. Mine Water

Mine water is pumped to the surface from the mine at both Russell Vale and No.4 Shaft sites. At Russell Vale up to 500-600 kL per day is added to the water management system for treatment and re-use. Any surplus treated water may be discharged directly under license into Bellambi Gully Creek.

3. FACTORS AFFECTING SURFACE FACILITY LAYOUT

3.1. INTRODUCTION

This section discusses those factors that have been considered during the design of the various components of the Russell Vale No. 1 Colliery surface layout arrangement. These factors will be discussed in more detail in the Part 3A Environmental Assessment however, they are included here to provide context and understanding on the selection of the components of the proposed surface layout.

The factors can be conveniently divided into the following sectors and are discussed in Sections 3.2, 3.3 and 3.4 respectively:

- Coal Mining and Transport Requirements;
- Land Ownership and Availability; and
- Environmental.

An iterative planning approach was used in order to ensure that the broad range of relevant environmental, safety, practical operational requirements, technology availability matters and financial objectives were incorporated into the final proposals. This approach is discussed in Section 3.5.

3.2. COAL MINING AND TRANSPORT REQUIREMENTS

The surface facilities at Russell Vale form integral components of the coal handling system that NRE is developing in order to plan, construct and operate a modern efficient coal mining operation within the current mining leases.

Coal will be mined from various areas within these leases. It will then be conveyed to the surface and stockpiled in readiness for transport to the Port Kembla Coal Terminal (PKCT) by truck. Coal is exported to India from PKCT.

The coal stockpiles provide surge storage for coal and enable loading of coal shipments with specific quality parameters and in the quantities required. Surge storage is required to maintain relatively constant rates of truck loading. The interruptive effects of mining delays can be avoided or minimised by utilising the surge capacity provided by the stockpiles. Similarly, delays to trucking, port and shipping operations can be minimised or avoided by the surge capacity in the stockpiles.

3.3. LAND OWNERSHIP AND AVAILABILITY

The mining lease covering the land on which construction is proposed, is held by GNCCL. The Russell Vale Site is located east of, and within, the foothills of the Illawarra Escarpment. It is not intended to construct any of the surface facilities at elevations higher than those currently supporting existing elements.

The land to the east, northeast and south of the site supports urban development and is not available for coal handling infrastructure.

3.4. ENVIRONMENTAL

3.4.1. Topography and Land Use

The Russell Vale Site is located in the foothills of the Illawarra Escarpment, which is located immediately to the west.

The Escarpment provides scenic and conservation values. The pit top (highest point) is located at approximately 150 m AHD and the entry to the site from Bellambi Lane (lowest point) is located at approximately 25 m AHD. Planning for adequate drainage across this topographic range is a critical part of the proposal to upgrade and improve the Russell Vale Site.

The Russell Vale Site has been used for coal production over a 120 year period and its appearance reflects this long term land use.

Urban development occurs along the north eastern, eastern and southern boundaries of the Russell Vale Site. The Princes Highway is located along the eastern boundary of the site. Land adjacent to the Highway is used for a range of small industrial and commercial purposes typical of ribbon development along a main road within an urban area.

The vehicle entry point for the site is off the Princes Highway at a point where it intersects with Bellambi Lane. Bellambi Lane is located alongside an old railway line reserve that originally served the colliery providing direct loading of coal onto the State Government rail system.

3.4.2. Drainage

The site is drained by a number of streams that are primarily sub-catchments of Bellambi Gully Creek and flow to the southern end of Bellambi Beach. All items of infrastructure located within the Russell Vale Site are located in the Bellambi Gully Creek catchment. The total catchment area of the Russell Vale Site within Bellambi Gully Creek is approximately 57 ha.

The proposed construction works to upgrade the site infrastructure all fall within the Bellambi Gully Creek catchment. It is noted that small sections of the total mine area lie outside this immediate catchment area, however works are not proposed at these locations.

Beca have prepared a detailed Hydrology Report for the development proposal (**Beca 2010**). Their report includes a detailed description of the various catchments on site. **Figure 2** of **OEC 2010A** (Appendix A of this report) shows these areas with individual catchments within the Upper Middle and Lower Zones identified U, M and L respectively.

Beca 2010 describes three broad catchment zones as follows:

- **Upper Catchment Zone (U).** This zone is predominantly natural escarpment area above the Russell Vale Site and considered to generate clean runoff water;

- **Middle Catchment Zone (M).** This zone supports the workshop, offices, portals and a number of roads. It is characterised by steep batters of both natural and mine washery reject material; and

- **Lower Catchment Zone (L).** The coal stockpile and truck haulage area facilities are located in this zone. It is where clean water, which has been directed around disturbed areas on site, discharges into Bellambi Gully Creek.

3.4.3. Rainfall

The site is located in the foothills of the Illawarra Escarpment, which is a geographical location conducive to generation of high intensity/high rainfall storm events. Local rainfall data has been used by Beca when assessing and designing hydrological aspects of the proposals.

3.4.4. Air Quality

Consideration of the various components of the surface facilities took potential air quality impacts into consideration. A range of responses were implemented to minimise air quality impacts including:

- Constructing the coal stockpiles close to geographical features to minimise exposure to wind;
- Enclosure of elevated conveyors (where appropriate);

- Provision for dust sprays at coal transfer points;
- Truck washing on site before departure; and
- Clean up arrangements will be developed and implemented during operations to manage fugitive dust sources. ERM has undertaken a detailed air quality assessment.

3.4.5. Visual

Potential visual impact was an important consideration in selecting the proposed surface layout arrangement.

A range of responses were implemented to minimise visual impact including:

- Consideration of the most effective orientation of individual components of the surface infrastructure;
- Planning to construct the coal stockpiles close to existing physical features;
- Placing the coal stockpile as far to the west, while taking into account geotechnical characteristics of the western embankment, maximising the visual attenuation provided by two naturally occurring ridge lines;
- Consideration of the colour treatment of components;
- Incorporating artificial bunds and landscaping; and
- Utilising already disturbed areas for the location of replacement components eg decline conveyor and stockpiles.

ERM have undertaken a more detailed assessment of the potential visual impact and its management.

3.4.6. Heritage and Archaeology

The Russell Vale Site has supported coal mining activities over a 120 year period. It is unlikely that any Aboriginal heritage items remain where new infrastructure is proposed.

Some of the early mine buildings and entries remain and they have heritage value. Those items with heritage value have been identified and their presence has been considered during the planning of the proposed surface infrastructure.

ERM have undertaken a detailed assessment to verify the actual site heritage and archaeological features. Their findings will be included in the Part 3A Environmental Assessment for the proposals.

3.4.7. Geotechnical and Land Stability

Land stability issues were incorporated into the design of the proposed surface infrastructure. Adequate geotechnical assessment has been undertaken by Coffey Geotechnics to confirm that the proposals are able to be constructed as indicated. Further geotechnical assessment will be required during the detail design and construction phase.

3.4.8. Flora and Fauna

Wherever possible, proposed infrastructure has been located in areas where vegetation has been removed or disturbed. Where vegetation is required to be impacted, appropriate fauna and flora investigations will be undertaken to assess impact and develop amelioration and management actions as required.

ERM have undertaken a detailed ecological assessment of the site and the details of that investigation will be included in the Part 3A Environmental Assessment for the proposals.

3.4.9. Traffic

This report only identifies on-site traffic arrangements. An off-site traffic study titled "Gujarat No. 1 Mine Traffic Study July 2010" was undertaken by Cardno Eppell Olsen (**Cardno Eppell Olsen 2010**).

All traffic will access the site via the existing entry location where Bellambi Lane intersects the Princes Highway immediately east of the site.

Matters taken into consideration for on-site traffic movements included:

- Maximising separation of light and heavy vehicles on the access road. The proposed truck loading arrangements reduce the mixing of light and heavy vehicles on the access road by approximately 60% when compared with existing arrangements;
- Avoiding at grade cross-over movements of coal trucks;
- Provision of adequate on-site parking for heavy vehicles during short term interruptions to coal loading; and
- Provision of suitable access for delivery and dispatch of materials from the workshop area.

3.4.10. Acoustic

The potential acoustic impacts were considered during the planning and location of the various components of surface infrastructure. Matters taken into consideration during planning included, but were not limited to the following:

- Location of components with respect to neighbours;
- "Line-of-site" considerations;
- Availability of noise attenuated items;
- Ability to incorporate noise attenuation in final structures; and
- Location of acoustic and visual bunding.

A detailed noise assessment was undertaken by ERM to determine the potential impact and management that will be required to ameliorate noise impacts. Additional acoustic input will be provided during the detail design and construction phase. Operational monitoring will be an integral part of ongoing management of the acoustic environment.

3.5. ITERATIVE PLANNING APPROACH

Development of the proposed surface layout at Russell Vale utilised an iterative approach to ensure that the broad range of relevant environmental, safety, practical operational requirements, technology availability matters and financial objectives were considered.

Early planning deliberations defined the range of issues that required consideration during the planning phase. These issues were then constantly considered during the iterative development of the final proposals.

The size and location of the coal stockpile was identified as being the critical issue in designing a suitable surface layout at Russell Vale. There is only one general location for the coal stockpile however, it was possible to incorporate small adjustments in response to the range of matters and objectives relevant to the proposal.

The size and location of the coal stockpile was determined taking into account such issues as noise, visual, air quality, drainage, geotechnical stability, practical operational considerations and financial objectives.

The construction of a channel in Bellambi Gully Creek during the Stage 1 of the development was required to facilitate the positioning of the stockpile footprint. This channel replaced a section of the existing Bellambi Gully Creek that was conveyed in a concrete pipe beneath the general coal stockpile area.

Site surface water treatment has been developed using the established general principle of separating clean and dirty water, while minimising the volume of potential dirty water needing treatment. The water treatments proposed do not affect the runoff flow characteristics downstream of the site. Details are included in the Beca Report (**Beca 2010**).

Consequently, the proposed surface layout has been developed with consideration of the potential environmental impacts. The environmental impact of the final proposed layout has been assessed in detail in the Part 3A Project Environmental Assessment prepared by ERM.

4. SURFACE INFRASTRUCTURE COMPONENTS LAYOUT AND FUNCTION

This section describes the surface components proposed for the Russell Vale Site during Stage 2 of the development. It also identifies the alternatives stockpile and conveyor arrangements considered during the planning of the site. **OEC 2010A** (Appendix A) contains a section describing the range of alternatives considered for other aspects of the development.

4.1. SURFACE FACILITIES

4.1.1. Proposal

Figure 1 (JBK Drawing 282800) shows plan views of the colliery site facilities proposed for Stage 2 of the development. **Figure 2** (JBK Drawing 282801) and **Figure 3** (JBK Drawing 282806) show a number of cross sections of the coal stockpiles and associated conveyors. The location of the cross sections is shown on **Figure 1**.

The installation and operation of Stage 2 will allow the orderly development of the No. 1 Colliery in a logical, sequential manner and enables coal supply to be maintained continually during modification of the stockpile arrangements. Coal production will be 3 Mtpa once Stage 2 is implemented.

The implementation of Stage 1 and Stage 2 of the proposed development has been planned to occur in three distinct Phases. Indicative timing of each phase is given below. Phase 1 will be undertaken during Stage 1 and Phases 2 and 3 will be undertaken during Stage 2 of the proposed development. The components of each phase will be dependent on coal markets existing at the time:

Phase 1.

Preliminary works. (to be completed by DECEMBER 2011 in readiness for the first Longwall start):

- Completely enclosed decline conveyor belt;
- Sizing/screening tower;
- Stack-out conveyor;
- Entire Tripper install;
- Integration of the above facilities into the existing coal clearance system, including the removal of the 'Balgownie Bin' and stockpiling for approximately 60,000 t;
- Re-alignment of Bellambi Gully Creek via an open channel, to include removal or other of the existing pipeline; and
- Drainage associated with the Stockpile from above the pit top to the culvert at the highway, including stabilisation works and removal of No. 6 Dam (**Beca 2010**).

Phase 2.

Transition works. (DECEMBER 2011 - DECEMBER 2012):

- New reclaim belt;
- New coal load out facility;
- New truck management facility, including new roads, truck parking, Traffic Management Plan, truck washing, etc;
- New 'dirty water' treatment facility and/or settling pond/s; and
- New stockpile area 2 to allow for stockpiling of approximately 140,000 t.

Phase 3.

Final Stockpile for 3Mtpa. (from DECEMBER 2012):

- New stockpile area 3 to allow for stockpiling of approximately 140,000 t.

Note: All the works proposed for Phase 1 will be in place at the time of commencement of Phase 2. The commencement of Phase 2 will initiate Stage 2 of development. The completion of Phase 3 will see the completion of Stage 2.

A new reclaim belt will be installed to replace the existing belt used to deliver coal from the ROM stockpile to the truck loading bin. At the same time a new truck loading facility will be installed to replace the current system. The location of the new conveyor and truck loading facility are shown on **Figure 1**.

The new conveyor will be fully enclosed providing acoustic, visual and air quality benefits.

During Stage 1 of development a sizing and screening plant will be installed to process coal to a manageable size prior to being delivered to the ROM stockpile. Further sizing and/or screening may be required when it is reclaimed from the ROM stockpile. Consequently, during Stage 2 there is no requirement for further coal sizing prior to its delivery into the new truck loading facility.

When the new reclaim conveyor and the new truck loading facility are installed, the existing conveyor and truck loading arrangement will be removed.

A description of the traffic arrangements proposed for the new truck loading facility and temporary parking area are included in Section 4.2.1.

Section A on **Figure 2** shows the relative locations of the reclaim conveyor and the truck loading facility. Section D on **Figure 2** provides a general view of the truck parking area. A bund wall approximately 3 m high will be constructed on the northern border of the truck parking area. This will provide an effective border to the area and will screen trucks from direct line of site from the north. The barrier will also provide noise and dust control management benefits.

These new surface facility arrangements will be supported by modified and new water treatment arrangements. The existing Settling Ponds, Storm Water Control Dam and the Thickener Tank will be retained for water quality management. A new Settling Pond will be installed as shown on **Figure 1** and this will be incorporated into the existing system to accommodate the new arrangements. The new Settling Pond will have a surface area of approximately 4000 m^3 and an approximate capacity of 6 ML. The new Settling Pond is discussed in **Beca 2010** and details will be determined during detail design.

The new Settling Pond will predominantly collect storm water from the area around the stockpile area. The catchment will be bordered on the south by the new Water Channel and to the west by a clean water diversion drain that directs clean water to the Water Channel. The Mine Access Road will define the northern boundary of the catchment area of the new Settling Pond. The new Water Channel will be installed during Stage 1 of development and the new Settling Pond will be installed during Stage 2 of development.

After entering the new Settling Pond, storm water will be retained to enable settling of particulate matter. Excess water will then be directed to the existing Settling Ponds north of the Mine Access Road. Further settling will occur in these ponds before the water is directed to the Storm Water Control Dam (SWCD). This Dam will continue to operate as it does currently. During normal operations, water from this Dam will be directed to the Thickener Tank for treatment and discharge via LDP 2 into Bellambi Gully Creek when required. During heavy storm events, water from this Dam will continue to be directed to the Thickener Tank for treatment and should the need arise the SWCD has the potential to discharge directly into Bellambi Gully Creek.

Phase 2 will also include the installation of Stockpile Area 2 (SP2). This is shown on **Figure 1** and is the southern stockpile of the two shown (SP2 and SP3). SP2 will enable up to approximately 140,000 t of coal to be stockpiled and reclaimed for loading through the truck loading facility. This will be additional to the approximate 60,000 to 80,000 t able to be stockpiled in SP1.

Coal will be delivered to SP2 via an overhead conveyor and tripper arrangement. Coal will be reclaimed from the base of SP2 and will be returned to Stockpile Area 1 (SP1 on **Figure 1**) via a reclaim conveyor. The coal will then be directed to the truck loading facility via the reclaim conveyor located beneath SP1.

Section B on **Figure 2** shows the general layout for SP2. Section C on **Figure 2** provides dimensions of the stockpile and also shows the location of drains servicing the stockpile area.

A gabion rock wall will be installed to retain the exposed toe of SP2 and SP3. This should retain coal within the stockpile area and prevent slumping coal from travelling away from the confined stockpile area.

A dirty water drain will be constructed immediately north of SP3 to direct dirty water to the new Settling Pond. Another drain will installed on the southern side of SP2 to direct dirty water to the new Settling Pond.

An elevated 6.2 m wide access road will separate this southern dirty water channel from the new Water Channel installed during Stage 1 of the development. The elevation will provide further protection against wet coal slumping from SP2, into the new southern Water Channel.

Phase 2 will be completed upon final commissioning of SP2, the new reclaim conveyor, a new truck loading facility, new truck loading and parking arrangements and the new Settling Pond.

Phase 3 will involve the installation of SP3. This will be a similar installation as SP2 with similar coal handling and stockpiling arrangements. The location of SP3 is shown on **Figure 1** and is the northern stockpile of the two shown (SP2 and SP3). SP3 will allow an additional 140,000 t of coal to be stockpiled on site. Once it is constructed there will be capacity to stockpile approximately 300,000 to 320,000 t of coal on site. This should be adequate for an annual production of approximately 3 Mtpa.

Table 4.1 identifies the site activity occurring during typical operations after implementation of Stage 2.

Table 4.1. Typical Operational Activity.

Equipment	Hours of Operation	% of time Operating	Comment
1x Dozer.	7 am to 6 pm Monday to Friday. 8 am to 6 pm Saturday.	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 and sizer (constructed during Stage 1 of Upgrade).	24x7.	100%.	Enclosed.
Trucking facilities	7 am to 10 pm Monday to Friday 8 am to 6 pm Saturday, Sunday and Public Holidays.	100% of daytime hours. 100% of daytime hours.	All loading from new facilities.
ROM stockpile.	24x7.	100%.	Dust suppression spray system.

4.1.2. Alternatives

The stockpile arrangements are required to be capable of handling multiple seam products from the Wongawilli, Bulli and Balgownie Seams. A number of alternative stockpile arrangements were assessed before the JBK Final Upgrade arrangement was selected.

Assessment of the alternative stockpile arrangement options for the Upgrade was undertaken with consideration of practical operational requirements and financial acceptability together with the environmental considerations described in Section 3.

Each of the alternatives incorporated open stockpiles with an overhead travelling tripper stacking conveyor and tunnel reclaim system. Feeders are proposed to transfer coal from the stockpile to the tunnel reclaim conveyor for delivery via an inclined conveyor to a truck loading station surge bin. The stockpile options had approximately 30% live capacity feed to the reclaim conveyor, the remainder requiring bulldozers to move coal from the dead zone to the feeder reclaim zone.

Various configurations of stockpile shape were assessed each being stacker-formed piles over the length of the tripper conveyor.

The selected JBK Final Upgrade arrangement incorporated a range of environmental considerations during planning. These included:

- Reducing height as much as practically possible in order to minimise potential noise, air quality and visual impacts;
- Avoiding extensive excavation of the fill batter above the current coal handling system while at the same time avoiding construction and operational activities close to the eastern boundary of the site; and
- Minimizing the amount time required for the bulldozer to reclaim stockpiled coal.

Stockpile arrangements that were alternatives to the JBK Final Upgrade arrangement included three broad options which are discussed in the following paragraphs.

Option 1

The Ellton multi-pile stacker/reclaimer stockpile system incorporated a series of four sequentially constructed stockpiles. The stockpiles and coal loading facilities were located further to the east than those currently proposed. The combined capacity of the four stockpiles at the completion of this option was planned to be 315,000 t.

Two elevated conveyors would deliver coal onto the stockpiles. Four conveyors beneath the stockpiles would transfer retrieved coal to a truck loading facility east of the stockpile area.

This option addressed all the considerations outlined in Section 3 of this report. However, this option was not selected on the basis of cost and the need to develop closer to the northern and eastern site boundaries than is required to implement the selected JBK Final Upgrade arrangement.

Option 2

This option incorporated a single conical stockpile 42 m high with 120,000 t capacity to handle Balgownie Seam product and located around the current coal bin. This conical stockpile would be serviced by dual reclaim feeders loading out onto a single reclaim conveyor. The reclaim conveyor would direct coal to a 50 t capacity truck loading bin.

There would also be a single elongated stockpile with 615,000 t capacity which would handle Wongawilli Seam product and Bulli Seam product and would be located to the east of the conical stockpile on land previously used for coal stockpiling. The height of the skyline conveyor above this stockpile would be 45 m. The stockpile would need to be 345 m long and 110 m wide. Coal would be reclaimed from this stockpile by feeders directing coal onto a reclaim conveyor which would run under the entire length of the stockpile. This reclaim conveyor would also deliver coal to the 50 t capacity truck loading bin.

This option was not selected due to the overall height of the stockpile arrangement. In addition, the eastern end of the stockpile and associated facilities were considered to be too close to the site boundary. These key factors resulted in an increase in the potential noise, dust and visual impacts. It also resulted in difficult design constraints due to the lack of available land on which to construct and operate essential components of the proposal.

Option 3

This option incorporated three conical stockpiles. The first conical stockpile would have 120,000 t capacity, be approximately 42 m high and would handle Balgownie Seam product. It would be located around the current coal bin.

There would be two additional 360,000 t capacity conical stockpiles to handle Bulli Seam product and Wongawilli Seam product separately. These conical stockpiles would be fed via rill towers and would be 60 m high. There were also a range of conveyor configurations considered for this option.

Reclaim conveyors would deliver coal from the stockpiles to a 50 t capacity truck loading bin.

This option was rejected for reasons similar to those for Option 2. There were height concerns and it was considered that the proposals would be located too close to the Princes Highway boundary.

4.2. SITE ROADWORKS AND TRAFFIC ARRANGEMENTS

4.2.1. Proposals.

Apart from modifications to the coal truck loading and parking area, the mine site road system substantially remains unaltered during Stage 2 of the development.

The general site layout, including the site roads and traffic arrangements is shown in **Figure 1** of **OEC 2010** (Appendix A). **Figure 1** at the back of this current report shows the modifications proposed for the truck loading and parking area.

Trucks will continue to access the site from the Bellambi Lane/Princes Highway intersection. Upon arrival at site, empty trucks will travel along the access road to a point approximately adjacent to the first settlement pond. They then verge to the left and proceed along a new section of road to enter the truck loading and temporary parking area. This area will have provision for trucks to park temporarily while awaiting opportunity to load from the truck loading facility. Trucks pass through the area in a clockwise direction and will either proceed directly to the truck loading facility or will park temporarily awaiting the opportunity to load.

All surfaces on which trucks park or travel in this area will be sealed to facilitate dust control and water management.

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

Loaded trucks will travel back onto the mine access road at a point uphill from where they originally entered the truck loading area. Other mine vehicles using the access road will give way to loaded and empty trucks. All loaded trucks will pass through a truck wash station prior to exiting the site.

4.2.2. Operational Traffic Arrangements

The following sections describe the future on-site traffic levels associated with Stage 2. Traffic will be associated with construction activities during the proposed upgrade and with operational activities during and following construction.

Off-site traffic impacts have been addressed in another report prepared by Cardno Eppell Olsen and titled, "Gujarat NRE No 1 Mine Traffic Study, July 2010" (**Cardno Eppell Olsen 2010**).

Table 4.2 details the number and distribution of the workforce at Russell Vale Site and No. 4 Site after the implementation of Stage 1. The workforce will consist of 278 staff and 90 contractors, totalling 368 employees.

Table 4.2 Typical Spread of Staff and Contractors on Site at the Russell Vale Site and the No. 4 Shaft Site after Implementation of Stage 1.

SHIFT	Russell Vale	No. 4 Shaft
Day Shift (6.30am to 2.30pm)	60	110
Afternoon Shift (2.30pm to 10.30pm)	54	58
Night Shift (10.30pm to 6.30am)	34	52

During normal operating times, there will be a mix of vehicle types accessing the site. In addition to the vehicles used by the workforce to access the site there will be a range of vehicles including coal trucks, assorted heavy vehicles delivering stores and supplies, courier vans. Regular sedans and some motorbikes will be used to provide employee, contractor and visitor access.

In addition, there will be a number of heavy vehicles permanently located on site to handle delivery and dispatch of stores and to load and deliver stores and materials underground. They are also used for general maintenance activities around the site as required. These heavy vehicles permanently located on site normally operate around the stores area, administration building and mine entries. From time to time, as required, they may operate in other distant areas.

During construction, there will be a range of vehicle types accessing the site and permanently located on site for the duration of construction activities.

After entering the site from the Bellambi Lane/Princes Highway intersection, all mine traffic other than coal trucks, will avoid entering the coal dispatch road and continue along the existing mine access road to the pit top site further up the escarpment. The mine traffic will continue to follow existing access roads to the employee, stores and workshop facilities on the pit top further up the escarpment.

When leaving the site, mine traffic will merge with the loaded coal trucks and proceed to the Bellambi Lane/ Princes Highway intersection to exit the mine site. There is a general 40kph site maximum speed limit and all site vehicles will give way to loaded and unloaded coal trucks.

The existing employee's car park is located adjacent to the mine administration building. The current car park can readily accommodate 90 vehicles. Additional car parking spaces (30) are located on the western side of the administration building and also generally throughout the pit top area (50). Consequently, there are 170 existing car parking spaces on site around the administration office. These parking spaces will be retained in their current condition. Safe walking access to the bathhouse buildings from the car parking spaces is provided.

Vehicles accessing the store area will travel past the employee, contractor and visitor car parking areas and will traverse a section of pavement between the administration building and the escarpment.

No changes are proposed to the current access and facilities at the No. 4 Shaft Site. Vehicular access is along a bitumen-sealed mine access road that branches off the Picton Road.

4.2.3. Construction Traffic Arrangements

Construction for Stage 2 will only occur at the Russell Vale Site and all construction activity will be associated with the stockpile area and immediate environs.

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

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

4.2.4. Current and Historic On-site Traffic

Both the Russell Vale Site and the No. 4 Shaft Site are currently operating. The Russell Vale Site has operated continuously since 1887 and the No. 4 Shaft Site since the 1970s. Most of the vehicles entering the sites transport employees and contractors. In addition, consultants, visitors and sales representatives make regular visits to both sites.

Parking facilities are established that have accommodated an historically large number of vehicles associated with the workforce and other groups of people accessing the site.

Heavy vehicles access the sites to deliver equipment and bulk stores such as fuel. Heavy vehicles are also utilised as required to dispatch heavy mine equipment offsite for maintenance and repairs as required.

Courier vehicles, which include pantechnicons of varying sizes, also access both sites, generally during daytime from 6.30 am to 2.00 pm Monday to Friday.

Coal is dispatched in trucks from the Russell Vale Site for delivery to Port Kembla Coal Terminal (PKCT) with subsequent export to world markets.

A coal preparation plant has previously operated at the Russell Vale Site. This required truck haulage of waste material to an on-site refuse emplacement area and a fleet of heavy vehicles associated with the emplacement, compaction and rehabilitation of the emplaced refuse. NRE do not currently operate an on-site preparation plant.

4.2.5. Historic and Current Employee Vehicle Access

The size of the workforce accessing both sites has varied over time, both in size and the proportion of the workforce attending each site accessed. The workforce has at various times included both company employed staff and contractors.

The size of the workforce has varied in response to market conditions and the objectives of various owners over time. Since the establishment of the No. 4 Shaft Site in the 1970s, there has always been workforce attendance at both sites. The workforce has been distributed at varying ratios between the Russell Vale Site and the No 4 Shaft Site depending on the location of mining activity underground.

During the late 1970s and early 1980s, there were up to 1,200 people employed at the sites. These employees reported for duty at both locations and car parking spaces were sufficient to accommodate this large workforce. Typically, up to 800 employees would report for duty at the No. 4 Shaft Site and up to 400 at the Russell Vale Site.

The current workforce totals approximately 368 individuals (staff and contractors) with an approximate 40/60 split between Russell Vale and the No. 4 Shaft respectively.

The colliery generally operates on a three shift basis during the week and a two shift basis at weekends covering 24 hours per day, 7 days per week. On weekdays the shift times have historically been, day shift (6.30am to 2.30pm), afternoon shift (2.30pm to 10.30pm) and night shift (10.30pm to 6.30am). On weekends shift times are day shift 10.30am to 10.30pm and night shift 10.30pm to 10.30am Friday and Saturday. These general operating shift changes have been modified to include a Tuesday to Saturday shift from 7.30am to 3.30pm at No. 4 Shaft. Additionally the weekend shifts at the Russell Vale Site have been modified and there is now no night shift at Russell Vale and the day shift runs from 6.30am to 6.30pm Saturday and Sunday.

There is a concentration of vehicles accessing and leaving the site around the shift change times. This concentration tends to be spread over the two hour period around the actual shift change time as not every employee will access and leave the site precisely at shift change time.

The actual numbers on each shift will vary in response to work requirements and attendance aspects. **Table 4.2** provides a typical breakdown of the number of employees currently on site during each shift. This workforce will not change after implementation of Stage 1 of the proposed development.

Table 4.3 includes the most likely number of vehicles required to transport the workforce assuming an occupancy rate of 2 employees per vehicle and the spread of these vehicles over the two hour period surrounding shift change times. This spread is based on the assumption that all the previous shift leaves the site in the hour following the shift change and all the following shift arrive at site during the hour prior to commencement of that shift. In reality, these numbers are likely to vary from this due to absentees and work arrangements including overtime and delayed departures. Despite this likely variation, the data in **Table 4.3** provides a sound basis for impact assessment.

Table 4.3. Typical Employee On-site Vehicle Movements at Russell Vale and No. 4 Shaft Sites after Implementation of Stage 1.

Site	Shift	Total Shift Vehicles	Time	Vehicles Accessing and Leaving site
No 1 Mine Site Russell Vale	Day (6.30am to 2.30pm)	30	5.30am to 6.30am	30 arriving
			6.30am to 7.300am	17 leaving
	Afternoon (2.30pm to 10.30pm)	27	1.30pm to 2.30pm	27 arriving
			2.30pm to 3.30pm	30 leaving
	Night (10.300pm to 6.30am)	17	9.30pm to 10.30pm	17 arriving
			10.30pm to 11.30pm	27 leaving
No 4 Shaft Site	Day (6.30am to 2.30pm)	55	5.30am to 6.30am	55 arriving
			6.30am to 7.300am	26 leaving
	Afternoon (3.00pm to 11.00pm)	29	1.30pm to 2.30pm	29 arriving
			2.30pm to 3.30pm	55 leaving
	Night (11.00pm to 7.00am)	26	9.30pm to 10.30pm	26 arriving
			10.30pm to 11.30pm	29 leaving

4.2.6. Historic and Current Visitor and Other Vehicles

In addition to employee and contractor vehicles, site access to both sites is required for visitors, sales representatives, stores deliveries and equipment dispatch for maintenance and repairs. These access visits normally occur Monday to Friday and during daylight hours. There may be special requirements for vehicle access outside these times, but they would be relatively infrequent and insignificant in relation to assessment of potential impact.

During a typical day at both the Russell Vale Site and the No. 4 Shaft Site, approximately 40 vehicles would access the site transporting visitors, consultants and sales representatives. At Russell Vale, these visits would be spread fairly evenly over the time 6.30am to 6.30pm with a bias towards morning and mid day visits. At the No. 4 Shaft Site these vehicles access the site between 6.00am and 3.00pm.

During a typical day at both sites approximately 15 courier vehicles (pantechnicons of various sizes) would access the sites. This number is likely to peak at 25 vehicles per day.

The number of heavy vehicles accessing both sites is between 6 and 8 per day. Visitor and consultant vehicles typically park in the main car parks at both sites adjacent to the administration buildings. Sales representatives, courier vehicles and heavy vehicles park adjacent to, or within, the stores areas at both sites.

4.2.7. Historic and Current Coal Truck Vehicles

Coal trucks access the Russell Vale Site only. During the 1980s and 1990s, the Mine was producing up to 3 Mtpa of Run-of-Mine coal. Washed coal was transported from site by 25 t capacity coal trucks regularly transporting between 8,000 and 12,000 tpd on a typical day and peaking at 18,000 tpd. This was achieved at a coal truck access rate of typically 35 per hour, ranging up to 55 per hour. During these times an average of approximately 250 truck loads per day (to and from the site) were required to achieve the transport task.

Table 4.4 provides a summary of the typical current levels of vehicles accessing the Russell Vale and No. 4 Shaft Sites at shift change.

Table 4.4. Typical Current Levels of Vehicle Access to Russell Vale and No 4 Shaft Sites at Peak Traffic Times Associated with Shift Changes during Stage 1.

Site	Time	Employee and Contractor Vehicles Accessing and Leaving site	Coal Trucks	Visitors and Sales representatives	Couriers	Heavy Vehicles
No 1 Mine Site Russell Vale	5.30am to 6.30am	30 arriving	Nil	5	3	1
	6.30am to 7.30am	17 leaving	14 arriving and 14 leaving	10	4	2
	1.30pm to 2.30pm	27 arriving	9 arriving and 9 leaving	5	2	1
	2.30pm to 3.30pm	30 leaving	Nil	5	2	1
	9.30pm to 10.30pm	17 arriving	Nil	Nil	Nil	Nil
	10.30pm to 11.30pm	27 leaving	Nil	Nil	Nil	Nil
No 4 Shaft Site	5.30am to 6.30am	55 arriving	Nil	5	3	1
	6.30am to 7.30am	26 leaving	Nil	10	4	2
	1.30pm to 2.30pm	27 arriving	Nil	5	4	2
	2.30pm to 3.30pm	55 leaving	Nil	5	Nil	Nil
	9.30pm to 10.30pm	26 arriving	Nil	Nil	Nil	Nil
	10.30pm to 11.30pm	27 leaving	Nil	Nil	Nil	Nil

4.2.8. Proposed On-site Traffic

Construction

All of the construction workforce for Stage 2 will be located on the Russell Vale Site. Construction will be undertaken in 3 stages over a 36 month period and a peak construction workforce is predicted to be up to approximately 65.

Construction work will be undertaken during daylight hours, generally 7.00am to 6.00pm Monday to Friday and from 8.00am to 1.00pm on Saturdays.

It is most likely that construction workers will arrive on site in their own vehicles. Assuming an occupancy rate of 2 people per vehicle, there will be approximately 30 vehicles arriving around the start time of 7.00am and leaving around the finishing time of 6.00pm Monday to Friday. Similar numbers may arrive and leave on Saturdays.

These vehicles would be parked within the contractors' construction and laydown area.

During construction there will be a range of vehicle types delivering supplies and equipment. At peak construction it is likely that up to 10 concrete agitators per day will access the site. Typically, 2 to 3 semi trailers will deliver materials to site. There may be peaks above these semi trailer levels, but only during special construction activities.

Heavy vehicles associated with construction will be located permanently on site. These vehicles could include such vehicles as an excavator, front end loader, bobcats and site trucks.

Operational Employees and Contractors.

Implementation of Stage 2 will increase the workforce to 421. In the early years of operation during Stage 2 of development, mining activity will be located in an area known as Wongawilli East. While mining operations are focussed in Wongawilli East, the bulk of the proposed operational workforce would report for duty at the Russell Vale Site.

Table 4.5 shows the distribution of the 421 employees after the implementation of Stage 2. This Table shows the distribution during both the Wonga East mining phase and the Wonga West mining phase.

Table 4.5. Stage 2 Employee Numbers and Distribution.

SITE	SHIFT	WONGA EAST	WONGA WEST
Russell Vale	Day Shift (6.30am to 2.30pm)	134	35
	Afternoon Shift (2.30pm to 10.30pm)	96	17
	Night Shift (10.30pm to 6.30am)	80	14
Total		**310**	**66**
No 4 Shaft	Day Shift (6.30am to 2.30pm)	54	160
	Afternoon Shift (2.30pm to 10.30pm)	33	104
	Night Shift (10.30pm to 6.30am)	24	91
Total		**111**	**355**

Shift times will remain the same as current arrangements. The mine operates on a three shift basis during the week and a two shift basis at weekends covering 24 hours per day, 7 days per week. On weekdays the shift times are day shift (6.30am to 2.30pm), afternoon shift (2.30pm to 10.30pm) and night shift (10.30pm to 6.30am). On weekends shift times have historically been, day shift 10.30am to 10.30pm and night shift 10.30pm to 10.30am Friday and Saturday. These general operating shift changes have been modified to include a Tuesday to Saturday shift from 7.30am to 3.30pm at No. 4 Shaft. Additionally the weekend shifts at the Russell Vale Site have been modified and there is now no night shift at Russell Vale and the day shift runs from 6.30am to 6.30pm Saturday and Sunday.

It can be assumed that these employees and contractors will drive to work in vehicles having an average occupancy rate of 2 people per vehicle. The arrival times will be concentrated in the two hour period around shift change times.

Operational Visitors and Other Vehicles

It is predicted that the number of visitor and other vehicles that access the sites will increase above the existing levels as described in Section 4.2.6. It has been assumed that the future levels of this traffic will double as a result of implementation of the Stage 2 of development.

Consequently, it is predicted that after implementation of Stage 2 during a typical day at both the Russell Vale Site and the No. 4 Shaft Site, approximately 80 vehicles would access the site transporting visitors, consultants and sales representatives. At Russell Vale, these visits would be spread fairly evenly over the time 6.30am to 6.30pm with a bias towards morning and mid day visits. At the No. 4 Shaft Site these vehicles access the site between 6.00am and 3.00pm.

During a typical day at both sites approximately 30 courier vehicles (pantechnicons of various sizes) would access the site. This number is likely to peak at 50 vehicles per day.

The number of heavy vehicles accessing both sites is between 12 and 16 per day.

Visitor and consultant vehicles typically park in the main car parks at both sites adjacent to the administration buildings. Sales representatives, courier vehicles and heavy vehicles park adjacent to, or within, the stores areas at both sites.

Apart from the Russell Vale Site during the operation of the Wonga East mining, these levels of vehicle access to site can be easily accommodated in existing car parks. However, when the mining operation is focussed in Wonga East, additional car parks will be required at Russell Vale. The gravel car park adjacent to the administration building at the pit top level will be extended to allow for up to 250 cars. This extension will only be necessary during mining activities in Wonga East. When mining commences in Wonga West, the bulk of the workforce will access the mine from the No. 4 Shaft Site. At that time, current parking capacity at Russell Vale will be adequate to accommodate vehicles on site.

Table 4.6 shows the traffic levels associated with site activity during the early part of Stage 2 when mining operations are focussed in Wongawilli East.

Table 4.7 details the typical levels of vehicle access to Russell Vale Site and No. 4 Shaft Site at the completion of Stage 2 and after production has reached 3 Mtpa. Mining will be located in Wonga West and the workforce would be mainly located at No. 4 Shaft.

Coal Trucks

Trucks will access only the Russell Vale Site to transport coal from the colliery to PKCT. Detailed trucking arrangements are discussed in **Cardno Eppell Olsen 2010**.

Table 4.6. Typical Levels of Vehicle Access to Russell Vale and No 4 Shaft Sites at Peak Traffic Times Associated with Shift Changes when Mining is Focussed in Wongawilli East.

Site	Time	Employee and Contractor Vehicles Accessing and Leaving site	Coal Trucks (Average)	Coal Trucks (Peak)	Visitors and Sales represent atives	Couriers	Heavy Vehicles
No 1 Mine Site Russell Vale	5.30am to 6.30am	67 arriving	Nil		10	6	2
	6.30am to 7.30am	40 leaving	9 arriving and 9 leaving	12 arriving and 12 leaving	20	8	4
	1.30pm to 2.30pm	48 arriving	17 arriving and 17 leaving	23 arriving and 23 leaving	10	4	2
	2.30pm to 3.30pm	67 leaving	17 arriving and 17 leaving	23 arriving and 23 leaving	10	4	2
	9.30pm to 10.30pm	40 arriving	9 arriving and 9 leaving	12 arriving and 12 leaving	Nil	Nil	Nil
	10.30pm to 11.30pm	48 leaving	Nil		Nil	Nil	Nil
No 4 Shaft Site	5.30am to 6.30am	27 arriving	Nil		10	6	2
	6.30am to 7.30am	12 leaving	Nil		20	8	4
	1.30pm to 2.30pm	17 arriving	Nil		10	8	4
	2.30pm to 3.30pm	27 leaving	Nil		10	Nil	Nil
	9.30pm to 10.30pm	12 arriving	Nil		Nil	Nil	Nil
	10.30pm to 11.30pm	17 leaving	Nil		Nil	Nil	Nil

Table 4.7. Typical Levels of Vehicle Access to Russell Vale and No 4 Shaft Sites at Peak Traffic Times Associated with Shift Changes after Completion of Stage 2.

Site	Time	Employee and Contractor Vehicles Accessing and Leaving site	Coal Trucks (Average)	Coal Trucks (Peak)	Visitors and Sales representatives	Couriers	Heavy Vehicles
No 1 Mine Site Russell Vale	5.30am to 6.30am	18 arriving	Nil		10	6	2
	6.30am to 7.30am	7 leaving	9 arriving and 9 leaving	12 arriving and 12 leaving	20	8	4
	1.30pm to 2.30pm	9 arriving	17 arriving and 17 leaving	23 arriving and 23 leaving	10	4	2
	2.30pm to 3.30pm	18 leaving	17 arriving and 17 leaving	23 arriving and 23 leaving	10	4	2
	9.30pm to 10.30pm	7 arriving	9 arriving and 9 leaving	12 arriving and 12 leaving	Nil	Nil	Nil
	10.30pm to 11.30pm	9 leaving	Nil		Nil	Nil	Nil
No 4 Shaft Site	5.30am to 6.30am	80 arriving	Nil		10	6	2
	6.30am to 7.30am	46 leaving	Nil		20	8	4
	1.30pm to 2.30pm	52 arriving	Nil		10	8	4
	2.30pm to 3.30pm	80 leaving	Nil		10	Nil	Nil
	9.30pm to 10.30pm	46 arriving	Nil		Nil	Nil	Nil
	10.30pm to 11.30pm	52 leaving	Nil		Nil	Nil	Nil

5. REFERENCES

Beca 2010. Water Management Report Gujarat NRE No. 1 Colliery Major Works Part 3A. November 2010.

Cardno Eppell Olsen 2010. Gujarat No. 1 Mine Traffic Study July 2010.

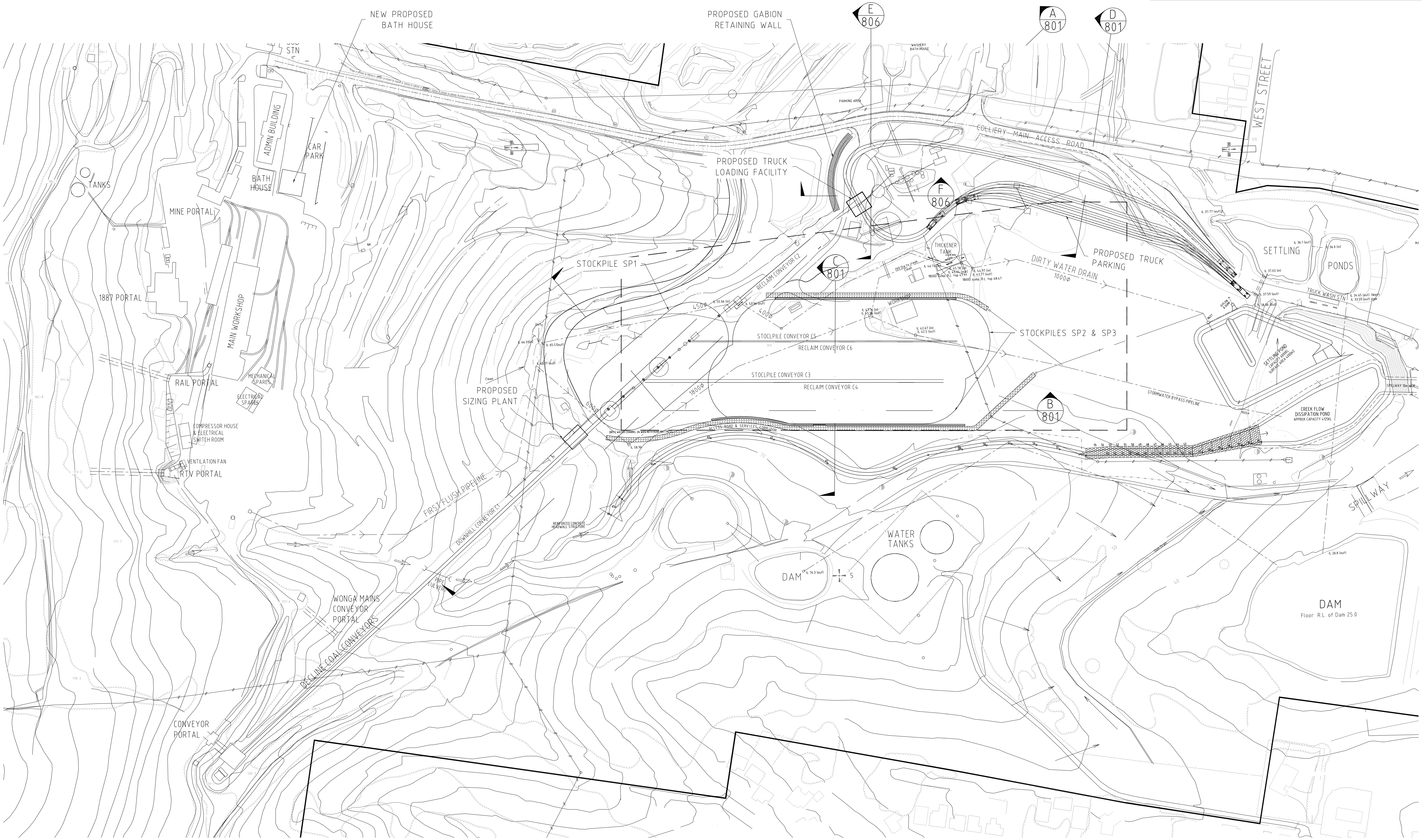
OEC 2010A. Surface Facilities and On-site Traffic Preliminary Works Part 3A, 26th May 2010.

Figure 1.

JBK Drawing No. 282800. No. 1 Colliery Russell Vale Proposed Upgrade 300KT Stockpile Project.

Plan.

REFERENCE DRAWINGS	DRG. No.
LONG SECTION AND SECTION VIEWS	282801
MUD MAP	282802



REV	DATE	REVISIONS	DRN	APP	REV	DATE	REVISIONS	DRN	APP
E	21/05/2010	REVISED TRUCK PATH AND PARKING	MJD						
D	14/04/2010	REVISED REVISION	MJD						
C	06/04/2010	REVISED SCREENING BLD,ACCESS & EGRESS ROAD	MJD						
B	24/03/2010	REVISED ACCESS ROAD AND TRUCK LOADING FACILITY	MJD		G	09/07/10	UPPER BENCH WITH NEW BATH HOUSE ADDED	JAH	DS
A	22/03/2010	ISSUED FOR REVIEW	GKL	-	F	21/06/10	POWER LINE ADDED	JAH	DS

AS 1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

	NAME	DATE
DESIGN	GKL	MAR 10
DRAWN	GKL	MAR 10
CHECKED	XXX	XXX
APPROVED	XXX	XXX
SCALE	1 : 1500	

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GUJARAT NRE COKING COAL Ltd

No. 1 COLLIERY RUSSELL VALE
PROPOSED UPGRADE
300KT STOCKPILE PROJECT – PLAN

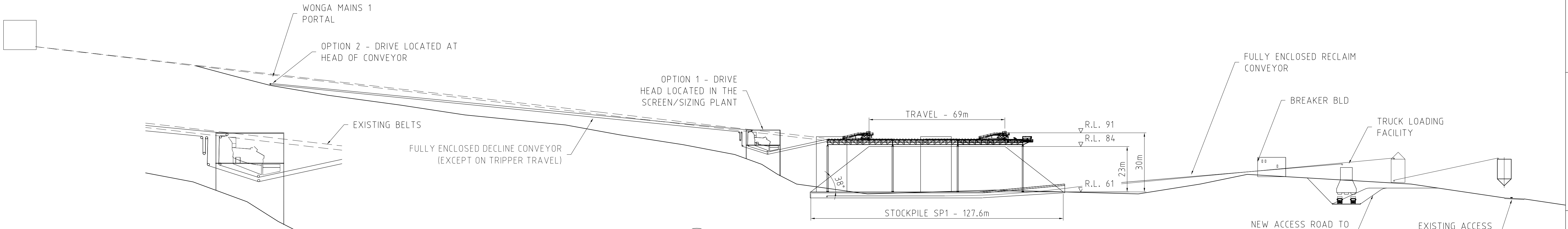
ISSUE: PROPOSAL
DWG. SIZE: A1
JBK DWG No.: 282800
REVISION: G

Figure 2.

JBK Drawing No. 282801. No. 1 Colliery Russell Vale Proposed Upgrade 300KT Stockpile Project.

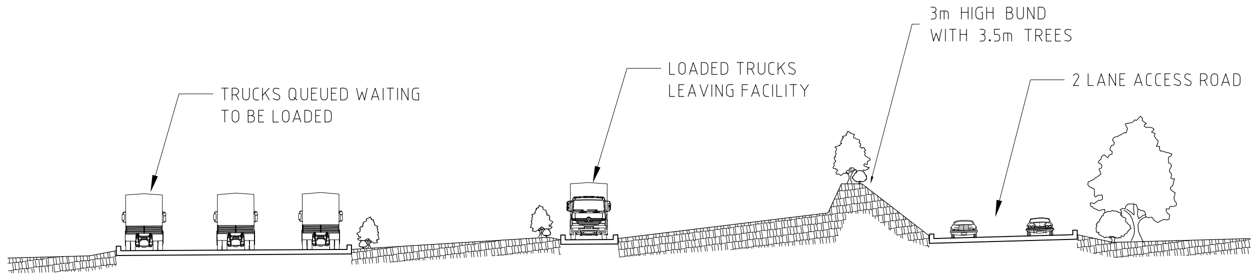
Long Sections.

REFERENCE DRAWINGS	DRG. No.
PLAN VIEW	282800
MUD MAP	282802

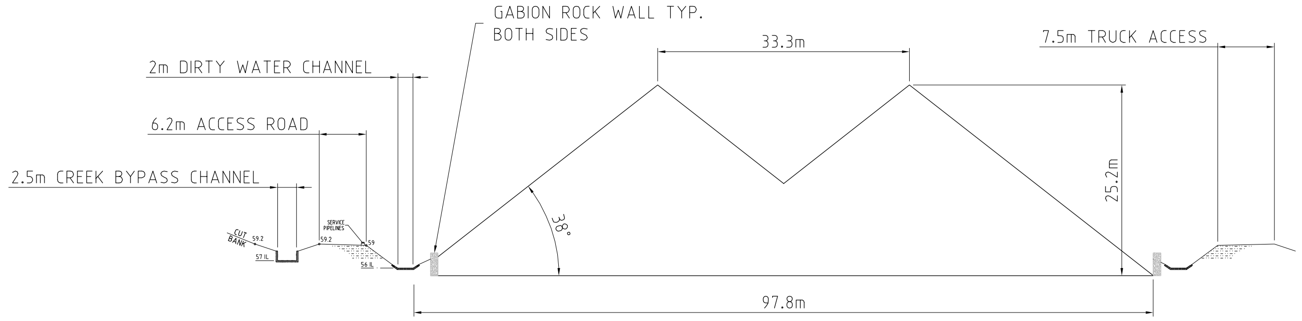


DETAIL VIEW OF SCREEN/SIZING BUILDING
SCALE 1 : 250

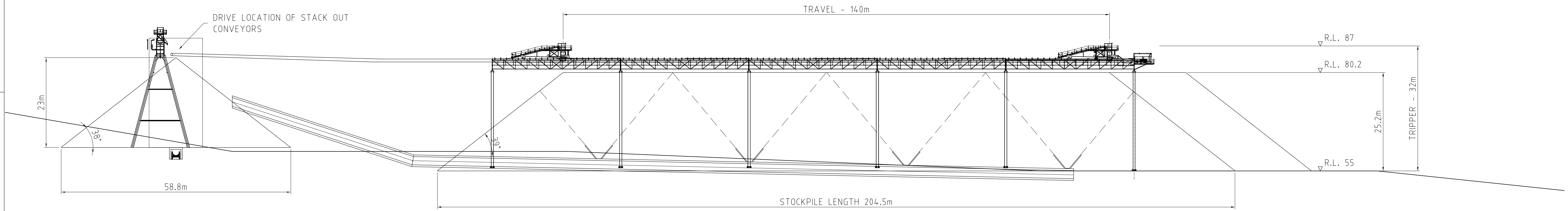
SECTION A/00 LONG SECTION OF DECLINE BELT AND STOCKPILE 1
SCALE 1 : 1000



SECTION D/00 SECTION VIEW OF NEW TRUCK ACCESS & EGRESS ROAD
SCALE 1 : 500



SECTION C/00 SECTION VIEW OF STACKOUT STOCKPILES 2 & 3
SCALE 1 : 500



TRUE SECTION VIEW OF STOCKPILE 1

SECTION B/00 LONG SECTION OF PROPOSED STACKOUT STOCKPILES 2 & 3
SCALE 1 : 500

REV	DATE	REVISIONS	DRN	APP
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D	06/04/10	REVISED SCREENING BLD, TRUCK ACCESS & EGRESS	MJD	
C	28/03/10	REVISED LOCATION OF SCREENING BLD	MJD	
B	24/03/10	REVISED LOCATION OF TRUCK LOADING	MJD	
A	22/03/10	ISSUED FOR REVIEW	GKL	-

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ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

	NAME	DATE
DESIGN	GKL	MAR '10
DRAWN	GKL	MAR '10
CHECKED	XXX	XXX
APPROVED	XXX	XXX
SCALE	1 : 1000	

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GUJARAT NRE COKING COAL Ltd
No. 1 COLLIERY RUSSELL VALE
PROPOSED UPGRADE
300KT STOCKPILE PROJECT – LONG SECTIONS

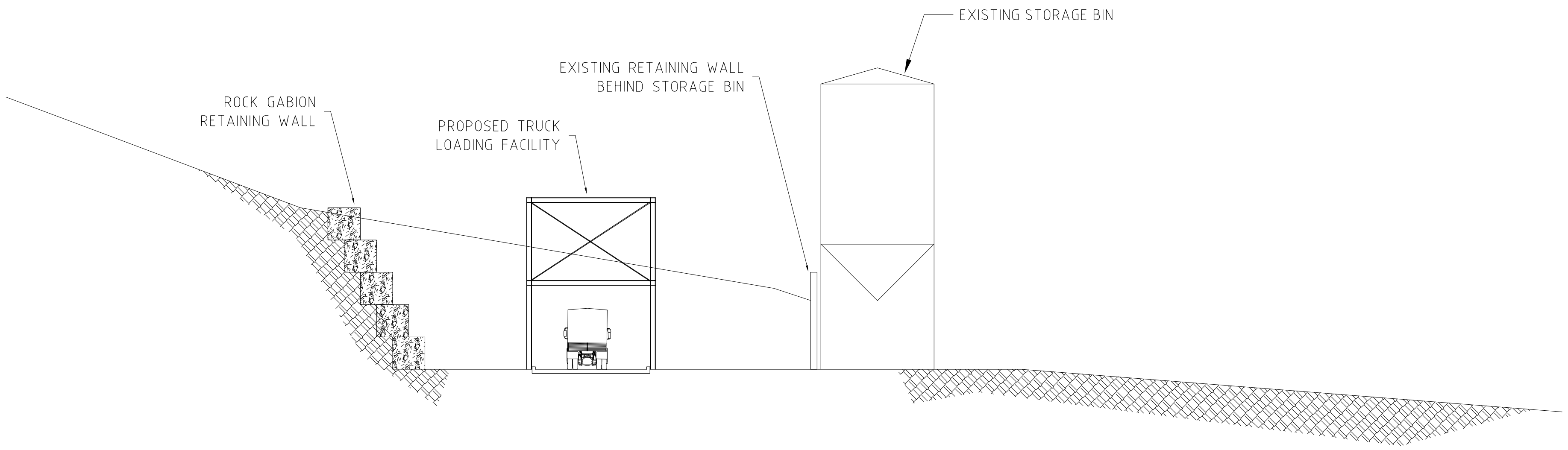
ISSUE: PROPOSAL
DWG. SIZE: A1
JBK DWG No. 282801
REVISION: E

Figure 3.

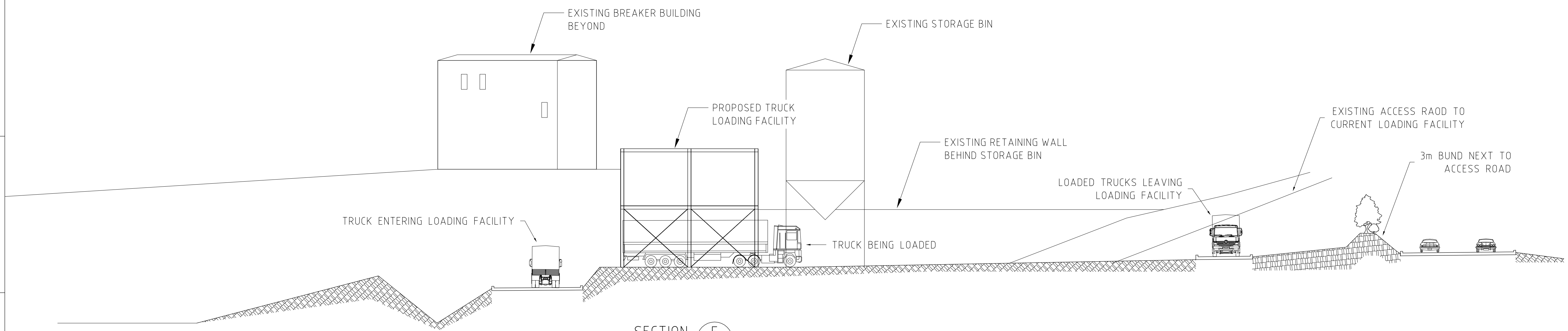
JBK Drawing No. 282806. No. 1 Colliery Russell Vale Proposed Upgrade 300KT Stockpile Project.

Sections E and F.

REFERENCE DRAWINGS	DRG. No.
PLAN VIEW	282800
MUD MAP	282802



SECTION F/00 SECTION VIEW OF LOADING FACILITY AND ROAD
SCALE 1 : 200



SECTION E/00 SECTION THROUGH ROADS AND LOADING FACILITY
SCALE 1 : 200

REV	DATE	REVISIONS	DRN	APP	REV	DATE	REVISIONS	DRN	APP
A	24/5/10	ISSUED FOR REVIEW	MJD	-	-	-	-	-	-

AS 1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

	NAME	DATE
DESIGN	GKL	MAY '10
DRAWN	MJD	MAY '10
CHECKED	XXX	XXX
APPROVED	XXX	XXX
SCALE	1 : 200	

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GUJARAT NRE COKING COAL Ltd
No. 1 COLLIERY RUSSELL VALE
PROPOSED UPGRADE
300KT STOCKPILE PROJECT – SECTIONS E & F

ISSUE: PROPOSAL
DWG. SIZE: A1
JBK DWG No. 282806
REVISION: A

Appendix A.

OEC 2010A. Surface Facilities and On-site Traffic Preliminary Works Part 3A, 26th May 2010.

Olsen Environmental Consulting Pty Limited

FINAL

NRE No 1 Colliery
Russell Vale Site

Surface Facilities and On-site Traffic
Preliminary Works Part 3A

May 2010

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OEC File Reference: P84/2308

TABLE OF CONTENTS

LIST OF FIGURES

1. INTRODUCTION

Gujarat NRE Coking Coal Limited (NRE) own and operate the NRE No 1 Colliery at Russell Vale and propose to upgrade the colliery. The colliery upgrade includes a reorganisation of the surface infrastructure, services and facilities at Russell Vale.

The upgrading will occur in a staged process with a Preliminary Stage providing a transition to the Final Upgraded Stage. This report describes the surface facilities and on-site traffic arrangements for the Preliminary Stage.

An additional report has been prepared to describe the surface facilities and on-site traffic arrangements for the Final Upgraded Stage of the project (Final Upgraded Surface Facilities and On-site Traffic Report, June 2010, Olsen Environmental Consulting Pty Limited).

NRE are required to obtain a valid development approval for the colliery in accordance with the Environmental Planning and Assessment Act 1979 (EP&A Act). This requires the preparation of an Environmental Assessment under the provisions of Part 3A of the EP&A Act. NRE have commissioned Environmental Resources Management (ERM) to prepare this Environmental Assessment.

In April 2009 NRE commissioned Olsen Consulting Group Pty Ltd (OCG) to provide the following services:

- Provide specific input into some components of the No 1 Mine Colliery Upgrade. These components include developing a storm water control and management system and developing a site traffic arrangement that addressed heavy, mining and light vehicle routes.

- Undertake a detailed survey of the existing facility at Russell Vale.

- Provide assistance to the Project Manager (Don Jephcott) to co-ordinate assessments relating to geotechnical, hydrological and water treatment systems for the Russell Vale site. These studies would provide the information necessary to determine general design and to locate components of the surface upgrade project. The design would be undertaken to a stage that ensures the proposed facilities can be built as described and where located. The general design does not include detailed construction design.

- To develop site plans incorporating the outcomes of the various component projects and studies. These plans will eventually be used in describing the proposed project within the Part 3A Environmental Assessment being prepared by ERM.

Other consultant groups have been involved in determining the layout of the upgraded surface facilities at NRE No 1 Colliery. These include;

- ERM have been commissioned to prepare the Part 3A Environmental Assessment. They have also been commissioned to conduct the noise, dust and visual assessments for the Part 3A Environmental Assessment.

- The engineering consultancy Beca was commissioned to provide expert hydrological advice for the design of the surface layout.

- Ellton Conveyors (Ellton) was engaged to design the conveyor/stockpile system. This was the central component of the overall layout design. The Ellton proposal became an option for the project.

- JBK Engineering and Mining were subsequently commissioned to provide an alternative conveyor/stockpile system. Their design became the adopted design for the project.

- Coffey Geosciences Pty Ltd (Coffeys) was commissioned to undertake geotechnical studies for the project.

- Cardno Eppell Olsen was engaged for an off-site Traffic Study.

In April 2010 NRE commissioned Olsen Environmental Consulting (OEC) to prepare reports on the surface facilities and on-site traffic proposals for the Preliminary and Final Upgraded Stages of the developments proposed for the No 1 Colliery at Russell Vale. This is the first of those two reports.

2. EXISTING SITE ARRANGEMENTS

2.1. OPERATIONS HISTORY

Gujarat NRE Coking Coal Limited (GNCCL) is the holder of Consolidated Coal Lease No 745 (CCL 745), which includes the surface at No.1 Colliery Russell Vale. CCL 745 covers 6,400 ha, of which 750 ha is freehold land and the balance is Crown Land located within the Cataract Dam catchment and is under the control of the Sydney Catchment Authority (SCA).

The mine includes 5 surface sites near Wollongong on the escarpment and in the catchment near to the dam. This report focuses on the original site at Russell Vale, which has been operating continuously since 1887. In the mid 1970's a vertical shaft (No. 4 Shaft) was established for men and materials access to the workings about 15 km west of the escarpment and the facilities at Russell Vale. This area comprises offices, workshop, bathhouse, store and winder. There are four other shafts, including the No.1, No.3 and No.5 which are all ventilation shafts and the No.2 Shaft which has been decommissioned.

2.2. MINE OWNERSHIP

Gujarat NRE Australia Pty Ltd (GNAL) purchased the colliery in December 2004. GNAL was a private company with its major shareholder an Indian public company and India’s largest independent metallurgical coke producer, Gujarat NRE Coke Limited (GNCL).

2.3. PROPOSED AND FUTURE OPERATIONS

Since taking over operation of the Mine, GNCCL has been sequentially implementing a Mine Plan that includes the following three broad stages:

Stage 1 (2007 – 2008)

- Continued mining in remnant Bulli blocks.
- Developed three new entries into Wongawilli Seam at Russell Vale.
- Conducted pre-feasibility study for longwall mining in Wongawilli Seam.
- Conducted pre-feasibility study for longwall mining in Bulli Seam.

Stage 2 (2008 – 2010)

- Develop new main access headings in Wongawilli Seam towards No.5 Shaft.

- Connect Wongawilli roadways to No.1 Shaft.
- Form stone drifts from Bulli to Wongawilli Seam.
- Conduct feasibility study for longwall mining in Wongawilli Seam.
- Recover coal from some existing roadways and commence development of new roadways heading towards the Western reserves of CCL 745.

Stage 3 (2010 and beyond)

- Develop longwall gateroad in Wongawilli Seam underneath extracted Bulli longwalls.
- Commence Wongawilli longwall operations.
- Form Wongawilli partial extraction panels between No.1 and No.5 Shafts.
- Undertake Bulli Pillar extraction in V Mains.
- Main heading development V Mains and Western longwall blocks.
- Commence longwall operations Western Bulli reserves.

The implementation of all stages of the proposed Mine Plan has been and will continue to be subject to feasibility studies on commercial viability and necessary stakeholder approvals and stakeholder endorsements.

2.4. EXISTING SURFACE INFRASTRUCTURE

The existing Russell Vale Site arrangement is shown on **Figure** 1. The mining lease can be split into landuse areas that are identified as follows:

- Russell Vale Site.
- Russell Vale Emplacement Area.
- SCA Catchment.

This report focuses on the Russell Vale Site which is the only area under assessment, however brief descriptions of the other two areas are included to provide project context.

2.4.1. Russell Vale Site

This site supports the following infrastructure:

- The pit top which provides storage for most of the mining materials.
- The main administration building.
- Two older portals. One, identified as the Mine Portal on **Figure 1**, operates as a track road which gives men and materials access to the mine. The other, identified as the Conveyor Portal is where a belt road conveys coal to the surface.
- The 3 new main access headings (J Mains) in Wongawilli Seam, which have recently been constructed. They are identified as the Rail Portal, RTV Portal and the Wonga Mains Conveyor Portal on **Figure 1**.
- After reaching the surface on the belt road conveyor via the belt portal, the coal passes through a vibrating feeder and is delivered onto a belt decline.
- The belt decline that leads from the belt portal to the ROM Stockpile area.
- A ROM stockpile and reclaim tunnel.
- The breaker building and conveyor that delivers coal to the road truck loading bins.
- A truck access road that runs to the public road system at the intersection of Bellambi Road with the Princes Highway. Trucks using the access road pass through a truck wash station and over a weighbridge before leaving the site.
- A water management facility that consists of remnants of the washery (thickener tanks) which was removed following a cessation of operations in 2003.

2.4.2. Russell Vale Emplacement Area

The emplacement area is located to the north of the pit top and administration access road, which forms the approximate boundary of the studies described in this report. The site washery ceased operations in 2003 and since then limited material has been deposited in the emplacement area.

2.4.3. SCA Catchment

CCL 745 extends for approximately 20 km to the west of the Russell Vale Site beneath and in some places on the surface of SCA Catchment land. There are five shaft sites identified as No.1 Shaft to No.5 Shaft located west of the Illawarra Escarpment.

2.5. WATER MANAGEMENT

The Beca Report, "Water Management at Russell Vale No. 1 Colliery" (**Beca 2009B**) contains a detailed description of current water management arrangements at Russell Vale (Refer to Section 3 of their report).

2.5.1. Russell Vale Site

Fresh water for the Russell Vale Site is supplied from the Sydney Water reticulated supply. Up to 500 KL per day of mine discharge water can be recycled into the surface water reticulation system. In the past, the recycled water has been used for a wide range of purposes including dust suppression, make up water to the washery, truck washing and road cleaning.

Site toilet and bathroom wastes are disposed of via the normal domestic sewage disposal system operated by Sydney Water.

The Storm Water Control Dam (SWCD) is identified as the Dam on **Figure 1** and is the main facility for controlling 'dirty' surface runoff water on the site. Excess water is discharged to Bellambi Gully in accordance with EPA license quality and quantity criteria and general conditions. The water collected in the SWCD is primarily 'dirty' storm water run-off that comes from disturbed areas such as the stockpile areas and unsealed roads around the coal handling facilities including the belt decline system. This water undergoes primary settling in both concrete and earthen dams prior to entering the SWCD.

Water is drawn from the SWCD via a floating suction and pumped into the water treatment facility adjacent to the truck loading bins. Coagulant is added to the water as it enters the water treatment facility. This coagulant dosing is controlled and occurs just prior to the water entering a mixing chamber, which thoroughly mixes the coagulant and water. The mix is then delivered into a large thickener where settling of sediment occurs.

After settling in the thickener, clarified water overflows into a launder and then to a pipe that discharges to Bellambi Gully. The inflow and outflow water quality is monitored using turbidity meters. Dosing of the coagulant is automatically controlled in response to the monitoring results.

In principle, wherever possible, dirty water is collected and directed into the SWCD. All water is collected from areas such as the coal handling facilities at the portals, ROM stockpile, reclaim tunnel, breaker building, former clean coal stockpile area and truck loading and tarping sections. In addition, perimeter roads both sealed and unsealed are drained such that contaminated rain water and wash down water is collected.

2.5.2. Groundwater

Surplus ground water is pumped to the surface from the mine at both Russell Vale and No.4 Shaft sites. At Russell Vale up to 1,000 KL per day is added to the water storages or, if not required, is discharged directly under license into Bellambi Gully.

3. FACTORS AFFECTING SURFACE FACILITY LAYOUT

3.1. INTRODUCTION

This section discusses those factors that have been considered during the design of the various components of the Russell Vale No. 1 Colliery surface layout arrangement. These factors will be discussed in more detail in the Part 3A Environmental Assessment however they are included here to provide context and understanding on the selection of the components of the proposed surface layout.

The factors can be conveniently divided into the following sectors and are discussed in Sections 3.2, 3.3 and 3.4 respectively:

- Coal Mining and Transport Requirements.
- Land Ownership and Availability.
- Environmental.

An iterative planning approach was used in order to ensure that the broad range of relevant environmental, safety, practical operational requirements, technology availability matters and financial objectives were incorporated into the final proposals. This approach is discussed in Section 3.5.

3.2. COAL MINING AND TRANSPORT REQUIREMENTS

The surface facilities at Russell Vale form integral components of the coal handling system that NRE is developing in order to plan, construct and operate a modern efficient coal mining operation based on CCL 745.

Coal will be mined from various areas within CCL 745. It will then be conveyed to the surface and stockpiled in readiness for transport to the Port Kembla Coal Terminal (PKCT) by truck. Coal is exported overseas from PKCT.

The coal stockpiles provide surge storage for coal and enable loading of coal shipments with specific quality parameters and in the quantities required. Surge storage is required to maintain relatively constant rates of truck loading. The interruptive effects of mining delays can be avoided or minimised by utilising the surge capacity provided by the stockpiles. Similarly, trucking, port and shipping delays can be minimised or avoided by the surge capacity in the stockpiles.

3.3. LAND OWNERSHIP AND AVAILABILITY

The mining lease covering the land on which construction is proposed, is held by GNCCL. The Russell Vale surface is located east of, and within, the foothills of the Illawarra Escarpment. It is not intended to construct any of the surface facilities at elevations higher than those currently supporting existing elements.

The land to the east, northeast and south of the site supports urban development and is not available for coal handling infrastructure.

3.4. ENVIRONMENTAL

3.4.1. Topography and Land Use

The Russell Vale site is located in the foothills of the Illawarra Escarpment, which is located immediately to the west.

The Escarpment provides scenic and conservation values. The pit top (highest point) is located at approximately 150 m AHD and the entry to the site from Bellambi Road (lowest point) is located at approximately 25 m AHD.

Planning for adequate drainage across this topographic range is a critical part of the proposal to upgrade and improve the Russell Vale site.

The Russell Vale site has been used for coal production for over 120 years and its appearance reflects this long term land use.

Urban development occurs along the north eastern, eastern and southern boundaries of the Russell Vale site.

The Princes Highway is located along the eastern boundary of the site. Land adjacent to the Highway is used for a range of small industrial and commercial purposes typical of ribbon development along a main road within an urban area.

The vehicle entry point for the site is off the Princes Highway at a point where it intersects with Bellambi Lane. Bellambi Lane is located alongside an old railway line reserve that originally served the colliery providing direct loading of coal onto the State Government rail system.

3.4.2. Drainage

The site is drained by a number of streams that are primarily sub-catchments of Bellambi Gully and flow to the southern end of Bellambi Beach. All items of infrastructure located within the Russell Vale site are located in the Bellambi Gully catchment. The total catchment area of the Russell Vale site within Bellambi Gully is approximately 57 ha.

A small section on the southern side of the Russell Vale site not affected by construction proposals, drains into the Towradgi Creek catchment and a small section of the site drains to the north of the main Bellambi Gully catchment into an unnamed watercourse that eventually flows into Bellambi Gully downstream of the site. These drainage sections will not be affected by NRE's proposal.

Beca have prepared a detailed Hydrology Report for the development proposal (**Beca 2009A**). Their report includes a detailed description of the various catchments on site. **Figure 2** shows these areas with individual catchments within the Upper Middle and Lower Zones identified U, M and L respectively.

Beca describe three broad catchment zones as follows:

Upper Catchment Zone (U). This zone is predominantly natural escarpment area above the Russell Vale Site and considered to generate clean runoff water.

Middle Catchment Zone (M). This zone supports the workshop, offices, portals and a number of roads. It is characterised by steep batters of both natural and mine washery reject material.

Lower Catchment Zone (L). The coal stockpile and truck haulage area facilities are located in this zone. It is where clean water, which has been directed around disturbed areas on site, discharges into Bellambi Gully.

3.4.3. Rainfall

As discussed in Section 3.4.1, the site is located in the foothills of the Illawarra Escarpment. This geographical location is conducive to generation of high intensity/high rainfall storm events. Local rainfall data has been used by Beca when assessing and designing hydrological aspects of the proposals.

3.4.4. Air Quality

The site experiences air quality conditions typical of a coal mining development within an urban area and adjacent to a relatively heavily trafficked main road.

Consideration of the various components of the surface facilities took potential air quality impacts into consideration. A range of responses were implemented to minimise air quality impacts including:

- Constructing the coal stockpiles close to geographical features to minimise exposure to wind.
- Enclosure of elevated conveyors.
- Provision for dust sprays at coal transfer points.
- Truck washing on site before departure.
- Clean up arrangements will be developed and implemented during operations to manage fugitive dust sources.

3.4.5. Visual

Potential visual impact was an important consideration in selecting the finally proposed surface layout arrangement.

A range of responses were implemented to minimise visual impact including:

- Consideration of the most effective orientation of individual components of the surface infrastructure.
- Constructing the coal stockpiles close to existing physical features.
- Placing the coal stockpile as far to the west, while taking into account geotechnical stability characteristics of the embankment, maximising the visual attenuation provided by two naturally occurring ridge lines.
- Consideration of the colour treatment of components.
- Artificial bunds and landscaping.
- Utilising already disturbed areas for the location of replacement components eg downslope conveyor and stockpiles.

ERM have undertaken a more detailed assessment of the potential visual impact and its management.

3.4.6. Heritage and Archaeology

The Russell Vale site has supported coal mining activities for over 120 years. It is unlikely that any Aboriginal heritage items remain where new infrastructure is proposed.

Some of the early mine buildings and entries remain and they have heritage value. Those items with heritage value have been identified and their presence has been considered during the planning of the proposed surface infrastructure.

ERM have undertaken a detailed assessment to verify the actual site heritage and archaeological features. Their findings will be included in the Part 3A Environmental Assessment for the proposals.

3.4.7. Geotechnical and Land Stability

Land stability issues were incorporated into the design of the proposed surface infrastructure. Adequate geotechnical assessment was been undertaken by Coffey Geosciences Pty Ltd (Coffeys) to determine that the proposals are able to be constructed as indicated. Further geotechnical assessment will be required during the construction design phase.

3.4.8. Flora and Fauna

Wherever possible, proposed infrastructure has been located in areas where vegetation has been removed or disturbed. Where vegetation has to be disturbed, appropriate fauna and flora investigations have been undertaken to assess impact and develop amelioration and management actions as required.

ERM have undertaken a detailed ecological assessment of the site and the details of that investigation will be included in the Part 3A Environmental Assessment for the proposals.

3.4.9. Traffic

This report only identifies onsite traffic arrangements. All traffic will access the site via the existing entry location where Bellambi Lane intersects the Princes Highway immediately east of the site.

Matters taken into consideration for onsite traffic movements included:

- Separation of light and heavy vehicles.
- Avoiding at grade cross-over movements of coal trucks.
- Provision of adequate on-site parking for heavy vehicles during short term interruptions to coal loading.
- Provision of suitable access for delivery and dispatch of materials from the workshop area.

3.4.10. Acoustic

The potential acoustic impacts were considered during the planning of the location of the various components of the surface layout. Matters taken into consideration during planning included:

- Location of components with respect to neighbours.
- “Line-of-site” considerations.

- Availability of noise attenuated items.
- Ability to incorporate noise attenuation in final structures.
- Location of acoustic and visual bunding.

A detailed noise assessment was undertaken by ERM to determine the potential impact and management that will be required to ameliorate noise impacts. Additional acoustic input will be provided during the construction design phase. Operational monitoring will be an integral part of ongoing management of the acoustic environment.

3.5. ITERATIVE PLANNING APPROACH

Development of the proposed surface layout at Russell Vale utilised an iterative approach to ensure that the broad range of relevant environmental, safety, practical operational requirements, technology availability matters and financial objectives were considered.

Early planning deliberations defined the range of issues that required consideration during the planning phase. These issues were then constantly considered during the iterative development of the final proposals.

The size and location of coal stockpile was identified as being the critical issue in designing a suitable surface layout at Russell Vale. There is only one general location for the coal stockpile, however, it was possible to incorporate small adjustments in response to the range of matters and objectives relevant to the proposal.

The size and location of the coal stockpile was determined taking into account such issues as noise, visual, air quality, drainage, geotechnical stability, practical operational considerations and financial objectives.

The construction of a by-pass channel in Bellambi Gully is required to facilitate the positioning of the stockpile footprint. This by-pass channel will replace a section of the existing Bellambi Gully that is currently a concrete pipe beneath the old coal stockpile area.

Site surface water treatment has been developed using the established general principle of separating clean and dirty water, while minimising the volume of potential dirty water needing treatment. The water treatments proposed do not affect the runoff flow characteristics downstream of the site. Details are included in the Beca Report (**Beca 2009A**).

Consequently, the proposed surface layout has been developed with consideration of the potential environmental impacts. The environmental impact of the final proposed layout has been assessed in detail in the Part 3A Project Environmental Assessment prepared by ERM.

4. SURFACE INFRASTRUCTURE COMPONENTS LAYOUT AND FUNCTION

This section describes the surface components proposed for the Russell Vale site during the Preliminary Stage of the development, which will enable the Colliery to logically progress to the Final Upgraded Stage. It also identifies the alternatives considered during the preliminary planning of the site.

4.1. STOCKPILE AND CONVEYOR

4.1.1. Proposal

Figure 3 (JBK Drawing 282803) shows plan perspectives of the mine site facilities proposed for the Preliminary Stage of the development. **Figure 4** (JBK Drawing 282804) shows a number of cross sections of the coal stockpiles and associated conveyors. The location of the cross sections is shown on **Figure 3**.

The installation and operation of the Preliminary Stage will allow the orderly development of the No 1 Colliery in a logical, sequential manner and enables coal supply to be maintained continually during construction of the new stockpile arrangements.

Actual timing of each stage is indicated as follows, but will be dependent on coal markets existing at the time:

Stage 1.

Preliminary works. (to be completed by DECEMBER 2011 in readiness for LW4 start):

- Completely enclosed decline conveyor belt;
- Sizing/screening tower;
- Stack-out conveyor;
- Entire Tripper install;
- Integration of the above facilities into the existing coal clearance system, including the removal of the ‘Balgownie Bin’ and stockpiling for approx. 60,000 tonnes;
- Re-alignment of ‘Bellambi Gully/Creek’ via an open channel, to include removal or other of the existing pipeline;
- Drainage associated with the Stockpile from ‘up the hill’ to the culvert at the highway, including stabilisation works and rehabilitation of ‘#6 Dam’(**Beca 2009A**).

Stage 2.

Transition works. (DECEMBER 2011 - DECEMBER 2012):

- New reclaim belt;
- New coal load out facility;
- New truck management facility, including new roads, truck parking, Traffic Mgt Plan, truck washing, etc;
- New ‘dirty water’ treatment facility and/or settling pond/s; and
- New stockpile area 2 to allow for stockpiling of approximately 140,000 t.

Stage 3.

Final Stockpile for 3Mtpa. (from DECEMBER 2012):

- New stockpile area 3 to allow for stockpiling of approximately 140,000 t.

Bulli Seam coal reaches the surface via conveyor at the Conveyor Portal (**Figure 3**). The existing decline conveyor will be retained to deliver Bulli Seam coal from the Portal to the stockpile area. This coal will pass through a new sizing station that will be constructed as part of the Preliminary Stage of development. The Sizing Station will be located just before the existing Bulli Bin and Bulli Bin Stockpiles (**Figures 3 and 4**).

The sized coal will then be delivered by conveyor and tripper onto the Bulli Bin Stockpiles.

Wongawilli Seam coal reaches the surface via conveyor at the newly established Wonga Mains Conveyor Portal (**Figure 3**).

A new decline conveyor will be constructed during the Preliminary Stage to deliver this coal from the Portal to the stockpile area. This new conveyor will be located in the existing decline conveyor easement and will be fully enclosed. The conveyor will deliver the coal to the Sizing Station, from where it will be delivered to the Wonga Stockpile.

Coal will be transferred from the Sizing Station to both the Bulli Bin Stockpile and the Wonga Stockpile via a conveyor and tripper arrangement as shown in **Figure 4**.

The Bulli Bin will be retained however the existing Balgownie Bin will be removed to accommodate the proposed Wonga Stockpile.

This stockpile arrangement will include the capability to push out coal from the stockpile to enable additional storage. A temporary bund wall will be constructed in the location shown on **Figure 3**. This wall will limit the extent of the stockpile and provide a barrier in order to prevent wet weather coal slumps from travelling into the surface drainage system.

The trippers and the stockpile areas will be serviced by water spray systems to provide dust control capability.

The existing unsealed heavy vehicle access road will continue to provide access to the Bulli Bin Stockpile and the Wonga Stockpile from the mine access road. Part of this road will be sealed and this sealed section could be used as part of a future upgraded truck loading arrangement. The unsealed section will have water sprays to moisten the surface and reduce dust generation.

The existing coal retrieval system will be retained during the Preliminary Stage (**Figures 3 and 4 Section A**). Coal will be reclaimed from the base of both stockpiles and feed onto an existing conveyor located within a tunnel beneath the stockpile area. The coal from this stockpile passes through an existing ‘Breaker’ Building and into a 600 t capacity surge bin. The breaker will not be operational during the Preliminary Stage.

Coal passes from the 600 t bin into the truck loading bins from where it is loaded for road transport to the PKCT. Apart from regular maintenance this existing coal retrieval system will not be modified during the Preliminary Stage.

During the Preliminary Stage there will be a temporary emplacement of clean fill established immediately south of the unsealed access road.

With this arrangement there are three operational scenarios for the Preliminary Stage of the development. These scenarios will operate typically independently and not concurrently and are as follows:

1. Normal operations.

2. Extreme operational conditions

3. Normal trucking operations from existing coal loading (7am-6pm) then truck loading directly from the stockpile (6pm-10pm).

Normal operating conditions give an average of 20,000 t per week to achieve 1 Mtpa based on 50 weeks per year.

Extreme operation conditions give an average of 28,000 t per week to achieve a particular shipping deadline.

Trucking in the evenings Monday to Friday and trucking on Sunday will only be used for the extreme condition in order to achieve shipping deadlines. When trucking occurs for the extended hours identified as extreme conditions (7 am to 10 pm Monday to Friday and 8 am to 6 pm Saturday and Sunday) NRE plan to move 80% of the product during daylight hours with the remaining 20% to go in the evenings and Sunday.

Table 4.1 lists the equipment, hours of operation, percentage of time operating and additional comments that provide an understanding of the operational activities typical of normal operating conditions during the Preliminary Development Stage.

Table 4.1 Typical Operational Activity During Normal Operating.

Equipment	Hours of operation	% of time operating	Comment
1x D10 dozer	7 am to 6 pm Monday to Friday 8 am to 6 pm Saturday	75% of operational hours.	The Dozer will be needed to push sized coal into the re-claim points for loading into trucks via the existing truck loading infrastructure.
1x Excavator 345	7 am to 6 pm Monday to Friday 8 am to 6 pm Saturday	70% of operational hours.	There are two excavators on site at present. In the future only one is required to work the screen for Bulli Coal as Wongawilli Coal will go through the new sizing plant. There will be 2 products identified as Bulli Coal and Wongawilli Coal. Initially the Wongawilli Coal will be the high ash coal. The Bulli Coal will still need to be screened and sized as per the existing operations and an excavator will be needed for majority of the time when trucking Bulli Coal.
Existing Conveyors	24x7	100%	Covered.
Proposed Conveyor	24x7	100%	Enclosed.
New Sizer	27x7	100%	Enclosed
Existing Trucking Facilities	7 am to 6 pm Monday to Friday 8 am to 6 pm Saturday	100% of daytime hours	Trucking a maximum 65 hours per week at an average of 20,000 tonne per week in 34 ton trucks gives an average of 9 trucks per hour.
ROM stockpile	24x7	100%	Dust suppression spray system.

Table 4.2 lists the equipment, hours of operation, percentage of time operating and additional comments that provide an understanding of the operational activities typical of extreme operating conditions during the Preliminary Stage of the development.

Table 4.2 Typical Operational Activity During Extreme Operating.

Equipment	Hours of operation	% of time operating	Comment
1x Dozer Size as appropriate	7 am to 10 pm Monday to Friday 8 am to 6 pm Saturday and Sunday	75% of operational hours. 25% daylight hours	The Dozer needed to push sized coal into the re-claim points for loading into trucks via the existing truck loading infrastructure. Used for shaping high ash coal stockpile daylight hours only.
1x Excavator 345	7 am to 10 pm Monday to Friday 8 am to 6 pm Saturday and Sunday	70% of operational hours. 30% daylight hours.	In the future only one is required to work the screen for Bulli Coal as Wongawilli Coal will go through the new sizing plant. There will be 2 products Bulli Coal & Wongawilli Coal. Initially the Wongawilli Coal will be the high ash coal. The Bulli Coal will still need to be screened and sized as per the existing operations and an excavator will be needed for majority of the time when trucking Bulli Coal. Used for moving high ash coal to stockpile & loading trucks off stockpile; daylight hours only.
Existing Conveyors	24x7	100%	Covered.
Proposed Conveyor	24x7	100%	Enclosed.
New Sizer	27x7	100%	Enclosed.
Existing Trucking Facilities	7 am to 10 pm Monday to Friday 8 am to 6 pm Saturday and Sunday. 7 am to 6 pm Monday to Friday and 8 am to 6 pm Saturday and Sunday.	100% operational hours. Day light hours.	Trucking 95 hours per week at an average of 28,000 tonne in 34 ton trucks (80% daylight hours Monday to Saturday and 20 % evenings Monday to Friday and Sunday). 80% is 22,000 tonnes in 34 ton trucks gives 10 trucks per hour (Mon to Sat daylight). 20% is 6,000 tonnes in 34 ton trucks gives 6 trucks every hour (Mon to Fri evenings & Sundays daylight). Loading off the high ash stock pile.
ROM Stockpile	24x7	100%	Dust suppression spray system.

Table 4.3 lists the equipment, hours of operation, percentage of time operating and additional comments that provide an understanding of the operational activities typical of high ash stockpile during the Preliminary Stage of the development.

Table 4.3. Typical Operational Activity Involving Existing Coal Loading Arrangements and Loading Directly From Stockpile.

Equipment	Hours of Operation	% of time Operating	Comment
1x Dozer size as appropriate	7 am to 6 pm Monday to Friday. 8 am to 6 pm Saturday	60% of operational hours..	To push sized coal into reclaim points in stockpile.
1x Excavator 345	7 am to 10 pm Monday to Friday.	60% of operational hours.	Will be used to load trucks directly from stockpile.
Existing Conveyors	24x7	100%	Covered
Proposed Conveyor	24x7	100%	Enclosed
New sizer	27x7	100%	Enclosed
Existing Trucking facilities	7 am to 6 pm Monday to Friday. 8 am to 6 pm Saturday	100% of daytime hours.	Peak. In daytime hours. Trucking 65 hours per week at an average of 28,000 tonne in 34 ton trucks gives 10 trucks per hour.
Evening operation loading trucks directly from stockpiles.	6pm to 10pm	100% of evening hours.	Peak. 6 trucks per hour. Trucks will use stockpile road shown on **Figure 3**.
ROM stockpile	24x7	100%	Dust suppression spray system

4.1.2. Alternatives Considered.

Apart from the do nothing option, there are no alternatives to the current proposal for the Temporary Stage of the development.

4.2. BYPASS STORMWATER CHANNEL

4.2.1. Proposal

The existing drainage of the Russell Vale site includes a clean water bypass pipe which conducts clean water flowing in Bellambi Gully underneath and past the current stockpiling and coal loading arrangements.

It is proposed to remove this pipe and replace it with a suitably designed and engineered open bypass stormwater channel constructed on the southern side of the planned coal stockpile area.

Detailed discussions of the Bypass Stormwater Channel are included in the Beca Report (**Beca 2009A**). The location of the Bypass Stormwater Channel is shown on **Figure 3**.

The channel commences at elevation RL65. At this point a reinforced concrete headwall structure will be built to direct stormwater flows out of the existing Bellambi Gully alignment and into the channel.

An existing dam on the ridge adjacent to the proposed channel will be removed and the slope regraded to ensure slope stability in major rainfall events. This will minimise the chance of landslip obstructing the channel.

The Bypass Stormwater Channel follows an alignment along the southern side of the coal stockpile and is positioned at a relative level generally above the stockpile coal stacking operations. A temporary bunded wall will prevent coal slumping into the channel from the Bulli Bin Stockpile and the Wonga Stockpile (**Figure 3**).

The channel is required to be wide enough (2.5 m) to permit vehicle access for inspection, maintenance and repair, more importantly it needs to be resistant to erosion and able to convey the 1:100 year storm event with a safety margin of 0.5 m freeboard.

The channel alignment is planned to generally follow the natural contour of the ridge on the southern side of the stockpile facility to:

- Minimise the cut necessary to construct the channel.
- Restrict the channel grade/maximum flow rate so a suitable cross section for the channel can be selected.

The channel grade from where it commences will be between 2 and 5%. Where the ridge terrain falls sharply on the eastern side of the stockpile a cascade drop structure consisting of gabion baskets or other suitable materials will be employed to control the stormwater flows.

Parts of the channel will be constructed in bedrock and will be stable. To ensure stability, all other sections will require installation of reno mattresses or shotcreting. Detailed geotechnical investigations during final design will define those areas requiring stabilisation and the appropriate treatments.

The proposed design incorporates a concrete box culvert section of approximate dimensions 2.5 m wide and 1.25 m high. This cross section has the capacity to deal with a 10 year ARI event. The box culvert then opens to a trapezoidal channel of 1 m depth which provides capacity for a 100 year ARI storm with a freeboard of 0.5 m.

The Bypass Stormwater Channel cascades into a pond (identified as Creek Flow Dissipation Pond on **Figure 3**) that will dissipate the flow rate of stormwater prior to discharge back into Bellambi Gully. During 1:100 year events water would discharge from the pond via a reno mattress lined spillway. In lesser events, stormwater would discharge from the base of the pond via a purpose built outlet pipe structure. This would consist of a grated surface inlet pit with restricted inlet capacity to allow low flows to enter Bellambi Gully. Details are included in Drawing 2591308-C-SK8 in the Beca Report (**Beca 2009A**). The inlet pit would be connected to the last section of the existing underground clean water pipeline. The remaining sections of the clean water pipeline upstream of this connection would be removed.

Downstream of the gabion basket spillway from the pond, the existing invert and banks of Bellambi Gully would be cleared of undergrowth and maintained to ensure potential flood debris is controlled.

There is an existing culvert crossing of Bellambi Gully between the proposed Creek Flow Dissipation Pond spillway and the existing culvert under the Princes Highway. The culvert crossing of Bellambi Gully will be removed and replaced with a causeway, which is less likely to be problematic during storm events.

Undergrowth and obstructions would be removed from around the existing culvert under the Princes Highway, and the area subject to ongoing maintenance to ensure that flood flow obstructions are not generated.

The Bypass Stormwater Channel would be inspected regularly (at least annually) to ensure all treatments are functioning and the system is free of slumps and damage.

4.2.2. Alternatives Considered

The majority of stormwater runoff emanating from the steeper areas of the mine site is currently collected and diverted through various pipes and channels and across benches to a watercourse that descends to the south western corner of the coal stockpile area. The watercourse channels into a large diameter sub-surface pipeline that runs under the stockpile pad to Bellambi Gully.

The existing pipeline is in poor condition and would need to be replaced if the existing stormwater drain connection into Bellambi Gully were to be retained. This option was investigated and eliminated due to the risk of blockages in the pipe caused by debris being carried down the watercourse during storm events. Should pipe blockage occur, overflow would pass through the coal stockpiling and handling area and could result in silt-containing water discharging directly into Bellambi Gully.

The preferred option is to employ an open channel located to by-pass the coal stockpiling and handling facilities and into Bellambi Gully.

4.3. CONVEYOR DECLINE CREEK CROSSING

4.3.1. Proposal

The new Downhill Conveyor from the Wonga Mains Portal (**Figure 3**) will be built in the corridor of the existing decline conveyor. The Bellambi Gully currently crosses beneath the conveyor corridor in a piped crossing.

The crossing was the site of a key failure in the 1998 storms. Storm debris caused blockage in the piped crossing and diverted the majority of stormwater flow from uphill catchment out of the alignment of Bellambi Gully and through the coal stockpile area.

In order to minimise the risk of future major storm events overtopping this crossing, a concrete box culvert will be installed at the location shown on **Figure 3**. The Beca Report (**Beca 2009A** under discussion of Catchment M3) provides typical details of this proposed crossing. In order to convey predicted flow rates with a 0.5 m freeboard in the 1:100 year storm event, a minimum cross section of approximately 2.5 m wide and 1.75 m deep is required for the box culvert.

In addition, the adjacent downstream ridgelines will be extended to the roadside and the road and adjacent area to the south will be graded toward the south. This regrading and ridgeline extension will provide a mechanism that, in the event of blockage of the culvert, stormwater flows will re-enter Bellambi Gully rather than continue down the belt decline towards the dirty water channel/catchment. This will maintain separation of clean and dirty water.

4.3.2. Alternatives Considered

Due to the potential for blockage resulting from storm debris, it was not considered appropriate to re-install a piped crossing.

An open gabion lined channel was also considered in combination with the box culvert. However, minimising cross section while maximising flow rate is the higher priority and a box culvert alone was selected.

4.4. ESCARPMENT DRAINAGE AND CREEKS STABILISATION

4.4.1. Proposals

The Russell Vale site is located at the foothills of the Illawarra Escarpment and runoff from the Escarpment traverses the site. Drainage considerations are an important component of surface infrastructure planning and design.

OCG developed concept plans for site drainage and creek stabilisation. Beca investigated the hydrological parameters of the concept designs and recommended various alternative treatments. A detailed description of their findings are included in their report, “Gujarat NRE Stormwater Hydrology – Summary of Investigations.” (**Beca 2009A**).

The main considerations in designing a suitable drainage system included the following:

- Separate clean water and dirty water catchments.
- Determine catchment area characteristics and design appropriate drainage structures.
- Ensure flow channels are stabilised.
- Provide facilities for treating dirty water prior to reuse or discharge.

Drainage proposals are shown on **Figure 2**, which is Drawing 2591308-C-SK7 from the Beca Report (**Beca 2009A**). There are a number of catchments in the north western sector of the site that flow toward the north of the site. These are identified as catchments U3, U4 and U5 on **Figure 2**. They do not create flow that has to be handled on site. However, drainage channels and access tracks that currently direct the flow to the north will be maintained to ensure that these catchments do not contribute storm flows to the site. In addition, a box culvert drain will be installed at the base of U5 to isolate runoff water from the lower catchments within the site.

There are another two catchments (U1 and U2 on **Figure 2**) on the escarpment slopes above and to the west of the site. Water flowing from these catchments will be directed by earthen channels into the upper reaches of Bellambi Gully that flows immediately south of the current workshop and stores area. This section of Bellambi Gully was constructed early in the mine operating life. It is heavily eroded and requires stabilisation for continued use.

The entire length of this flow channel will be stabilised with reno mattresses and gabion drop structures where required. An existing debris and trash collection device will be retained. The existing channel will be cleared and stabilised. All areas that are not on bedrock will be lined with reno mattress. In addition, all large boulders and obstructions will be cleared from the channel in order to minimise the potential for downstream blockages.

In addition to the runoff water from the catchments on the Escarpment, Bellambi Gully will also receive clean runoff water from the other catchments located around the mine office, workshop and stores areas. These are identified as catchments M1, M3, M4, M5, and M6 on **Figure 2**. Earthen bunds approximately 0.5 m high will be constructed where required to define these catchments. These bunds will ensure that storm water does not flow between catchments during intense storm events leading to exceedances of structure design capacities and/or the mixing of clean and dirty water.

Prior to entering Bellambi Gully, runoff water from M1 passes through a first flush system which will be retained and maintained as part of the proposed site drainage system.

Water from catchment M3 flows into Bellambi Gully at a location with high erosion potential. A Gabion Basket spillway will be installed here to enable water to safely pass from catchment M3 into Bellambi Gully.

Catchment M4 directs clean runoff water into Bellambi Gully. No works are proposed in this catchment.

Catchments M5 and M6 will have diversion drains and bunds constructed to direct runoff water to Bellambi Gully without causing erosion and sediment generation. Runoff water from these catchments will pass under the new Downhill Conveyor (DC01) via a box culvert approximately 1.5 m wide and 1.0 m deep.

Catchments M2, M7 and M8 do not generate clean water and runoff from these catchments will be directed to the dirty water treatment system, which is discussed in Section 4.5.

Details of typical diversion drains, piped stormwater drainage and box culvert diversions are included in the Beca Report (**Beca 2009A**).

There are two catchments on the relative flatter eastern section of the site. These are identified as catchments L1 and L2 on **Figure 2**. Catchment L1 generates dirty water and as discussed in Section 4.5, existing dirty water treatment systems will be retained.

Catchment L2 generates clean water which will flow into the Bypass Stormwater Channel. No works are proposed for this catchment.

As discussed in Section 4.2, the Bypass Stormwater Channel cascades into a pond that, by dissipating energy, will enable stormwater to discharge safely back into Bellambi Gully.

4.4.2. Alternatives Considered

Erosion control design requirements dictated the location of drains, channels, culverts and other treatment structures.

Alternative materials were considered for stabilising flow channels. These included shotcrete lining of channels with sprayed concrete, reno mattressing and gabion basket treatments. The final selection was based on the degree of stabilisation required.

4.5. DIRTY WATER HANDLING AND TREATMENT

4.5.1. Proposals

There are no proposed changes to the existing dirty water handling treatment system (Refer Section 2.5.1).

4.5.2. Alternatives Considered

Due to the decision to not change existing dirty water handling treatment system, consideration of alternatives was not necessary.

4.6. SITE ROADWORKS AND TRAFFIC ARRANGEMENTS

4.6.1. Proposals.

The mine site road system will not be altered during the preliminary Stage of the development at No 1 Site Russell Vale.

The general site layout, including the site roads and traffic arrangements is shown in **Figure 1**.

4.6.2. Alternatives Considered

Due to the decision to not change existing traffic system, consideration of alternatives was not necessary.

4.6.3. Operational Traffic Arrangements

The following sections describe the historic, current and future on-site traffic levels associated with the proposed Preliminary Stage. Traffic will be associated with construction activities during the proposed upgrade and with operational activities following construction.

Off-site traffic impacts have been addressed in another report prepared by Cardno Eppell Olsen and titled, “Gujarat NRE No 1 Mine Traffic Study, 2010.

During normal operating times, there will be a mix of vehicle types accessing the site including coal trucks, assorted heavy vehicles delivering stores and supplies, courier vans, with regular sedans and some motorbikes providing employee, contractor and visitor access.

In addition, there will be a number of heavy vehicles permanently located on site to handle delivery and dispatch of stores and to load and deliver stores and materials underground. They are also used for general maintenance activities around the site as required.

During construction, there will be a range of vehicle types accessing the site and permanently located on site for the duration of construction activities.

Figure 3 details the proposed Preliminary Stage site layout including the site roadworks and traffic arrangements.

Coal trucks will use the existing Truck Loading Facility and new loading facilities are not proposed for the Preliminary Stage.

All mine traffic will enter the site from the Princes Highway/ Bellambi Lane intersection and follow the existing single lane access road. NRE operate a CCTV (closed circuit television) to monitor mine vehicles entering and leaving the site through this intersection. This facility provides a real time direct record of all mine vehicle movements adjacent to the intersection.

Empty coal trucks travelling towards the Truck Loading Facility will leave the site access road and diverge to the left onto the existing one-way dedicated coal dispatch road which passes beneath the coal loading bins.

After loading, the coal trucks will leave the coal dispatch road and re-enter the access road via an at grade intersection. Existing traffic controls and management procedures will continue.

When coal is directly loaded from the stockpiles, trucks will use the stockpile road (**Figure 3**) to access the stockpile area.

The practice of washing trucks prior to departure and use of the existing weighbridge will be retained.

After entering the site from the Princes Highway/Bellambi Lane intersection, all mine traffic other than coal trucks, will avoid entering the coal dispatch road and continue along the existing mine access road to the pit top site further up the escarpment. The mine traffic will continue to follow existing access roads to the employee, stores and workshop facilities on the pit top further up the escarpment. This section of road is steep.

When leaving the site, mine traffic will merge with the loaded coal trucks and proceed to the Princes Highway/ Bellambi Lane intersection to exit the mine site. There is a general 40kph site maximum speed limit.

The existing employee's car park is located adjacent to the mine administration building (**Figure 1**). The current car park can readily accommodate 90 vehicles. Additional car parking spaces (30) are located on the western side of the administration building and also generally throughout the pit top area (20). Consequently, there are 140 existing car parking spaces on site around the administration office. These parking spaces will be retained in their current condition. Safe walking access to the bathhouse buildings from the car parking spaces will be provided.

Heavy vehicles permanently located on site normally operate around the stores area, administration building and mine entries. From time to time, as required, they may operate in other distant areas.

Vehicles accessing the store area will travel past the employee, contractor and visitor car parking areas and will traverse a section of pavement between the administration building and the escarpment.

No changes are proposed to the current access and facilities at the No 4 Shaft site. Vehicular access is along a bitumen-sealed mine access road that branches off the Picton to Mount Keira Road.

4.6.4. Construction Traffic Arrangements

Construction will be limited to the No 1 Colliery Site at Russell Vale. The majority of construction activity will be associated with the stockpile area and immediate environs to:

- Install the enclosed decline conveyor,
- Install the sizing station,
- Install the stackout conveyor and associated trippers,
- Remove the Balgownie Bin and general civil works associated with integrating the new construction into existing facilities, and,
- Improve general site drainage to control water flow across the entire site from the escarpment to the Princes Highway. The Storm Bypass Channel will be installed as part of the Preliminary Stage.

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

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

4.6.5. Current and Historic On-site Traffic

Both the Russell Vale Site and the No 4 Shaft Site are currently operating. The Russell Vale Site has operated continuously since 1887 and the No 4 Shaft Site since the 1970s. Most of the vehicles entering the sites transport employees and contractors. In addition, consultants, visitors and sales representatives make regular visits to both sites.

Parking facilities are established that have accommodated an historically large number of vehicles associated with the workforce and other groups of people accessing the site.

Heavy vehicles access the sites to deliver equipment and bulk stores such as fuel. Heavy vehicles are also utilised as required to dispatch heavy mine equipment offsite for maintenance and repairs as required.

Courier vehicles, which include pantechnicons of varying sizes, also access both sites, generally during daytime from Monday to Friday.

Coal is dispatched in trucks from the No 1 Colliery Site for delivery to PKCT with subsequent export to world markets.

A coal preparation plant has previously operated at the No 1 Mine Site. This required truck haulage of waste material to an on-site refuse emplacement area and a fleet of heavy vehicles associated with the emplacement, compaction and rehabilitation of the emplaced refuse. NRE do not currently operate an on-site preparation plant.

4.6.6. Historic and Current Employee Vehicle Access

The size of the workforce accessing both sites has varied over time, both in size and the proportion of the workforce attending each site accessed. The workforce has at various times included both company employees and contractors.

The size of the workforce has varied in response to market conditions and the objectives of various owners over time. Since the establishment of the No 4 Shaft Site in the 1970s, there has always been workforce attendance at both sites. The workforce has been distributed at varying ratios between the Russell Vale Site and the No 4 Shaft Site depending on the location of mining activity underground.

During the late 1970s and early 1980s, there were up to 1,200 people employed at the sites. These employees reported for duty at both locations and car parking spaces were sufficient to accommodate this large workforce. Typically, up to 800 employees would report for duty at the No 4 Shaft Site and up to 400 at the Russell Vale Site.

The current workforce totals approximately 400 individuals with an approximate 55/45 split between Russell Vale and the No 4 Shaft.

The mine operates on a three shift basis covering 24 hours per day, 7 days per week. The shift times are day shift (7.00am to 3.00pm), afternoon shift (3.00pm to 11.00pm) and night shift (11.00pm to 7.00am). There is a concentration of vehicles accessing and leaving the site around the shift change times. This concentration tends to be spread over the two hour period around the actual shift change time as not every employee will access and leave the site precisely at shift change time.

There are more employees on site during the day shift than on the other two shifts. In addition, there are more employees on site during the afternoon shift than there are during the night shift.

The actual numbers on each shift will vary in response to work requirements and attendance aspects. **Table 4.4** provides a typical breakdown of the number of employees currently on site during each shift.

Table 4.4. Typical Spread of Employees and Contractors on Site at the Russell Vale Site and the No 4 Shaft Site. February 2010.

SHIFT	Russell Vale	No 4 Shaft
Day Shift (7.00am to 3.00pm)	108	68
Afternoon Shift (3.00pm to 11.00pm)	63	63
Night Shift (11.00pm to 7.00am)	49	49

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. General site observations indicate a vehicle occupancy rate of 2 people per vehicle.

Table 4.5 includes the most likely number vehicles required to transport the workforce assuming an occupancy rate of 2 employees per vehicle and the spread of these vehicles over the two hour period surrounding shift change times. This spread is based on the assumption that all the previous shift leaves the site in the hour following the shift change and all the following shift arrive at site during the hour prior to commencement of that shift. In reality, these numbers are likely to vary from this due to absentees and work arrangements including overtime and delayed departures. Despite this likely variation, the data in **Table 4.5** provides a sound basis for impact assessment.

4.6.7. Historic and Current Visitor and Other Vehicles

In addition to employee and contractor vehicles, site access to both sites is required for visitors, sales representatives, stores deliveries and equipment dispatch for maintenance and repairs. These access visits normally occur Monday to Friday and during daylight hours. There may be special requirements for vehicle access outside these times, but they would be relatively infrequent and insignificant in relation to impact assessment.

During a typical day at both the Russell Vale Site and the No 4 Shaft Site, approximately 40 vehicles would access the site transporting visitors, consultants and sales representatives. At Russell Vale, these visits would be spread fairly evenly over the time 6.30am to 6.30pm with a bias towards morning and mid day visits. At the No 4 Shaft Site these vehicles access the site between 6.00am and 3.00pm.

During a typical day at both sites approximately 15 courier vehicles (pantechnicons of various sizes) would access the sites. This number is likely to peak at 25 vehicles per day.

The number of heavy vehicles accessing both sites is between 6 and 8 per day.

Visitor and consultant vehicles typically park in the main car parks at both sites adjacent to the administration buildings. Sales representatives, courier vehicles and heavy vehicles park adjacent to, or within, the stores areas at both sites.

Table 4.5. Typical Employee On-site Vehicle Movements at Russell Vale and No 4 Shaft Site. February 2010.

Site	Shift	Total Shift Vehicles	Time	Vehicles Accessing and Leaving site
No 1 Mine Site Russell Vale	Day (7.00am to 3.00pm)	54	6.00am to 7.00pm	54 arriving
			7.00am to 8.00am	25 leaving
	Afternoon (3.00pm to 11.00pm)	32	2.00pm to 3.00pm	32 arriving
			3.00pm to 4.00pm	54 leaving
	Night (11.00pm to 7.00am)	25	10.00pm to 11.00pm	25 arriving
			11.00pm to 12.00pm	32 leaving
No 1 Shaft Site	Day (7.00am to 3.00pm)	34	6.00am to 7.00pm	34 arriving
			7.00am to 8.00am	25 leaving
	Afternoon (3.00pm to 11.00pm)	32	2.00pm to 3.00pm	32 arriving
			3.00pm to 4.00pm	34 leaving
	Night (11.00pm to 7.00am)	25	10.00pm to 11.00pm	25 arriving
			11.00pm to 12.00pm	32 leaving

4.6.8. Historic and Current Coal Truck Vehicles

Coal trucks access the Russell Vale Site only. During the 1980s and 1990s, the Mine was producing up to 3 Mtpa of Run-of-Mine coal. Washed coal was transported from site by 25 t capacity coal trucks regularly transporting between 8,000 and 12,000 tpd on a typical day and peaking at 18,000 tpd. This was achieved at a coal truck access rate of typically 35 per hour, ranging up to 55 per hour. During these times an average of approximately 250 truck loads per day (to and from the site) were required to achieve the transport task.

The report by Cardno Eppell Olsen and titled, “Gujarat NRE No 1 Mine Traffic Study, 2010”, details the current coal truck numbers accessing the Russell Vale site.

In summary, coal vehicles currently access and leave the site between 7.00am to 6.00pm Monday to Friday and between 8.00am to 6.00pm on Saturdays. There is a fleet of between 8 and 10 coal trucks with an average 30 t capacity that service the Russell Vale Site. Approximately 120 truck visits per day (and subsequent dispatches) are required to achieve the current coal transport task for the NRE No 1 Mine.

The rate of truck movement at the site typically is biased towards greater numbers in the morning with a gradual decline over the day. During a typical day an average 10 trucks per hour would access the site (and then depart the site). Typically, during the first 2 to 3 hours an average 14 trucks per hour would access the site. Then the rate declines to between 8 and 9 trucks per hour thereafter until, during the last two hours of truck operations, the transport task is achieved at a rate varying between 1 and 4 trucks per hour.

Table 4.6 incorporates the above comments with employee and contractor vehicle data from **Table 4.5** and presents an overview of vehicle movements for both sites on a typical day. The data is focussed on the change of shift times when the traffic levels would be at their highest.

Table 4.6. Typical Current Levels of Vehicle Access to Russell Vale and No 4 Shaft Sites at Peak Traffic Times Associated with Shift Changes.

Site	Time	Employee and Contractor Vehicles Accessing and Leaving site	Coal Trucks	Visitors and Sales representatives	Couriers	Heavy Vehicles
No 1 Mine Site Russell Vale	6.00am to 7.00pm	54 arriving	Nil	5	3	1
	7.00am to 8.00am	25 leaving	14 arriving and 14 leaving	10	4	2
	2.00pm to 3.00pm	32 arriving	9 arriving and 9 leaving	5	2	1
	3.00pm to 4.00pm	54 leaving	Nil	5	2	1
	10.00pm to 11.00pm	25 arriving	Nil	Nil	Nil	Nil
	11.00pm to 12.00pm	32 leaving	Nil	Nil	Nil	Nil
No 4 Shaft Site	6.00am to 7.00pm	34 arriving	Nil	5	3	1
	7.00am to 8.00am	25 leaving	Nil	10	4	2
	2.00pm to 3.00pm	32 arriving	Nil	5	4	2
	3.00pm to 4.00pm	34 leaving	Nil	5	Nil	Nil
	10.00pm to 11.00pm	25 arriving	Nil	Nil	Nil	Nil
	11.00pm to 12.00pm	32 leaving	Nil	Nil	Nil	Nil

4.6.9. Proposed On-site Traffic

NRE propose to instigate the Preliminary Stage works to upgrade the NRE No 1 Colliery Site to enable stockpile and dispatch of approximately 1 Mtpa. Coal transport from site by trucks will continue. Various improvements to the site layout and underground mining facilities will be installed to underpin the upgrade.

During the Preliminary Stage construction will be undertaken on the Russell Vale Site only.

NRE do not plan to increase the current workforce during the Preliminary Stage.

Construction

All construction workforce will be located on the Russell Vale Site. Construction will be undertaken over a one year period and a peak construction workforce is predicted to be 32.

Construction work will be undertaken during daylight hours, generally 7.00am to 7.00pm Monday to Friday and from 8.00am to 5.00pm on Saturdays.

It is most likely that construction workers will arrive on site in their own vehicles. Assuming an occupancy rate of 2 people per vehicle, there will be approximately 16 vehicles arriving around the start time of 7.00am and leaving around the finishing time of 7.00pm Monday to Friday. Similar numbers would arrive and leave on Saturdays.

These vehicles would be parked within the contractors' construction and laydown area.

During construction there will be a range of vehicle types delivering supplies and equipment. At peak construction it is likely that up to 10 concrete agitators per day will access the site. Typically, 2 to 3 semi trailers will deliver materials to site. There may be peaks above these levels, but only during special construction activities.

Heavy vehicles associated with construction will be located permanently on site. These vehicles would typically be a water truck, two cranes, three backhoes, two excavators, a front end loader, two bobcats and three general site trucks.

For impact assessment purposes, traffic generated by the peak construction workforce and the current operational workforce have been combined and the data presented in **Table 4.8** later in this report.

Operational Employees and Contractors.

In the early years of operation during the Preliminary Stage of development, mining activity will be located in an area known as Wongawilli East. While mining operations are focussed in Wongawilli East, the bulk of the proposed operational workforce would report for duty at Russell Vale. It is anticipated that the current workforce would be unaltered. The current workforce numbers and location are shown in **Table 4.4**. During this time approximately 220 employees and contractors will report for duty at the Russell Vale Site and the remaining 180 employees and contractors will report to the No 4 Shaft Site.

Shift times will remain the same as current arrangements. Day shift will be from 7.00am to 3.00pm, afternoon shift from 3.00pm to 11.00pm and night shift will be from 11.00pm to 7.00am. As is the current situation, there will be more people on day shift than on the afternoon and night shifts. Afternoon shift will have more people than the night shift.

It can be assumed that these employees and contractors will drive to work in vehicles having an average occupancy rate of 2 people per vehicle. The arrival times will be concentrated in the two hour period around shift change times.

Operational Visitors and Other Vehicles

It is predicted that the number of visitor and other vehicles that access the sites will remain at existing levels as described in Section 4.6.7.

Consequently, it is predicted that during a typical day at both the Russell Vale Site and the No 4 Shaft Site, approximately 40 vehicles would access the site transporting visitors, consultants and sales representatives. At Russell Vale, these visits would be spread fairly evenly over the time 6.30am to 6.30 pm with a bias towards morning and mid day visits. At the No 4 Shaft Site these vehicles access the site between 6.00am and 3.00pm.

During a typical day at both sites approximately 15 courier vehicles (pantechnicons of various sizes) would access the site. This number is likely to peak at 25 vehicles per day.

The number of heavy vehicles accessing both sites is between 6 and 8 per day.

Visitor and consultant vehicles typically park in the main car parks at both sites adjacent to the administration buildings. Sales representatives, courier vehicles and heavy vehicles park adjacent to, or within, the stores areas at both sites.

Coal Trucks

NRE have predicted coal truck numbers accessing the Russell Vale site to accommodate the transport task associated with 1 Mtpa production during the Preliminary Stage. These are shown in **Table 4.7**. The data identifies details for average coal truck movements and for peak coal movements.

Truck figures identify loaded trucks one way from Russell Vale to Port Kembla Coal Terminal. To identify the number of truck journeys the numbers should be multiplied by 2 in order to allow for the return trip. To measure the impact of traffic flow, the peak or extreme should be considered. Under the peak scenario for every day where the peak is achieved there will be a number of days when there are significantly less trucks in operation.

Table 4.7. Truck Movements at 1 Mtpa Production During Preliminary Stage.

Operation Criteria	Average Production	Peak Production
Tonnes / week	20,000	28,000
Truck capacity (t)	34	34
Trucks / Week	589	824
Truck / Hour Daylight and Saturday	9	10
Trucks / Hour Evening and Sunday	0	6
Trucks / Day Monday to Friday	99	134
Trucks / Day Saturday	90	100
Trucks / Day Sunday	0	6
Truck / Day Averaged	83.5	111

Table 4.8 collates all the previous traffic information from **Tables 4.4 to 4.7** to provide an overall description of the levels of traffic generated during the construction and operation of the preliminary Stage of the development.

4.6.10. Employee and Contractor Facilities

The existing employee's car park is located adjacent to the mine administration building (**Figure 1**). The parking area will be retained. Safe walking access will be provided for employees to the bathhouse buildings.

Table 4.8. Preliminary Stage Typical Levels of Vehicle Access to Russell Vale and No 4 Shaft Sites at Peak Traffic Times.

Site	Time	Employee and Contractor Vehicles Accessing and Leaving site	PeakCoal Trucks	Visitors and Sales representatives	Couriers	Heavy Vehicles (Construction and Operation)
No 1 Mine Site Russell Vale	6.00am to 7.00pm	54 arriving	Nil	10	6	4
	7.00am to 8.00am	25 leaving	10 arriving and 10 leaving	20	8	8
	2.00pm to 3.00pm	32 arriving	10 arriving and 10 leaving	10	4	6
	3.00pm to 4.00pm	54 leaving	10 arriving and 10 leaving	10	2	6
	10.00pm to 11.00pm	25 arriving	Nil	Nil	Nil	Nil
	11.00pm to 12.00pm	32 leaving	Nil	Nil	Nil	Nil
No 4 Shaft Site	6.00am to 7.00pm	34 arriving	Nil	10	6	2
	7.00am to 8.00am	25 leaving	Nil	20	8	4
	2.00pm to 3.00pm	32 arriving	Nil	10	8	4
	3.00pm to 4.00pm	34 leaving	Nil	10	Nil	Nil
	10.00pm to 11.00pm	25 arriving	Nil	Nil	Nil	Nil
	11.00pm to 12.00pm	32 leaving	Nil	Nil	Nil	Nil

5. REFERENCES

Ellton Conveyors. 2009. Proposed Concept Plan. Russell Vale Surface Works. Stockpile Facility Project.

Beca 2009A. Gujarat NRE. Stormwater Hydrology. Summary of Investigations. October 2009.

Beca 2009B. Water Management at Russell Vale No. 1 Colliery. November 2009.

Figure 1.

Drawing DP 3673. Existing Mine Site Facilities.

No.	DESCRIPTION	DRN	CHKD	DATE
	REVISIONS			

Olsen Consulting Group Pty Ltd

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DESIGN:	
DATE:	
DRAWN:	K.E.
DATE:	10.12.09
CAD – B1	

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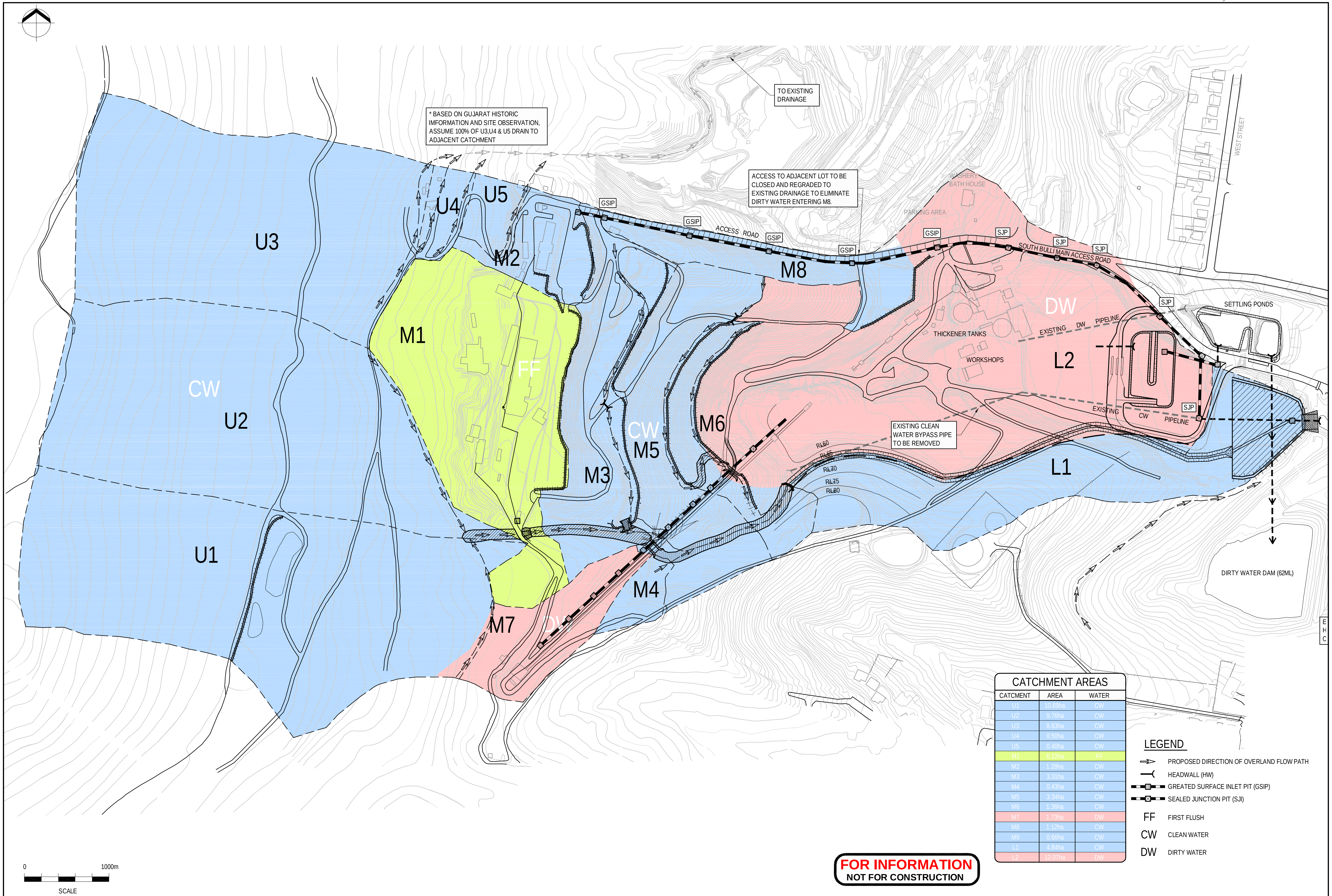
GUJARAT NRE No.1 COLLIERY RUSSELL VALE

EXISTING MINE SITE FACILITIES

DATUM: AHD | SCALE: 1:1750 | DRAWING No: DP-3673 | REV:

Figure 2.

Drawing No 2591308-C-SK7. Site layout Clean/Dirty Water Regions.



CATCHMENT AREAS

CATCMENT	AREA	WATER
U1	10.69ha	CW
U2	9.76ha	CW
U3	8.63ha	CW
U4	0.50ha	CW
U5	0.40ha	CW
M1	6.12ha	FF
M2	1.28ha	CW
M3	3.31ha	CW
M4	0.43ha	CW
M5	3.34ha	CW
M6	1.36ha	CW
M7	1.73ha	DW
M8	1.12ha	CW
M9	0.66ha	CW
L1	4.84ha	CW
L2	12.07ha	DW

LEGEND

- PROPOSED DIRECTION OF OVERLAND FLOW PATH
- HEADWALL (HW)
- GREATED SURFACE INLET PIT (GSIP)
- SEALED JUNCTION PIT (SJI)
- FF FIRST FLUSH
- CW CLEAN WATER
- DW DIRTY WATER

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
B	CONCEPT DESIGN - NOT FOR CONSTRUCTION	AS	SM		8/10/09
A	CONCEPT DESIGN - ISSUED FOR REVIEW	SK	SM		23/7/09

Drawing Originator: Beca

Original Scale (A1) 1:2000	Design	PI	23/7/09
Reduced Scale (A3) 1:4000	Drawn	SK	23/7/09
	Dsg Verifier	SM	29/9/09
	Dwg Check		

Approved For Construction*
Date
* Refer to Revision 1 for Original Signature

Client: GUJURAT NRE

Project: GUJURAT No. 1 HYDROLICAL INVESTIGATION

Title: SITE LAYOUT CLEAN/DIRTY WATER REGIONS

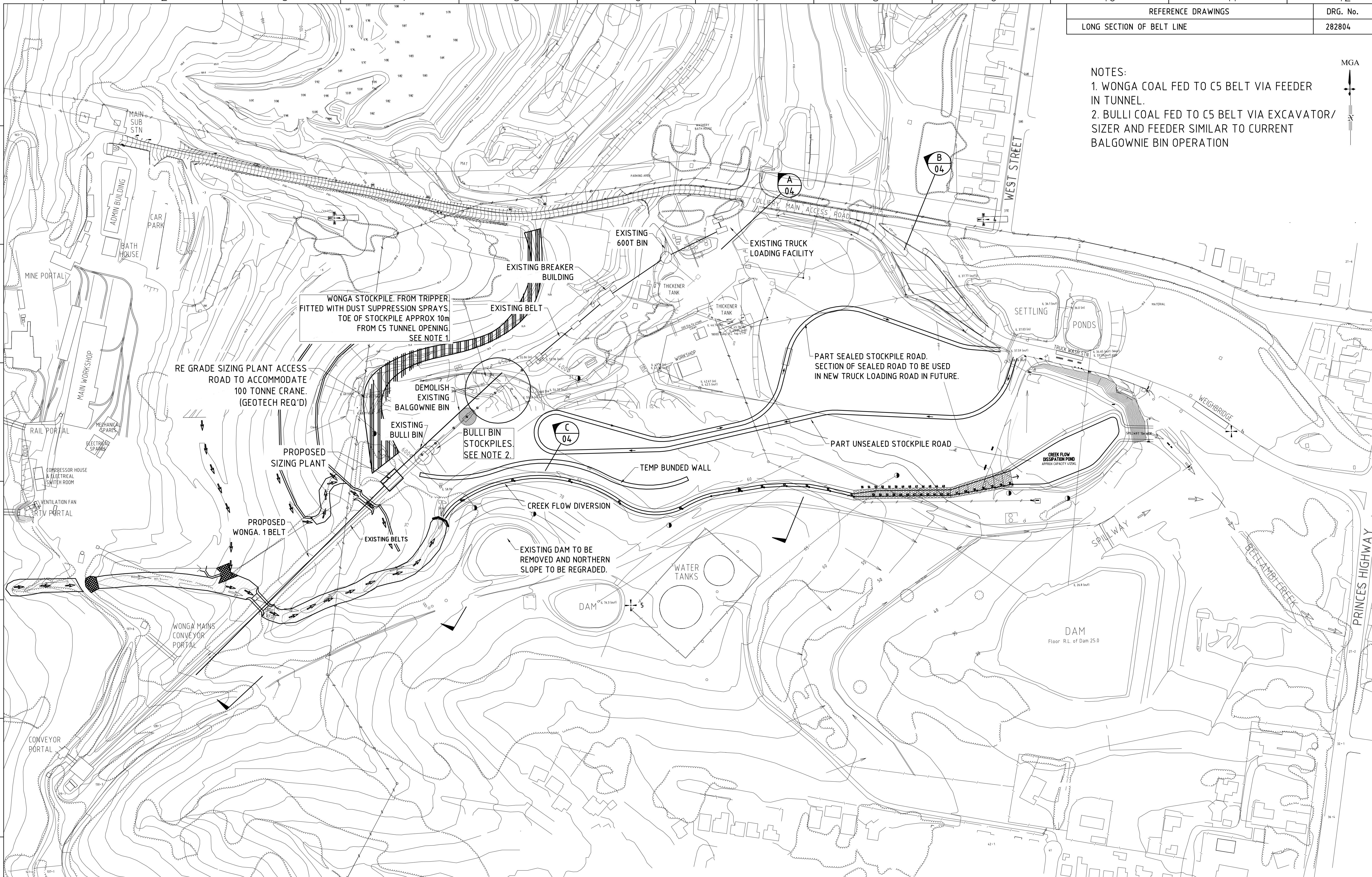
Discipline: CIVIL

Drawing No. 2591308-C-SK7

Rev. B

Figure 3.

JBK Drawing 282803. No. 1 Colliery Russell Vale. Preliminary Works Plan.



REV	DATE	REVISIONS	DRN	APP
E	10/5/10	NEW ROM STOCKPILE LOADING ROUTE ADDED	JAH	DC
D	6/5/10	SECTION C ADDED. NEW LEADERS AND NOTES ADDED	JAH	-
C	14/4/10	TEXT BOX REMOVED, TEMP STOCKPILE RE WORDED	JAH	DC
B	8/4/10	DETAIL WORKS AND TRUCK MOVEMENTS ADDED.	JAH	-
A	6/4/10	PRELIMINARY	MJD	-

AS 1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

	NAME	DATE
DESIGN	GKL	APRIL '10
DRAWN	GKL	APRIL '10
CHECKED	XXX	XXX
APPROVED	XXX	XXX
SCALE	1 : 1000	

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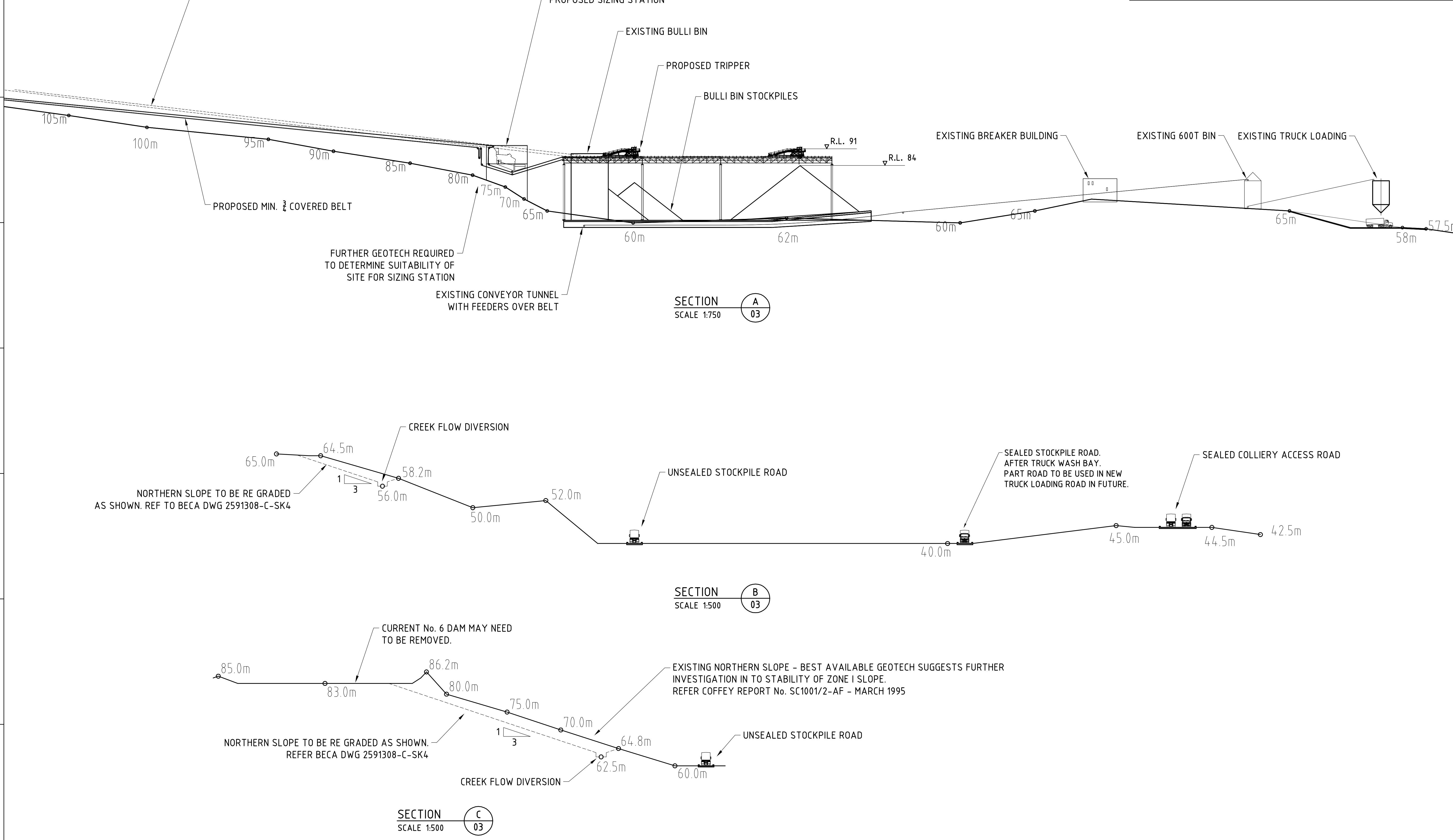
GUJARAT NRE COKING COAL Ltd
No. 1 COLLIERY RUSSELL VALE
PRELIMINARY WORKS PLAN
–

ISSUE: PRELIMINARY
DWG. SIZE: A1
JBK DWG No. 282803
REVISION: E

Figure 4.

JBK Drawing 282804. No. 1 Colliery Russell Vale. Preliminary Works Long Section.

REFERENCE DRAWINGS	DRG. No.
PRELIMINARY WORKS PLAN	282803



REV	DATE	REVISIONS	DRN	APP	REV	DATE	REVISIONS	DRN	APP
D	10/5/10	NEW ROM STOCKPILE LOADING ROUTE ADDED	JAH	-					
C	6/5/10	SECTION C ADDED	JAH	-					
B	8/4/10	SECTION B ADDED	JAH	-					
A	6/4/10	PRELIMINARY	MJD	-	-	-	-	-	-

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DESIGN	GKL	APRIL '10
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APPROVED	XXX	XXX
SCALE	1 : 750	

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GUJARAT NRE COKING COAL Ltd

No. 1 COLLIERY RUSSELL VALE
PRELIMINARY WORKS LONG SECTION
–

ISSUE: PRELIMINARY

DWG. SIZE: A1

JBK DWG No.: 282804

REVISION: D

Annex E

Community Engagement

specialists in
engaging people

Community Engagement Strategy

FOR

NRE Coking Coal Limited

PREPARED BY

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TWYFORDS

MAY 2012

TABLE OF CONTENTS

1. Executive Summary

In support of the Part 3A approval for Preliminary Works at the No.1 Colliery, Gujarat NRE Coking Coal Limited (NRE) MP10_0046, commenced the 'Co-Design' of its Community Engagement Strategy for the NRE No.1 Colliery operations in January 2012.

The 'Co-Design' process aimed to invite and involve the Community and Stakeholders of NRE in the definition of the key principles, parameters, and processes to implement an effective Community Engagement Strategy.

The resultant 'Co-Design' recommendations consist of four parallel programs of improvement to realise the community objectives and principles for effective Community Engagement:

TACTICAL COMMUNITY ENGAGEMENT RESPONSE	
Actions that can be progressed immediately with known resources and accountabilities.	
Time Horizon	May 2012 – July 2012 Ongoing
Commitments	1. Recruit and establish a Community Reference Group for NRE to provide input to and review actions in addressing community concerns.
	2. Improve effectiveness of the 24-hour Community Call Line with record logging and feedback process.
	3. Continue a community Newsletter, and review format, distribution and publication timetable.
	4. Establish a dust and noise measurement process and integrate into the community engagement process

The Reference Group would consist of a panel of up to 50 community members who would be recruited independently against specified criteria to provide a balance of location, demographics and perspectives across neighbours, local community and regional community. The group members would be prompted to provide regular feedback on current and emerging issues, and how these were being tackled by the company. The group would also receive regular information and updates from the company about the operation and responses to the issues identified.

Given the work of the community in contributing to the strategy, it will be important to take the issues and suggestions recorded in this document into the short term tactical response, and use the Reference Group as a check to ensure that action is occurring.

EDUCATIONAL COMMUNITY ENGAGEMENT RESPONSE

Actions that need to be progressed immediately to inform or provide a basis for the Strategic actions to be progressed.

Time Horizon	May 2012 – August 2012 Ongoing
Commitments	1. The Community Reference Group to provide input to allow NRE to coordinate a series of information briefings, workshops and displays on key topics including: • 24/7 Air Quality Management and Monitoring, • Compliance Reporting, • Planned Vs Current workings, • Hours of Operation, and • Risk Management Processes.
	2. Establish shop front/drop-in facility to provide one-on-one consultation, information and feedback for the local community

This activity is recognised as a key element in building mutual understanding of the operational challenges and means to address these challenges collectively.

STRATEGIC COMMUNITY ENGAGEMENT RESPONSE

Actions that need to be progressed over a 3-12 month timeframe because they are dependent on tactical or educational prerequisites.

Time Horizon	May 2012 – October 2012
Commitments	1 Use the Community Reference Group to oversee and monitor the implementation and effectiveness of the NRE Community Engagement Strategy.
	2. NRE to fully implement environmental monitoring and reporting processes as required by the Project Approval conditions and publish results on the company website to ensure appropriate community governance.
	3. Continue to use the Bellambi Community drop-in centre to share information regarding mine operations and planned developments which would also facilitate community consultation during exhibition periods for future project approvals.

The role of this monitoring would be to ensure that implementation of the Strategy implementation is transparent and progressive, satisfies commitments made, and aligns with the stated principles for effective Community Engagement.

The monitoring would also provide NRE with feedback regarding the effectiveness of their work to build “good neighbour” relationships.

REVIEW COMMUNITY ENGAGEMENT STRATEGY RESPONSE

Specific action in 12 months to assess the effectiveness of community engagement and where necessary implement changes to the overall strategy

Time Horizon	June 2013 – September 2013
Commitment	1 Consult via the Community Reference Group to establish the effectiveness of the overall NRE Community Engagement Strategy and implement any necessary changes.

The overall Strategy is designed to be progressive and adaptive to community issues. The review process will support and provide stimulus for the implementation and progressive improvement of the Community Engagement Strategy over a fifteen month period.

2. Introduction

2.1 Project Background

Gujarat NRE Coking Coal Ltd (NRE) operates the NRE No. 1 Colliery in the Southern Coalfield of New South Wales (NSW). The mine is located at Russell Vale approximately 8km north of Wollongong and 70km south of Sydney, within the local government areas (LGAs) of Wollongong and Wollondilly in the Illawarra region of NSW.

On 13 October 2011, NRE was granted Project Approval by the NSW Minister for Planning an Infrastructure under Section 75J of the Environmental and Planning Assessment Act 1979 (EP&A Act) to continue mining its operations at the No. 1 Colliery.

The Project involves the continuation of existing operations at NRE No. 1, Colliery which extends the life of mining by up to three years. It will involve the extraction of 1 Mtpa of ROM coal from the Bulli and Wongawilli Seams, as well as upgrading the mine's surface facilities and environmental improvement works at the Pit Top Site at Russell Vale.

The works approved by MP 10_0046 are classed as the Stage 1, Preliminary Works Project. Further stages of work and associated approvals are envisaged to upgrade facilities to raise ROM production to 3Mtpa. However, a timeframe for these works has not yet been confirmed.

2.2 Purpose and Scope

Condition5/Schedule 5 of the Conditions of Approval requires the establishment of a Community Consultative Committee (CCC) in accordance with the NSW Department of Planning (now Department of Planning and Infrastructure (DP&I) *Guidelines for Establishing and Operating Community Consultative committees for Mining Project (2007).* This Community Engagement Strategy considers the requirements of the Guidelines, which are discussed in further detail at Section 2.4.

Furthermore, NRE have agreed to a number of commitments as detailed in Appendix 3 of the Project Approval, one of which relates to stakeholder consultation. NRE will conduct regular liaison meetings and provide regular updates to the community at least twice a year.

2.3 Context

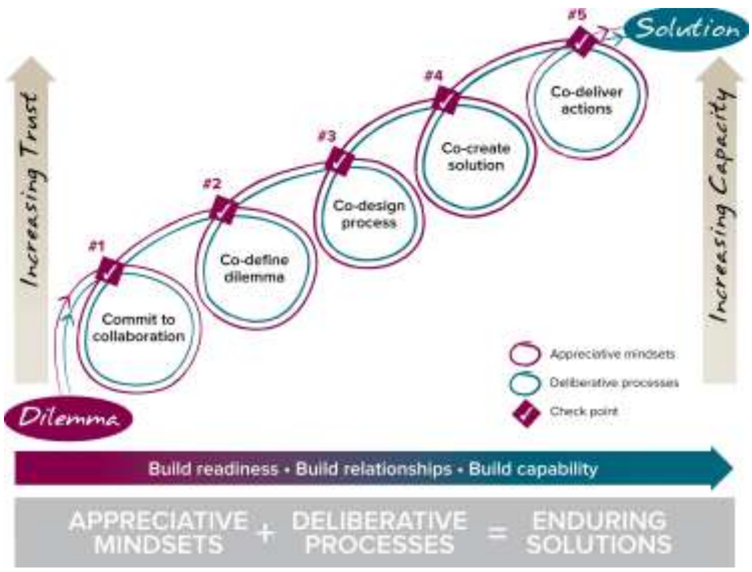
The local impact of mining operations tends to result in relationships with groups within our communities that have varying expectations. Understanding these differences is an important part of successful community engagement.

Regulatory requirements and the practicalities associated with major events including planning, operation, and mine closure drive most mining operations to adopt a systematic approach to their consultation. However, the most effective relationship with members of our community is one that is ongoing and represents a genuinely participatory approach.

Effective engagement means providing the community with an early and decisive voice at different stages of a project and seeking their assistance and contribution to help solve challenges.

It also includes developing partnerships that add value for both parties. For mining companies this means belonging to the community and being able to understand and address many of their concerns. This involves communicating the details of mining projects and being genuinely involved in community issues which extend beyond meetings, newsletters and other formal engagement.

Recognising this challenge, Twyfords recommended that NRE adopt a 'Co-Design' approach for the development of its Community Engagement Strategy. 'Co-Design' requires the community and stakeholders to join with the Company to identify and define the dilemma or potential issue from their perspective and agree on the process to be used to define and implement the Community Engagement Strategy (see Diagram below for an overview of this methodology).



2.4 NSW Government Guidelines

The DP&I Guidelines[1] establish objectives to provide for open discussion between representatives of the company, the community, the council and other stakeholders on issues directly relating to the mine's operations, environmental performance and community relations, and to keep the community informed of these matters.

The objectives include:

- Establish good working relationships between the company, the community and other stakeholders in relation to the mine;
- Provide for the ongoing communication of information on mining operations and the environmental performance of the mine;
- Provide an opportunity for comment on the mine's environmental performance discuss community concerns and review the resolution of community complaints;
- Discuss how best to communicate relevant information on the mine and its environmental performance to the broader community, and
- Work together towards outcomes of benefit to the mine, immediate neighbours and the local and regional community.

NRE's Community Engagement Strategy needs to meet with these objectives.

A number of different community consultation methods could be used to satisfy these objectives (see Table over-page). The aim of the 'Co-Design' approach used to draft the NRE Community Engagement Strategy is to investigate the merits and shortcomings of these various techniques relative to the specific community requirements and concerns.

The following table outlines options that were actively explored with stakeholders and NRE in the co-design of the strategic Community Engagement Strategy. This is by no means an exclusive list of ideas. Other ideas were sought from stakeholders based on their best experiences of consultation and engagement in the past.

[1] GUIDELINES FOR ESTABLISHING AND OPERATING COMMUNITY CONSULTATIVE COMMITTEES FOR MINING PROJECTS
© State of New South Wales through the Department of Planning June 2007
23-33 Bridge Street Sydney NSW Australia
www.planning.nsw.gov.au
Publication number 2006_0022
ISBN 0 7347 5795 6

The top row lists the key objectives referred to in the DP&I Guidelines.

DoPI Objectives	Establish working relationships	Ongoing communi-cation on operations	Opportunities for comment	Discuss concerns	Discuss how best to communicate	Work together for outcomes of mutual benefit
Briefings	Very useful Initially one on one. Potential for group briefings	Very useful	Very useful	Useful	Limited	Limited
Open House (shopfront)	Somewhat useful	Very useful	Very useful	Very useful	Useful	Limited
Open Days	Somewhat useful	Very useful	Useful	Useful	Somewhat useful	Limited
Resident Feedback Panel	Limited	Useful	Very useful	Useful	Could be explored	Limited
Feedback line	Somewhat useful	N/A	Very useful	Very useful	Somewhat useful	Very useful
Consultative Committee	Useful (though with very few people)	Somewhat useful	Somewhat useful	Useful	Useful	Useful
E-newsletters / newsletters	Limited	Very useful	Potentially	Useful in giving feedback on action taken in response	Limited	Limited
Web based forum	Limited	Very useful	Very useful	Useful	Somewhat useful	Limited
Workshops	Very useful	Useful	Useful	Very useful	Very useful	Very useful

3. Community Engagement Methodology

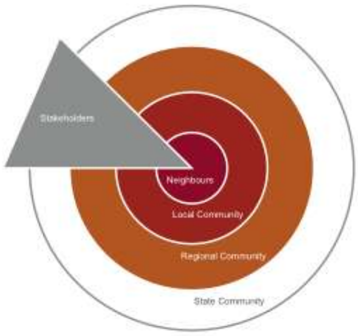
To ensure that the NRE Community Engagement Strategy meets the stated objectives of the DP&I and the specific needs of the surrounding communities, the following methodology was applied:

Step 1	Identify stakeholders/community of interest and the role they can play in NRE's Community Engagement Strategy.
Step 2	Interview key community stakeholders and research/understand their interests and experience of effective community engagement. Determine from the community what they believe constitutes effective community engagement.
Step 3	Co-design the Community Engagement Strategy with a representative forum of its stakeholders by exploring techniques to achieve the Community Engagement Principles drawn from Step 2 Community Interviews.
Step 4	Meet with DP&I to review and discuss the NRE co-designed Community Engagement Strategy.
Step 5	Using the outputs from above steps to prepare a draft Community Engagement Strategy and review with representatives from the community.
Step 6	Complete the Community Engagement Strategy and present to DP&I for comment and endorsement.

3.1 Stakeholder Analysis

The first step in the development of the NRE Community Engagement Strategy was a detailed appreciative Stakeholder Analysis that identified the following Stakeholder groups as having a key interest in the mining operations.

In general these groups tend to be defined by their proximity to the mine, as defined below.



Neighbours - those people living or working in direct proximity to the proposed or existing mining operation.

Local Community - those people living and working in the nearby community (including minor and major towns) who have an indirect relationship with the project proposal but an active interest in what happens in their part of the world.

Regional Community - the community within the wider region who have a shared interest in the economic, social and environmental profile of the region but who in most cases will not live or work near the project itself.

The broader NSW Community - the people of NSW who share in the common interests and aspirations of the State as a whole.

Stakeholders - all those who have an interest in the project, either as individuals or as representatives of a group. This includes people who could or do influence a decision, as well as those affected by it e.g. neighbours, the local, regional and broader community, government (including local councils), non-government organisations, mining employees and special interest groups.

The NRE Community Engagement Strategy focuses on the following stakeholder groups:

I. Neighbours
II. Local Community
III. Regional Community

3.2 Community Interview Process

The second step in the NRE Community Engagement Strategy development was the interviewing of community members from the Wongawilli and Russell Vale/Bellambi areas.
A series of twelve (12) one-on-one interviews were conducted with a cross-section of the community from the Wongawilli and Bellambi/Corrimal areas during the period 7th to 25th February 2012.

The community members were randomly selected by Twyfords from a list of community contacts that the NRE organisation had on its database from areas surrounding their mine operations (see *Appendix A – Participants in the Community Engagement Interview Process*).

The interviews followed an Appreciative Inquiry format where community members were requested to share their experiences and responses to the following questions:

- What should NRE pay attention to when designing a Community Engagement Strategy?
- What are the sensitivities or key principles that should be considered by the strategy?
- How can NRE best involve the community in the design of the Community Engagement Strategy?
- What can be learnt from earlier and other efforts to involve this community?
- What methods have worked?
- How can NRE listen and get the views of the broader community?
- Can NRE piggy back on existing forums or activities?
- Who would best represent the diversity of interests in the community?
- Who might have been left out to date?
- (Names and contacts)

The purpose of the interview was to determine the principles needed to guide the effective design of NRE's Community Engagement Strategy. The questions were designed to assist in the capture of key principles to be considered in the design of the Community Engagement Strategy and not to define the strategy/solution.

The full interview guide used throughout all interviews can be found in *Appendix B – Community Engagement Interview Guide.*

3. On the completion of the interview the minutes were recorded and returned to the interviewees for review and approval. A set of common principles for effective community engagement were drawn from the interviews and taken forward to the next phase of the Co-Design process (see *Appendix C – Community Interview Findings*).

The key principles that were drawn from the interview process include:

i) The key to effective Community Engagement is to be a good neighbour.

ii) A simple and workable process to call the Company and register a concern.

iii) A simple and implementable 'Code of Conduct'.

iv) Diversity in Community Engagement needs to be encouraged.

v) Focus on doing the little things well and it will provide a foundation of trust for tackling the bigger issues.

vi) Proactively share the facts.

vii) NO SPIN in community engagement.

viii) Community Engagement means different things to different people and should be multi-dimensional.

ix) Community engagement is collaborative.

x) Community Engagement is about establishing the trust to manage the exceptional circumstances better.

xi) Community Engagement needs to be both focused on immediate operations and future plans.

xii) Community Engagement needs to be 2-way.

The overriding message from the community surrounding NRE operations is that **effective Community Engagement is about being a 'good neighbour' and that principles, rather than the technique**, **should guide the Community Engagement Strategy development**. A copy of the complete interview minutes for the Community Interviews can be found in *Appendix D – Detailed Community Interviews*.

The next step in the process was to conduct three (3) 'Co-Design' Strategy workshops to develop a draft of the Community Engagement Strategy with the community for NRE.

3.3 Community Workshop Process

A series of three (3) Community 'Co-Design' Workshops were conducted with members from the Wongawilli and Bellambi/Corrimal communities:

- **Workshop #1** 6-8pm, Thursday 22nd March
  @ Wongawilli Rural Fire Service (Training Room), Wongawilli Road, Wongawilli.
- **Workshop #2** 10am-12 noon, Friday 23rd March
  @ Russell Vale Community Hall, Keerong Ave, Russell Vale.
- **Workshop #3** 6-8pm,Friday 23rd March
  @ Corrimal Community Centre (Grevillea Rm1), 15 Short St, Corrimal.

The objectives of the 'Co-Design' Workshops were twofold:

I. Determine the community engagement strategy that will best support the 'good neighbour' principles raised by community members; and
II. DRAFT the process(es) by which NRE and the community will work together on both mine and neighbour relations issues.

Workshop Invitation flyers were letterbox-dropped to the following neighbour streets (see *Appendix E – Community Workshop Invitation* for a copy of the Workshop Flyer) and electronic invitations forwarded to all community members who participated in the interview process.

The workshops were attended by the following community members:

Workshop # 1 Wongawilli Attendees Thursday 22nd March 2012	**Workshop #2** Russell Vale Attendees Friday 23rd March 2012	**Workshop #3** Corrimal Attendees Friday 23rd March 2012
Tom Wetherall Evan Perkins Alex Stanoski Harvey Bailey Ron Cooper David Clarkson (NRE) Tania Jones (Twyfords)	Ann Young Maurie Chapman Lynette Jacona Kamlesh Prajapti (Gujarat) Don Jepcott (NRE) Tania Jones (Twyfords)	Dick Knappett Helen Cousins Rosalynd McGibbon Peter McGibbon Gavin Workman Alison Edwards

		Graham A Heath Rowan Huxtable Peter Turner Rina Wainwright Susan Fawaz Mark Aquilina Colin Duffy (NRE) David Clarkson (NRE) Kamlesh Prajapti (Gujarat) Don Jepcott (NRE) Janelle Mousley (Twyfords) Tania Jones (Twyfords)

Key themes that arose from all three workshops concerning NRE Community Engagement included:

- The community needs a consistent and transparent understanding of NRE's long-term development plans and current operational / environmental performance.
- Repeated expressions of concern regarding noise, dust, truck speed, inadequate noise and dust monitoring.
- 24 hour call centre with a Community-focus.
- The community needs a REAL invitation to engage. Documents issued with enough time and context to be understood and able to be responded to.
- Community engagement needs to have multiple channels and feedback loops.
- The Community needs a process in place where by NRE liaises with the community on a problem/issue and the illustrates actions taken.
- The community is interested to learn and understand more about - 24/7 Air Quality Management and Monitoring, Compliance Reporting, Planned v Current workings, Hours of Operation, and Risk Management Processes.
- Community interested in the availability and publication of key mine statistics and information such as, the mine's underground extent - with relation to catchment, dams, houses, noise levels – day and night, Truck movements – day and night, methane emissions, and salt production and disposal.

Volunteers were requested to form a Community Review Team to work with Twyfords and NRE to review the Community Workshop Minutes and help draft the Community Engagement Strategy.

Members of the Community Review Team include:

- Ms Ann Young
- Mr Gavin Workman
- Mr Peter McGibbon
- Mrs Rosalynd McGibbon
- Mr Peter Turner
- Mr Ron Cooper

The Community Review Team's feedback post the Community Workshops has been recorded in *Appendix F – Community Review Team Feedback* and used to shape the recommendations for the Community Engagement Strategy.

A midpoint review was conducted with DP&I to brief them on the 'Co-Design' process and the community findings compiled by 29th March 2012 (*see Appendix G – Executive Summary for DP&I*).

3.4 Review of appropriateness of a Community Consultative Committee

There has been a strong drive from some of the community stakeholders for a CCC as a key vehicle for the community engagement. As identified in section 2.2 such a technique does work well in satisfying a number the DP&I guidelines.

However based on NRE and other operators experience, NRE believes such a technique at the core of the strategy has a high risk in compromising both effective engagement, and effective business operation.

This experience has identified the following challenges:

- The formation of a CCC is process focused and is not necessarily objective driven, more often the approach is “we have one because we have to” rather than having it to meet specific objectives

- The concept that because every other mine or operation has one therefore one is required only ensures conformity and does not guarantee outcomes

- CCC tend to become excessively formal and procedural focused with considerable time being spent debating process and procedures rather than addressing key issues of concern

- The more vocal members of a CCC tend to dominate and overrule the opinion of other less dominant individuals

- The formalisation of the consultation process via a CCC means that meetings are held at times and locations which disadvantages certain members and people within the broader community; hence their direct involvement is not possible

- Membership or involvement in a CCC is often seen as promoting the status of specific individuals within the broader community. This in turn relates to access to information made available to the CCC members which is then used either consciously or subconsciously as a power base within the general community

- It follows that the creation of a CCC creates a forum for interest groups within the broader community and with different and potentially conflicting agendas that can highjack and manipulate the consultation to achieve their own personal needs and not be truly representative of the broader community in addressing local issues

- A CCC may see and take the opportunity to use its status and power to influence operational decisions that are outside its scope

- The formation of a CCC does not engender or guarantee information transfer within the broader community; there is no guarantee the community members convey correct and consistent information to the people they represent

- To ensure the broader community is made aware of issues and outcomes discussed in a CCC alternate community inter-phase opportunities are required, over and above the CCC. This creates unnecessary delay and duplication within the consultation process and can be seen as giving mixed or different messages to different sections within the community

- The formation of a CCC does not ensure that the effectiveness and/or adequacy of consultation is quantified. It does not necessarily mean that an audit and review process is undertaken to ensure that consultation with the broader community is happening and that it is effective

In view of these risks, the proposed strategy proposes an alternative approach involving a range of alternative techniques.

4. Community Engagement Strategy

A series of recommendations have been drawn from the Community Interviews, Workshops and Review process to address the key community requirements for effective engagement and meet the objectives in the DP&I guidelines.

These recommendations do not rely on a CCC, but on a combination of techniques that NRE believe will more effectively deliver on the above requirements.

The recommendations were categorised based on their ability and need to be implemented quickly and with existing resources:

- **Tactical** - Actions that can be progressed immediately with known resources and accountabilities.
- **Educational** - Actions that need to be progressed immediately to inform or provide a basis for the Strategic actions to be progressed.
- **Strategic** - Actions that need to be progressed over a 3-12 month timeframe because they are dependent on tactical or educational pre-requisites.
- **Review**- Actions to ensure the continuing adequacy of the strategy

4.1 Tactical Plan and Actions

The following section identifies the ***tactical*** recommendation, time horizon and resources required to complete, who needs to be involved, the deliverable required and the community requirements/concerns that prompted the action.

<table>
<tr><td colspan="7">TACTICAL COMMUNITY ENGAGEMENT RESPONSE

Actions that can be progressed immediately with known resources and accountabilities.</td></tr>
<tr><td>Recommendation #1</td><td colspan="5">Recruit and establish a Community Reference Group for NRE.

This panel would be recruited independently against specified criteria to provide balance. Members will be prompted regularly to provide feedback and progress on issues, and would receive information about operations and responses to issues</td><td>HIGH</td></tr>
<tr><td>Time Horizon</td><td>Jan - Mar 2012</td><td>Apr - Jun 2012</td><td>Jul - Sep 2012</td><td>Oct - Nov 2012</td><td>Resources Required</td><td>1 person (No. 1 Colliery)

Setup – 1-2 weeks

Runs - 2-3 days month</td></tr>
</table>

Who needs to be involved	• Community Reference Group (up to 50 participating). • NRE Community Team.

Recommendation #2	Improve effectiveness of the 24-hour Community Call Line with record logging and feedback process.					**HIGH**
Time Horizon	Jan - Mar 2012	Apr - Jun 2012	Jul - Sep 2012	Oct - Nov 2012	**Resources Required**	1 person (No. 1 Colliery) 2-3 days a month
Who needs to be involved	• Community Reference Group • NRE Community Team.					

Recommendation #3	Continue the community Newsletter, and review format, distribution and publication timetable.					**MED**
Time Horizon	Jan - Mar 2012	Apr - Jun 2012	Jul - Sep 2012	Oct - Nov 2012	Resources Required:	1 person (No. 1 Colliery) 2-3 days a month
Who needs to be involved:	• NRE Community Team.					

Recommendation #4	Establish a dust and noise measurement process and integrate into the community engagement process					**HIGH**
Time Horizon	Jan - Mar 2012	Apr - Jun 2012	Jul - Sep 2012	Oct - Nov 2012	Resources Required:	1 person (No. 1 Colliery) 2-3 days a month

Who needs to be involved:	• NRE Community Team.

4.2 Educational Plan and Actions

The following section identifies the ***educational*** recommendation, time horizon and resources required to complete, who needs to be involved, the deliverable required and the community requirements/concerns that prompted the action.

<table>
<tr><td colspan="8"><u>EDUCATIONAL</u> COMMUNITY ENGAGEMENT RESPONSE

Actions that need to be progressed immediately to inform or provide a basis for the Strategic actions to be progressed.</td></tr>
<tr><td>Recommendation #1</td><td colspan="6">The Community Reference Group to provide input to facilitate NRE co-ordinating a series of Information Briefings, workshops and displays on key topics including:
24/7 Air Quality Management and Monitoring,
Compliance Reporting,
Planned v Current workings,
Hours of Operation, and
Risk Management Processes.</td><td>HIGH</td></tr>
<tr><td>Time Horizon</td><td>Jan - Mar 2012</td><td>Apr - Jun 2012</td><td>Jul - Sep 2012</td><td>Oct - Nov 2012</td><td>Resources Required</td><td colspan="2">1 person (No. 1 Colliery)

2-3 days a month</td></tr>
<tr><td>Who needs to be involved</td><td colspan="7">Community Reference Group
NRE Community Team.</td></tr>
</table>

<table>
<tr><td>Recommendation #2</td><td colspan="6">Establish shopfront/drop-in facility to provide one-on-one consultation, information and feedback for local community</td><td>HIGH</td></tr>
<tr><td>Time Horizon</td><td>Jan - Mar 2012</td><td>Apr - Jun 2012</td><td>Jul - Sep 2012</td><td>Oct - Nov 2012</td><td>Resources Required</td><td colspan="2">1 person (No. 1 Colliery) to set up and maintain

Manned appropriately</td></tr>
<tr><td>Who needs to be involved</td><td colspan="7">NRE Community Team.</td></tr>
</table>

4.3 Strategic Plan and Actions

The following section identifies the ***strategic*** recommendation, time horizon and resources required to complete, who needs to be involved, the deliverable required and the community requirements/concerns that prompted the action.

<table>
<tr><td colspan="7"><u>STRATEGIC</u> COMMUNITY ENGAGEMENT RESPONSE
Actions that need to be progressed over a 3-12 month timeframe as they are dependent on tactical or educational pre-requisites.</td></tr>
<tr><td>Recommendation #1</td><td colspan="5">Use the Community Reference Group to oversee and monitor the implementation and effectiveness of the NRE Community Engagement Strategy.</td><td>HIGH</td></tr>
<tr><td>Time Horizon</td><td>Jan - Mar 2012</td><td>April - Jun 2012</td><td>Jul - Sep 2012</td><td>Oct - Nov 2012</td><td>Resources Required</td><td>1 person (No. 1 Colliery)
2-3 days</td></tr>
<tr><td>Who needs to be involved</td><td colspan="6">• Community Reference Group
• NRE Community Team.</td></tr>
</table>

<table>
<tr><td>Recommendation #2</td><td colspan="5">NRE to fully implement its environmental monitoring and reporting processes and publish on the company website to assist with maintaining ‘Good Neighbour’ governance.</td><td>HIGH</td></tr>
<tr><td>Time Horizon</td><td>Jan - Mar 2012</td><td>Apr - Jun 2012</td><td>Jul - Sep 2012</td><td>Oct - Nov 2012</td><td>Resources Required:</td><td>1 person (No. 1 Colliery)
1 person (Wongawilli)
4-5 days a month</td></tr>
<tr><td>Who needs to be involved:</td><td colspan="6">• NRE Community Team.</td></tr>
</table>

<table>
<tr><td>Recommendation #3</td><td>Use the Bellambi Community drop-in centre to share information on mine operations and planned developments. This will facilitate community</td><td>MED</td></tr>
</table>

	consultation during exhibition periods for further works approvals.					
Time Horizon	Jan - Mar 2012	Apr - Jun 2012	Jul - Sep 2012	Oct - Nov 2012	Resources Required:	1 person (No. 1 Colliery) 2-3 days a month
Who needs to be involved:	• NRE Community Team.					

4.4 Review Plan and Actions

The following section identifies the ***review*** recommendations, time horizon and resources required to complete, who needs to be involved, and the deliverable required.

<table>
<tr><td colspan="8"><u>REVIEW</u> COMMUNITY ENGAGEMENT RESPONSE

Actions that need to be progressed in the longer term to assess the effectiveness of the overall strategy, and where necessary implement changes</td></tr>
<tr><td>Recommendation #1</td><td colspan="5">• Consult via the reference group to establish the effectiveness of the overall strategy and implement any necessary changes</td><td colspan="2">HIGH</td></tr>
<tr><td>Time Horizon</td><td>Jan - Mar 2013</td><td>Apr - Jun 2013</td><td>Jul - Sep 2013</td><td>Oct - Nov 2013</td><td>Resources Required</td><td colspan="2">1 person (No. 1 Colliery)

2-3 days</td></tr>
<tr><td>Who needs to be involved</td><td colspan="7">• Community Reference Group
• NRE Community Team.</td></tr>
</table>

APPENDIX A: List of Community Interviewees

PARTICIPANTS IN THE

COMMUNITY ENGAGEMENT INTERVIEW PROCESS

7th- 25th February 2012

Item #	Stakeholder Group	Name	Gujarat Connection	Interview Candidate
1	Local Groups (e.g. IRRM)			
1.1		Dick Knappett Helen Cousins	Don Jephcott	YES
1.2		Gavin Workman Kaye Osborne	Don Jephcott	YES
1.3		Rod Plant	Don Jephcott	
2	Local Residents			
2.1	West Street/North side of property			
	2.1.1	George and Alison Held, Heather Drylie	Don Jephcott	YES
	2.1.2	Neil McLean	Don Jephcott	
	2.1.3	Tom Kerr	Don Jephcott	
	2.1.4	Fraser and Jane Davey	Don Jephcott	
2.2	Southern Side of Property			
	2.2.1	Greg and Suzi Eager	Don Jephcott	
	2.2.2	Bill Patching	Don Jephcott	
	2.2.3	Mark and Rhonda Aqualina	Don Jephcott	YES
	2.2.4	George Evans	Don Jephcott	YES
	2.2.5	Joy Mulready	Don Jephcott	
	2.2.6	Gerad Lynch	Don Jephcott	
2.3	Bellambi Lane - East side of Property			
	2.3.1	Rodger Smith	Don Jephcott	
	2.3.2	Patsy Glasgow	Don Jephcott	
	2.3.3	Warren and Monica Gray	Don Jephcott	
	2.3.4	Dick Knappett	Don Jephcott	YES
	2.3.5	Peter and Rosalynd McGibbon	Don Jephcott	YES
2.4	Northern Distributor (Memorial Drive)			
	2.4.1	Maureen Guest	Don Jephcott	YES
2.5	Woonana			
	2.5.1	Maureen Slapp	Don Jephcott	
2.6	Wongawilli			
	2.5.1	Dawn Goldman	David Clarkson	YES
	2.5.2	Paul Stanley	Chris Irving	
	2.5.3	Evan Perkins	Chris Irving	YES
3	Regional Groups			
	3.1	Prof Bob and Dr Anne Young	Don Jephcott	YES
4	Sponsored Organisations, Community Groups and Neighbours			
	4.1	Harvey Bailey	David Clarkson	YES

APPENDIX B: Interview Guide

Gujarat Community Engagement Strategy - Interview Guide

Pre-Interview information		
Name of interviewee(s)		
Organisation / Role:		
Contact details - Work:	Phone:	Fax:
	Email:	
Contact details - Personal:	Phone:	Mobile:
	Email:	
Venue of Interview:		
Interview Date/Time:		

Objectives:

- To increase Gujarat NRE's awareness and understanding of the knowledge, attitudes, perceptions and issues of the various community stakeholders related to the company's operations, project activities and outcomes.
- To develop a 'shared' understanding with stakeholders of the principles required in the design of an effective Community Engagement Strategy.
- To open up a dialogue and two-way communication channels with stakeholders.
- To build relationships and trust with key players in the community.

Introduction:	*Explain that the purpose of this interview is to determine the principles needed to guide the effective design of Gujarat NRE's Community Engagement Strategy.* *The questions are designed to assist in the capture of key principles to be considered in the design of the Community Engagement Strategy and not to define the strategy/solution.*

Statements & Questions: (use as a guide to prompt the conversation and keep on track)

What do you know about the company Gujarat NRE, and its operations?

(Background, any issues, what needs to be considered from their perspective?)

How important are the operations of Gujarat NRE to you and the local community?

What is your level of interest in the company and its operations?
i.e. position, interests and values

Why do you hold that view and why is it important to you?

How important are the operations of Gujarat NRE to you and the local community?

What is your level of interest in the company and its operations?
i.e. position, interests and values

Why do you hold that view and why is it important to you?

What should Gujarat NRE pay attention to when designing a Community Engagement Strategy?

What are the sensitivities or key principles that should be considered by the strategy?

How can Gujarat NRE best involve the community in the design of the Community Engagement Strategy?

What can be learnt from earlier and other efforts to involve this community?

What methods have worked?

How can Gujarat NRE listen and get the views of the broader community?

Can Gujarat NRE piggy back on existing forums or activities?

Who else should be involved?

Who would best represent the diversity of interests in the community?

Who might have been left out to date?

(Names and contacts)

APPENDIX C: Community Interview Findings

	Key Community Engagement Principles drawn from Community interviews conducted during the period 7th to 25th February 2012.
1	**The key to effective Community Engagement is to be a <u>good neighbour</u>.** The Community has experienced good community engagement where it - • Seeks and allows for inquiring questions; • Encourages all parties to look at it from another's perspective; • Follows-up all inquiries or reporting of incidents / complaints; and • Manages expectations with education and empathy. In the community's experience, the broader the cross-section of interests the richer the conversations and the diversity of insights. They are eager to see that there is an <u>even playing field for all neighbours – no double standards</u>.
2	**A simple and workable process to call the Company and register a concern.** In Community's experience, a pre-requisite for effective community engagement is the existence and <u>operation of a dynamic feedback loop</u>. Based on the Community's best experience with Community Engagement, when they have needed to raise a concern they have received feedback and a response to their call within 24 hours. The issue may not have been resolved – but they get a call back. Their best experience with community engagement involved: • Being open and able to listen to concerns, • Not being emotive, and • Being able to ring up and raise an issue. Community members need to be assured that their concerns are taken seriously and have faith in a process that will capture track and feedback progress on these concerns. Community concerns / incidents are: i) It is logged and time stamped; ii) They are advised as to what NRE plans to do; iii) They are advised as to when/if NRE can fix the problem; and iv) They are provided with regular updates on the progress of the fix.
3	**A simple and implementable 'Code of Conduct'.** The community also reinforced the importance of a code of conduct for everybody. That way the <u>community of peers keep each other in check</u>. In all conversations, stakeholders should refrain from any form of conduct which may cause any reasonable person unwarranted offence or embarrassment. Community engagement must be respectful and not engage in unconstructive or intimidating behaviour.
4	**Diversity in Community Engagement needs to be encouraged.** The Community's best experience with community engagement was when different people with different skills came around the table to look at the situation from a neighbourhood perspective – what is required to make this a <u>good neighbourhood for all</u>. They valued the sharing of science – just the facts, no emotion, being honest.

5	**Focus on doing the little things well and it will provide a foundation of trust for tackling the bigger issues.** **Community Engagement is more about the relationship than the mechanism.** The Community wants to work towards outcomes of benefit to all parties – immediate neighbours, the mine, and the local and regional community. They acknowledge the enormity of some of the issues that need to be addressed – but believe that community engagement must start somewhere. Collaboration and transparency on some of the 'actionable' smaller issues will provide momentum for tackling some of the more complex issues.
6	**Proactively share the facts.** The Community discussed the importance of understanding the whole story and not receiving pieces over time or inconsistent messages. People jump to conclusions when they get half the story. They are eager to hear the full story directly from the company. The Community's expectation is to work with Gujarat to determine how best to communicate relevant information on the mine and its environmental performance to the broader community (in common man's language) – the release of multi-volume, 1000-page technical reports is not effective community engagement.
7	**NO SPIN in community engagement.** In the community's experience, credibility is the only thing that gets tarnished with this approach. In their words - it is no good 'writing poetry & not doing it'.
8	**Community Engagement means different things to different people and should be multi-dimensional.** Some residents have the interest and the energy to attend community meetings and others who are still interested to learn of the Mine's improvements, projects and planned activities are happy to receive that update via Newsletters.
9	**Community Engagement is about establishing the trust to manage the exception better.** In the Community's experience, they have been more worried when they have not heard any noise from the Mine's operation or unexpected noises, because it means that something is wrong. They would like to know what it was and whether it is likely to happen again.
10	**Community engagement is collaborative.** The Community all have the interest and passion to improve the quality and safety of their neighbourhood for all businesses, residents and commuters. They want to be involved and engaged in an efficient and respectful way i.e. Terms of Reference, Codes of Conduct etc.
11	**Community Engagement needs to be both focused on immediate operations and future plans.** The Community is interested to learn about what is going on at the Mine and what is being planned. Based on their long-standing relationship with the Mine, they have always appreciated being kept in the loop when it comes to changes in NRE's operations and possible impact on them. It's the 'surprises' that concern them or 'disrupt' them.
12	**Community Engagement needs to be 2-way.** In Community's experience, the best community engagement experiences have been ongoing two-way communications. They would like to have more opportunity to understand future plans for the mine and be able to ask questions. Also to be able to see the improvements being made e.g. new monitoring equipment, repair works, etc. The Community would be interested to meet on a regular basis to discuss issues and upcoming activities – the meetings would need to be a set frequency and a set time on the calendar.

APPENDIX D: Detailed Community Interviews

Interview with Mr Evan Perkins – Thursday 16th February

Key Principles

1. **The key to effective Community Engagement is to be a good neighbour.**

   In Evan's experience, the broader the cross-section of interests the richer the conversations and the diversity of insights. He is eager to see that there is an even playing field for all neighbours – no double standards.

2. **NO SPIN in community engagement.**

   In Evan's experience, credibility is the only thing that gets tarnished with this approach. He commented that it is no good 'writing poetry and not doing it'.

3. **Diversity in Community Engagement needs to be encouraged.**

   Evan's best experience with community engagement was when different people with different skills came around the table to look at the situation from a neighbourhood perspective – what is required to make this a good neighbourhood for all. He valued the sharing of science – just the facts, no emotion, being honest.

4. **A simple and implementable 'Code of Conduct'.**

   Evan also reinforced the importance of a code of conduct for everybody. That way the community of peers keep each other in check.

AUSTRALIA NEW ZEALAND

specialists in engaging people

TWYFORDS

Discussion Notes:

- Evan's key interest in Gujarat NRE operations is to ensure that all neighbours in the Wongawilli Community are 'good neighbours' - Gujarat NRE is but one neighbour.
- Evan commented that Gujarat NRE had inherited a few operational issues from the previous Mine owners e.g. water being pumped out from local dams.
- Evan's experience with the previous owners and community engagement saw them start out poorly but improve over time.
- Evan's experience with Gujarat NRE has been a positive one:
    - Better communications.
    - Eager to be good neighbours.
    - NRE been understanding under the circumstances.
    - Great empathy, understanding and attitude from Gujarat NRE people – Evan commented that if he saw Chris Irving down the street he would go up to him and say hi.
- Evan made the point that community engagement is about being a 'good neighbour'. Cited the example of the local gun club and the potential that it may bring toxic materials into the community. Need to understand the facts and share the science of what is being proposed. No double standards. If Gujarat NRE is held accountability for needing to be good neighbours, so should other local businesses and groups.
- Evan's experience with the previous mine owners commenced with engagement being all about spin and propaganda – they would bring in experts (20 people at a time) to try and prove something. When they changed their focus from being controlling owners ("Nazis") to being good neighbours the conversations changed and the community started to respect them more.
- Evan used the example of a truck speeding issue – Wongawilli community had an issue with the mine whereby some truck drivers were speeding down New Dapto Road and using the excuse of the road gradient to mask their driving habits. Evan mentioned that they tried a few things to address the speeding problems– external inspectors, complaints etc. But it was not until the community group suggested that the truck drivers be put in charge of the problem and self-regulate the speed that they saw a marked difference in truck driver behaviour. Because their job and reputation was at stake and in their hands of their peers

their behaviour changed. Put the right people in charge of solving the problem.

- Evan reinforced the importance of NO SPIN in community engagement. Credibility is the only thing that gets tarnished with this approach. He commented that it is no good 'writing poetry and not doing it'.
- Evan's best experience with community engagement was when different people with different skills came around the table to look at the situation from a neighbourhood perspective – what is required to make this a good neighbourhood for all. He valued the sharing of science – just the facts, no emotion, being honest.
- Evan commented that if a company lies the group loses respect very quickly.
- Evan also reinforced the importance of a code of conduct for everybody. That way the community of peers keep each other in check.
- Evans respected the company when it briefed and educated the group on technical issues.
- Evan also commented that the broader the cross-section of interests the richer the conversations and the diversity of insights. He is eager to see that there is an even playing field for all neighbours – no double standards.

Interview with Mr Mark Aquilina – Friday 17thth February

Key Principles

1. **A simple and workable process to call the Company and register a concern.**

   Based on Mark's experience, when he has needed to contact the mine he has always received feedback and a response to his call within 24 hours. The issue may not have been resolved – but he gets a call back.

   Mark's best experiences with community engagement involved :
   - Being open and able to listen to concerns,
   - Not being emotive, and
   - Being able to ring up and raise an issue.

2. **2-way communications with the Community.**

   Mark would be interested if the community and Gujarat were to meet on a regular basis to discuss issues and upcoming activities – the meetings would need to be a set frequency and set time on the calendar.

Discussion Notes:

- Mark's key concern with NRE is to do with the noise and dust from the operations.
- Mark indicated that noise/dust issues are improving and would very much like to be informed of any operational changes that may impact noise/dust in the future.
- Going forward, Mark expressed that he would like to understand how Gujarat is tracking against NSW Government environmental measures via the 24-hour monitoring explained by Don Jephcott.
- Mark commented that it is easy for him to contact the company via either email or phone. He has a good rapport with Don.
- Based on Mark's experience, when he has needed to contact the mine he has always received feedback and a response to his call within 24 hours. The issue may not have been resolved – but he gets a call back.
- Mark would like to continue to receive the newsletter from NRE outlining what is coming up. He cited the example of the Open Day at No.1. Colliery.
- Mark would be interested if the community and Gujarat were to meet on a regular basis to discuss issues and upcoming activities – the meetings would need to be a set frequency and set time on the calendar.
- Mark then spoke of his experience on the southern side of the operations of noises from the fan unit. Depending on the prevailing winds – sound is louder and more disruptive. Some days it sounds like a 'street-sweeping truck' outside.
- Mark's best experiences with community engagement involved :
    - Being open and able to listen to concerns,
    - Not being emotive, and
    - Being able to ring up and raise an issue.
- Mark would be interested to be involved in the Community Co-Design Workshop.

Interview with Mr and Mrs George and Denise Evans (Robson Road) – Wednesday 8th February

Key Principles

1. **Community Engagement means different things to different people and should be multi-dimensional.**

   Some residents have the interest and the energy to attend community meetings and others who are still interested to learn of the Mine's improvements, projects and planned activities are happy to receive that update via Newsletters.

2. **Community Engagement is more about the relationship than the mechanism.**

   In George and Denise's experience, even though they have never had occasion to complain they know who to call and feel comfortable to talk about their experience.

3. **Community Engagement is about establishing the trust to manage the exception better.**

   In George and Denise's experience, they have been more worried when they have not heard any noise from the Mine's operation or 'unexpected' noises because it means that something is wrong. They would like to know what it was and whether it is likely to happen again.

Discussion Notes:

- George and Denise have little occasion to contact NRE regarding any issues. In fact, they only become concerned when they do not hear any noise from the operations – it means that something has gone wrong.
- George and Denise have lived at their residence for over 40 years and George was a long-term employee of the Mine.
- Noise and dust had been a problem in the past when the operations used to stockpile and load trucks at the top end of the Mine and the crusher was in operation. Recently much better.
- They do know of neighbouring residents who have complained of noise from the lower portal.
- George and Denise have participated and co-operated in noise testing and surveys in recent times.
- George and Denise do not attend any resident meetings.
- George and Denise rely on the Gujarat Newsletter and refer to it to know what was going on or planned at the mine. For example, the running of the Long wall machinery at night.
- March 2011 was the last issue of the NRE newsletter that they received.
- George and Denise are interested to learn of the Mine's improvements, projects and planned activities e.g. the Open Day in October 2011 and the activities impact on traffic, movements, people to the site, noise and dust.
- George and Denise hear the rail carriages and engines more than the coal trucks. Recently they have noticed an oscillating sound, like a fan, coming from the site. Would be interested to learn more as to the nature of the noise.
- Don explained the criteria in the NSW Legislation for what would be classified as an 'offensive' noise. Don also explained that NRE are now required to install continuous monitoring for dust and noise. That equipment would be installed by an independent environment specialist company who would collect the data and interpret the results prior to publishing to the company's website.
- George and Denise also discussed with Don how the key findings in technical planning reports can be best shared and communicated with the community (non-technical experts). Agreed that it should be in an open and continuous way.

AUSTRALIA NEW ZEALAND

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TWYFORDS

Interview George and Alison Held, Heather Drylie (West Street) – Thursday 9th February

Key Principles

1. **It is important for the Community to have faith in Gujarat's incident reporting and tracking process (simple and reliable).**

   Alison, Heather and George's expectation is that when they report a problem or incident that
   i) It is logged and time stamped;
   ii) They are advised as to what Gujarat NRE plans to do;
   iii) They are advised as to when/if Gujarat NRE can fix the problem; and
   iv) They are provided with regular updates on the progress of the fix.

2. **Community Engagement needs to be both focused on immediate operations and future plans.**

   George, Alison and Heather are interested to learn about what is going on at the Mine and what is being planned. Based on their long-standing relationship with the Mine, they have always appreciated being kept in the loop when it comes to changes in Gujarat NRE's operations and possible impact on them. It's the 'surprises' that concern them or 'disrupt' them.

3. **Community Engagement needs to be 2-way.**

   In George, Alison and Heather's experience, the best community engagement experiences have been ongoing 2-way communications. They would like to have more opportunity to understand future plans for the mine and be able to ask questions. Also to be able to see the improvements being made e.g. new monitoring equipment, repair works etc.

Discussion Notes:

- George, Alison and Heather have been long-term residents of West Street and are Gujarat NRE's No. 1 Colliery's closest neighbour.
- Their key interest in Gujarat is in relation to noise and dust management at the No.1 Colliery Mine Site and Security.
- George, Alison and Heather expressed that they would like a 24 hour service where they can pickup the phone and report 'unusual' noises, 'disruptive' noises and security breaches on the Mine's property. In calling the hotline number, they would like to have acknowledged that the incident has been logged, that it is being addressed, how long it will take to rectify and what the nature of the disruption / incident is.
- George, Alison and Heather are also interested to learn about what is going on at the Mine and what is being planned. They asked about the planned use of a pocket of rainforest bushland just behind their residence.
- They received a CD copy from Gujarat NRE of the latest Technical Report (1000 pages), but requested that an Executive Summary or Overview Summary also be provided for ease of interpretation.
- George, Alison and Heather also suggested that the opportunity to have a 2-way conversation about the Technical Report would be welcomed.
- George, Alison and Heather indicated that their key requirement with Gujarat NRE was the ability to easily report and timestamp an incident, and have the chance to talk with someone about what happened and understand what the follow-up action will be. They indicated that Don and Kamlesh return their calls when they have had occasion to report incidents.
- George, Alison and Heather indicated that the noise from Trucks going down Broker Street and over the cattle grid used to be very troublesome. But the change in Truck access routes to the Mine site has improved this.
- George, Alison and Heather appreciate the one-to-one communications they have with Gujarat NRE - being the closest neighbouring residents.

- They find that they are often placed in the position of being spokes person for other residents who do not feel comfortable to speak up or call Gujarat NRE.
- George, Alison and Heather would appreciate more education and awareness of Gujarat operations, safety and monitoring. They had a discussion with Don about where monitoring equipment will be setup, how the figures will be interpreted and how best for residents to interpret the results.
- Don explained that one of the conditions for the Part 3A approval was for Gujarat NRE to establish 24 hour monitoring. The monitoring equipment will be setup and managed by an independent consulting firm.
- Don then spoke with Heather, Alison and George about trucks and dust management. How trucks returning from the coal loader sometimes pickup mud from the open stockpiles. Gujarat's vision is to have clean trucks enter Gujarat's operations, a clean process on site and trucks leave clean. The Coal Loader needs to also take this approach.
- Heather, Alison and George expressed an interest in understanding the operations better – perhaps a tour around the site and what is being done to minimise and reduce pollution.
- Don talked with Heather and Alison and George about traffic management and the 50 km speed limit on Bellambi Lane. The need to educate drivers and monitor.
- George also spoke about local school children trespassing on the site and Don mentioned that Gujarat NRE has conducted education sessions at some of the primary schools about Mine Site safety.
- George, Alison and Heather identified the following residents as also potential contributors to the community engagement strategy:
    - Steve and Megan Spence
    - Neil McClane
    - Tom Kerr
    - Ben Baan
    - James Tolhurst

Interview with Mr and Mrs George and Denise Evans (Robson Road) – Wednesday 8th February

Key Principles

1. **Community Engagement means different things to different people and should be multi-dimensional.**

   Some residents have the interest and the energy to attend community meetings and others that are still interested to learn of the Mine's improvements, projects and planned activities are happy to receive that up-date via Newsletters.

2. **Community Engagement is more about the relationship then the mechanism.**

   In George and Denise's experience, even though they have never had occasion to complain they know who to call and feel comfortable to talk about their experience.

3. **Community Engagement is about establishing the trust to manage the exception better.**

   In George and Denise's experience, they have been more worried when they have not heard any noise from the Mine's operation or unexpected' noises because it means that something is wrong. They would like to know what it was and whether it is likely to happened again.

Discussion Notes:

- George and Denise have little occasion to contact Gujarat NRE regarding any issues. In fact, they only become concerned when they do not hear any noise from the operations – it means that something has gone wrong.

- George and Denise have lived at their residence for over 40 years and George was a long-term employee of the Mine.
- Noise and dust had been a problem in the past when the operations used to stockpile and load trucks at the top end of the Mine and the crusher was in operation. Recently much better.
- They do know of neighbouring residents that have complained of noise from the lower portal.
- George and Denise have participated and co-operated in noise testing and surveys in recent times.
- George and Denise do not attend any resident meetings.
- George and Denise rely on the Gujarat Newsletter and refer to it to know what was going on or planned at the mine. For example, the running of the Long wall machinery at night.
- March 2011 was the last issue of the Gujarat NRE newsletter that they received.
- George and Denise are interested to learn of the Mine's improvements, projects and planned activities e.g. the Open Day in October 2011 and the activities impact on traffic, movements, people to the site, noise and dust.
- George and Denise hear the rail carriages and engines more then the coal trucks. Recently they have noticed an oscillating sound, like a fan, coming from the site. Would be interest to learn more as to the nature of the noise.
- Don explained the criteria in the NSW Legislation for what would be classified as an 'offensive' noise. Don also explained that Gujarat NRE are now required to install continuous monitoring for dust and noise. That equipment would be installed by an independent environment specialist company who would collect the data and interpret the results prior to publishing to the company's website.
- George and Denise also discussed with Don how the key findings in technical planning reports can be best shared and communicated with the community (non-technical experts). Agreed that it should be in an open and continuous way.

Interview with Dick and Helen, Peter and Rosalynd – Wednesday 15th February

Key Principles

1. **Community engagement is about being a 'good neighbour'.**

   Dick, Helen, Peter and Rosalynd have experienced good community engagement where it
   - Seeks and allows for inquiring questions;
   - Encourages all parties to look at it from another's perspective;
   - Follows-up all inquiries or reporting of incidents / complaints; and
   - Manages expectations with education and empathy.

2. **Community engagement is 2-way and collaborative.**

   Dick, Helen, Peter and Rosalynd all have the interest and passion to improve the quality and safety of their neighbourhood for all businesses, residents and commuters. They want to be involved and engaged in an efficient and respectful way i.e. Terms of Reference, Codes of Conduct etc.

3. **Proactively share the facts.**

   Dick, Helen, Peter and Rosalynd discussed the importance of understanding the whole story and not receiving pieces over time or inconsistent messages. People jump to conclusions when they get half the story. They are eager to hear the full story directly from the company.

Discussion Notes:

Areas of interest that Dick, Helen, Peter and Rosalynd have with NRE operations include:

- Speed limits along Bellambi Lane
- Vibration
- Dust
- Water pollution
- Hours of operation

Greatest concern is with coal haulage routes, and speed and dust issues along Bellambi Lane and Memorial Drive.

Bellambi Lane was re-surfaced a couple of years back when the area was re-zoned. The re-surfacing has been an improvement, however it's the speeding infringements of truck drivers entering and leaving the NRE No. 1 Colliery that generates the greatest noise, dust and safety concerns. Dick has spoken with the owner of the Trucking Company – Brindles and Alex Chalks from the Coal Loader about rogue drivers who break the law and also those who fail to ensure that the rollback tarps have been secured.

It's a serious issue – a traffic infringement. Both speeding and no tarp incidents get reported to the Police and the EPA. Need some way of ensuring that any trucks leaving the operations have their tarps safety secured. – e.g. surveillance, penalties.

There seems to be more dust now than when Bellambi Lane was a residents' route. Since Memorial Drive extended the volume of traffic is predominantly coal trucks.

Truck wheel washers only go up to a certain level and water droplets are still leaving the operations. Need to reduce the incidence of water droplets i.e. air blower. Coal Truck wash water ending up in the creek – need to monitor the creeks and waterways.

Dust monitoring equipment setup at Dick's residence becomes ineffectual when it rains as it corrupts the readings. Dick, Helen, Peter and Rosalynd are all interested in the environmental monitoring plans for NRE and wish to be kept abreast of monitoring controls and readings.

In Peter and Rosalynd's experience - coal dust has fallen out of the ceiling. They re-painted the house 6 years ago and cracks from the vibrations of heavy trucks down Bellambi Lane have opened up the ceiling cornices and coal dust coming down.

Peter and Rosalynd needed to install shutters on their back windows and doors. They close the back doors for most of the day to dampen traffic noise and dust from Bellambi Lane – limited air flow through the house.

Both couples spoke of the change in the hours of operation for the mine - lifted when coal terminal hours of operation revised. Currently they understand the hours of operation to be:

- Monday to Friday 7-10pm
- Weekends 8-6pm

Areas of improvement that Dick, Helen, Peter and Rosalynd would like to see with NRE's community engagement activities include:

- They cannot but help feeling that a deal between NRE and Government has already been done and the community is slowly being made aware of the implications. They would very much like to see the Community Engagement activities of NRE become more proactive and inclusive. They want to know the whole story – they have the perception that they are being drip-fed information.

- The Technical Report that was issued outlining NRE's plans for No. 1 Colliery expansion was difficult to read and time-boxed. Dick, Helen, Peter and Rosalynd would like to receive a summary for such a report written in layman's speak and well in advance of the review deadline.

- Dick, Helen, Peter and Roslynd are eager and willing to work with NRE to improve neighbourhood conditions around No. 1 Colliery. They cited the example of the successful submission they made to NSW State Government that resulted in the speed limit being dropped to 50 km on Bellambi Lane. This had a positive impact for noise reduction, dust and safety for all businesses and residents on Bellambi Lane.

- The last experience that Dick, Helen, Peter and Rosalynd had with NRE community engagement seemed to be disjointed, it ran over many hours and could have been more collaborative. They are interested to see a code of conduct or rules for holding a meeting put in place so that it does not get hijacked.

Some ideas that Dick, Helen, Peter and Rosalynd had for Community Engagement going forward, based on their best community engagement experiences included:

Peter's experience in community engagement (15 years experience in client services) has lead him to suggest that good engagement needs to:

- Seek and allow for inquiring questions;
- Encourage all parties to look at it from another's perspective;
- Always follow-up an inquiry or reporting of an incident / complaint; and
- Manage expectations with education and empathy.

Dick, Helen, Peter and Rosalynd all expressed concern with the amount of time and energy being invested into PR by NRE – need to balance this focus with investment in the local neighbourhood.

Retold story about a resident reporting that they had high levels of dust on back patio and requesting some assistance to clean the area for Christmas – the company's response has become folklore.

Techniques that Dick, Helen, Peter and Rosalynd indicated have worked well in contacting community members include:

- Letter box mail drops
- Community noticeboard
- ABC radio

Interview with Gavin and Kaye Workman (Illawarra Residents for Responsible Mining IRRM) – Tuesday 14th February

Key Principles

1. **Focus on doing the little things well and it will provide a foundation of trust for tackling the bigger issues.**
   Gavin and Kaye want to work towards outcomes of benefit to all parties – immediate neighbours, the mine, and the local and regional community. They acknowledge the enormity of some of the issues that need to be addressed – but believe that community engagement must start somewhere. Collaboration and transparency on some of the 'actionable' smaller issues will provide momentum for tackling some of the more complex issues.

2. **Reliable process for raising community concern and reviewing the resolution of community complaints.**
   In Gavin and Kaye's experience, a pre-requisite for effective community engagement is the existence and operation of a dynamic feedback loop. Community members need to be assured that their concerns are taken seriously and have faith in a process that will capture, track and feedback progress on these concerns.

3. **Ongoing communication of information on mining operations and the environmental performance of the mine.**

   Gavin and Kaye's expectation is to work with Gujarat to determine how best to communicate relevant information on the mine and its environmental performance to the broader community (in common man's language) – the release of multi-volume, 1000 page technical reports is not effective community engagement.

4. **Respectful conversations.**
   In all conversations, stakeholders should refrain from any form of conduct which may cause any reasonable person unwarranted offence or embarrassment. Community engagement must be respectful and not engage in unconstructive or intimidating behaviour.

Discussion Notes:

Areas of interest that Gavin and Kaye have with NRE operations include:

- Mining in residential areas.
- Integrity and operational quality of No. 1 Colliery's equipment.
- Management of Stockpiles.
- Mining under Sydney Water Catchment area.
- Faith in the safeguards put in place to protect environment and water.
- Drip waste management.
- Coal haulage movements, particularly trucks.
- Faith in Gujarat operational management policy and processes.
- Future plans for expansion and use of land around Bellambi Lane e.g. the intended use for the pocket of land on the north-eastern end of Bellambi Lane.
- Health concerns for residences close to the mine – dust, airborne particles, the demographic (young and elderly) most prone to respiratory illness.

Areas of improvement that Gavin and Kaye would like to see with NRE's community engagement activities include:

- Need an incident reporting and tracking process – whereby residents can report a concern and have it tracked and expect feedback. Currently infuriated by the process. Spending a lot of time and energy being a 'cockatoo', not being paid and not seeing any progress.
- Clear and regular communications on the activities of the Mine.
- A shared and agreed agenda of items for community and NRE discussion.
- Consistent and reliable communications and updates on key issues. Stop conflicting stories.
- At present the NRE website is too biased towards providing information on the commercial face of the business (e.g. share price). Would like to see more on its operations, plans, efforts in environmental monitoring and management.
- Need to share information in 'common man' language – Technical Reports submitted to the NSW Planning Department too difficult for the average person to interpret.

Techniques that Gavin and Kaye indicated have worked well in contacting community members include:

- Door-knocking
- Letter box mail drops
- Media articles
- Email
- Face-to-face

Looking forward, Gavin and Kaye would expect community engagement improvements in the following areas:

- The proof is in the pudding – need to see what comes out of the Community Engagement discussion.
- Good experience in community engagement with the Wollongong City Council and the Corrimal revitalisation program. Lots of great ideas and energy went into the DRAFT plan. Ideas unfortunately were not carried forward to the FINAL plan.
- Traceability and transparency of issues, priorities and resolutions.
- Tell the community when issues have been resolved and share the good stories.
- Agree on and focus on clear KPIs – transparency in their tracking, monitor their progress, share and communicate progress.
- NRE Coking India doing some great work on
    - CO_2 capture,
    - wind farms,
    - green belts,
    - dust efficiency, and
    - capture and re-use of fugitive gases – methane

  as well as working with community groups with offsets. Why are these initiatives not being shared with the Illawarra community?

Interview Mr Harvey Bailey (Rural Fire Service) – Friday 10th February

Key Principles

1. **Community Engagement is Core Business.**

Companies have a role to educate the community and make them aware of what is happening and/or planned.

2. **Community Engagement needs to be 'fit-for-purpose'.**

In Harvey's experience, Community Engagement needs to be focused and localised. What works for one community does not necessarily mean that it would work well for another.

3. **Community Engagement is ongoing.**

In Harvey's experience, the best community engagement experiences have been the ongoing, 1-on-1 partnering kinds. Its all about managing expectations and knowing what is going on.

Discussion Notes:

- Harvey's interest in NRE's operations are predominantly around what is happening at the Mine and whether it presents a fire hazard.
- Harvey plays a partnering role with NRE's Wongawilli Mine – RFS is contracted to test and maintain the Mine's fire hoses and the Mine sometimes uses the RFS Training Facilities to conduct training.
- Harvey is interested to know when and if there are local Wongawilli Community, Mine or Resident meetings being held. If so, he would like the RFS to be involved as a community member.
- Harvey would see value in the establishment of a Community Noticeboard or drop-in centre that would provide the community and local businesses with information on planned Mine activities and scheduled meetings.
- Harvey noted that the Rural Fire Service embarked on an extensive Community Engagement re-think and strategy about 2 years ago. He noted that for the RFS – Community Engagement was Core Business. Just as important as putting out the fires.

- Harvey indicated that educating the community and making them aware of fire hazards and how to best respond in a fire emergency was core to his role. He did indicate that Community Engagement needed to be fit-for-purpose and localised. What worked for one part of the State did not necessarily mean that it would translate well to another.
- Harvey shared that Community Street meetings worked well for the RFS as they could use the fire trucks to draw attention to their presence in the street and have residents meet. Worked particularly well for streets with young children.
- Harvey indicated that engaging the Community was difficult sometimes when there was no apparent issue or need to. For example, organising a Community Meeting for Cedar Estate when we have had the wettest summer on record.
- Harvey's best community engagement experiences with companies like NRE have been the ongoing, 1-on-1 partnering relationship ones. Its all about managing expectations and knowing what is going on.
- Harvey offered the use of the RFS Training Room for a Gujarat to hold a Community Engagement Strategy design workshop in March. Need to liaise with Harvey as to a suitable day and time.

Interview with Mrs Maureen Guest (Cross St) – Monday 13th February

Key Principles

1. **The role of the community needs to be clearly defined and valued.**
   Many residents do not understand their role as community members is to provide feedback or lodge incidents (if required). At best they feel like their voice is not valued or they do not have a legitimate role, and at worst that they will be labelled a complainer/whinger.

2. **The mindset and attitude of a company towards its community is crucial in setting the tone of the relationship.** In Maureen's experience, how people are treated and the attitude towards them sets up their reaction.

3. **The more frequent the conversation the more respectful the relations.**
   In Maureen's experience, the more you talk the more likely that you will come to a 'workable' landing on an issue. The parties may not agree . . but they will be civil and respectful.

4. **Proactively share the facts.**
   Discussed the importance of understanding the whole story and not receiving pieces in the media and pieces from the workforce. People jump to conclusions when they get half the story. Maureen eager to hear the full story directly from the company.

5. **Always follow-up any conversation.**

   Maureen's best experience with Community engagement was when an RTA officer met with her to explain planned roadworks. He listened to her concerns and came back out to the house to inform her first hand that the road works were going to be delayed by a couple of days and the team was asked to keep sound at a minimum.

Discussion Notes:

- Maureen has lived at her current residence since 1969.
- Maureen's main connection/concern with the NRE is the traffic and the truck noise linked to the transportation of coal.
- There used to be a curfew with trucks not moving coal after 6pm, as the Coal Loader was not open to receive the loads. They would only move coal on a Saturday up until 1pm and never on Sunday. When and how did the curfew change?
- Air brakes used by trucks can make such a noise that it 'lifts the roof'. Maureen needs to close up the house at night to be able to sleep. Braking leading up to Railway Street is the issue.
- The truck drivers are ignoring the signs and road regulations. Using their air brakes inappropriately.
- Prior to NRE taking over the operations of the mine, Maureen called the owners of the mine and explained her issue with the trucks and the noise. A representative from the mine met with Maureen and asked that she keep a log of loud truck noises and braking – particularly the time and date. Maureen collected these stats for close to a month and sent the logbook onto the company, but never heard anything more.
- Maureen spoke about the fact that while many neighbours have lived there just as along as she has, they do not feel comfortable about ringing up NRE. We talked about how residents are in the best and often the only position to be able to provide a 'real' perspective on what it is like.
- Maureen has spoken with David Campbell on a number of occasions about the traffic along Memorial Drive and the lack of sound barriers between Fairy Meadow and Bellambi. Maureen indicated that David sent off a few letters and kept Maureen updated, but no action resulted.

APPENDIX E: Community Workshop Invitation

Invitation to Community Co-design Workshop

You are invited to register your interest to join a representative Community Team to work on the Co-design of the Community Engagement Strategy for Gujarat NRE.

The team will be drawn from different demographic, geographic and community perspectives. This will ensure the Community Engagement Strategy is balanced and representative of the engagement needs of the Community.

The following Co-design Workshops will be conducted:

- **Workshop #1 - 6-8pm, Thursday 22nd March** @ Wongawilli Rural Fire Service (Training Room), Wongawilli Road, Wongawilli.
- **Workshop #2 - 10am-12 noon, Friday 23rd March** @ Russell Vale Community Hall, Keerong Ave, Russell Vale.
- **Workshop #3 - 6-8pm, Friday 23rd March** @ Corrimal Community Centre (Grevillea Rm1), 15 Short St, Corrimal.

Please register your interest to join the Community Team by emailing Michelle@Twyfords.com.au or calling Twyfords on 02 42 264040 by Tuesday 20 March.

Places will be limited at each design workshop to 40 participants and successful registrants will receive confirmation by email or phone.

The workshop aim is to establish a 'good neighbour' strategy for Gujarat NRE and its Community. The strategy will detail the WHAT and HOW Gujarat NRE and the Community will work together on mine issues.

TWYFORDS

APPENDIX F: Community Workshop Findings

WONGAWILLI COMMUNITY WORKSHOP

Thursday 22nd March, 2012

WONGAWILLI Community Co-Design Workshop Thursday 22nd March 2012	
Attendees	Alex Stanoski, Tom Wetherall, Even Perkins, Ron Cooper, Harvey Bailey, Dave Clarkson (NRE), Tania Jones (Twyfords)
Apologies	Katrina McDonald, Dawn Goldman
Key Community Questions and Concerns	• Noise – Vehicle reversing beepers/alarms can be heard in the Village.
	• Increased number of new neighbours will heighten the need for an effective call centre.
	• Need for greater awareness of the risk at the GIVEWAY sign at the level railway crossing.
	• Ringing Gujarat and return of phone calls.
	• Workers and mine equipment driving through the Village is a risk. A road is planned to divert traffic around the Village – awaiting funding approval.
Key Community Engagement Considerations	• Need a dedicated Community Call Line through to a trained Community Officer.
	• Awareness and notification of hours of operation around longwall change-outs.
	• Interested in viewing the Mine footprint – Current vs Planned.
	• 24 hour Call Centre with a Community focus.
	• Community engagement needs to have multiple channels and feedback loops.
	• Multiple contact points and escalation process e.g. Control Room -> Community Officer #1 -> Community Officer #2.
	• Community Drop-in Centre with an information board, plasma screen displaying recent operations/environment monitoring statistics, and plans / maps. • Potentially the house on the corner of Jersey Road, Wongawilli can be used as a Community Office and drop-in centre.

Possible Community Engagement Mechanisms	• Posters (Notice board of current and upcoming events).
	• Kiosk or Information Days (block of time).
	• Newsletter.
	• Internet.
	• Letterbox drops.
	• Non-attendance to meetings should NOT be interpreted as the Community not being interested. • Getting hard to get to meetings (time poor).
	• e-Mail distribution list.
	• Need to rotate the members/representatives on any community forum for it to remain representational.
	• A potential problem with meetings is that actions/discussions revolve around who is present or not.

RUSSELL VALE COMMUNITY WORKSHOP

Friday 23rd March, 2012

RUSSELL VALE Community Co-Design Workshop Friday 23rd March 2012	
Attendees	Ann Young, Maurie Chapman, Lynette Jacona, Kamlesh Prajapti (NRE), Don Jepcott (NRE), Tania Jones (Twyfords)
Apologies	Bruce Rowles, John Baker
Key Community Questions and Concerns	• Noise and Dust from the Gujarat No.1 Colliery operations.
	• Traffic and truck behaviour on Bellambi Lane.
	• Need to understand the current situation with approvals with the Department of Planning.
	• Dust level monitoring and detection beyond the boundaries of Gujarat No.1 Colliery operations.
Key Community Engagement Considerations	• Gujarat should be reporting what is happening regularly to the Community.
	• Community engagement focus needs to be both Regional and Local.
	• Need to monitor the regional impacts of mining – particularly on the water catchment *(post-meeting email from Ann Young).*
	• 24 hour Call Centre with a Community focus.
	• Gujarat needs to get into the habit/process of reporting what is happening.
	• The company and environmental groups and residents will disagree on issues – how to best manage this tension *(post-meeting email from Ann Young).*
	• Need regular and consistent dialogue and context to issues being tracked and the history behind a matter *(post-meeting email from Ann Young).*
	• Need to manage emergency situations with a dedicated/agreed procedure – how is the community to be contacted, alerted and advised of status?
	• People eager to understand facts from Gujarat.
	• 24-hour contact required with the mine.
Possible Community Engagement Mechanisms	• Website that is easy to navigate and access critical community information. • Meeting frequency – Every 2 months to start and then Quarterly *(post-meeting email from Ann Young).*
	• Regular scheduled meetings to get consistent input /appreciation.
	• Field trips and site visits have been very useful with other mines.
	• Formal meeting structure provides for complaints being tabled and assessed for action.

CORRIMAL COMMUNITY WORKSHOP

Friday 23rd March, 2012

CORRIMAL Community Co-Design Workshop **Friday 23rd March 2012**	
Attendees	Peter McGibbon, Rosalynd McGibbon, Rowan Huxtable, Rina Wainwright, Gavin Workman, Peter Turner, Alison Edwards, Graham Heath, Mark Aquilina, Dick Knappett, Helen Cousins, Kamlesh Prajapti (NRE), Don Jepcott (NRE), Dave Clarkson (NRE), Colin Duffy (NRE), Janelle Mousley (Twyfords), Tania Jones (Twyfords)
Apologies	Charmaine Sweeney, Ann Brown, Irene Tognetti
Key Community Questions and Concerns	• The Community needs a consistent and transparent understanding of Gujarat long-term development plans.
	• Repeated expressions of concern regarding noise, dust, truck speed, inadequate noise and dust monitoring (24/7 'air quality' monitoring repeatedly requested) and the project proposal being based on dust levels obtained from an inappropriate location some 6 km away.
	• Process of communication and follow-up -> proof of follow-up.
	• Are there any additional or special compliance requirements for mines in close proximity to residential areas?
	• Is this Community Engagement process just more spin? • The Community needs some tangible information with definite outcome. No more Share Price beat-ups. Do something – NRE needs to stand up.

	• Community has an issue when it contacts the No. 1 Colliery :
	    ○ After hours – contact is not immediate
	    ○ Sometimes the Community feels that Gujarat does not recognise a reported problem/issue.

	• Community concerned about dust and wash quality practices at No.1 Colliery and the Coal Terminal.
	• The Community needs consistent and regular updates from Gujarat.
	• The Community needs to have an understanding of regulations and operational/environmental limits.
	• Community needs time and appropriate format to interpret technical reports / applications.
	• Community needs to be kept updated with regard to Planned vs Actual.

	• People need to know where to go to find out current development plans/applications.
Key Community Engagement Considerations	• Community are interested in the visibility / transparency of Mine Operations and Mine Plans.
	• It pays to be proactive and alert. Do not rely on the regulator to prompt your Community Engagement.
	• The Community needs facts and real risk assessments.
	• The Community needs a REAL invitation to engage. Documents issued with enough time and context to be understood and able to respond on (not issued for comment on Dec 10 – Jan 26).
	• The Community needs a process in place that liaises with the community on a problem/issue – where the Company shows steps for all community and actually actions.

Possible Community Engagement Mechanisms	• Community would like an information session on Air Quality management and monitoring.
	• Community would like an information session on what new Infrastructure and equipment will be in use as part of the expansion of operations at No. 1 Colliery.
	• Community would like an information session on the Risk Management practices of Gujarat.
	• Community very interested to understand the process by which Gujarat manages risks(TARP process) – ○ **T**rigger ○ **A**ction ○ **R**esponse ○ **P**lans
	• People would like to understand the hours of operation for the new stockpile loading process.
	• Community would like to find out the timetable and high-level details for Gujarat development applications/plans.
	• People need to know where to go to find out current development plans/applications.
	• Community would like to know the Mine footprint – current and planned.
	• Community interested in the availability and publication of key Mine statistics and information: ○ Envelope area – with relation to catchment, dams, houses. ○ Noise levels – day and night. ○ Truck movements – day and night. ○ Methane emissions. ○ Salt production and disposal. ○ Etc
	• Community would benefit from a summary document that explains and indexes the key parts of the Technical Documents supporting development applications.
	• Invite the regulators to help educate the community.

APPENDIX G: Community Review Team Feedback

NRE Community Engagement Strategy
Community Review Team Feedback

No	Issue	Raised by	Via	Date	Follow-up / Response
1	I think you have the Russell Vale points accurately. I don't recall the comment of meetings being 2 monthly then quarterly but I could be wrong and it's a minor point. I know that Metrop CCC started quarterly and changed to bi-monthly.	Ann Young	Email	31/03/2012	Minutes from the Russell Vale Workshop have been updated to reflect that Ann's comment re 'frequency of meetings' was received in an email post-workshop. Minutes recorded in Appendices of Community Engagement Strategy.
2	I feel that people are going to become impatient with the slow progress. I know I would like to see a CCC in place in the near future. As I said the outline was quite good but more will have to be set in place.	Rosalynd McGibbon	Email	31/03/2012	Community Review Team session planned for 16th April to agree on recommendations for Community Engagement Strategy to ensure momentum.
3	The meeting summary doesn't reflect/capture the repeated expressions of concern regarding noise, dust, truck speed, inadequate noise and dust monitoring (24/7 'air quality' monitoring repeatedly requested) and the project proposal being based on dust levels obtained from an inappropriate location some 6 km away.	Peter Turner	Email	2/04/2012	Minutes from the Corrimal Workshop have been updated to reflect the concerns raised by residents regarding dust, noise, and truck speed. All these concerns featured heavily in the Community interviews. Key recommendation made in the Strategy to establish a portable dust and noise monitoring process. Both Interviews and Minutes recorded in Appendices of Community Engagement Strategy.
4	A CCC surely has limitations. Nonetheless a CCC has benefits and is 'standard practice', so it would seem reasonable to expect good reasons would be given for replacing it and community agreement would be sought. As far as I can tell that hasn't happened. The summaries for the three recent community meetings have sections on "Key Community Engagement Considerations", but they are not put in the context of questioning or considering the role and value (or otherwise) of a CCC.	Peter Turner	Email	2/04/2012	Agreed. The pros and cons of a CCC as an effective Community Engagement mechanism will be the focus of discussion and agreement at the Community Review Team meeting planned for 16th April 2012.

5	According to the summary, those interviewed define the "NRE Community", yet there is no information as to how those interviewed were selected or how it was established that they reflect the community.	Peter Turner	Email	2/04/2012	The methodology used to select the 12 interviewees, the interview guide and questions used and the minutes of all interviews are included in the Appendices of the Community Engagement Strategy. All community members interviewed received a copy of the minutes and principles recorded from their session.
6	The advice they've been given is that the motivation is driven by the February interviews with twelve community members from the Wongawilli and Russell Vale/Bellambi areas. The summary of those interviews doesn't list the questions asked, there is no indication of concerns being raised regarding the effectiveness of a CCC and there is no indication that those being interviewed were being asked to consider alternatives to a CCC.	Peter Turner	Email	2/04/2012	See response to Issue #5. The Community Review Team meeting scheduled for 16th April will focus on the learnings / experience with CCCs drawn from the interviews.
7	I spoke to the DoP about this today and they're also unclear about the intentions and motivations in Gujarat's seeking an alternative to a CCC. Their understanding is that Gujarat will be proposing an alternative to a CCC and that may still involve a committee of some kind, but they are unsure and await the proposal from Gujarat.	Peter Turner	Email	2/04/2012	NRE meet with the DoPI on Thursday 29th March 2012 and provided an update on the process and status of the Community Engagement Strategy. A copy of the Executive Summary brief submitted to the DoPI is included in the Appendices of the Community Engagement Strategy.
8	In replying to Gavin's observation, you commented that the community meetings satisfied the Director General's community consultation requirements. So it would seem then that Gujarat has decided to pursue and propose to the DoP an alternative to the CCC, without adequate explanation or adequately canvassing community views of the desirability or otherwise of a CCC.	Peter Turner	Email	2/04/2012	Correction - when asked whether a Community Consultative Committee (CCC) would be established by mid-April the response was that a committee would not be in place by that date but that the community consultation process had started with interviews kicking off in Feb 2012 and adhering to an approach that had the Community co-designing the Strategy.

9	Recall you suggesting there was plenty of time to decide if a CCC was the best option but as Gavin pointed out, the Director General and DoP are to be advised of the community consultation mechanism by April 13. That date seems to leave no time to form a CCC, should that be desired, let alone establish a community consensus regarding the formation or otherwise of a CCC.	Peter Turner		2/04/2012	See response to Issue #8.
10	Referring to your email below though, and while the agenda may have intended otherwise, the Corrimal meeting didn't seem to me to directly address "requirements to inform the design of a DRAFT Community Engagement Strategy ".	Peter Turner		2/04/2012	Noted.
11	There was a repeated request for a mobile dust monitor.	Peter Turner	Email	2/04/2012	See response to Issue #3.
12	There was an expression of concern (query) regarding the manner in which Gujarat are seeking to start long wall mining at Wongawilli East, discussion of the approval requirements and concern at the nature of recent press releases from Gujarat - which Dave conceded were intended for share holders.	Peter Turner	Email	2/04/2012	Minutes from the Corrimal Workshop have been updated to reflect these concerns. Minutes recorded in Appendices of Community Engagement Strategy.
13	The Corrimal meeting focused on local community concerns (leaving no time for catchment concerns, alas) and didn't discuss consultation mechanism options to any extent and, as far as I recall, the meeting wasn't given direction or time to consider the pros and cons of a CCC or how a CCC might be improved or improved upon by replacement. The summary makes no mention of the questions (Gavin and I) asked in the meeting regarding the formation of a CCC.	Peter Turner		2/04/2012	Agreed. The pros and cons of a CCC as an effective Community Engagement mechanism will be the focus of discussion and agreement at the Community Review Team meeting planned for 16th April 2012.

14	Could you please find out and send me/us some information about why GNRE do not want to put in place a CCC following the NSW Govt guidelines. I would like specifics rather than 'GNRE believe they can do it better. I think that this information is very important for this Community Consultation Strategy and to date there has been no discussion or information offered. Given the community has now spent a lot of their time and energy to get this far (that is talking about what we see is good communication and what information we would like available) I think it is appropriate and necessary at this stage to have information from GNRE as to why we are involved in this process.	Gavin Workman	Email	2/04/2012	See response to Issue #13.

15	The discussions and interviews and workshops have only been about communication between GNRE and the community and vice versa.	Gavin Workman	Email	3/04/2012	Noted. A wider group of stakeholders have been identified as part of the planning process and need to be brought into the Community Engagement activities as a next step. E.g. Local Government, NGOs.

16	There hasn't been any discussion about: the form we would like the CCC to take; the necessary interaction between community and Govt departments and agencies; the necessary interaction between community and Council; what we could have expected from a CCC under the NSW Govt guidelines; why specifically GNRE do not want a CCC under the NSW Govt guidelines; the policing or regulating GNRE under the CCC; the Govt agencies or Councils views on this process;	Gavin Workman	Email	3/04/2012	See response to Issue #13.

17	We have not seen all the interview data that you have collected from other stakeholders.	Gavin Workman	Email	3/04/2012	The methodology used to select the 12 interviewees, the interview guide and questions used and the minutes of all interviews are included in the Appendices of the Community Engagement Strategy.

18	GNRE need to tell us in good faith what they are intending with the whole strategy process.	Gavin Workman	Email	3/04/2012	Noted.

19	I do not believe that a draft strategy can be made on such limited data. Inform the community about what they could expect from a NSW Govt guideline CCC, then ask them what they would prefer.	Gavin Workman	Email	3/04/2012	Noted.
20	It is also my understanding that you have been in discussion with DoP. Could you please forward information about this meeting and what was discussed.	Gavin Workman	Email	3/04/2012	NRE meet with the DoPI on Thursday 29th March 2012 and provided an update on the process and status of the Community Engagement Strategy. A copy of the Executive Summary brief submitted to the DoPI is included in the Appendices of the Community Engagement Strategy and forwarded to all members of the Community Review Team the week commencing 2nd April 2012.
21	The draft instead seems to me to present a proposal for an engagement and consultation development strategy that might or might not deliver over a 3 to 12 month time frame a CCC or an agreed alternative in accord with the NSW CCC guidelines. That is, seems to me the proposal won't deliver a CCC or an operational equivalent by April 13. Presumably Gujarat have not put the project on hold and won't be putting it on hold until an effective framework is in place.	Peter Turner	Email	4/04/2012	Noted and to be discussed at the Community Review Team meeting scheduled for Monday 16th April 2012.
22	Could you please inform us when you were approached by GNRE and when you were engaged?	Gavin Workman	Email	4/04/2012	Twyfords was approached in mid 2011 about Community Engagement and formally engaged in late January 2012.
23	Could you please also ensure that GNRE have also fulfilled their obligations in regard to getting all the required information on the website by that time.	Gavin Workman	Email	4/04/2012	Noted.

24	I see how they (recommendations) could have arisen from the community meeting but I really don't see that these suggestions meet the requirement of the DA. Obviously very little meaningful community engagement will occur for 12 months or so, and I can't see the community being happy with this. Certainly I would not be. No problem with starting the call line etc - the company can do all these things without any external input. As for an oversight group, I think that's a waste of time, and I would have thought a chat with the chairs of existing CCCs, not to mention DoP people would have given you any info you needed about what did and didn't work. The real problem is that this sort if delay is - rightly or wrongly - perceived as delaying tactics and as the company trying to avoid accountability. Which I would have thought is the opposite of what it wanted to achieve.	Ann Young	Email	5/04/2012	Noted and to be discussed at the Community Review Team meeting scheduled for Monday 16th April 2012.

25	The tasks for the Oversight Group overlap with the role of a CCC significantly and I personally see no reason not to get on with setting up a CCC. If that CCC then investigates options about how further community engagement occurs, that is quite proper and within the usual role as defined by DoP.	Ann Young	Email	5/04/2012	Noted and to be discussed at the Community Review Team meeting scheduled for Monday 16th April 2012.

APPENDIX G: Executive Summary for DoPI

Executive Summary
Community Engagement Strategy

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Executive Summary

This document summarises the approach proposed by Gujarat NRE to:

i) Develop a fit-for-purpose Community Engagement Strategy with its Community;

ii) Outline where Gujarat NRE is up to in the process and what is planned; and

iii) Share the findings from Community Engagement activities to date.

Approach

To ensure that the Gujarat NRE Community Engagement Strategy meets the stated objectives of the NSW Department of Planning and Infrastructure and the specific needs of the Wongawilli and No.1 Colliery Russell Vale Mine Communities, the following approach will be used (see Attachment 1 – Project Plan for further details):

Step 1	Identify stakeholders/community of interest and the role they can play in Gujarat NRE's Community Engagement Strategy.
Step 2	Interview key community stakeholders and research/understand their interests and experience of effective Community Engagement. Determine from the Community what they believe constitutes effective Community Engagement.
Step 3	Co-design the Community Engagement Strategy with a representative forum of its stakeholders by exploring techniques to achieve the Community Engagement Principles drawn from Step 2 Community Interviews.
Step 4	Meet with Department of Planning and Infrastructure to review and discuss the Gujarat NRE co-designed Community Engagement Strategy.
Step 5	Using the outputs from above steps to prepare a draft Community Engagement Strategy and review with representatives from the community.
Step 6	Complete Community Engagement Strategy and present to Department of Planning and Infrastructure for endorsement.

Executive Summary
Community Engagement Strategy

Community Engagement Findings

Engagement with the Gujarat NRE Community concerning the Strategy has commenced with the interviewing of twelve (12) Community members from the Wongawilli and Russell Vale/Bellambi areas.

The interviews were undertaken during the period 7th to 25th February with a cross-section of the Community and conducted by Gujarat NRE and Twyfords. A copy of the Interview Guide is provided in Attachment 2 and the key findings/principles drawn from the Community discussions are summarised in the table below.

The overriding message from the Gujarat NRE Community is that **effective Community Engagement is about being a 'good neighbour' and that principles, rather then the technique,** should guide the Community Engagement Strategy development.

The next step in the process is to conduct three (3) co-design strategy workshops in mid March 2012 to develop a draft Community Engagement Strategy with the Community for Gujarat NRE.

	Key Community Engagement Principles drawn from Community interviews conducted during the period 7th to 25th February 2012.	DoPI Requirements*
1	**The key to effective Community Engagement is to be a good neighbour.** The Community has experienced good community engagement where it - • Seeks and allows for inquiring questions; • Encourages all parties to look at it from another's perspective; • Follows-up all inquiries or reporting of incidents / complaints; and • Manages expectations with education and empathy. In the community's experience, the broader the cross-section of interests the richer the conversations and the diversity of insights. They are eager to see that there is an even playing field for all neighbours – no double standards.	**Work together towards outcomes of benefit to the mine, immediate neighbours and the local and regional community.**
2	**A simple and workable process to call the Company and register a concern.** In Community's experience, a pre-requisite for effective community engagement is the existence and operation of a dynamic feedback loop. Based on the Community's best experience with Community Engagement, when they have needed to raise a concern they have received feedback and a response to their call within 24 hours. The issue may not have been resolved – but they get a call back. Their best experience with community engagement involved: • Being open and able to listen to concerns, • Not being emotive, and • Being able to ring up and raise an issue. Community members need to be assured that their concerns are taken seriously and have faith in a process that will capture, track and feedback progress on these concerns.	**Discuss community concerns and review the resolution of community complaints.**

* *Page 1 - Guidelines for establishing and operating community consultative committees for mining projects. Department of Planning, June 2007.*

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	Community concerns / incidents are: i) It is logged and time stamped; ii) They are advised as to what Gujarat NRE plans to do; iii) They are advised as to when/if Gujarat NRE can fix the problem; and iv) They are provided with regular updates on the progress of the fix.	
3	**A simple and implementable 'Code of Conduct'.** The community also reinforced the importance of a code of conduct for everybody. That way the community of peers keep each other in check. In all conversations, stakeholders should refrain from any form of conduct which may cause any reasonable person unwarranted offence or embarrassment. Community engagement must be respectful and not engage in unconstructive or intimidating behaviour.	**Establish good working relationships between the company, the community and other stakeholders in relation to the mine.**
4	**Diversity in Community Engagement needs to be encouraged.** The Community's best experience with community engagement was when different people with different skills came around the table to look at the situation from a neighbourhood perspective – what is required to make this a good neighbourhood for all. They valued the sharing of science – just the facts, no emotion, being honest.	**Work together towards outcomes of benefit to the mine, immediate neighbours and the local and regional community.**
5	**Focus on doing the little things well and it will provide a foundation of trust for tackling the bigger issues.** **Community Engagement is more about the relationship than the mechanism.** The Community wants to work towards outcomes of benefit to all parties – immediate neighbours, the mine, and the local and regional community. They acknowledge the enormity of some of the issues that need to be addressed – but believe that community engagement must start somewhere. Collaboration and transparency on some of the 'actionable' smaller issues will provide momentum for tackling some of the more complex issues.	**Discuss community concerns and review the resolution of community complaints.**
6	**Proactively share the facts.** The Community discussed the importance of understanding the whole story and not receiving pieces over time or inconsistent messages. People jump to conclusions when they get half the story. They are eager to hear the full story directly from the company. The Community's expectation is to work with Gujarat to determine how best to communicate relevant information on the mine and its environmental performance to the broader community (in common man's language) – the release of multi-volume, 1000-page technical reports is not effective community engagement.	**Provide for the ongoing communication of information on mining operations and the environmental performance of the mine.**
7	**NO SPIN in community engagement.** In the community's experience, credibility is the only thing that gets tarnished with this approach. In their words - it is no good 'writing poetry & not doing it'.	**Establish good working relationships between the company, the community and other stakeholders in relation to the mine.**

8	**Community Engagement means different things to different people and should be multi-dimensional.** Some residents have the interest and the energy to attend community meetings and others who are still interested to learn of the Mine's improvements, projects and planned activities are happy to receive that update via Newsletters.	**Discuss how best to communicate relevant information on the mine and its environmental performance to the broader community.**
9	**Community Engagement is about establishing the trust to manage the exception better.** In the Community's experience, they have been more worried when they have not heard any noise from the Mine's operation or unexpected noises, because it means that something is wrong. They would like to know what it was and whether it is likely to happen again.	**Establish good working relationships between the company, the community and other stakeholders in relation to the mine.**
10	**Community engagement is collaborative.** The Community all have the interest and passion to improve the quality and safety of their neighbourhood for all businesses, residents and commuters. They want to be involved and engaged in an efficient and respectful way i.e. Terms of Reference, Codes of Conduct etc.	**Discuss how best to communicate relevant information on the mine and its environmental performance to the broader community.**
11	**Community Engagement needs to be both focused on immediate operations and future plans.** The Community is interested to learn about what is going on at the Mine and what is being planned. Based on their long-standing relationship with the Mine, they have always appreciated being kept in the loop when it comes to changes in Gujarat NRE's operations and possible impact on them. It's the 'surprises' that concern them or 'disrupt' them.	**Discuss how best to communicate relevant information on the mine and its environmental performance to the broader community.**
12	**Community Engagement needs to be 2-way.** In Community's experience, the best community engagement experiences have been ongoing two-way communications. They would like to have more opportunity to understand future plans for the mine and be able to ask questions. Also to be able to see the improvements being made e.g. new monitoring equipment, repair works, etc. The Community would be interested to meet on a regular basis to discuss issues and upcoming activities – the meetings would need to be a set frequency and a set time on the calendar.	**Establish good working relationships between the company, the community and other stakeholders in relation to the mine.**

Attachment 1
Community Engagement Strategy Project Plan

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Executive Summary
Community Engagement Strategy

Attachment 2
Community Engagement Interview Guide

Gujarat Community Engagement Strategy - Interview Guide

Pre-interview information		
Name of interviewee(s)		
Organisation / Role:		
Contact details - Work:	Phone:	Fax:
	Email:	
Contact details - Personal:	Phone:	Mobile:
	Email:	
Venue of Interview:		
Interview Date/Time:		

Objectives:

- To increase Gujarat NRE's awareness and understanding of the knowledge, attitudes, perceptions and issues of the various community stakeholders related to the company's operations, project activities and outcomes.
- To develop a 'shared' understanding with stakeholders of the principles required in the design of an effective Community Engagement Strategy.
- To open up a dialogue and two-way communication channels with stakeholders.
- To build relationships and trust with key players in the community.

Introduction:	*Explain that the purpose of this interview is to determine the principles needed to guide the effective design of Gujarat NRE's Community Engagement Strategy.* *The questions are designed to assist in the capture of key principles to be considered in the design of the Community Engagement Strategy and not to define the strategy/solution.*

Statements & Questions: (use as a guide to prompt the conversation and keep on track)

What do you know about the company Gujarat NRE, and its operations?

(Background, any issues, what needs to be considered from their perspective?)

How important are the operations of Gujarat NRE to you and the local community?

What is your level of interest in the company and its operations?
i.e. position, interests and values

Why do you hold that view and why is it important to you?

How important are the operations of Gujarat NRE to you and the local community?

What is your level of interest in the company and its operations?
i.e. position, interests and values

Why do you hold that view and why is it important to you?

What should Gujarat NRE pay attention to when designing a Community Engagement Strategy?

What are the sensitivities or key principles that should be considered by the strategy?

How can Gujarat NRE best involve the community in the design of the Community Engagement Strategy?

What can be learnt from earlier and other efforts to involve this community?

What methods have worked?

How can Gujarat NRE listen and get the views of the broader community?

Can Gujarat NRE piggy back on existing forums or activities?

Who else should be involved?

Who would best represent the diversity of interests in the community?

Who might have been left out to date?

(Names and contacts)

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Annex F

Risk Assessment

Gujarat NRE Minerals Limited

No 1 Colliery
Wongawilli East and West Mining Areas

Failure Mode and Effects Analysis Report

Prepared by Olsen Environmental Consulting Pty Limited

January 2012

Olsen Environmental Consulting Pty Limited

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NEW SOUTH WALES

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OEC File Reference: P84/2308

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1. INTRODUCTION

Gujarat NRE Minerals Limited (NRE) own and operate the NRE No 1 Colliery at Russell Vale and are planning to upgrade the colliery. Part of the mining development of the colliery upgrade includes a proposal to mine Wongawilli coal from two areas known as Wongawilli East and Wongawilli West.

NRE are required to obtain a valid development approval for the colliery in accordance with the ***Environmental Planning and Assessment Act 1979*** (EP&A Act). This requires the preparation of an Environmental Assessment under the provisions of Part 3A of the EP&A Act. NRE have commissioned Environmental Resources Management (ERM) to prepare this Environmental Assessment.

NRE developed a mine plan proposal for these two areas based on economic extraction requirements and taking into account the larger environmental impact issues.

The proposed mining will be undertaken in the Wongawilli Seam in an area where the Bulli Seam and in some places, the Balgownie Seam have already been extracted. This is the first instance of this sequence of extraction to be proposed in Australia and consequently, there is no appropriate data to develop suitable models to predict detailed mine subsidence parameters. Consequently, the mining proposals incorporate a risk assessment methodology and an hierarchy of risk management strategies was applied during planning. Details of the strategies and the projected outcomes are included in a report prepared by Seedsman Geotechnics Pty Ltd (Seedsman 2009).

The hierarchy of risk management controls is:

- Elimination,
- Substitution,
- Engineering, and,
- Administration.

The mine plan proposals have already incorporated matters considered under Elimination and Substitution. There are a number of surface features above the proposed mining that are considered to be of special significance. These are the Illawarra Escarpment, Mount Ousley Road, Cataract Reservoir and Dam Wall, indigenous heritage sites, upland swamps, sensitive habitat areas, and named third and fourth order streams. There are other features of less significance.

A number of man-made features, such as transmission lines, optic fibre cables (Telstra), etc have also been considered. It is understood that specific management plans will be developed for these features in consultation with infrastructure owners.

Utilising an elimination approach for risk management, NRE have decided to not undertake longwall extraction under or in close proximity to the above features of special significance.

Utilising a substitution approach for risk management, NRE have decided to extract coal from the Wongawilli East area using narrow longwall blocks (nominally 150m wide) in conjunction with wide chain pillars so that the coal within the Cataract Reservoir Notification Area can be extracted.

The Failure Mode and Effect Analysis (FMEA) approach was undertaken for the other features of less significance. Its primary objectives were to identify:

- Environmental effects (system failures) that would require additional study in order to quantify and minimise potential impact, and,

- Any relevant environmental effects that had not as yet been considered in the FMEA process.

Actions determined during the FMEA will assist development of engineering and administration approaches to risk management that could be implemented to ensure appropriate management of subsidence impacts on the environment. Only some of these controls will be able to be developed prior to mining commencing, with some being progressively developed as monitoring data is collected and prediction models refined.

In November 2009, NRE commissioned Olsen Consulting Group Pty Ltd (OCG) to facilitate a FMEA review of the likely environmental impact associated with the mining proposals. OCG prepared coordinated the review and prepared a report. That report is titled NRE No 1 Colliery Wongawilli East and West Mining Areas. Failure Mode and Effects Analysis" and is dated December 2009.

Subsequent to the review and report preparation the mine subsidence information was modified. NRE then commissioned Olsen Environmental Consulting Pty Limited (OEC) to co-ordinate another review and prepare a final report (this report) detailing the outcomes of the original and subsequent reviews. The main objective of the subsequent review was to assess whether updated mining subsidence information had any effect on the conclusions of the original FMEA.

The methodology is discussed in Section 2 of this report.

2. FEMA METHODOLOGY

Failure Mode and Risk and Effect Analysis (FMEA) is a recognized methodology described in the NSW Department of Primary Industries document MDG 1010, "Risk Management Handbook for the Mining Industry". It is most applicable when only one type of impact is being considered (eg environmental impact) and was therefore considered appropriate for this exercise.

FMEA aims to identify the nature of failures which can occur in a system:

- By identifying the components or subsystems,

- Considering for each the full range of possible failure types, and,

- The effect on the system of each type of failure.

Further insight into the consequence of the failure modes was achieved by undertaking a Criticality Analysis to assign a rating to both the severity of the possible effects and their likelihood. This enabled the risks to be ranked, and was achieved utilising the assessment matrix shown in **Table 1**.

The steps in the FMEA were to:

Step 1. Define the scope of the study.

Step 2. Decide the level of analysis. In a broad study the main areas of potential environmental impact (flora and fauna, surface water etc) were regarded as the elements. For each of these elements a variety of potential failure modes were identified.

The Main Elements and a list of Possible Failure Types for the FMEA were prepared by Seedsman Geotechnics, NRE and OCG prior to the meeting. It was not intended to be an exclusive list but was generated to provide guidance on the distinction between elements and failure types in the FMEA process. Modifications and additions were made during the FMEA meeting and the eventual list is as follows:

Flora and Fauna Element

- Unacceptable impact on ecological significant areas above first 3 longwall blocks in Wongawilli East – Area 1.
- Unacceptable impact on ecological significant areas above last 8 longwall blocks in Wongawilli East – Area 2.
- Unacceptable impact on ecological significant areas above 5 longwall blocks southwest of Lizard Creek in Wongawilli West - Area 3.

Surface Water Element

- Unacceptable subsidence effects on Cataract Creek above Wongawilli East – Area 1.
- Unacceptable subsidence effects on Cataract Creek above Wongawilli East – Area 2.
- Unacceptable subsidence effects on main channel of Lizard Creek above Wongawilli West on the boundary between Areas 3 and 4.
- Unacceptable subsidence effects on 1st to 3rd order tributaries of Wallandoola Creek above Wongawilli West - Area 3.
- Unacceptable subsidence effects on main channel of Wallandoola Creek above Wongawilli West - Area 3.
- Unacceptable subsidence effects on 1st to 3rd order tributaries of Lizard Creek above Wongawilli West.

Groundwater Element

- Unacceptable impacts on groundwater resource as a result of mining.

Archaeology and Heritage Element

- Unacceptable impacts on archaeological and/or heritage items as a result of mining subsidence.

Surface Features

- Unacceptable impact on surface features above mining areas.

Step 3. For all the potential failure modes, the effect on the system as a whole and the relative importance of those effects was determined by the appropriate expert present in the FMEA meeting. The effects were predicted based on the assumption that all proposed ameliorative actions had been implemented. The objective was to identify risks that had been overlooked or that were still significant subsequent to ameliorative action. The prediction of effects was achieved by discussion and a consensus was reached before moving on to the next effect. There was additional discussion subsequent to the meeting to clarify some matters.

Step 4. A Critical Analysis was undertaken for each failure mode utilising the Assessment Matrix shown in Table 1.

Step 5. A response was developed for each failure mode that received a higher risk ranking than Low-Medium based on the matrix in **Table 1.**

Table 1. Risk Assessment Matrix.

FREQUENCY	**SEVERITY**		
	Low	**Medium**	**High**
High	Medium Risk	Medium-High Risk	High Risk
Medium	Low-medium Risk	Medium Risk	Medium-High Risk
Low	Low Risk	Low-medium Risk	Medium Risk

The response was based on the following three categories:

(a) The means of preventing the failure by design, operating and maintenance practices and management.

(b) The means of detecting the failure and responding effectively to it, and

(c) The means (if any) of limiting the impact of the failure, particularly by design change, and,

The ultimate outcome of the response was a recommended action.

In response, NRE will ensure that all recommended actions are implemented to improve environmental management of the mining proposal.

Discussion among the participants to identify any environmental effects that had not been listed for discussion during the FMEA occurred as part of Step 2. This was also repeated at the conclusion of the FMEA. All participants in the FMEA were satisfied that all potential predictable effects had been addressed.

Table 2 identifies the participants in the original review FMEA (2009) and their area of expertise.

Table 2. FMEA Participants (2009)

Participant	**Organisation**	**Area of Expertise**

Dr Chris Harvey	NRE	Mining Engineering and Environment
Danyil Skora	NRE	Environment
Don Jephcott	NRE	Environment
Kris Markowski	NRE	Mine Planning
Bronte Blay	NRE	Project Management
Dr Ross Seedsman	Seedsman Geotechnics	Mine Subsidence
Dr Andrew Dawkins	Geoterra	Surface Water and Groundwater
Mike Shelly	ERM	Environmental Planning
Christine Allen	ERM	Environmental Planning
Mark Benson	ERM	Flora and Fauna
Luke Baker	ERM	Archaeology
Doug Hazell	Cardno Ecology Lab	Aquatic Ecology
David Olsen	OCG	Risk Assessment and Environment

3. OUTCOMES, FINDINGS AND RECOMMENDATIONS

During the FMEA meeting a worksheet was completed for each identified Possible Failure Type. A complete set of worksheets is included in **Appendix I**.

The Worksheets identify the following:

- Element,
- Possible Failure Type,
- Effect on System of that Failure Type,
- A Criticality Analysis that provides a ranked risk,
- Planned Responses to effect with a risk rating higher than Low - Medium, and,
- Recommended Actions.

It is considered that any effect rated to have a Low - Medium Risk or lower does not require any further Planned Responses.

Planned Responses have been developed and will be implemented for those effect rated to have a risk higher than Low - Medium.

The identified Effects requiring a Planned Response are listed in **Table 3** together with the proposed responses. Note that the number of the Identified Effect is the number from the relevant Worksheet in the Appendix.

Table 3. Identified Effects with a Risk above Low and Proposed Responses

Identified Effect	Risk	Proposed Response and Recommended Action.
2.4. Adverse impact on the habitat of the aquatic threatened species (Macquarie Perch) above Wongawilli East – Area 2 resulting in interruption to/loss of spawning cycles.	Medium	Cardno Ecology Lab to undertake necessary field work to determine whether Macquarie Perch is present in Creek.
3.2. Loss of maternity and roost sites for a local cave-roosting population of the threatened Eastern Bent-wing Bat.	Medium	Design monitoring activity to enable better prediction of the effects of mine subsidence on potential roost sites.
3.5. Potential adverse subsidence effects on specific highly significant upland swamp and associated creek (Frog Swamp and Frog Creek) resulting in loss of breeding habitat for the Giant Burrowing Frog (*Heleioperous australiacus*)..	High	ERM to undertake field studies to ascertain extent and condition of species habitat.
7.5. Disturbance to tributary standing pools in tributaries to Wallondoola Creek above Wongawilli West Area 3. Adverse impacts are not likely.	Medium	Implement appropriate monitoring program to confirm subsidence predictions. Mine plan has already been modified to minimise effects on major structures.
9.6 Disturbance to tributary standing pools in 1st to 3rd order tributaries of Lizard Creek above Wongawilli West.	Medium	Ensure appropriate monitoring program is in place prior to mining in these areas.
10.5 Failure of Bald Hill Claystone due to mine subsidence leading to potential draining of Hawkesbury Sandstone aquifer through the Claystone and through underlying lithologies to workings.	Medium	Undertake appropriate monitoring to ascertain whether this type of failure has occurred. Will enhance future modelling predictions.
10.6. Mine subsidence leading to potential draining of lower to middle Bulgo Sandstone aquifer and underlying aquifers through goaf to workings.	Medium	Undertake appropriate monitoring to ascertain whether this type of failure has occurred. Will enhance future modelling predictions.
11.3. Rock shelters without art – Wongawilli East – Area 2. Potential impacts Collapse of rock shelter, cracking, changed conditions relating to water exposure.	Medium	Detailed monitoring prior to mining in conjunction with improved subsidence monitoring base. Should failure be predicted, suitable response can be developed at the time eg physical support of overhang. Rating all sites for scientific significance and potential damage. Detailed monitoring prior to mining in conjunction with improved subsidence monitoring base. Should failure be predicted, suitable response can be developed at the time eg physical support of overhang.
11.5. Mine subsidence resulting in collapse of rock shelter along major creeks and their tributaries (Lizard Creek and Wollondoola Creek) in Wongawilli West – Areas 3 and 4.	Medium	Detailed monitoring prior to mining in conjunction with improved subsidence monitoring base. Should failure be predicted, suitable response can be developed at the time eg physical support of overhang.

4. SUBSEQUENT FMEA REVIEW 2011

Subsequent to the 2009 FMEA, mining subsidence information was updated. An additional FMEA meeting and process was undertaken to assess whether the updated mining subsidence information had any effect on the conclusions of the original FMEA.

Table 4 lists the participants in the subsequent FMEA (2011) process.

Table 4. Subsequent FMEA (2011) Participants.

Participant	Organisation	Area of Expertise
Dr Chris Harvey	NRE	Mining Engineering and Environment.
Danyil Skora	NRE	Environment.
Don Jephcott	NRE	Environment.
Dr Ross Seedsman	Seedsman Geotechnics	Mine Subsidence.
Dr Andrew Dawkins	Geoterra	Surface Water and Groundwater.
Mike Shelley	ERM	Environmental Planning.
Christine Allen	ERM	Environmental Planning.
Sarah Xiang	ERM	Environment.
Theresa Dye	Cardno Ecology Lab	Aquatic Ecology.
David Olsen	OEC	Risk Assessment and Environment.

Participants had received the updated mine subsidence information prior to the meeting. Additional subsidence information was circulated after the meeting and participants were given the opportunity to comment on the likely effects of all information.

At the meeting Dr Ross Seedsman presented his mine subsidence data. Then Christine Allen presented details on the implications of that data and any additional flora, fauna and archaeological studies that had been undertaken since the December 2009 FMEA. Dr Andrew Dawkins discussed the implications of the modified subsidence parameters on surface water and ground water aspects of the proposed activities. Theresa Dye addressed aquatic ecology implications.

The following comments and conclusions summarise the outcome of the subsequent FMEA:

1. Dr Seedsman subsidence assessment has been reviewed by MSEC and SCT. In addition it has been reviewed by Pells Consulting and Professor van de Merwe.

2. Subsidence predictions in the Wongawilli West areas are unchanged from those used in the December 2009 FEMA. There are changes in some areas of the eastern Wongawilli areas.

3. Detailed cumulative impacts cannot be determined because pre-mining data is not available.

4. The modified subsidence predictions do not affect any identified archaeological items and the findings of the December 2009 FEMA are not changed.

5. Christine Allen emphasized the need to assess the likely impacts on swamps over Longwalls 4 and 5 in Wongawilli East. OEH have commented that there are more swamps in this area than identified in the original flora assessment and subsequent to the original assessment, swamps have received an interim EEC listing. In addition OEH requested that criteria used in the Bulli Seam PAC be applied to assess likely impact on the swamps and any streams associated with the swamps. Later in the meeting the validity of using these criteria for impact assessment was rejected following a more detailed reading of the Bulli Seam PAC Report (Refer Outcome 9).

6. Dr Andrew Dawkins addressed the likely effects of the modified subsidence impacts on surface water and groundwater. In relation to groundwater there is no change to the predictions used in the December 2009 FEMA. There are no changes to subsidence predictions in Wongawilli and the changes determined in the Wongawilli East area do not change predicted groundwater impacts in that area. Once subsidence data has been provided for the Wongawilli East No 1 area (Refer Outcome 2) Dr Dawkins will comment on the likely groundwater effects associated with those modified predictions. Dr Dawkins made similar observations in relation to surface water. However he did emphasize the additional swamps and associated streams in conjunction with the more stringent impact assessment criteria be requested by OEH.

7. Subsequent to and during the presentations by Christine Allen and Dr Dawkins, there was a lot of discussion about the implications of applying these criteria to the swamps and streams. It was agreed that the predicted subsidence is unlikely to have a significant impact on the swamps. This view was based on observed behaviour of subsided swamps in the region. Strict application of the criteria as requested by OEH would likely result in not achieving the required outcome of "negligible impact". However, and very importantly, closer examination of the Bulli Seam PAC confirmed that these criteria were to be used to determine only whether swamps should be assessed rather than be used as criteria to assess acceptable impacts (Refer Footnote 2.2.7 @ p 143 of Bulli Seam PAC Report).

8. Given this clarification of the correct use of the Bulli Seam PAC criteria, ***it was agreed that a data matrix be developed by ERM for all the identified swamps. This data would include predicted subsidence and any information on the environment of the swamp. The matrices would be used to determine likely impact on the swamp. The Bulli Seam PAC criteria determine that all the swamps should be assessed. The collated data in the matrices will be used by appropriate participants to determine likely impact. This will enable the currently predicted impacts to be compared to those used in the December 2009 FEMA.***

9. ***In addition NRE would search for subsidence and ecological data associated with swamps subsided by mining in the Woronora Plateau environment that could be used to support the environmental impact assessment of the swamps above the proposed Wongawilli mining areas.***

10. Theresa Dye commented that the modified subsidence data did not change the impacts and outcomes discussed in the December 2009 FEMA.

11. All agreed that the proposed mining would not affect the original assessments associated with mining beneath the Shale Transition Forest above Wongawilli West Area 3.

The overall conclusion was that the findings of the original FMEA are still valid and are not affected by the modifications to the mining subsidence information provided subsequent to the original FMEA review and report.

APPENDIX

FAILURE MODE AND EFFECT ANALYSIS

MEETING WORKSHEETS

FAILURE MODE AND EFFECTS ANALYSIS

Element	Possible Failure Type	Effect on System	Criticality Analysis	Planned Response			Recommended Actions
				Prevent by design/management	Detection and response	Limit Impacts	
Flora and Fauna	1. Unacceptable impact on ecological significant areas above first 3 longwall blocks in **Wongawilli East - Area 1**.	1.1 Upland swamp is damaged through subsidence resulting in loss of water holding capacity. Note that the upland swamp is not a listed EEC, but is in good condition!	Freq: Low Sev: Low **LOW**				Visual inspection and seasonal report on swamp habitat pre-mining and post mining.
		1.2 Damage to threatened species habitat for *Darwinia grandiflora* that has have been identified in the area.	Freq: Low Sev: Low **LOW**				Visual inspection and seasonal report on swamp habitat pre-mining and post mining.
		1.3 Adverse impact on the aquatic ecology due to subsidence impacts in the stream. Expert ecologist has determined that given the proposed mining proposals there are no concerns.	Freq: Low Sev: Low **LOW**				Seasonall monitoring of aquatic ecology pre-mining and post-mining.

FAILURE MODE AND EFFECTS ANALYSIS

Element	Possible Failure Type	Effect on System	Criticality Analysis	Planned Response			Recommended Actions
				Prevent by design/management	Detection and response	Limit Impacts	
Flora and Fauna	2. Unacceptable impact on ecological significant areas above last 8 longwall blocks in **Wongawilli East - Area 2**.	2.1 Cataract Creek Damage to individuals, the population and habitat of the Stuttering Barred Frog (*Mixophyes balbus)* in Cataract Creek. The potential impact on this species is required to be assessed under TSC Act and EPBC Act using the accredited process.	Freq: Low Sev: Low **LOW**				Visual inspection and seasonal report on swamp habitat pre-mining and post-mining. Targetted monitoring of Stuttering Barred Frog
		2.2 Upland swamp subject to subsidence impacts resulting in loss of water holding capacity, and thus potential habitat for threatened species.	Freq: Low Sev: Low **LOW**				Visual inspection and seasonal report on swamp habitat pre-mining and post-mining.
		2.3 Adverse impact on threatened fauna species identified in the area including Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis)* and their habitat	Freq: Low Sev: Low **LOW**				Seasonal reporting on Threatened Fauna species pre-mining and post-mining.
		2.4 Adverse impact on the habitat of the aquatic threatened species (Macquarie Perch) resulting in interuption to/loss of spawning cycles.	Freq: Low Sev: Med **LOW-MED**	Current Mine Plan minimises subsidence in Cataract Creek.	Undertake additional site investigations and monitoring to determine presence of species in Cataract Creek.		Cardno Ecology Lab to undertake necessary field work to determine whether Macquarie Perch is present in Creek.
		2.5 General loss/degradation of aquatic habitat due to subsidence effects.	Freq: Low Sev: Low **LOW**				Continue monitoring of aquatic habitat pre-mining and post-mining.

FAILURE MODE AND EFFECTS ANALYSIS

Element	Possible Failure Type	Effect on System	Criticality Analysis	Planned Response			Recommended Actions
				Prevent by design/management	Detection and response	Limit Impacts	
Flora and Fauna	3. Unacceptable impact on ecological significant areas above 5 longwall blocks southwest of Lizard Creek ie. **Wongawilli West - Area 3**	3.1 Loss of EEC (Shale Sandstone Transition Forest in the Sydney Basin Bioregion) due to excessive tilting that would cause death of vegetation and alter the forest structure.	Freq: Low Sev: Low **LOW**				Visual inspection and seasonal reporting on forest conditions.
		3.2 Loss of maternity and roost sites for a local cave-roosting population of the threatened Eastern Bent-wing Bat.	Freq: Low Sev: High **MED**	Current mine plan reduces impacts along major drainage lines coincident with roost site locationsS.	Subsidence monitoring during mining will generate actual subsidence data that will enable more accurate prediction of likely mine subsidence impacts.		Design monitoring activity to enable better prediction of the effects of mine subsidence on potential roost sites.
		3.3 Loss of local population of swamp dependant species including Southern Emu-wren (*Stripituris malachurus*) or Eastern Pygmy Possum (Cercartetus nanus)..	Freq: Low Sev: Low **LOW**				Visual inspection and seasonal report on swamp habitat pre-mining and post-mining. Targetted monitoring of identified key species.
		3.4 Loss of threatened species habitat within upland swamps within the Wallandoola Cluster, due to loss of water holding capacity.	Freq: Low Sev: Low **LOW**				Visual inspection and seasonal report on swamp habitat pre-mining and post-mining. Targetted monitoring of identified key species.
		3.5 Potential adverse subsidence effects on specific highly significant upland swamp and associated creek (Frog Swamp and Frog Creek) resulting in loss of breeding habitat for the Giant Burrowing Frog (*Heleioperous australiacus*).	Freq: High Sev: High **HIGH**		Collect more information about species habitat to enable more accurate prediction of impacts.		ERM to undertake field studies to ascertain extent and condition of species habitat.
		3.6 Adverse subsidence impact resulting in loss of local breeding habitat forthreatened species of frog ((Little John's Frog (*Litoria littlejohni*) and Red-crowned Toadlet)).	Freq: Low Sev: Low **LOW**				Visual inspection and seasonal reporting on specific frog species pre-mining and post-mining.
		3.7 Adverse subsidence impact resulting in loss of wintering for threatened rock-dwelling threatened reptiles ((Rosenberg's Goanna (*Varanus rosenberg*) and Broad-headed Snake (*Hoplocephalus bungaroides*)).	Freq: Low Sev: Low **LOW**				Visual inspection and seasonal reporting on rock dwelling reptiles pre-mining and post-mining.
		3.8 Adverse subsidence impacts resulting in loss of aquatic habitat in Lizard Creek. It is noted that this is currently degraded habitat.	Freq: Low Sev: Low **LOW**				Continue monitoring of aquatic habitat in Lizard Creek pre-mining and post-mining
		3.9 Adverse subsidence impacts resulting in loss of aquatic habitat in Wollondoola Creek.	Freq: Low Sev: Med **LOW-MED**				Continue monitoring of aquatic habitat in Wallandoola Creek pre-mining and post-mining.

FAILURE MODE AND EFFECTS ANALYSIS

Element	Possible Failure Type	Effect on System	Criticality Analysis	Planned Response			Recommended Actions
				Prevent by design/management	Detection and response	Limit Impacts	
Surface Water	4. Unacceptable subsidence effects on Cataract Creek above **Wongawilli East - Area 1**.	4.1 Volumetric stream flow to Cataract Dam reduced. Not predicted to occur.	Freq: Low Sev: Low **LOW**				Flow monitoring in Cataract Creek.
		4.2 Stream water quality adversely impacted. Not predicted to occur.	Freq: Low Sev: Low **LOW**				Water quality monitoring in Cataract Creek.
		4.3 Stream connectivity interupted due to sibsidence. Not predicted to occur.	Freq: Low Sev: Low **LOW**				
		4.4 Integrity of standing pools interupted due to mine subsidence. Not predictedto occur.	Freq: Low Sev: Low **LOW**				Monitoring of water levels in selected pools.

FAILURE MODE AND EFFECTS ANALYSIS

Element	Possible Failure Type	Effect on System	Criticality Analysis	Planned Response			Recommended Actions
				Prevent by design/management	Detection and response	Limit Impacts	
Surface Water	5. Unacceptable subsidence effects on Cataract Creek above **Wongawilli East - Area 2**.	5.1 Reduction to volumetric stream flow to Cataract Dam. Not predicted to occur due to historical data and prediction of <300mm subsidence.	Freq: Low Sev: Low **LOW**				Monitoring stream flow in Cataract Creek.
		5.2 Swamp seepage to Cataract Creek resulting in adverse water quality impact. No adverse effects based on predicted <300mm subsidence.	Freq: Low Sev: Low **LOW**				Monitoring stream flow in Cataract Creek.
		5.3 Adverse effects on stream water quality. Existing stream TDS-50mg/L with no prediction of significant increase in salinity.	Freq: Low Sev: Low **LOW**				Water quality monitoring in Cataract Creek.
		5.4 Interuption to stream connectivity. No adverse impacts likely based on predicted <300mm subsidence.	Freq: Low Sev: Low **LOW**				
		5.5 Adverse effects on standing pools due to mine subsidence. No pools identified except closer to the dam - 'back water'; dam levels are rainfall dependent and dam water management effects 'back water' height / position.	Freq: Low Sev: Low **LOW**				Monitoring water levels in selected pools.

FAILURE MODE AND EFFECTS ANALYSIS

Note: a 1.3km and 1km section/s of Lizard creek has experienced loss of water.

Element	Possible Failure Type	Effect on System	Criticality Analysis	Planned Response			Recommended Action		
				Prevent by design and/or management	Detection and response	Limit Impacts			
Surface Water	6. Unacceptable subsidence effects on main channel of Lizard Creek above **Wongawilli West on the boundary between Areas 3 and 4**. Effects determined on the basis the main creek channel is not undermined but may undergo some creek bed uplift.	6.1 Reduced volumetric stream flow to Cataract River / SCA water supply. No adverse flow volume effects monitored although non-quantitative observations indicate no loss of flow to date and none predicted for future.	Freq: Low Sev: Low **LOW**				Monitoring stream flow in Lizard Creek.		
		6.2 Adverse effect on water quality in previously unaffected areas. Significant iron hydroxide precipitation / minor salinity increase / low dissolved metal increase recorded to date.	Freq: Low Sev: Medium **LOW - MEDIUM**				Monitoring water quality in Lizard Creek.		
		6.3 Adverse interuption to stream connectivity in previously unaffected areas. Two sections (1.3km and 1km) of Lizard Creek bed dry from previous mining but it is interpreted that all water flows along creek catchment (as shallow groundwater) in cracked sections.	Freq: Low Sev: Medium **LOW - MEDIUM**						
		6.4 Adverse effects on standing pools in previously unaffected areas.	Freq: Low Sev: Medium **LOW - MEDIUM**				Monitoring selected pools.		
		6.5 Adverse effects on Waterfall L1. No adverse effects, impacts or consequences anticipated as less than 0.04m of subsidence is predicted at Waterfall L1.	Freq: Low Sev: Medium **LOW - MEDIUM**						

FAILURE MODE AND EFFECTS ANALYSIS

Note: Some significant loss of tributary stream pools observed.

Element	Possible Failure Type	Effect on System	Criticality Analysis	Planned Response			Recommended Actions
				Prevent by design/manageme	Detection and response	Limit Impacts	
Surface Water	7. Unacceptable subsidence effects on 1st to 3rd order tributaries of Wallandoola Creek above **Wongawilli West - Area 3**. Note: There are no data that measures previous mining effects on Lizard Creek.	7.1 Reduced volumetric flows in tributaries to Cataract River / SCA water supply. There is potential upsidence of tributary creek beds with potential enhanced drainage from individual pools.	Freq: Medium Sev: Low **LOW - MEDIUM**				Monitoring stream flow in Wallandoola Creek.
		7.2 Reduced swamp seepage volume and water quality to Wallandoola Creek resulting in reduced stream flow or adverse water quality in Wallandoola Creek. This is not anticipated.	Freq: Low Sev: Low **LOW**				Monitoring stream flow in Wallandoola Creek.
		7.3 Adverse effect on tributary water quality. Salinity increase in downstream direction already evident, but may not be due to mining. Downstream of water seep inflow points, water quality is highly reducing and iron staining is visible. Low potential of adverse effects is predicted.	Freq: Low Sev: Medium **LOW-MEDIUM**				Water quality monitoring in Wallandoola Creek.
		7.4 Interuptions to connectivity along tributary channel to Wallandoola Creek. Adverse impacts are not likely.	Freq: Medium Sev: Low **LOW - MEDIUM**				
		7.5 Disturbance to tributary standing pools. Adverse impacts are not likely.	Freq: Low Sev: High **MEDIUM**		Confirm prior to mining using monitoring data obtained as mining progresses.		Implement appropriate moitoring program to confirm subsidence predictions. Mine plan has already been modified to minimise effects on major structures.
		7.6 Reduced volumetric flows from tribitaries to Wallondoola Creek and subsequently to Cataract River/SCA water supply. There is potential upsidence of tributary creeks with poitwential enhanced drainage from individual pools. However, no adverse impacts are anticipated to volumetric flows to the Cataract River/Broughton Pass Weir	Freq: Low Sev: Low **LOW**				

FAILURE MODE AND EFFECTS ANALYSIS

Element	Possible Failure Type	Effect on System	Criticality Analysis	Planned Response			Recommended Actions
				Prevent by design and/or management	Detection and response	Limit Impacts	
Surface Water	8. Unacceptable subsidence effects on main channel of Wallandoola Creek above **Wongawilli West - Area 3**. Effects assessed on the basis the main creek channel is not undermined but may undergo some creek bed uplift.	8.1 Reduction in volumetric stream flow. No adverse stream flow effects recorded to date. No predicted future adverse effects.	Freq: Low Sev: Low **LOW**				Monitoring stream flow in Wallandoola Creek
		8.2 Reduced stream water quality resulting in iron hydroxide precipitation / salinity increase / presence of dissolved metals.	Freq: Low Sev: Medium **LOW - MEDIUM**				Monitoring water quality in Wallandoola Creek.
		8.3 Interuption to stream connectivity. Stream currently connected top to bottom; no adverse impacts likely.	Freq: Low Sev: Medium **LOW - MEDIUM**				
		8.4 Adverse effects on standing pools. No impacts to rock bar are anticipated therefore it's predicted there will be no adverse effects to pools.	Freq: Low Sev: Medium **LOW - MEDIUM**				Monitoring selected pools.
		8.5 Adverse effects on Waterfall W1. No adverse subsidence effects, impacts or consequences are anticipated at or downstream of W1 due to less than 20mm of predicted subsidence.	Freq: Low Sev: Medium **LOW - MEDIUM**				

FAILURE MODE AND EFFECTS ANALYSIS

Note: Some significant loss of tributary stream pools observed.

Element	Possible Failure Type	Effect on System	Criticality Analysis	Planned Response			Recommended Actions
				Prevent by design/management	Detection and response	Limit Impacts	
Surface Water	9. Unacceptable subsidence effects on 1st to 3rd order tributaries of Lizard Creek above **Wongawilli West**.	9.1 Reduced volumetric flows in tributaries. There is potential upsidence of tributary creek beds with potential enhanced drainage from individual pools.	Freq: Low Sev: Medium **LOW -MEDIUM**				Flow monitoring in Lizard Creek.
		9.2 Reduced volumetric flows in tributaries to Lizard Creek and subsequently to Cataract River / SCA water supply. There is potential upsidence of tributary creek beds with potential enhanced drainage from individual pools. However, no adverse impacts are anticipated to volumetric flows to the Cataract River / Broughtons Pass Weir.	Freq: Low Sev: Low LOW				Flow monitoring in Lizard Creek.
		9.3 Reduced swamp seepage volume and water quality to Lizard Creek resulting in reduced stream flow or adverse water quality in Lizard Creek. This is not anticipated.	Freq: Low Sev: Low **LOW**				Flow monitoring in Lizard Creek.
		9.4 Adverse effect on tributary water quality. Salinity increase in downstream direction already eveident, but may not be due to mining. Downstream of water seep inflow points, water quality is highly reducing and iron staining is visible. Low potential of adverse effects is predicted.	Freq: Low Sev: Medium **LOW-MEDIUM**				Water quality monitoring in Lizard Creek
		9.5 Interuptions to connectivity along tributary channel to Lizard Creek. Adverse impacts are not likely.	Freq: Medium Sev: Low **LOW - MEDIUM**				
		9.6 Disturbance to tributary standing pools. Adverse impacts are possible	Freq: Low Sev: High **MEDIUM**		Monitoring of prior longwalls will enable better prediction of likely impacts. Appropriate actions determined at that time.		Ensure appropriate monitoring program is in place prior to mining in these areas.

FAILURE MODE AND EFFECTS ANALYSIS

Element	Possible Failure Type	Effect on System	Criticality Analysis	Planned Response			Recommended Actions
				Prevent by design/management	Detection and response	Limit Impacts	
Ground Water	10. Unacceptable impacts on groundwater resource as a result of mining.	10.1 Adverse effect on tributary stream flow due to loss of shallow groundwater due to seepage induced by subsidence. Tributaries primarily dependent on rainfall not groundwater although base flow may come from groundwater.	Freq: Medium Sev: Low **LOW - MEDIUM**				Continual monitoring of groundwater levels pre-mining and post-mining.
		10.2 Adverse effect on main stream flow out of lease area due to loss of groundwater due to subsidence induced seepage. Mainstreams protected with proposed mine layout. No groundwater loss to to discharge out of system via streams.	Freq: Low Sev: Low **LOW**				Continual monitoring of groundwater levels pre-mining and post-mining.
		10.3 Reduction of up to 10m to 20m in upper Hawkesbury Sandstone aquifer, with subsequent recovery. Expect groundwater to re-establish. Protection provided to main channels via mine plan.	Freq: Medium Sev: Low **LOW - MEDIUM**				Continual monitoring of groundwater levels pre-mining and post-mining.
		10.4 Flow to main streams may be adversely affected as a result of swamp drainage. Valley infill swamps are aligned with 3rd order streams which are protected by mine layout. Headwater swamps located on 1st and 2nd order tributaries over the proposed workings.	Freq: Low Sev: Low **LOW**				Continual monitoring of groundwater levels pre-mining and post-mining.
		10.5 Failure of Bald Hill Claystone due to mine subsidence leading to potential draining of Hawkesbury Sandstone aquifer through the Claystone and through underlying lithologies to workings. Potential for Bald Hill Claystone to fail is low.	Freq: Low Sev: High **MEDIUM**		Monitor groundwater at time of mining to confirm incident.		Undertake appropriate monitoring to ascertain whether this type of failure has occurred. Will enhance future modelling predictions.
		10.6 Mine subsidence leading to potential draining of lower to middle Bulgo Sandstone aquifer and underlying aquifers through goaf to workings. Depressurisation focussed over proposed workings in maximum subsidence areas.	Freq: Low Sev: High **MEDIUM**		Monitor groundwater at time of mining to confirm incident.		Undertake appropriate monitoring to ascertain whether this type of failure has occurred. Will enhance future modelling predictions.

FAILURE MODE AND EFFECTS ANALYSIS

Note: concentration of sites around main water ways

Element	Possible Failure Type	Effect on System	Criticality Analysis	Planned Response			Recommended Actions
				Prevent by design/management	Detection and response	Limit Impacts	
Archaeology and Heritage	11. Unacceptable impacts on archaeological and/or heritage items as a result of mining induced subsidence.	11.1 Artefact scatter - Wongawilli East - Area 1. Potential impacts: Disturbance of archaeological integrity through subsidence.	Freq: Low Sev: Low **LOW**				
		11.2 Rock shelters with art - Wongawilli East - Area 2. The location of these rock shelters have been confirmed as different to those originally identified in previous study.	Freq: Low Sev: Low **LOW**				
		11.3 Rock shelters without art - Wongawilli East - Area 2. Potential impacts: Collapse of rock shelter, cracking, changed conditions relating to water exposure.	Freq: Med Sev: Med **MED**	Prediction of damage ahead of subsidence impossible to predict.	Detailed monitoring prior to mining in conjunction with improved subsidence monitoring base. Should failure be predicted, suitable response can be developed at the time eg physical support of overhang.	Early detection of changes to integrity of roavk shelter stability. Any subsidence movement in the vicinity of rock shelters to be immediately evaluated by Gujarat staff and a qualified cultural heritage advisor.	Rating of all sites (low, medium, high) for scientific significance and potential damage. Detailed monitoring prior to mining in conjunction with improved subsidence monitoring base. Should failure be predicted, suitable response immediately developed eg physical support of overhang.
		11.4 Grinding grooves identified in Wongawilli East - Area 2. Potential impacts: cracking of large sandstone blocks.	Freq: Low Sev: Low **LOW**				
		11.5 Mine subsidence resulting in collapse of rock shelters along major creeks and their tributaries (Lizard Creek and Wollondoola Creek) in Wongawilli West - Areas 3 and 4.	Freq: Med Sev: Med **MED**	Avoidance of subsidence impact areas for site adjacent to the Cataract Dam - completed. Prediction of damage for remaining sites ahead of subsidence impossible to predict.	Detailed monitoring prior to mining in conjunction with improved subsidence monitoring base. Should failure be predicted, suitable response can be developed at the time eg physical support of overhang.	Early detection of changes to integrity of rock shelter stability. Any subsidence movement in the vicinity of rock shelters to be immediately evaluated by Gujarat staff and a qualified cultural heritage advisor.	Detailed monitoring prior to mining in conjunction with improved subsidence monitoring base. Should failure be predicted, suitable response can be developed at the time eg physical support of overhang.
		11.7 Mine subsidence resulting in damage to the natural water fall feature on Lizard Creek in Wongawilli West - Area 3.	Freq: Low Sev: Med **LOW-MED**				

Annex G

Pillar Run

STRATA ENGINEERING (Australia) Pty Ltd
Consulting and Research Engineering

A.B.N. 26 074 096 263

29 October 2012

Dr. Chris Harvey
Head of Corporate Relations
NRE No. 1 Colliery
Gujarat NRE Coking Coal Limited
PO Box 281
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Report No. 06-001-NRE-2

Chris

Re: The Potential for a Pillar Run in the Balgownie and Bulli Seams following the Extraction of the Wongawilli East Longwall Panels

In regard to the above, the main points of note are as follows:

1. **The main point to be considered in this assessment is whether, following the extraction of the proposed Wongawilli East longwalls, the pillars in the overlying Balgownie and Bulli seams will fail in a catastrophic manner and in doing so, induce a pillar run in the barrier pillar located below Mt. Ousley Road (see Figure 1)** – note: a) the Wongawilli East longwalls are located in the Wongawilli Seam and in the areas considered in this assessment, at an approximate depth of 260 to 340m, b) the workings in the Balgownie Seam are located approximately 20m above the proposed extraction horizon in the Wongawilli Seam and are characterised by first workings pillars and longwall panels (see **Figure 2**), c) the workings in the Bulli Seam are located approximately 30m above the proposed extraction horizon in the Wongawilli Seam and are characterised by first workings pillars and pillar extraction panels (see **Figure 3**) and d) for the purpose of this assessment, the term "pillar run" refers to a large-scale catastrophic pillar failure.

2. **In regard to the recommended design standards, the following are of relevance to an assessment such as this where the main aim is to ensure that the pillars remain in a stable long-term condition:**

   (i) The combined Factor of Safety (FoS) and width to height (w/h) ratio of the pillar should exceed the Design Limit Line shown on the failed pillar database (see Figure 4) – note: a) the database contains 73 cases where the pillars in question were of a known geometry and were subjected to a quantifiable overburden load, b) it is also reasonable to assume that accepting that the pillars did not fail as a result of excessively weak roof or floor material, the database is almost certainly representative of a wide range of roof and floor conditions, c) a back analysis of case histories in Australia and South Africa indicates that in addition to the pillar's FoS, w/h ratio exerts a major influence on pillar stability (**Hill, 2010**), d) at low ratios (<3) overloaded pillars tend to collapse in a brittle, uncontrolled manner, whereas at higher ratios (>4) overloaded pillars exhibit a more plastic form of deformation and are able to maintain some load bearing capability and e) as a means of conservatism, the Design Limit Line adds a 20% buffer to the Limit Line of Known Failed Cases shown in **Figure 4**.

(ii) A minimum w/h ratio of >5 – note: a) it is generally recognised that squat pillar behaviour, where the pillar exhibits a more plastic form of deformation under extreme load, starts at a w/h ratio of 4 and is fully established at a w/h ratio of >5 and b) in the abovementioned database, there is only one failed case with a w/h ratio of >5.

(iii) A minimum FoS of 2.11 – note: a) using the pillar strength formula used in this report (see point 6), this will result in a maximum Probability of Failure of 1 in a million (**Salamon *et al*, 1996**) and b) although the Design Limit Line is normally deemed adequate for the purpose of long-term stability, in those cases where the pillars of interest are located under sensitive surface features, a minimum FoS of 2.11 is deemed prudent.

Critically, there is no known precedent for pillar failure where pillars have been designed to these combined criteria.

3. The areas considered in this assessment were selected by the mine site and in each case, a representative number of pillars have been assessed to cater for the anticipated worst case loading scenario (see Figures 2 and 3) – note: a) as shown in **Figure 5**, the 0.8 to 1.4m of surface subsidence recorded following the extraction of LW's 5 to 11 in the Balgownie Seam indicates that unless shown otherwise, any remnants left in the Bulli Seam have in all likelihood crushed out (see **Figure 6** which shows that the 0.8 to 1.4m of subsidence plots above the maximum subsidence prediction line proposed for the Southern Coalfield) and b) accepting that the Balgownie Seam is around 1.3m thick, the data points shown in **Figure 6** conservatively assume that (for practical reasons) the longwalls were cut to a nominal height of 1.8m.

4. As part of the Balgownie Seam assessment, the following inputs were used (see Figure 2):

Area	Pillar No.	Length	Width	Depth of Cover	Assumed Loading
A	1	39.6m*	30.1m*	250m	T + A(BAL)
	2	84.8m	29.9m	240m	T + A(WGA)
	3	39.4m*	37.9m*	240m	T + A(WGA)
B	1	41.6m	39.2m	280m	T + 2A(BAL)
	2	41.6m*	38.3m	290m	T + 2A(BAL)
	3	41.6m*	39.2m	290m	T + 2A(BAL)
C	1	100m**	40.3m	340m	T + 1.5A(BAL)
D	1	42.2m	39.6m	320m	T + A(BAL)
E	1	55.3m*	17.4m*	240m	T + A(BAL)
	2	38.9m	17.3m	240m	T + A(WGA)
	3	17.1m	16.4m	240m	T + 0.5A(BUL)
	4	28.5m***	28.5m***	240m	T + A(BUL)
	5	16.5m	16.2m	240m	T + (0.5A x R)(BUL)
	6	31.3m*	25.4m*	240m	T + A(BUL)
	7	64.7m*	31.2m*	240m	T + A(BUL)

	8	94.7m*	29.8m*	240m	T + (A x R)(BUL)
	9	52.1m*	30.1m*	240m	T + (A x R)(BUL)

Note:
(i) All pillar dimensions are solid rib-to-rib dimensions.
(ii) In all cases, the maximum Depth of Cover has been used, and a roadway height of 2m and roadway width of 5.5m have been assumed.
(iii) * - as the pillar is not rectangular, the average pillar width / length has been used.
(iv) ** - as the actual length of the pillar is >100m, in order to ensure that the length of the pillar remains close to the confines of the database on which the pillar formulae used in this report were based, a 100m long solid pillar has been assumed.
(v) *** - as the pillar is highly irregular, both the width and length are based on the hydraulic radius of the pillar (i.e., 4 x area / circumference).
(vi) (BAL) – indicates the seam in which the maximum abutment loading condition has been assessed.

5. As part of the Bulli Seam assessment, the following inputs were used (see Figure 3):

Area	Pillar No.	Length	Width	Depth of Cover	Assumed Loading
A	1	100m**	21.3m*	230m	T + (0.5A x R)(BUL)
	2	52.5m	11.8m*	230m	T + 0.5A(BUL)
	3	70.7m*	23.7m	230m	T + (0.5A x R) (BUL)
	4	100m**	21.7m	230m	T + (A x R) (BUL)
	5	62.4m*	14.4m	230m	T + (A x R)(BUL)
	6	56.2m*	14m	230m	T(BUL)
	7	100m**	23.3m	230m	T(BUL)
	8	70.1m*	26.7m	230m	T(BUL)
B	1	62.4m*	14.2m	330m	T + A(BAL)
	2	36.1m*	14.3m	330m	T + 0.5A(BAL)
	3	45.9m*	13.8m	330m	T(BUL)
	4	91.8m*	13.1m	330m	T + (A x R)(BUL)
	5	65m*	13.4m	330m	T + (A x R)(BUL)
C	1	45.7m*	13.5m*	300m	T + A(WGA)
	2	17.3m***	17.3m***	300m	T + 0.5A(WGA)
	3	37.1m*	18.6m*	310m	T + 0.5A(WGA)
	4	51.7m*	15.2m*	320m	T + (A x R)(BUL)
	5	44.7m*	13.5m*	320m	T + (A x R)(BUL)
	6	55.5m*	13.0m*	320m	T + (A x R)(BUL)
D	1	29.9m***	29.9m***	240m	T + (A x R)(WGA)
	2	20.7m***	20.7m***	240m	T + (A x R)(BUL)
	3	29.4m***	29.4m***	240m	T + A(WGA)
	4	45.3m*	20.4m*	230m	T + (A x R)(BUL)
	5	100m**	21.4m*	230m	T + (A x R)(BUL)
	6	63m*	17.3m*	230m	T(BUL)
	7	45.3m*	12.4m*	230m	T(BUL)
	8	100m**	13.4m*	230m	T(BUL)
	9	57m*	13.4m*	230m	T + (A x R)(BUL)

Note:
(i) All pillar dimensions are solid rib-to-rib dimensions.
(ii) In all cases, the maximum Depth of Cover has been used, and a roadway height of 2.4m and roadway width of 5.5m have been assumed.

(iii) * - as the pillar is not rectangular, the average pillar width / length has been used.
(iv) ** - as the actual length of the pillar is >100m, in order to ensure that the length of the pillar remains close to the confines of the database on which the pillar formulae used in this report were based, a 100m long solid pillar has been assumed.
(v) *** - as the pillar is highly irregular, both the width and length are based on the hydraulic radius of the pillar (i.e., 4 x area / circumference).
(vi) (BAL) – indicates the seam in which the maximum abutment loading condition has been assessed.

6. In the case of those pillars where the w/h ratio is >5, the following "squat pillar formula" will be used to calculate the strength of the pillars (Salamon *et al*, 1996):

$$\sigma_p = \frac{27.63\Theta^{0.51}}{w_m^{0.22} h^{0.11}} \left\{ 0.29 \left[\left(\frac{w_m}{5h} \right)^{2.5} - 1 \right] + 1 \right\} \qquad [1]$$

where w_m = minimum pillar width (m)
h = mining height (m)
Θ = a dimensionless "aspect ratio" factor

In the case of those pillars where the w/h ratio is $\leq$5, the following formula will be used to calculate the strength of the pillars (Salamon *et al*, 1996):

$$\sigma_p = 8.6 \frac{(w_p \Theta)^{0.51}}{h^{0.84}} \qquad [2]$$

where w_p = minimum pillar width (m)
h = mining height (m)

7. The main points of note with regard to the pillar loading assumptions used in this report are as follows:

(i) Considering the amount of extraction that has already taken place in the Bulli and Balgownie seams, Tributary Area loading is assumed – note: a) Tributary Area loading assumes that the pillar carries a proportionate share of the full overburden load up to the surface (see **Figure 7**), b) in those areas where the pillars are surrounded by large barriers, this is a conservative assumption as in these cases, the height of loading is generally restricted to 1 to 2 x the width of the intervening panel (**Hill *et al*, 2008**) and c) Tributary Area loading can be defined as follows:

$$T = \frac{(w_p + w_r)(l_p + w_r)\rho g H}{w_p l_p} \qquad [3]$$

where T = pillar load (MPa)
w_p = pillar width (m)
l_p = pillar length (m)
w_r = roadway width (m)
H = cover depth (m)
ρ = density of rock (taken as 2.5 t/m^3)
g = gravitational acceleration (10 m/s^2)

(ii) Depending on the pillar's proximity to either one or two goaf edges, the pillar will be subjected to one of four abutment loading conditions (see Figure 8) – note: a) as shown in **Figure 8**, single-sided front abutment loading is applicable to those pillars located next to the corner of a single goaf, side abutment loading to those pillars located next to the side of a single goaf, tailgate front abutment loading to those pillars located next to the side of a single goaf and the corner of a second goaf and double abutment loading to those pillars which are surrounded on two sides by goaf, b) considering both the size of the goaf and the amount of fractured material located in the already subsided overburden, in contrast to normal practice in the Southern Coalfield where as a result of the amount of competent strata located in the upper overburden abutment angles of as low as 5^o are used, the industry standard abutment angle of 21^o is considered more appropriate and c) depending on the width to depth ratio of the goaf, the magnitude of the side abutment load (A) can be calculated as follows:

For critical and super-critical panels (see **Figure 7**):

$$A = \rho g(H^2(l_p + w_r)\tan\phi) \qquad [4]$$

where
- A = abutment load (MPa)
- l_p = pillar length (m)
- w_r = roadway width (m)
- H = depth (m)
- ρ = density of rock (taken as 2.5 t/m^3)
- g = gravitational constant (10 m/s^2)
- ϕ = abutment angle (^{o})

Similarly, for sub-critical panels (see **Figure 7**):

$$A = \rho g(0.5HW – 0.125W^2/\tan\phi) \qquad [5]$$

where
- W = panel width (m)
- H = depth (m)

(iii) In all cases the loading condition was assessed for each seam and on this basis, the maximum or worst case loading condition was used in the final assessment.

8. **The results of this assessment are presented (i) against the failed pillar database in Figures 9 and 10 and (ii) on copies of the mine plan in Figures 11 and 12** – note: one important point to consider as part of this assessment, is the assumption that all pillars are currently in a stable condition and have not therefore already failed.

9. **From these figures, the main points of note are as follows:**

   (i) It is evident that all but one of the pillars assessed in the Balgownie Seam exceed the minimum design standards specified earlier in the report (i.e., that the combined FoS and w/h ratio of the pillar should lie outside the Design Limit Line and that the pillars should have a minimum w/h ratio of 5 and a minimum FoS of 2.11) – note: the w/h ratio of the pillars which exceed the Design Limit Line ranges between 8.1 and 20.2, and the FoS, between 1.37 and 9.1.

(ii) In regard to the one pillar located below the Design Limit Line (i.e., E2), it is of note that a) the pillar has a w/h ratio of 8.7, b) is located above the Limit Line of Known Failed Cases and c) the neighbouring pillars are located above the Design Limit Line and should in the highly unlikely event that the pillar fails, restrict any potential pillar run.

(iii) Although a number of the pillars in the Bulli Seam do not attain the required design standards, in particular the pillars located in areas B and C, a) in all areas the pillars are surrounded by large pillars or barriers which will restrict the magnitude of loading and hence, the likelihood that the pillars will fail in a catastrophic manner and b) the w/h ratio of the unsatisfactory pillars ranges between 4.9 and 8.6 and as such, the pillars can be described as squat – note: a) the locations of those pillars which do not satisfy the recommended design standards are highlighted in **Figure 13**, b) in the case of the unsatisfactory A2 pillar, it is of note that this pillar is surrounded by large pillars which attain the required design standards, c) in the case of the pillars located in areas B and C, these pillars are surrounded by 42 to 96m wide barrier pillars which achieve a FoS of 5.8 to 34 and probably more importantly, in doing so will limit the height of loading above the pillars (see **Figure 14**), d) on this basis, it is therefore reasonable to assume as per **Hill *et al* (2008)**, a maximum height of loading that is equal to 2 times the associated panel width and a consequent maximum FoS on pillars B3 to B5 and C4 to C6 of between 4.17 and 7.04 (see **Figure 15**), e) further to this, it is therefore assessed that should the pillars located closest to the longwalls in the Balgownie Seam (i.e., pillars B1 and B2) and the pillars located closest to the proposed longwalls in the Wongawilli Seam (i.e., pillars C1, C2 and C3) fail, the intervening pillars will remain stable and in doing so, restrict any potential pillar run and f) although it is not possible to be certain how much of the barrier remains, the subsidence data collected following the extraction of the Balgownie longwalls indicates that the Angle of Draw does not extend several 10's of metres to the west of the main heading pillars shown in areas B and C and as such, suggests that a large percentage of the barrier shown on the eastern side of these headings is still in place (see **Figure 5**).

10. **In regard to undermining and the potential impact on the strength of the pillars assessed in this report, it is of note that (i) none of the Bulli Seam pillars located under or directly adjacent to Mt Ousley Road have been undermined by longwalls in the Balgownie Seam or will be undermined by the proposed longwalls in the Wongawilli Seam and (ii) should the stability of the Balgownie pillars that will be undermined by the proposed longwalls in the Wongawilli Seam be compromised in any way, any potential pillar run in this seam will be restricted by the neighbouring pillars located both under and directly adjacent to Mt Ousley Road** – note: as shown in **Figure 11** a) the Balgownie pillars located in Area B have a nominal w/h ratio of 19 to 20 and a nominal FoS of 3.3 to 3.7 and b) the Balgownie pillars in Area E, a nominal w/h ratio of 13 to 16, and a nominal FoS of 2.1 to 9.1.

11. **On the basis of the above, it is therefore assessed that the proposed longwall extraction in the Wongawilli Seam is unlikely to induce a pillar run in the overlying Balgownie and Bulli seams which would otherwise adversely affect surface subsidence around Mt. Ousley Road.**

Yours sincerely
STRATA ENGINEERING (Australia) Pty Ltd

Rob Thomas
Principal

References:

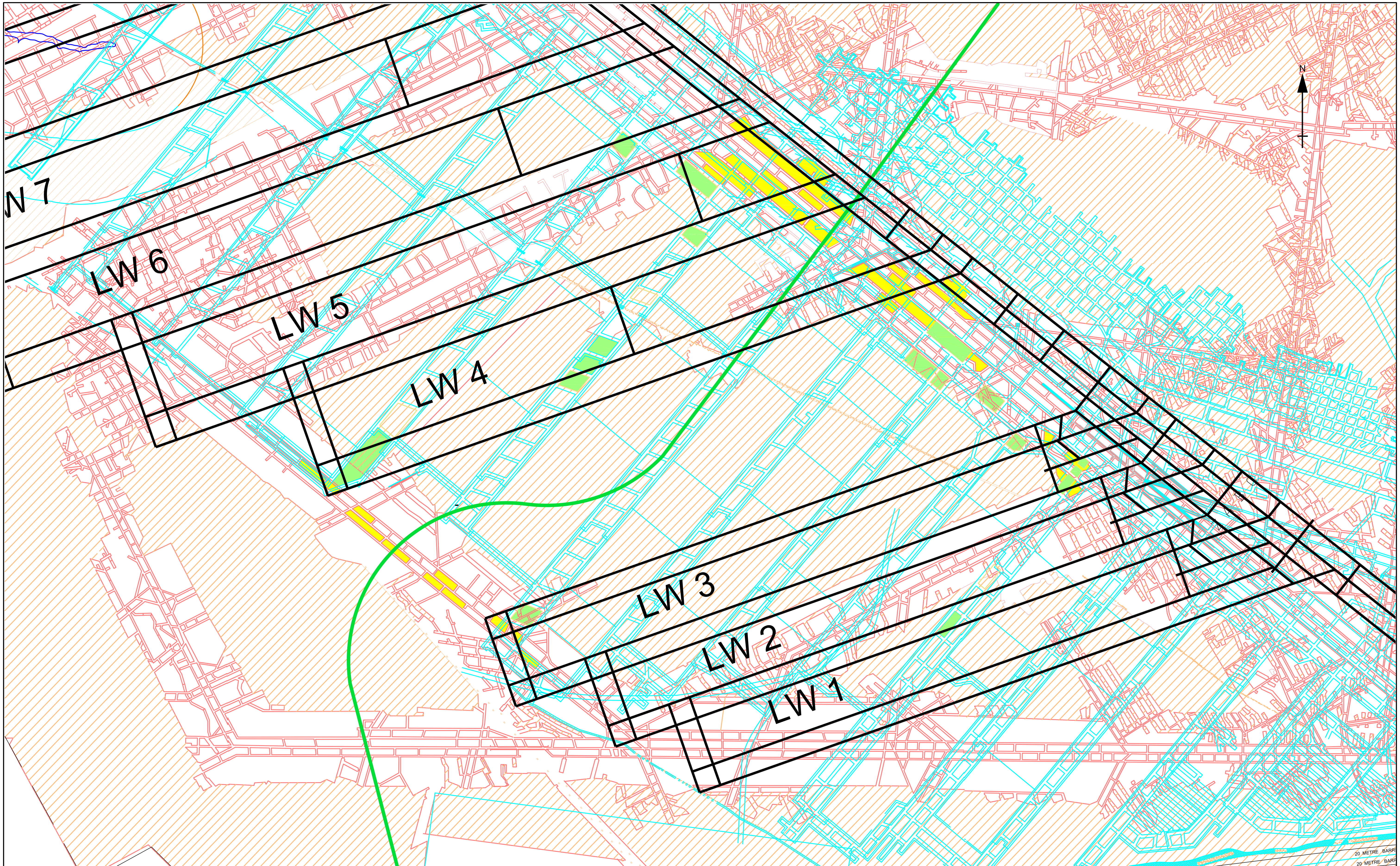
Hill, D, Canbulat, I, Thomas, R and van Wijk, J. (2008) **Coal Pillar Loading Mechanisms and Progress in Pillar Design.** 27th International Conference on Ground Control in Mining, 28th to 31st July 2008.

Hill, D (2010). **Long-Term Stability of Bord and Pillar Workings.** 3rd International Workshop on Coal Pillar Mechanics and Design, Morgantown, WV, 26th July 2010.

Holla, L (1985). **Mining Subsidence in NSW, Surface Subsidence Prediction in the Southern Coalfield**. N.S.W. Department of Minerals Resources.

Holla, L (1987). **Mining Subsidence in NSW, Surface Subsidence Prediction in the Newcastle Coalfield**. N.S.W. Department of Minerals Resources.

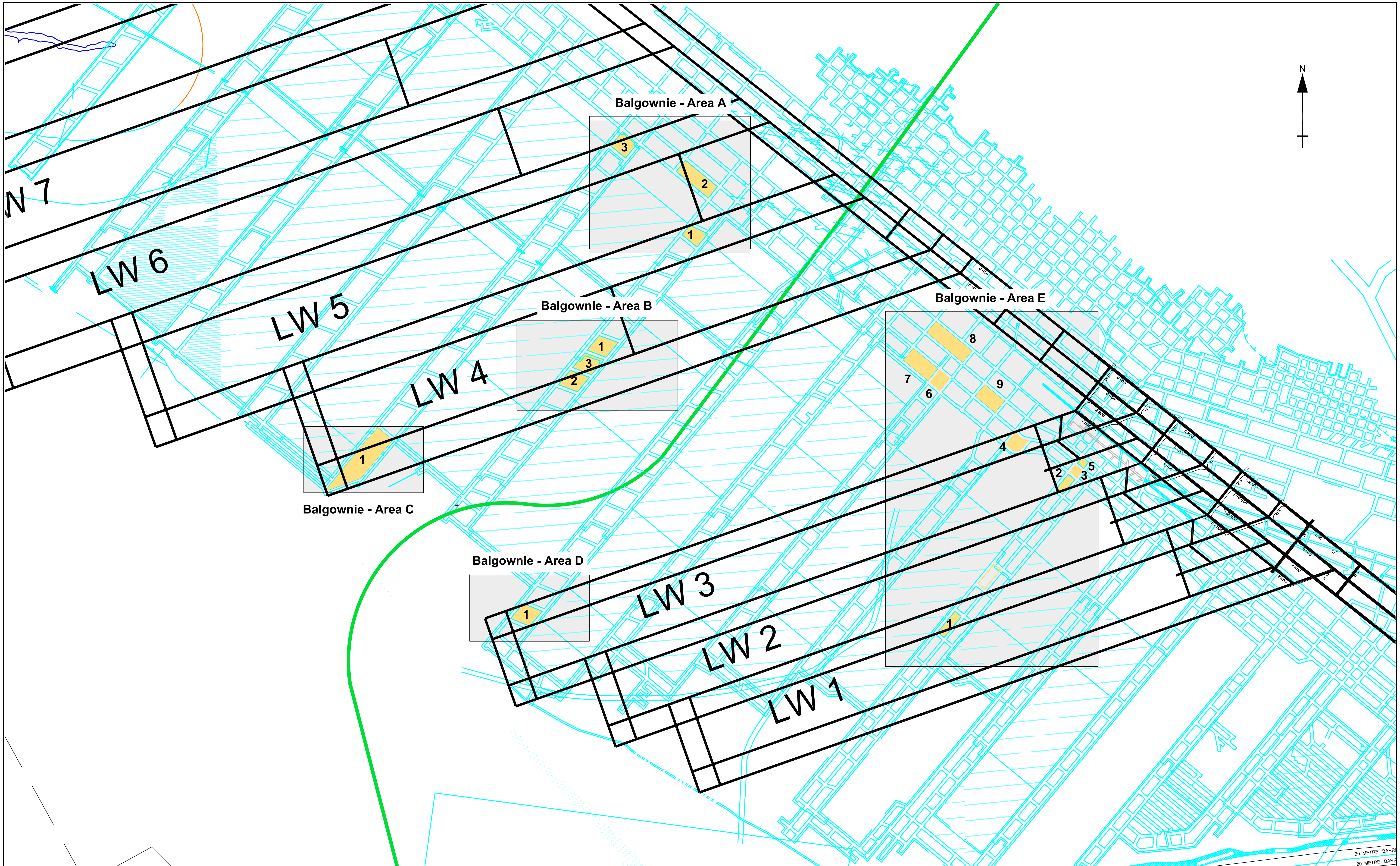
Salamon, M.D.G, Galvin, J.M, Hocking, G and Anderson, I (1996). **Coal Pillar Strength from Back-Calculation**. Strata Control for Coal Mine Design, UNSW. Final Project Report, No: RP 1/96. Joint Coal Board.



Key:

- Wongawilli Seam proposed workings
- Bulli Seam workings
- Balgownie Seam workings
- Mt. Ousley Road
- Bulli Seam pillars assessed in the report
- Balgownie Seam pillars assessed in the report

Engineer:	R. Thomas	**Client:**	NRE No.1 Colliery		
Drawn:	C. Wagner	**Title:**	Proposed Wongawilli East Mine Plan Showing Location of Overlying Balgownie and Bulli Seam Workings		
Date:	24.10.12				
STRATA ENGINEERING (Australia) Pty Ltd		**Ref:**	R06-001-NRE-2	**Support Plan No:**	NRE-MNPL
		Scale:	NTS	**Figure No:**	1



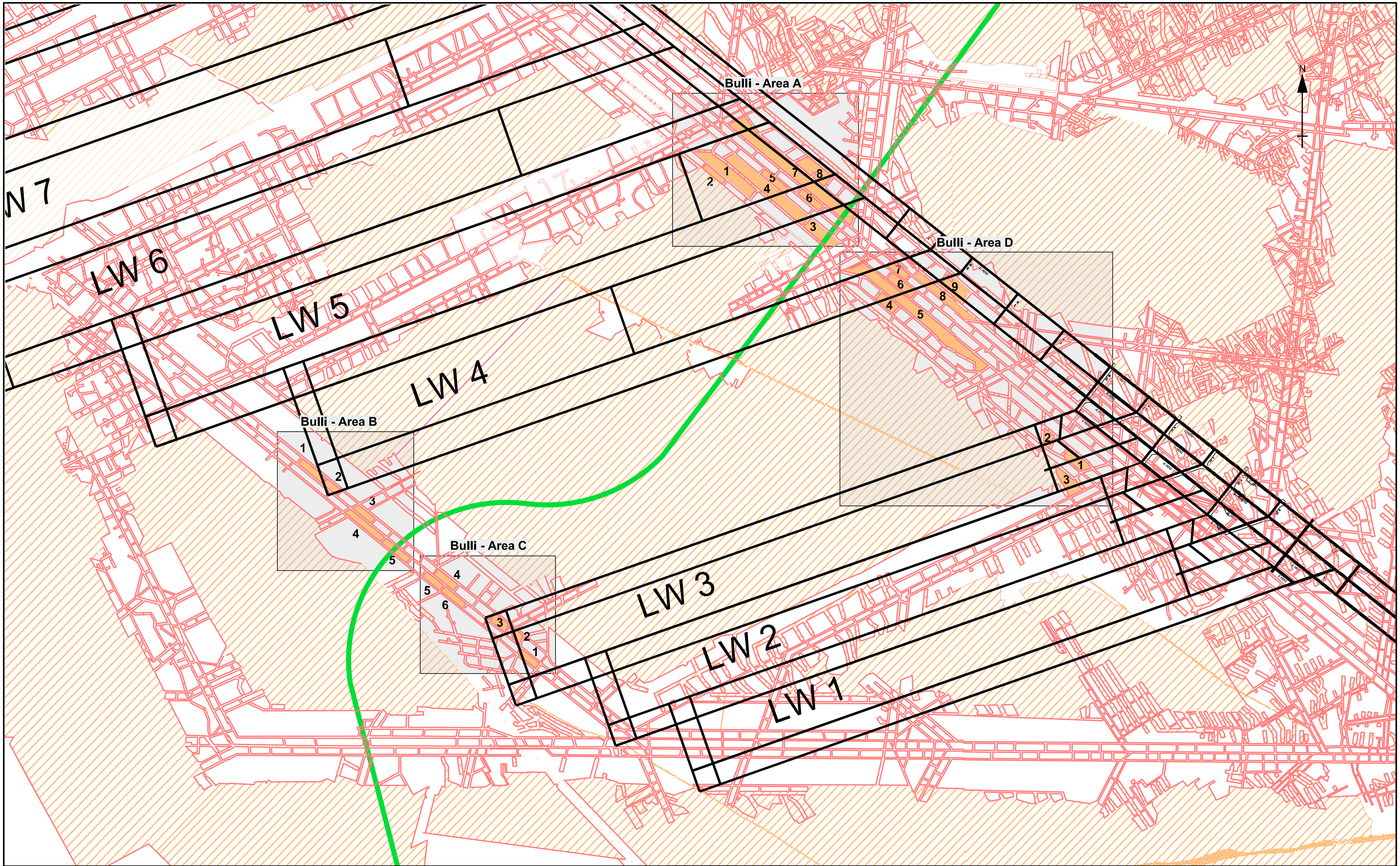
Key:

- Wongawilli Seam proposed workings
- Balgownie Seam workings
- Mt. Ousley Road

Engineer:	R. Thomas	Client:	NRE No.1 Colliery
Drawn:	C. Wagner	Title:	Proposed Wongawilli East Mine Plan Showing Location of Balgownie Seam Pillars Assessed in Report
Date:	24.10.12		

STRATA ENGINEERING (Australia) Pty Ltd

Ref:	R06-001-NRE-2	Support Plan No:	NRE-MNPL
Scale:	NTS	Figure No:	2



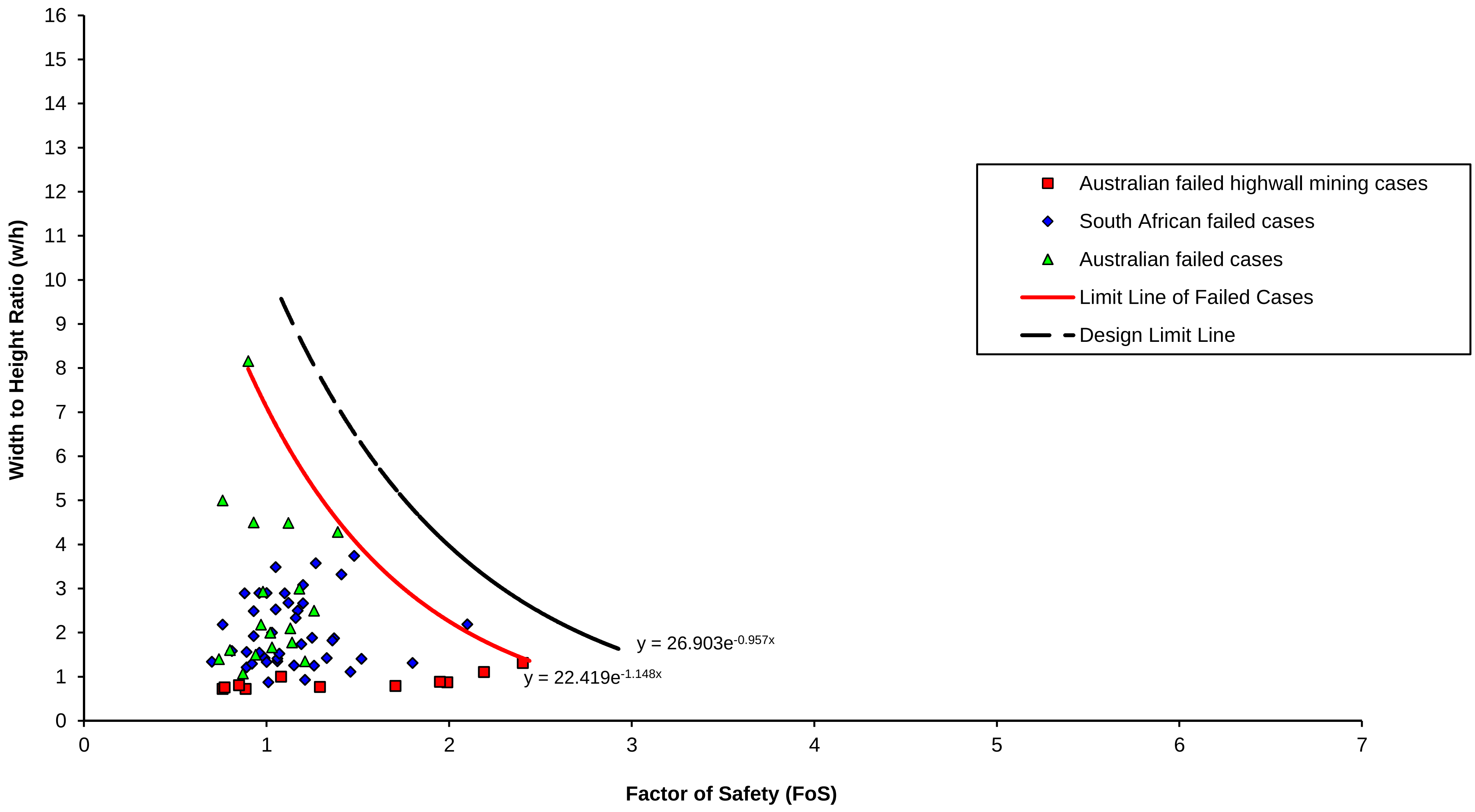
Key:

- Wongawilli Seam proposed workings
- Bulli Seam workings
- Mt. Ousley Road

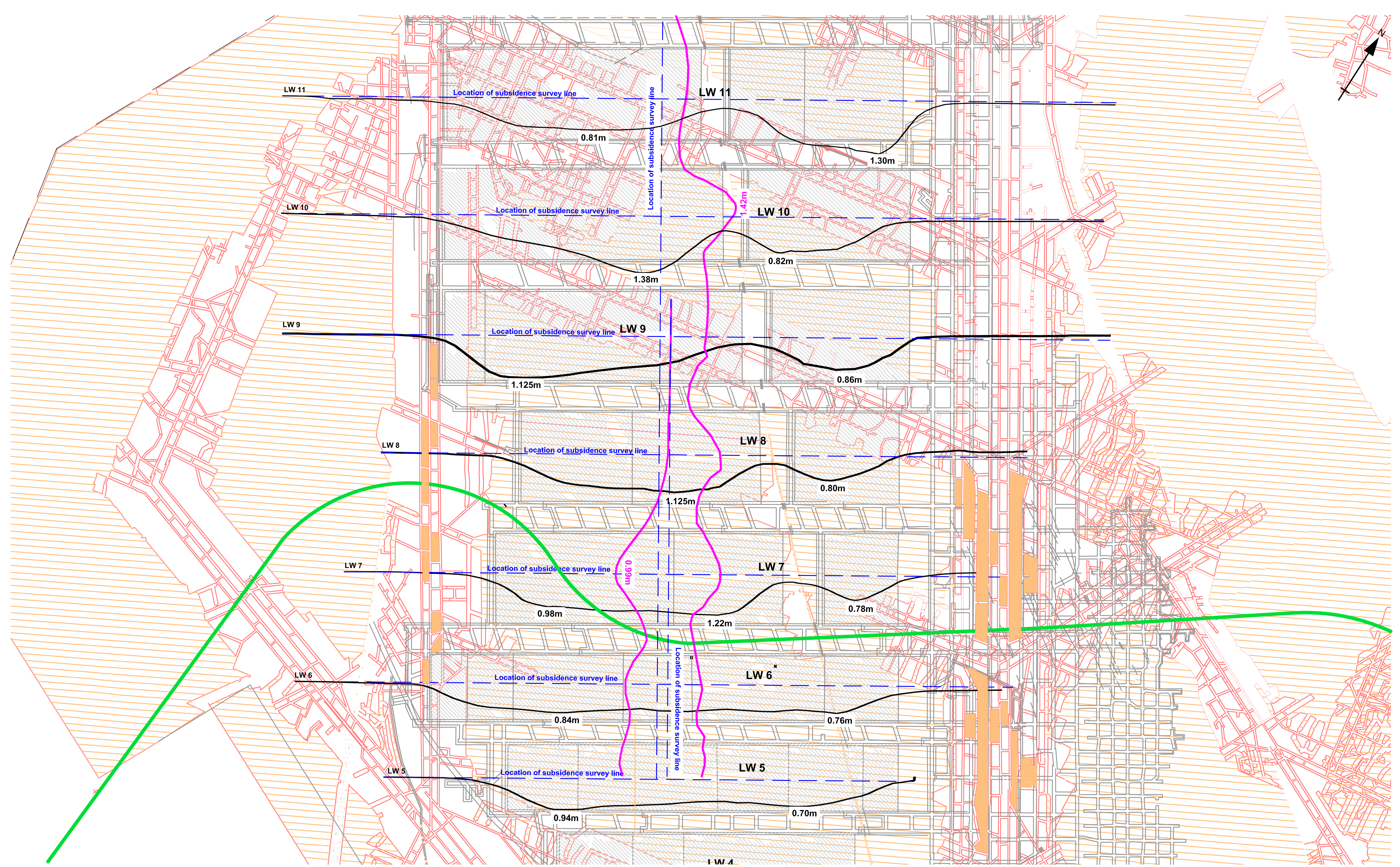
Engineer:	R. Thomas	Client:	NRE No.1 Colliery
Drawn:	C. Wagner	Title:	Proposed Wongawilli East Mine Plan Showing Location of Bulli Seam Pillars Assessed in Report
Date:	24.10.12		

STRATA ENGINEERING (Australia) Pty Ltd

Ref:	R06-001-NRE-2	Support Plan No:	NRE-MNPL
Scale:	NTS	Figure No:	3



Engineer:	R. Thomas	**Client:**	NRE No.1 Colliery		
Drawn:	C. Wagner	**Title:**	Australian and South African Failed Pillar Database Showing Proposed Design Limit Line (**Hill, 2010**)		
Date:	24.10.12				
STRATA ENGINEERING (Australia) PTY LTD		**Ref:**	R06-001-NRE-2	**Support Plan No:**	N/A
		Scale:	N/A	**Figure No:**	4



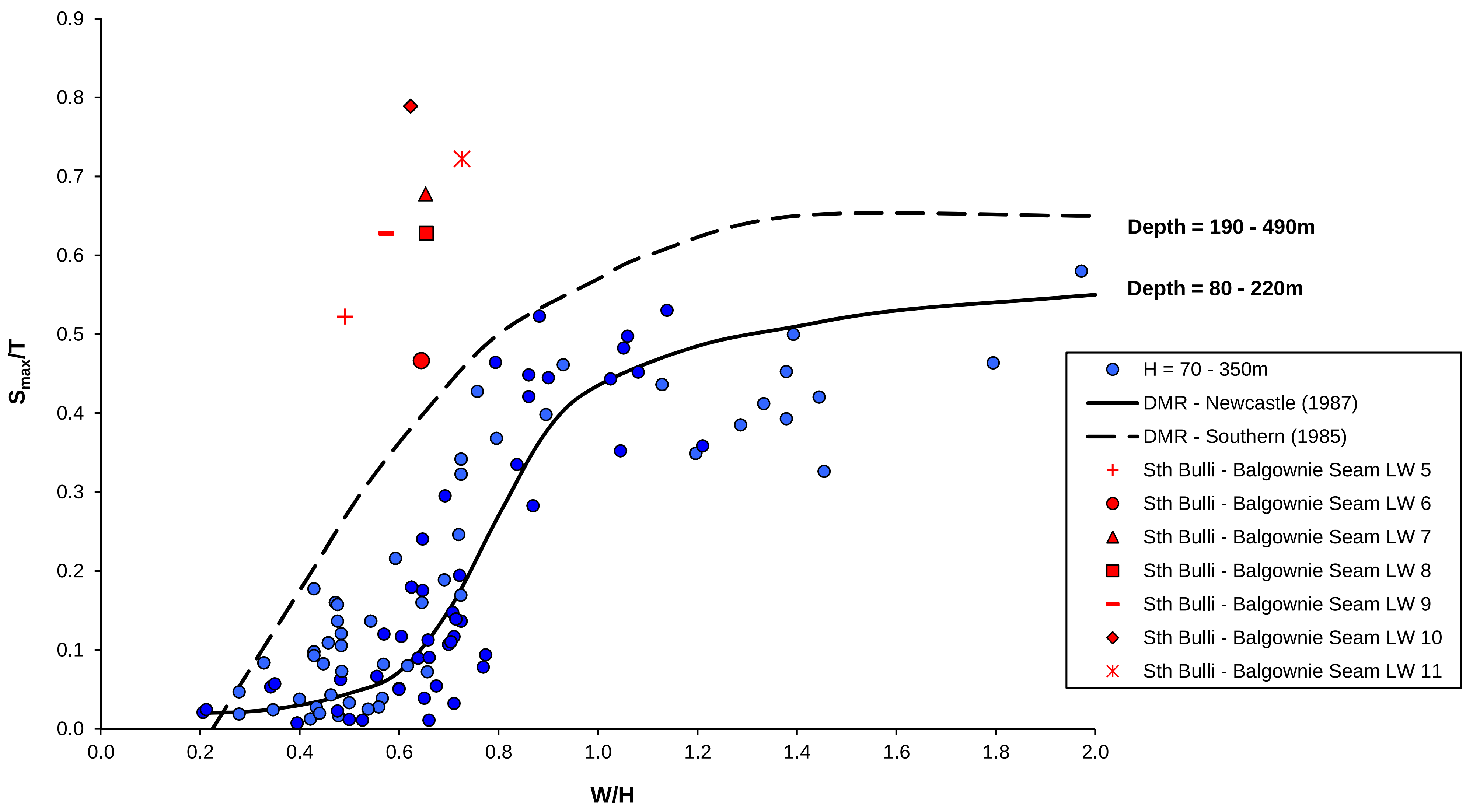
Key:

- Balgownie Seam workings
- Bulli Seam workings
- Bulli Seam pillars assessed in the report
- Mt. Ousley Road

Engineer:	R. Thomas	**Client:**	NRE No.1 Colliery
Drawn:	C. Wagner	**Title:**	Schematic Representation of Surface Subsidence Profiles Measured above LW's 5 to 11 in the Balgownie Seam
Date:	24.10.12		

STRATA ENGINEERING (Australia) Pty Ltd

Ref:	R06-001-NRE-2	**Support Plan No:**	N/A
Scale:	NTS	**Figure No:**	5



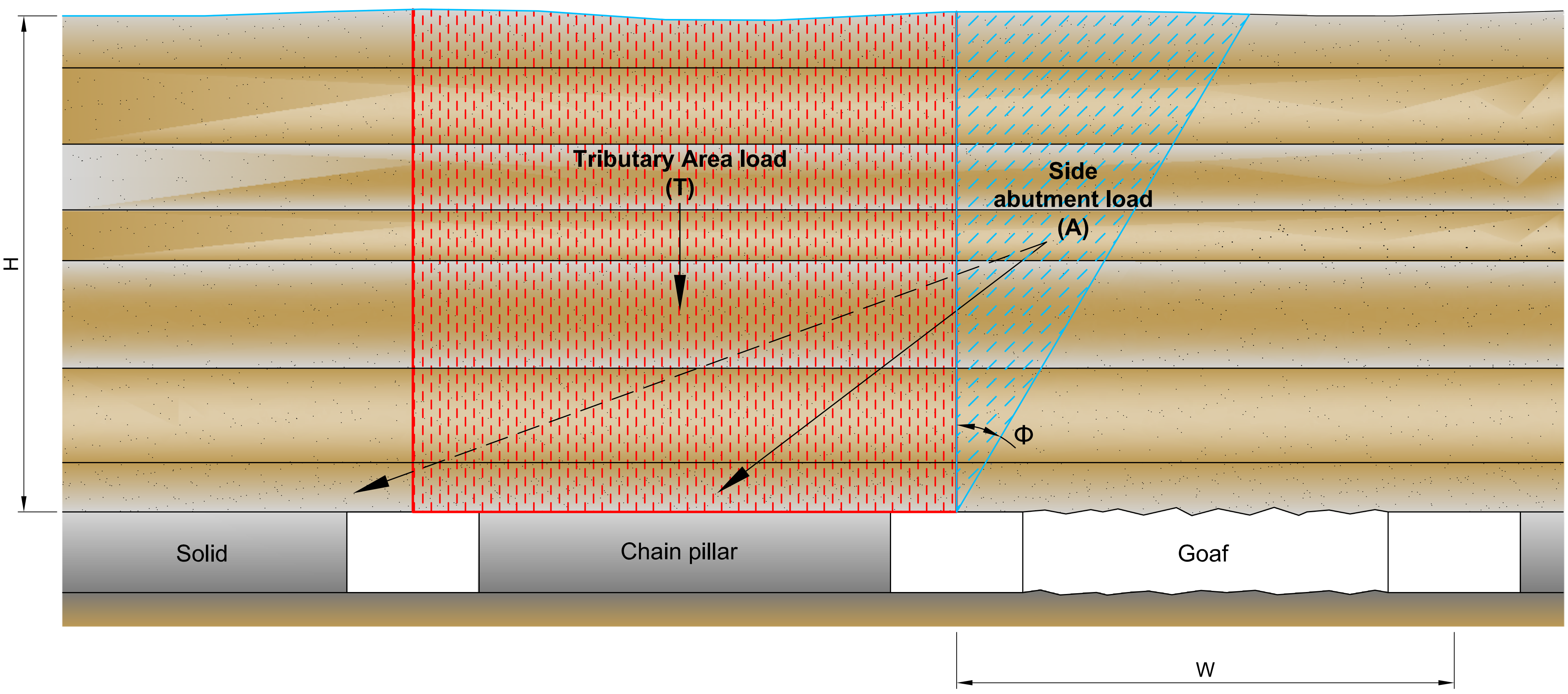
Note:
Smax - maximum surface subsidence
T - thickness of extraction
W/H - panel width to depth ratio

Engineer:	R. Thomas	**Client:**	NRE No.1 Colliery
Drawn:	C. Wagner	**Title:**	Holla's Surface Subsidence Database Showing Measured Subsidence Values above LW's 5 to 11 in the Balgownie Seam **(Holla, 1985 and Holla, 1987)**
Date:	24.10.12		

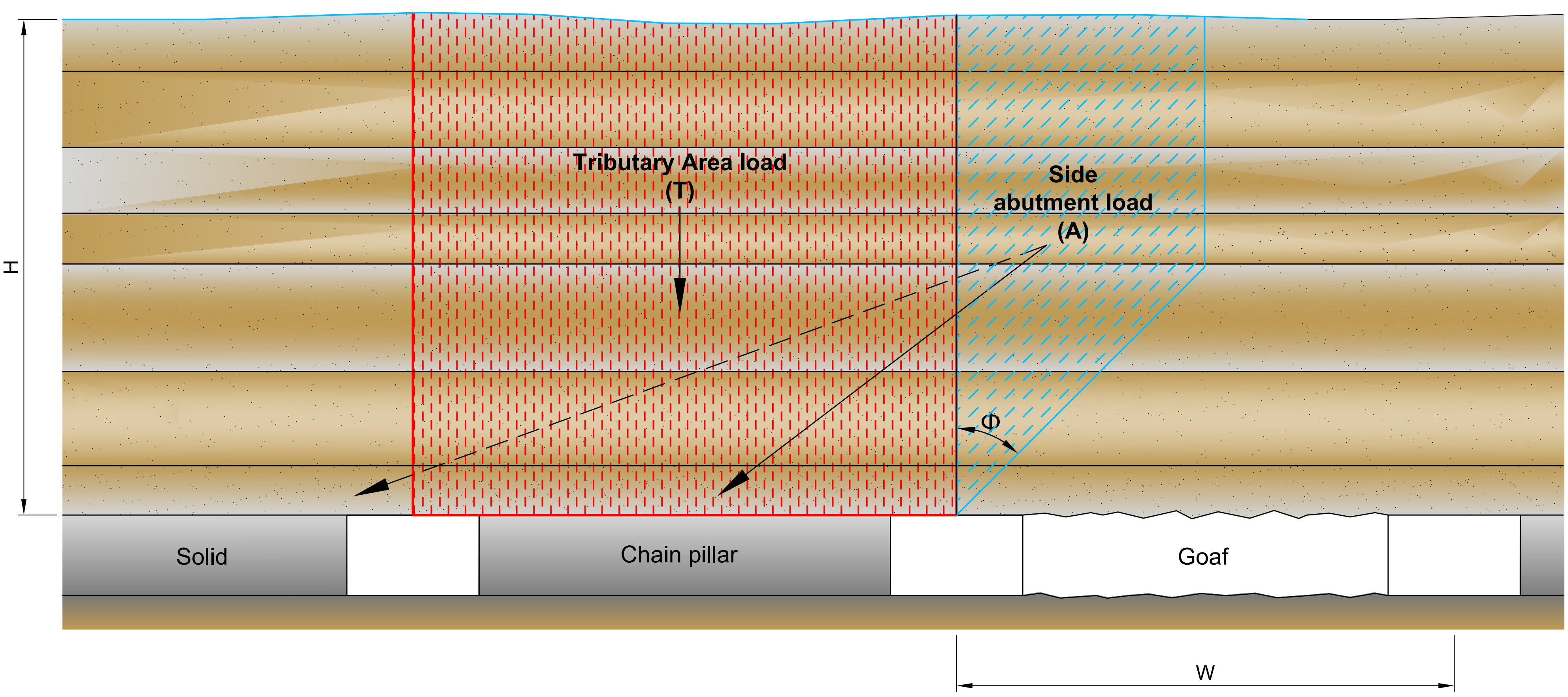
STRATA ENGINEERING (Australia) PTY LTD

Ref:	R06-001-NRE-2	**Support Plan No:**	N/A
Scale:	N/A	**Figure No:**	6

(i) Tributary Area and Critical / Super-critical Abutment Loading (Htan Φ <0.5W)



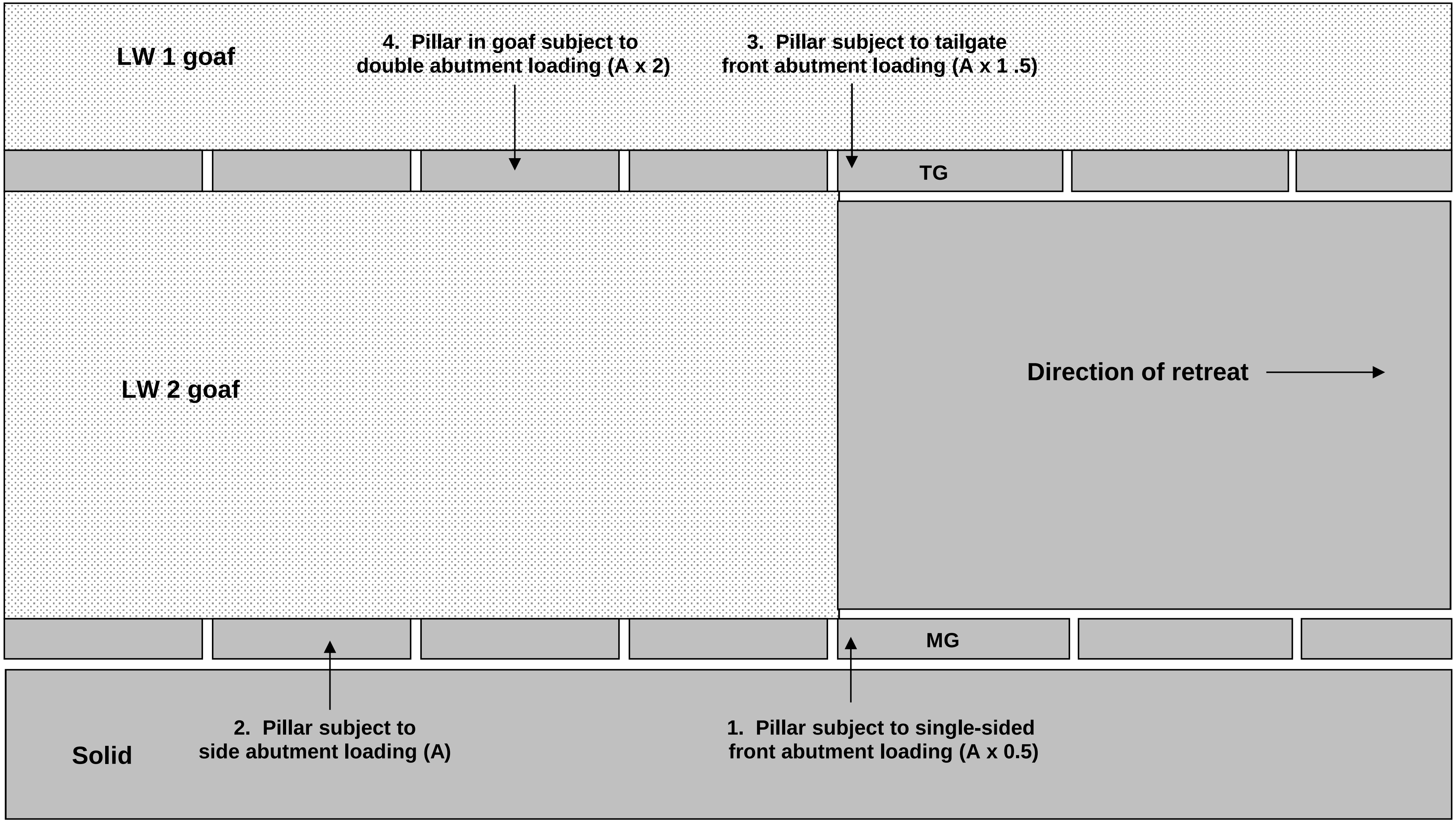
(ii) Tributary Area and Sub-critical Abutment Loading (Htan Φ >0.5W)



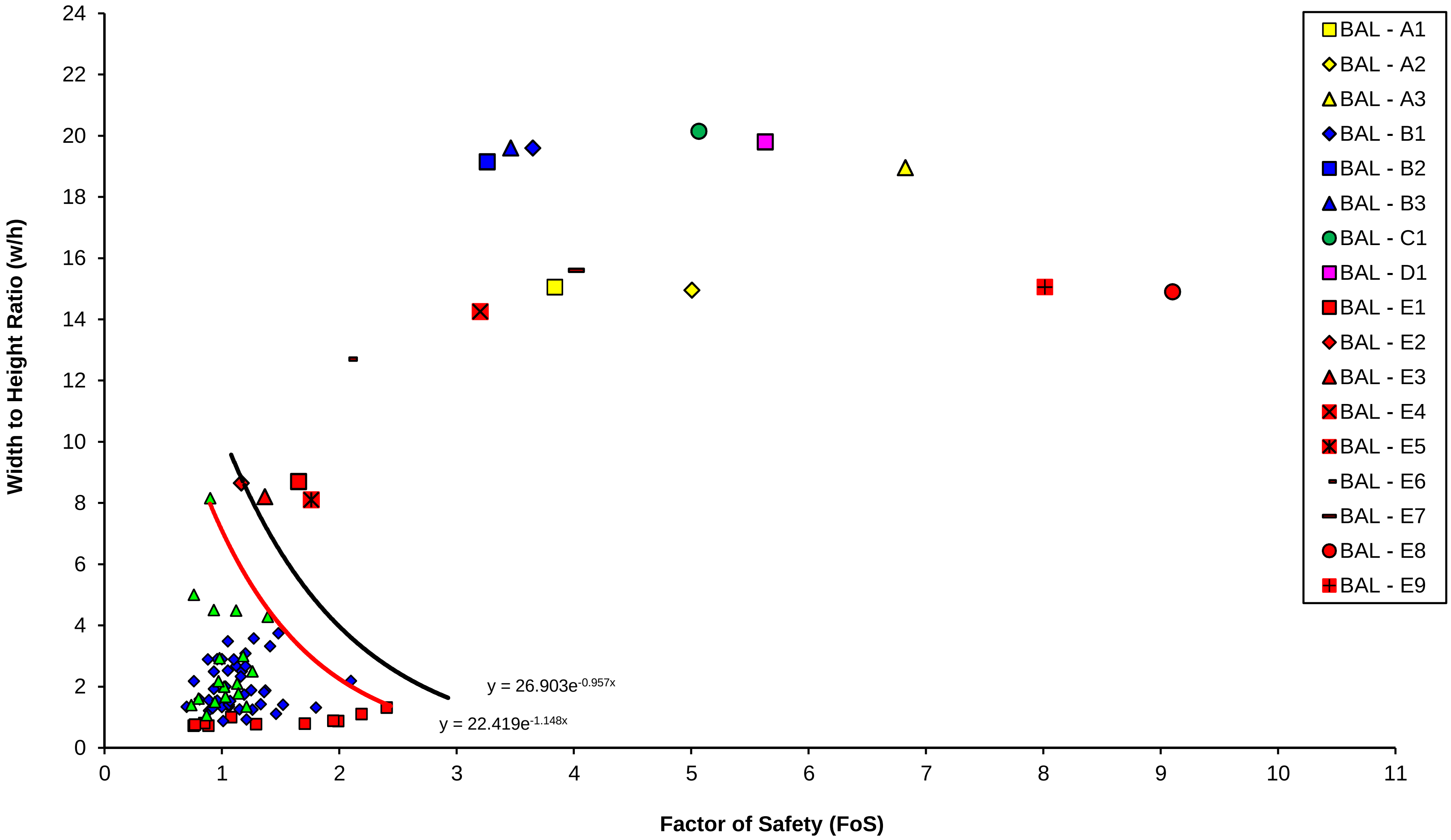
Engineer:	R. Thomas	**Client:**	NRE No. 1 Colliery
Drawn:	M. Schwendi	**Title:**	Schematic Illustration of the Tributary Area and Abutment Loadings Concepts
Date:	29.10.12		

STRATA ENGINEERING (Australia) Pty Ltd

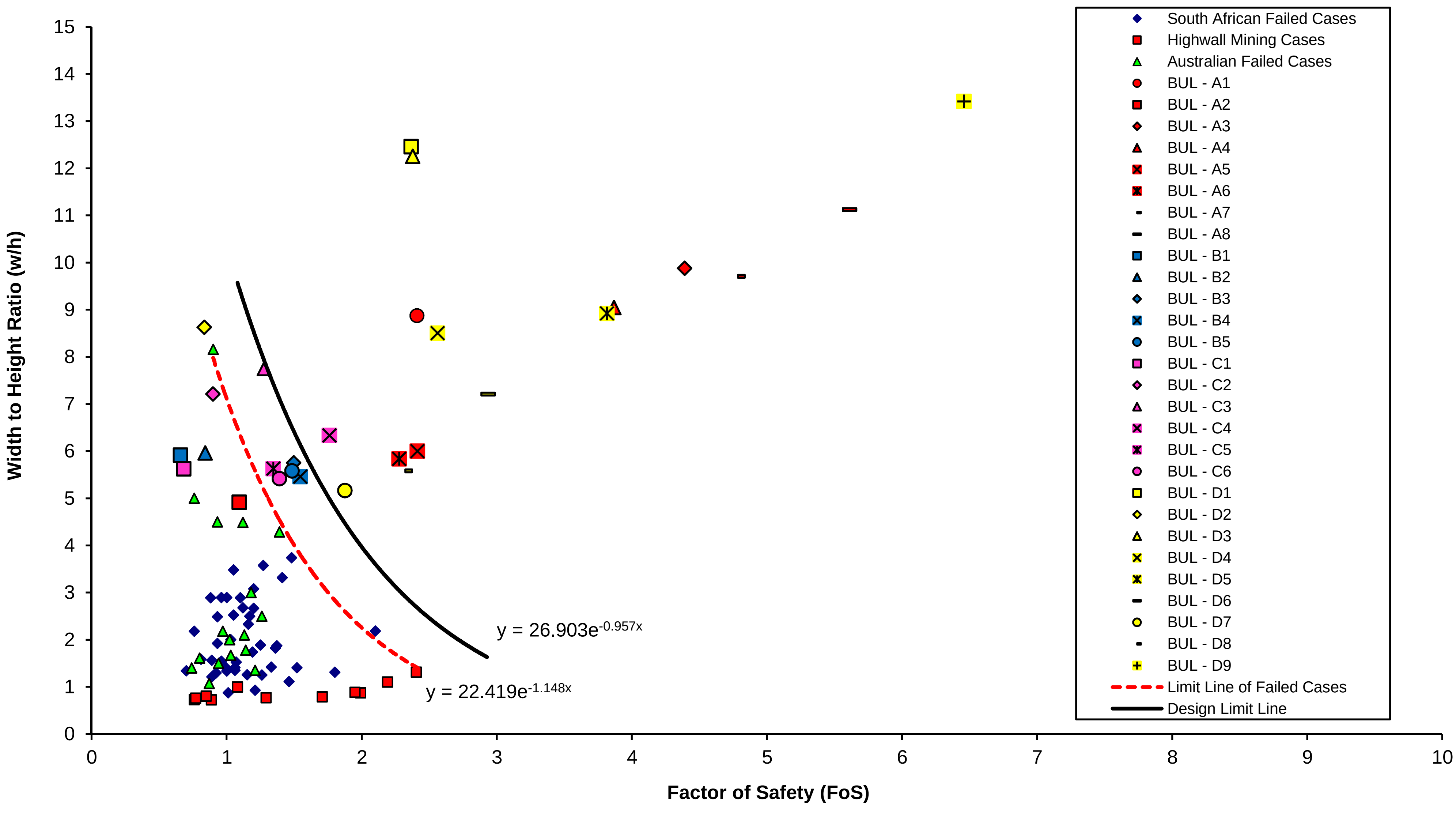
Ref:	R06-001-NRE-2	**Support Plan No:**	N/A
Scale:	NTS	**Figure No:**	7



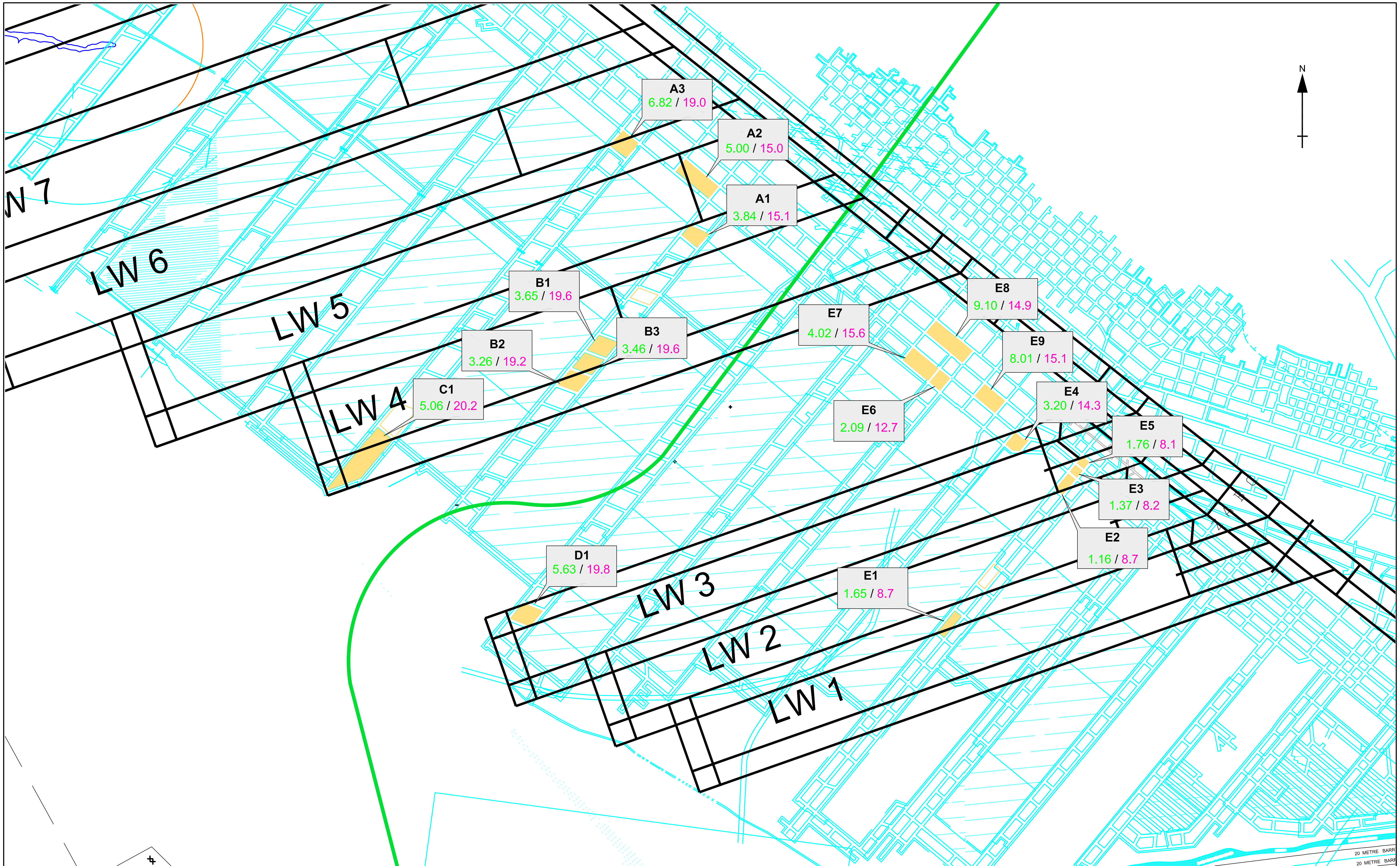
Engineer:	R. Thomas	**Client:**	NRE No.1 Colliery	
Drawn:	C. Wagner	**Title:**	Schematic Illustration of the Four Phases of Longwall Abutment Loading	
Date:	24.10.12			
STRATA ENGINEERING (Australia) PTY LTD		**Ref:**	R06-001-NRE-2	**Support Plan No:** N/A
		Scale:	N/A	**Figure No:** 8



Engineer:	R. Thomas	Client:	NRE No.1 Colliery	
Drawn:	C. Wagner	Title:	Failed Pillar Database Showing Balgownie Seam Pillars Highlighted in **Figure 2**	
Date:	28.10.12			
STRATA ENGINEERING (Australia) PTY LTD		Ref:	R06-001-NRE-2	Support Plan No: N/A
		Scale:	N/A	Figure No: 9



Engineer:	R. Thomas	**Client:**	NRE No.1 Colliery		
Drawn:	C. Wagner	**Title:**	Failed Pillar Database Showing Bulli Seam Pillars Highlighted in **Figure 3**		
Date:	28.10.12				
STRATA ENGINEERING (Australia) PTY LTD		**Ref:**	R06-001-NRE-2	**Support Plan No:**	N/A
		Scale:	N/A	**Figure No:**	10



Key:

- Wongawilli Seam proposed workings
- Balgownie Seam workings
- Mt. Ousley Road

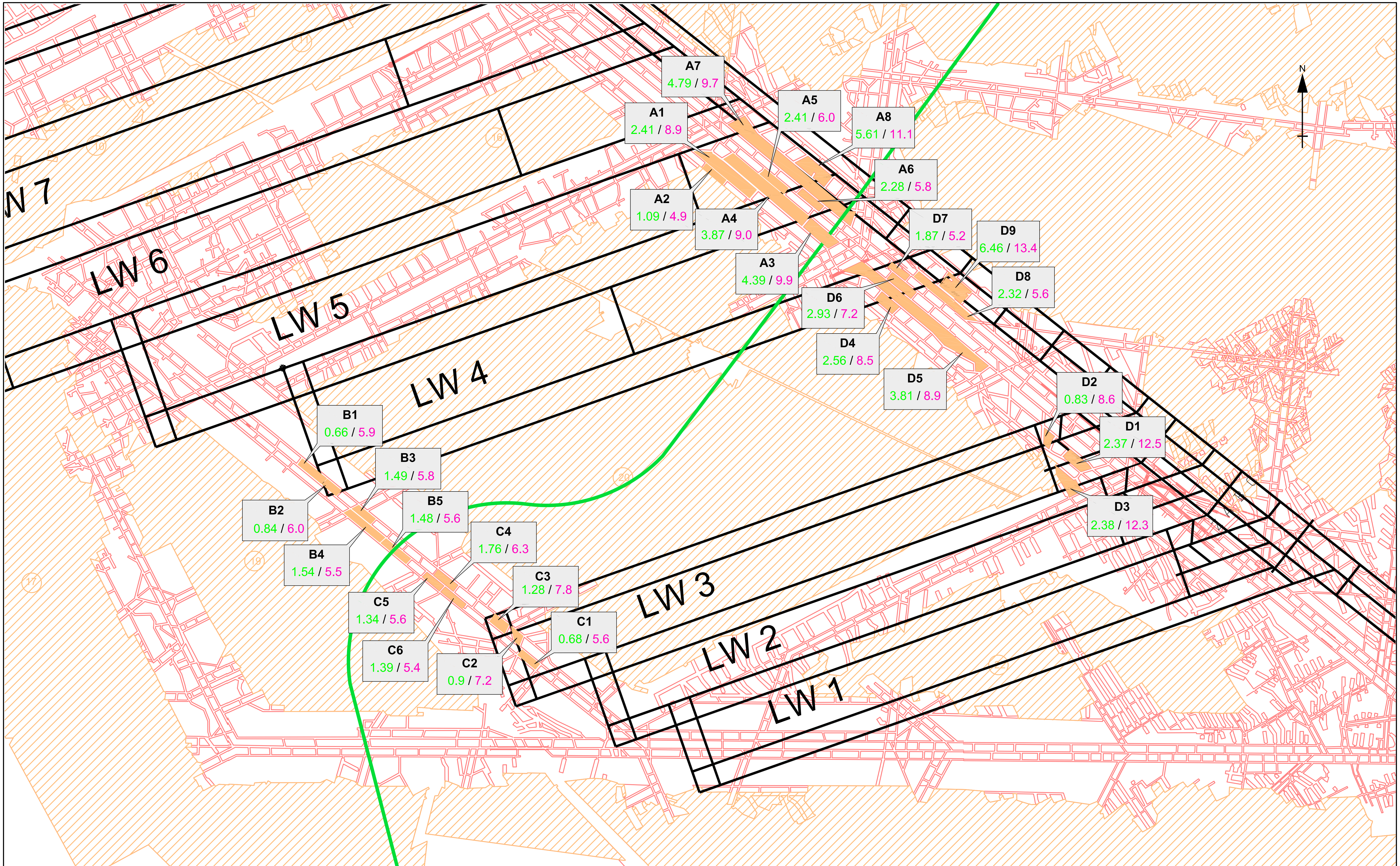
1.27 Factor of Safety

8.5 Width to height ratio

Engineer:	R. Thomas	Client:	NRE No.1 Colliery
Drawn:	C. Wagner	Title:	Proposed Wongawilli East Mine Plan Showing (i) Balgownie Seam Pillars Assessed in Report and (ii) Calculated Factors of Safety and Width to Height Ratios
Date:	29.10.12		

STRATA ENGINEERING (Australia) Pty Ltd

Ref:	R06-001-NRE-2	Support Plan No:	NRE-MNPL
Scale:	NTS	Figure No:	11



Key:

Wongawilli Seam proposed workings

Bulli Seam workings

Mt. Ousley Road

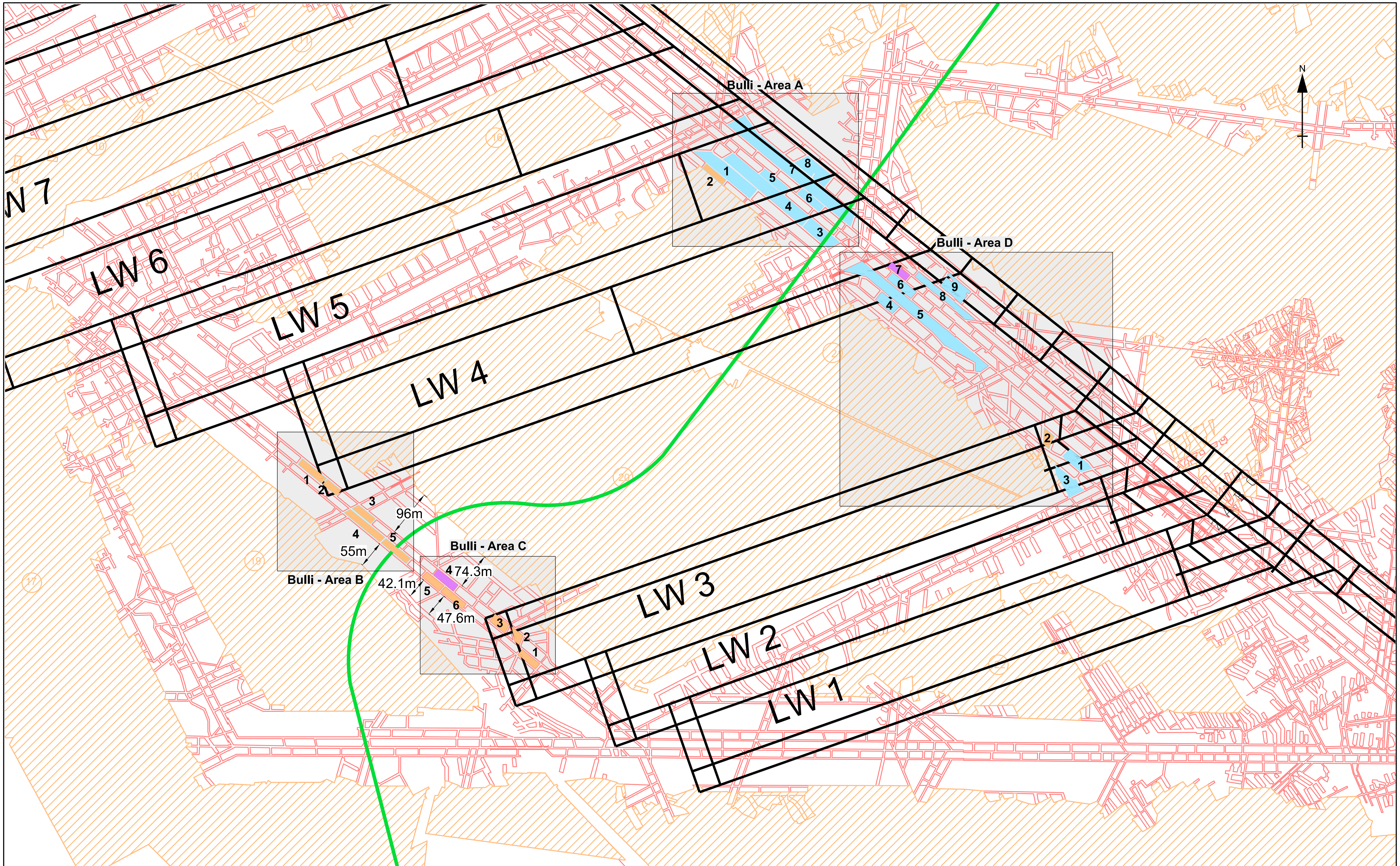
1.27 Factor of Safety

8.5 Width to height ratio

Engineer:	R. Thomas	Client:	NRE No.1 Colliery
Drawn:	C. Wagner	Title:	Proposed Wongawilli East Mine Plan Showing (i) Bulli Seam Pillars Assessed in Report and (ii) Calculated Factors of Safety and Width to Height Ratios
Date:	29.10.12		

STRATA ENGINEERING (Australia) Pty Ltd

Ref:	R06-001-NRE-2	Support Plan No:	NRE-MNPL
Scale:	NTS	Figure No:	12

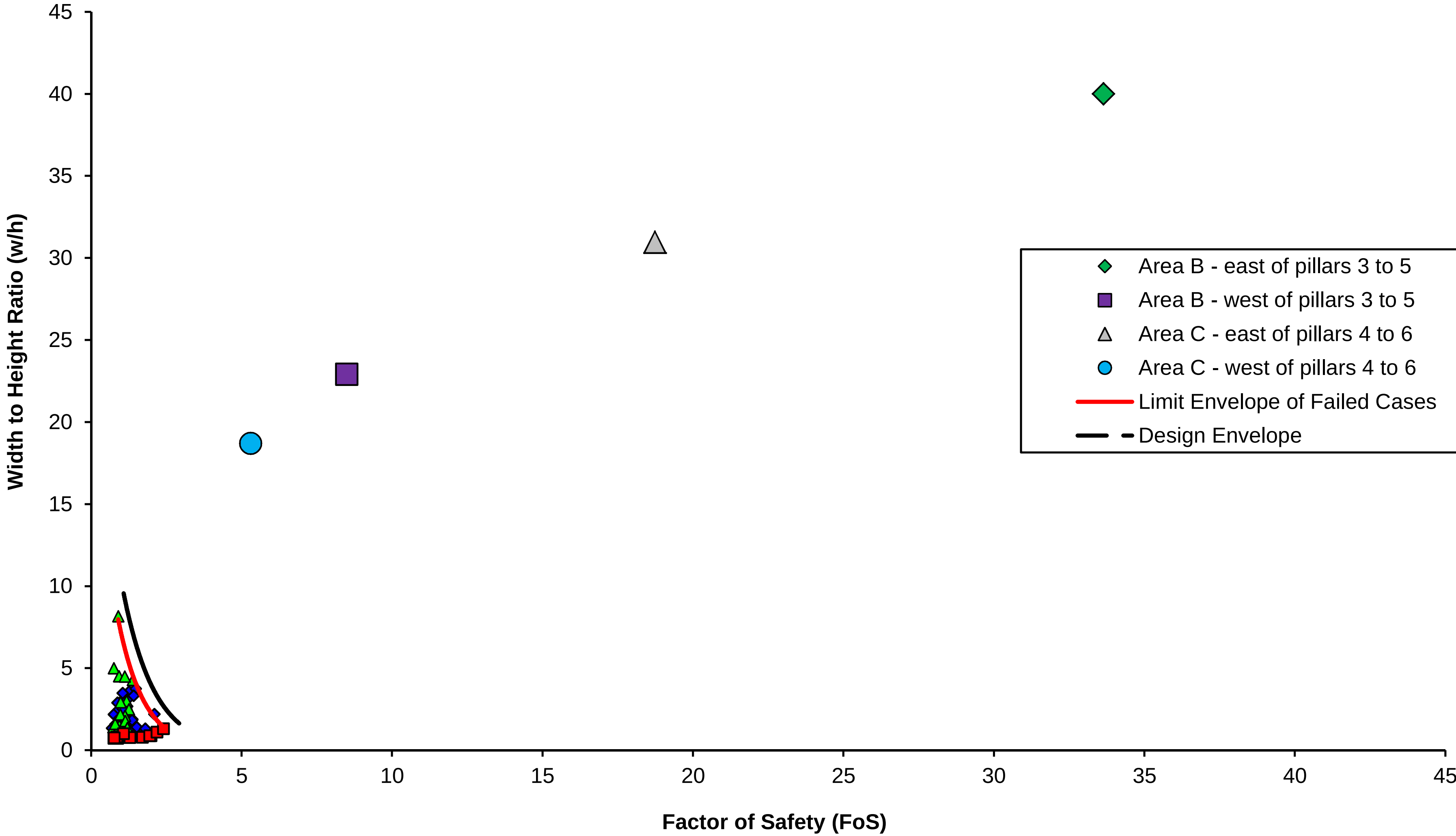


Key:
- Wongawilli Seam proposed workings
- Bulli Seam workings
- Mt. Ousley Road
- Factor of Safety <2.11
- Factor of Safety <2.11 and <Design Limit Line
- Factor of Safety >2.11 and >Design Limit Line
- 50m Assumed barrier pillar dimensions

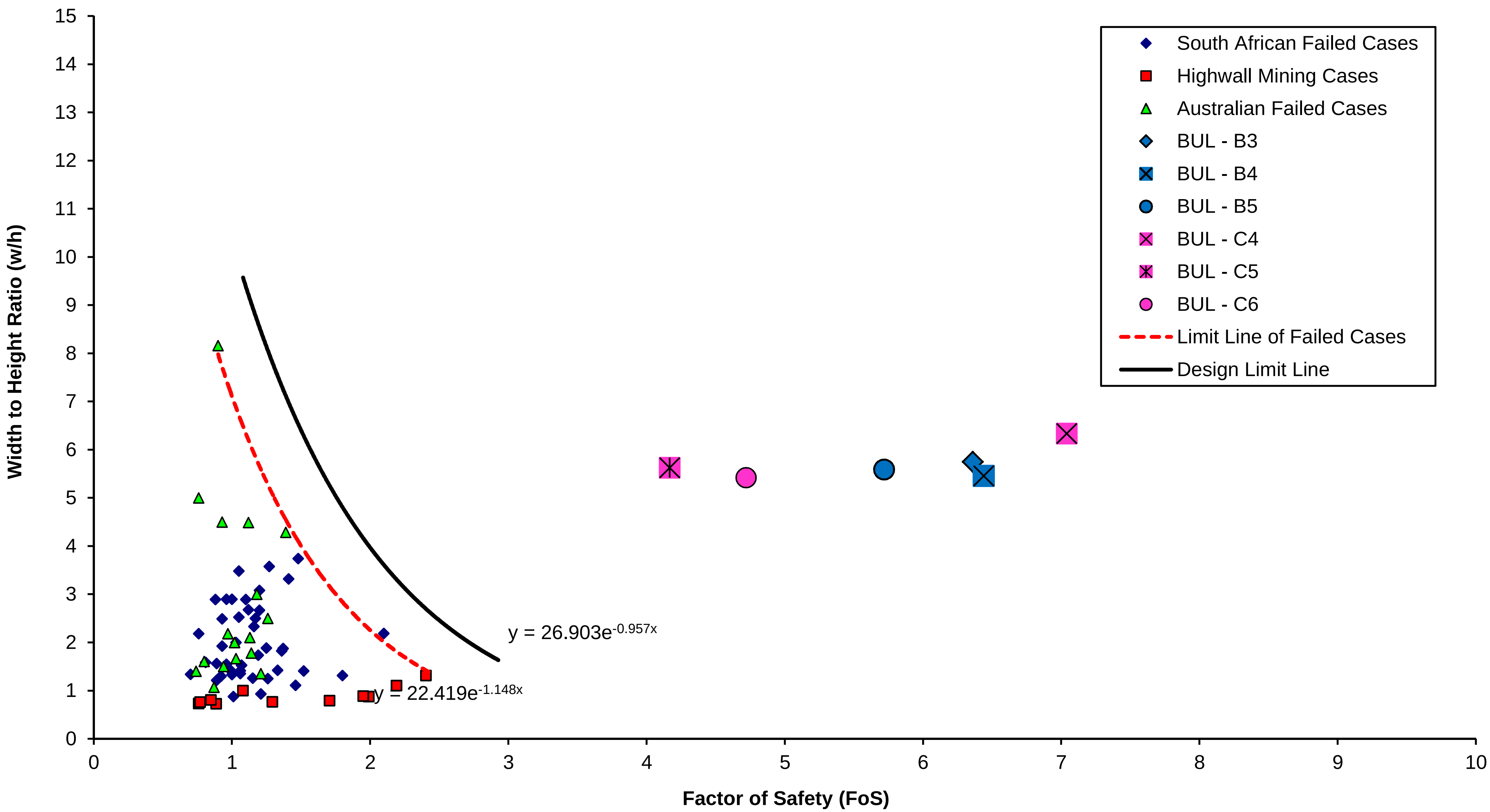
Engineer:	R. Thomas	Client:	NRE No.1 Colliery
Drawn:	C. Wagner	Title:	Proposed Wongawilli East Mine Plan Showing Location of Bulli Seam Pillars Assessed in Report Which Do Not Satisfy the Required Design Standards
Date:	24.10.12		

STRATA ENGINEERING (Australia) Pty Ltd

Ref:	R06-001-NRE-2	Support Plan No:	NRE-MNPL
Scale:	NTS	Figure No:	13



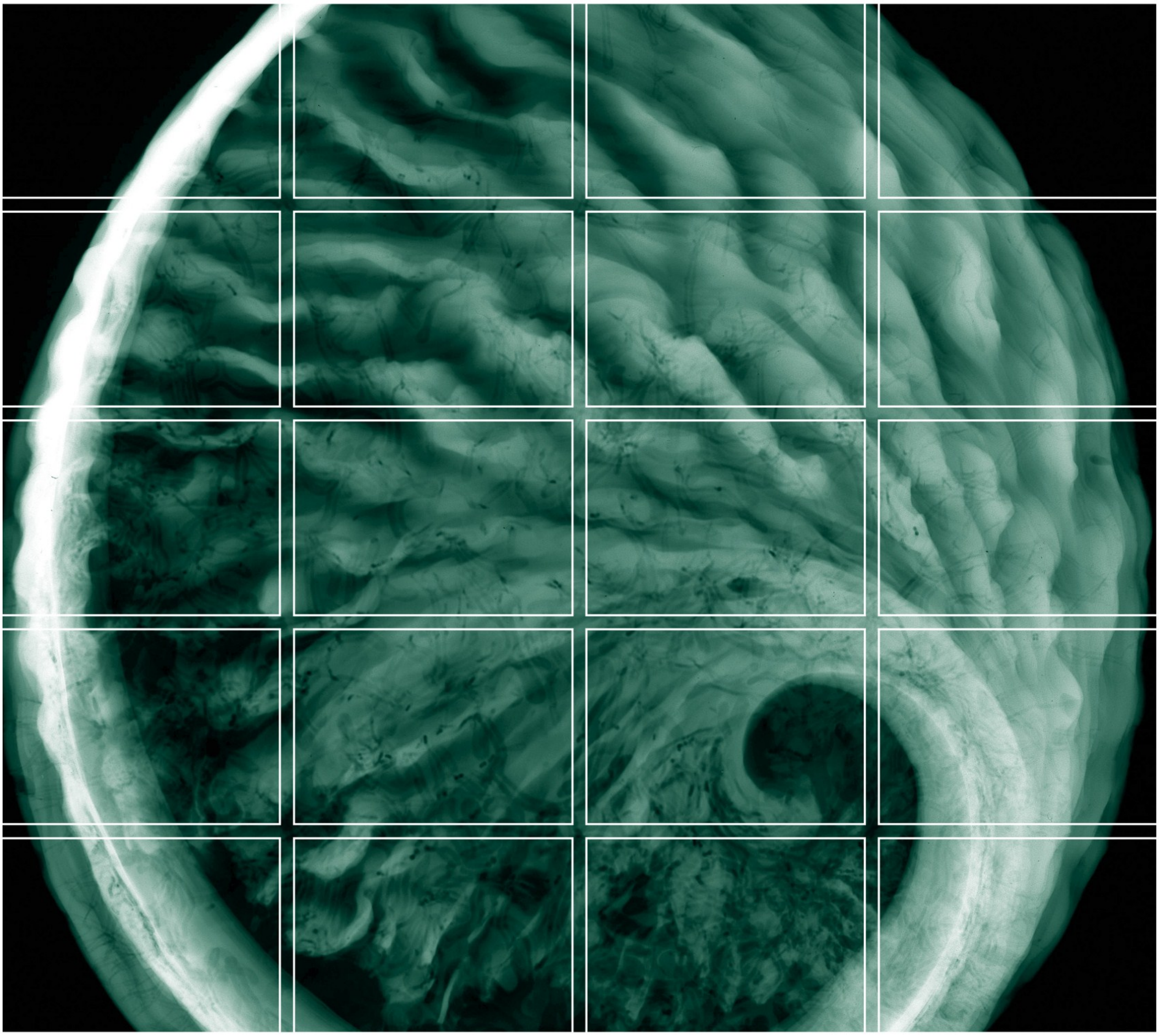
Engineer:	R. Thomas	**Client:**	NRE No.1 Colliery	
Drawn:	C. Wagner	**Title:**	Failed Pillar Database Showing Barrier Pillars Located in Areas B and C shown in **Figure 3**	
Date:	24.10.12			
STRATA ENGINEERING (Australia) PTY LTD		**Ref:**	R06-001-NRE-2	**Support Plan No:** N/A
		Scale:	N/A	**Figure No:** 14



Engineer:	R. Thomas	**Client:**	NRE No.1 Colliery		
Drawn:	C. Wagner	**Title:**	Failed Pillar Database Showing Bulli Seam Pillars B3 to B5 and C4 to C6 Assuming Effective Loading		
Date:	24.10.12				
STRATA ENGINEERING (Australia) PTY LTD		**Ref:**	R06-001-NRE-2	**Support Plan No:**	N/A
		Scale:	N/A	**Figure No:**	15

Annex H

Acoustic Report



NRE No.1 Colliery

Noise Assessment Major Works Project

Gujarat NRE Coking Coal Pty Ltd

November 2012

0079383

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NRE No.1 Colliery

Noise Assessment Major Works

Gujarat NRE Coking Coal Limited

Approved by:	*Steve O'Connor*
Position:	*Technical Director*
Signed:	
Date:	*30 November 2012*

Environmental Resources Management Australia Pty Ltd Quality System

November 2012

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FINAL REPORT

Gujarat NRE Coking Coal Limited

NRE No.1 Colliery

Noise Assessment Major Works Project

February 2013

Reference: 0079383 Noise

Environmental Resources Management Australia
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Pyrmont, NSW 2009
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1 INTRODUCTION

1.1 BACKGROUND

Environmental Resources Management Australia Pty Ltd (ERM) was engaged to undertake a noise impact assessment (NIA) for the expansion of mining operations and upgrade of associated surface facilities as part of Stage 2 (Major Works Project). This Project includes an increase in production to 3mtpa and a major expansion of NRE No. 1 Colliery in the Southern Coalfield (the 'Project'). NRE No. 1 Colliery is located at Russell Vale, to the west of Bellambi, in the Illawarra region of New South Wales (NSW). A noise impact assessment was conducted to identify potential acoustic impacts associated with mine operation and traffic generating activities associated with the Project. This assessment was prepared to support the Environmental Assessment (EA) required by the Director-General of the Department of Planning and Infrastructure (DoPI) as part of the Part 3A application process.

This assessment has been undertaken in accordance with the Office of Environment and Heritage (OEH) Industrial Noise Policy (EPA, 2000) (hereafter referred to as the "INP"). Traffic generation on public roads, associated with the proposal, is assessed in accordance with the OEH's Environmental Criteria for Road Traffic Noise (EPA, 1999) (hereafter referred to as the "ECRTN"). Construction noise has been assessed in accordance with the OEH's Interim Construction Noise Guidelines (2009) (hereafter referred to as the "ICNG").

A glossary of terms, definitions and abbreviations used in this report is provided in *Annex A*.

1.2 OBJECTIVES AND ASSESSMENT METHODOLOGY

The Director General's Requirements (DGR's) for the Project relating to noise are:

Noise *– including on-site construction and operational noise and off site road noise and vibration impacts from the haulage of coal along the coal transport corridor to Port Kembla Coal Terminal.*

With due regard to the DGR's, the assessment included the following:

- quantification of the existing acoustic environment and characterisation of existing influences on the local noise climate including local meteorological conditions with potential to affect noise propagation;

- determination of Project Specific Noise Levels (PSNL) in accordance with INP methodology;

- identification of noise sources, equipment sound power levels and operating times and locations for significant noise generating plant and equipment;

- development of a noise model using topographical data for the region and proposed development plans to predict noise levels from the operations;

- development of a noise model to predict road traffic noise along Bellambi Lane and adjacent streets;

- assessment of whether predicted construction, operation, road traffic and cumulative noise levels are acceptable;

- assessment of potential vibration impacts associated with coal transport from the operations.

Further details of the INP assessment methodology used in this NIA are provided in *Annex B*.

1.3 SITE DESCRIPTION

The Project Application Area (PAA) is approximately eight kilometres north of Wollongong and 70 km south of Sydney, within the local government areas (LGAs) of Wollongong and Wollondilly in the Illawarra region of NSW.

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

The Russell Vale site is located on the lower slopes and foothills of the Escarpment at approximately 140 m AHD. The Russell Vale site is bounded by the Princes Highway to the east, with residential areas of Russell Vale and Corrimal to the east and south respectively.

The study area for this assessment focuses on the surrounds of the Russell Vale site and Bellambi Lane as detailed in *Chapter 3*.

2 *EXISTING OPERATIONS*

2.1 *COAL HANDLING FACILITIES*

The existing surface infrastructure at the Russell Vale site is shown in *Figure 2.1* and includes:

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

This Project is Stage 2 of a major upgrade to NRE No.1 Colliery. Stage 1, the Preliminary Works Project (MP10_0046) subject to a recent Part 3A approval is to be completed prior to the commencement of Stage 2 (Major Works Project). Stage 1 will involve the following coal handling facility upgrades and will transition into Stage 2:

- removal of the existing Balgownie decline conveyor and storage bin and replacement with a newly designed Wongawilli decline conveyor on a similar alignment;
- decommissioning of the existing Bulli decline conveyor;
- construction of a stackout conveyor and tripper system;

- construction of a new screening and sizing station; and
- construction of a partial temporary and partial permanent new internal haul road.

Stage 1 also includes a number of environmental improvements at the Russell Vale site including the construction of a new open channel to improve stormwater flows in Bellambi Gully Creek located on NRE controlled land within CCL745.

2.2 *PRODUCT COAL TRANSPORT*

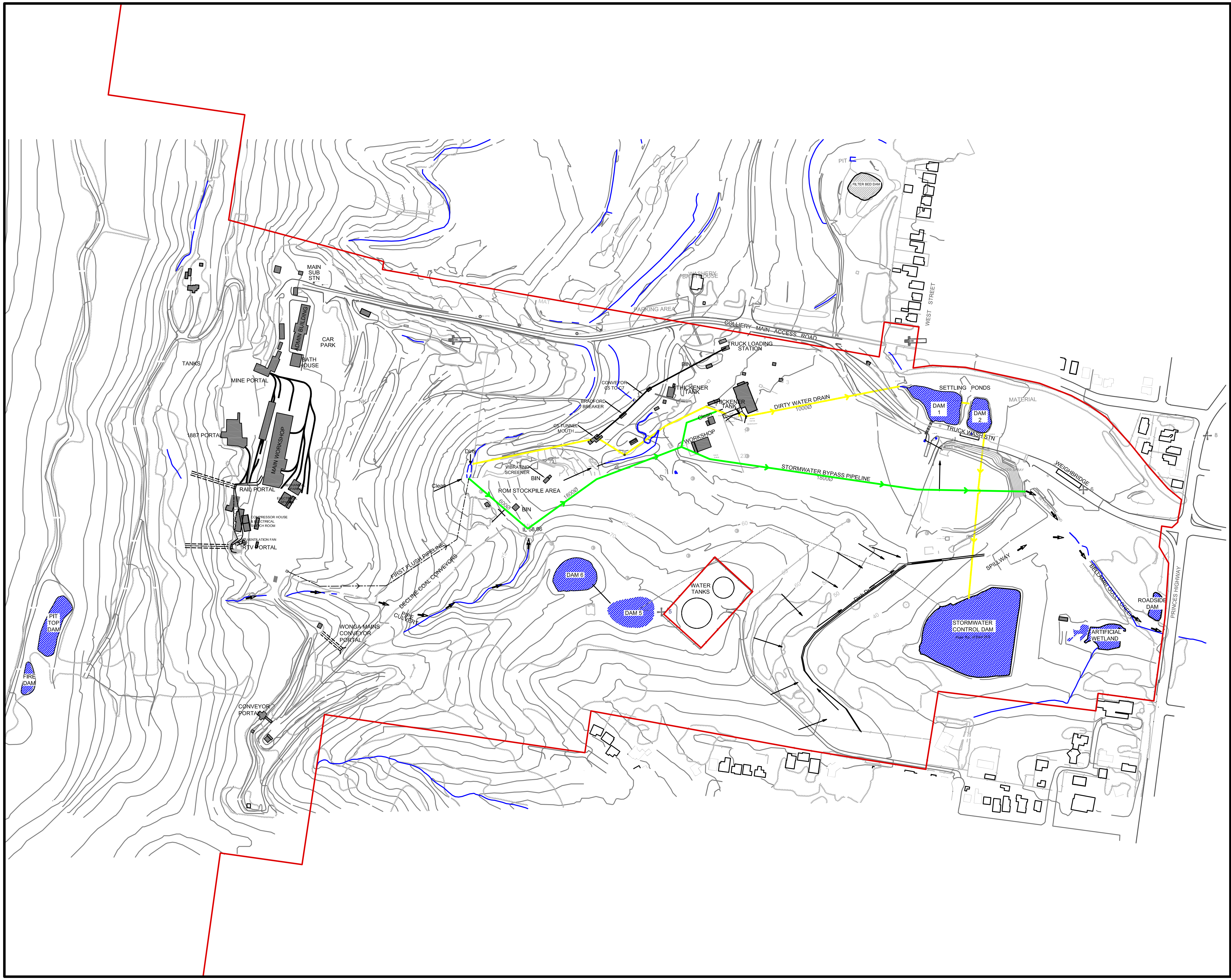
Coal is currently transported, unwashed, by truck from NRE No.1 Colliery to PKCT for shipment to India. The loading of product coal onto trucks and transport off site by road is currently approved between 7am to 10pm, Monday to Friday and between and 8 am to 6 pm on Saturdays, Sundays and public holidays. Coal transport trucks operate in accordance with these times.Trucks leave the site travelling east along Bellambi Lane to Memorial Drive, along which they travel south onto the Southern Freeway to Masters Road and Springhill Road to PKCT. The transport routes from NRE No.1 Colliery to PKCT are shown on *Figure 2.2*.

The Memorial Drive has recently been extended to Bulli, north of Bellambi Lane, to the north-east of the Russell Vale site. This provides an arterial road connection around part of the haulage transport route for the existing Russell Vale operations.

The roads surrounding the Russell Vale site and the haul route to PKCT are currently subject to mine-related traffic. This includes heavy vehicles for deliveries and coal transport and light vehicles for movement of staff, contractors and visitors. The regional road network, including the Memorial Drive, is also subject to heavy vehicle traffic from coal mines and other industries .

2.2.1 *Acoustic Mitigation*

The modelling for Stage 2 of the Project has been based on the assumption that certain mitigation measures recommended are implemented. These include mitigation of equipment including the dozer and mine ventilation fan as discussed in *Section 6.1*, and construction of noise barriers on the northern part of the site, within CCL 745, as discussed in *Section 6.2.*



Legend
- Project Application Area
- Dam
- Buildings
- Waterway
- Dirty Water Flows
- Clean Water Flows

Figure 2.1
Existing Coal Handling Facilities Layout

Client:	Gujarat NRE Coking Coal Limited
Project:	NRE No.1 Colliery Noise Assessment
Drawing No:	0079383s_NA_CAD001_R0.dwg
Date:	11/01/2011 — Drawing Size: A3
Drawn By:	NS — Reviewed By: PM
Source:	Olsen Environmental Consulting Ref: DP-3673.dwg
Scale:	Refer to scale bar

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

Client:	Gujarat NRE Coking Coal Limited
Project:	NRE No.1 Colliery Noise Assessment
Drawing No:	0079383s_NA_G004_R0.mxd
Date:	16/11/2010 Drawing size: A4
Drawn by:	NS Reviewed by: PM
Scale:	Refer to Scale Bar

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Figure 2.2
Truck Transport Route

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3 PROPOSED OPERATIONS

3.1 COAL HANDLING FACILITIES

New coal handling facilities and surface infrastructure upgrades are illustrated in *Figure 3.1*. Stage 2 of the upgrade of coal handling infrastructure is described in detail in the EA.

Coal will be delivered to the existing stockpile (SP1) via the newly constructed Wongawilli decline belt (Stage 1). The existing stockpile has a capacity of 60 000 t - 80 000 t. Two additional stockpile areas (SP2 and SP3) will be installed east of SP1. Each stockpile will enable up to approximately 140 000 t of coal to be stockpiled and reclaimed for loading through the truck loading facility. The installation of SP2 and SP3 will enable a total stockpiling capacity of approximately 300 000 t to 320 000 t of coal on site.

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 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 bunding. During the time which the new truck loading facility is constructed trucks will be loaded directly from the ROM coal stockpile. Once the new facility is implemented and operational, 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 verge to the left and proceed along a new section of road to enter the truck loading and temporary parking area. This area will have provision for trucks to park whilst waiting to load from the truck loading facility. Trucks will pass through the area in a clockwise direction.

Trucks will load beneath the bins of the truck loading facility. Loading will be undertaken in batch mode, which will also weigh each load to avoid overloading and to record individual truck gross weights. The existing truck weigh bridge will be retained as a contingency if 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.

A bund wall or noise barrier approximately 3 m high will be constructed on the northern border of the truck parking area. This will screen trucks from direct line of site from the north. The barrier will also provide noise management benefits.

3.2 PRODUCT COAL TRANSPORT

In accordance with existing operations, unwashed coal will continue to be loaded into trucks for haulage to PKCT and loading into ships.

Road haulage of product from the Colliery to PKCT will be according to the currently approved operational and receival conditions for PKCT in respect of coal from the NRE No.1 Colliery. The proposed trucking hours from NRE No.1 Colliery will be 7.00am to 10.00pm Monday to Friday and 8.00am to 6.00pm for weekends and public holidays, giving 95 hours of coal haulage per week

The truck fleet has been undergoing a progressive upgrade and it is proposed that all trucks will have a capacity of at least 38 tonnes and up to 44 tonnes, specially designed trailers with noise dampening to prevent metal on metal impact, and current best technology suspension and braking systems.

Bellambi Lane is an east-west road linking NRE No.1 Colliery, the Princes Highway, the Memorial Drive and Bellambi Railway Station. The section used for coal haulage is between NRE No.1 Colliery and Memorial Drive.

3.3 *HOURS OF OPERATION*

Operations such as coal handling, maintenance and coal production will be conducted 24 hours a day, 7 days a week. Transport of coal will be restricted as described in *Section 3.2*.

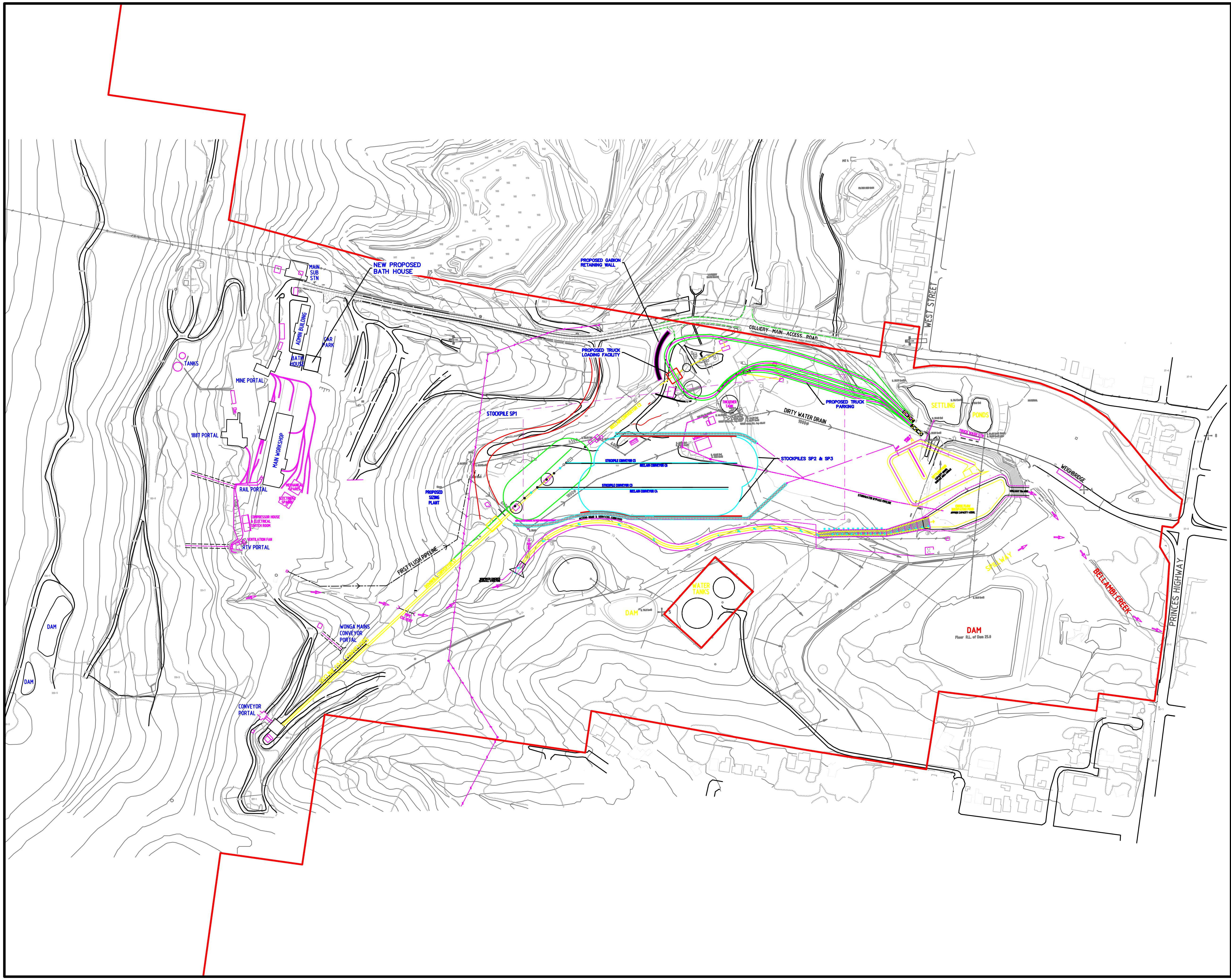
3.4 *NOISE SENSITIVE RECEIVERS*

The nearest receivers are to the north and north-east in Broker and West Streets, Russell Vale; to the south-east in Midgley Street, Lyndon Street and Taylor Street to the south in Corrimal. Representative receiver locations were chosen to provide an indication of the extent of potential noise emissions associated with the proposed development.

Noise monitoring and assessment locations were selected as representative areas for the noise sensitive receivers. *Figure 3.2* presents the locations of representative areas locations, and noise monitoring locations are presented in *Table 3.1*.

Table 3.1 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



Legend

Project Application Area

Figure 3.1

Proposed Surface Facility Upgrades

Client:	Gujarat NRE Coking Coal Limited
Project:	NRE No.1 Colliery Noise Assesment
Drawing No:	0079383s_NA_CAD002_R0.dwg
Date:	11/01/2011 Drawing Size: A3
Drawn By:	NS Reviewed By: PM
Source:	-
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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 3.2

Sensitive Receivers and Representative Areas

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE No.1 Colliery Noise Assessment		
Drawing No:	0079383s_NA_G001_R0.mxd		
Date:	28/11/2012	Drawing Size:	A4
Drawn By:	NS	Reviewed By:	PM
Projection:	GDA 1994 MGA Zone 56		
Scale:	Refer to scale bar		

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4 EXISTING ACOUSTIC AND METEOROLOGICAL ENVIRONMENT

4.1 UNATTENDED CONTINUOUS NOISE MONITORING

Noise monitoring was undertaken by ERM using continuous noise loggers from 1 December 2008 to 25 December 2008 to determine existing ambient noise environment at the receiver locations identified in *Figure 3.2*. These locations represent the nearest residential receiver areas. Details of the noise monitoring schedule are presented in *Table 4.1*. The background (L_{A90}) and amenity (L_{Aeq}) noise levels within the residential receiver areas adjacent to the Russell Vale site were assessed using the results of this monitoring.

The continuous noise loggers recorded:

- date, time and temperature;
- ambient background, L_{A90} noise levels and amenity, $L_{Aeq, 15min}$ noise levels;
- maximum and minimum noise levels; and
- statistical noise levels representative of the noise environment.

Table 4.1 Background Noise Monitoring

Representative Area	Logger Serial No.	Measurement Started	Measurement Stopped
24 Moreton Street, Russell Vale	194684	14:55, 1/12/2008	15:53, 23/12/2008
5 Bloomfield Avenue, Corrimal	194685	16:50, 1/12/2008	00:15, 23/12/2008
34-36 Robson Street, Corrimal	194698	17:02, 1/12/2008	00:45, 23/12/2008

The Rating Background Level (RBL), intrusiveness criteria and amenity criteria for monitoring locations were determined in accordance with INP methodology.

A summary of the results of the unattended continuous noise monitoring are provided in *Table 4.2*. Noise data during any periods of rain and/or wind speeds in excess of 5 m/s (18 km/h) were discarded in accordance with INP weather-affected data exclusion methodology.

Table 4.2 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
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; and
3. The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

4.2 *ROAD TRAFFIC NOISE MONITORING*

Unattended noise monitoring was undertaken to determine existing road traffic noise levels for receivers along Bellambi Lane in near and far proximity to the road alignment. 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 continuous unattended noise monitoring completed at these locations on Bellambi Lane are summarised in *Table 4.3*. 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 4.3 Summary of Existing Road Noise Levels

Location	Leq, 15hr dB(A)	Leq, 1hr 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.

4.3 METEOROLOGICAL CONDITIONS

Noise propagation over distance can be significantly affected by the prevailing weather conditions. Source to receiver winds, the presence of temperature inversions and drainage flow effects can enhance received noise levels. To account for these phenomena, the INP specifies meteorological analysis procedures to determine the prevalent weather conditions that enhance noise propagation in a particular area, with a view to determining whether they can be described as a feature of the project area.

Wind

Wind has the potential to increase noise impacts at a receiver when it is light and stable and blows from the direction of the noise source. As the strength of the wind increases the noise produced by the wind usually obscures noise from most industrial and transport sources.

The prevailing wind directions in the area have been determined in accordance with Section 5 of the INP. The prevailing wind directions during 1 January 2008 to 3 September 2009 for Wollongong NSW have been analysed using data from the Bellambi Weather Station (068228; latitude 34.37 °S, longitude 150.93 °E). The INP requires that source-to-receiver wind speed (at 10 me height) of 3m/s or below with an occurrence for 30 per cent of the time or more be assessed (refer to Section 5.3.1 of the INP[1]). The results of this analysis are shown in *Table 4.4,* and indicate that there are no prevailing winds.

[1] 'Where inversion conditions are predicted for at least 30% (or approximately 2 nights per week) of the total night time in winter, then inversion effects are considered to be significant and should be taken into account in the noise assessment'

Table 4.4 INP Prevailing Wind Analysis Summary

INP WIND ANALYSIS SUMMARY					
DAYTIME					
Period	**Calm**	**Wind Direction**	**0.5 to 2 m/s**	**2 to 3 m/s**	**0.5 to 3 m/s**
Summer	0.4%	ESE±45	1.0%	2.8%	3.8%
Autumn	1.8%	ESE±45	1.8%	4.2%	6.0%
Winter	1.2%	WNW±45	1.8%	3.4%	5.1%
Spring	0.7%	NNE±45	1.1%	3.0%	4.0%
EVENING					
Period	**Calm**	**Wind Direction**	**0.5 to 2 m/s**	**2 to 3 m/s**	**0.5 to 3 m/s**
Summer	0.8%	NNW±45	2.0%	2.8%	4.8%
Autumn	3.0%	WNW±45	4.6%	12.6%	17.1%
Winter	1.4%	W±45	4.6%	11.0%	15.6%
Spring	2.6%	NW±45	2.6%	5.8%	8.3%
NIGHT TIME					
Period	**Calm**	**Wind Direction**	**0.5 to 2 m/s**	**2 to 3 m/s**	**0.5 to 3 m/s**
Summer	4.3%	W±45	5.5%	8.6%	14.0%
Autumn	2.6%	W±45	5.6%	13.2%	18.8%
Winter	1.6%	W±45	5.0%	9.1%	14.0%
Spring	4.1%	W±45	4.4%	8.9%	13.3%

Temperature Inversion

Temperature inversions, which occur predominantly at night during winter, can increase noise levels by focusing sound waves. For a temperature inversion to be considered as significant, it needs to occur for approximately 30 percent of the total night-time (ie the evening and night time periods) during winter, or approximately two nights per week. Temperature inversions are generally determined based on the occurrence of atmospheric stability classes, with moderate and strong inversions corresponding to atmospheric stability categories F and G respectively.

Meteorological data was assessed in accordance with INP methodology to determine the likelihood of temperature inversions during the night-time period in the assessment area. These results are presented in *Table 4.5*.

Table 4.5 Inversion Analysis Summary – Frequency of Stability Classes during Winter Evening and Night time Periods

Pasquill-Gifford Stability Class	Frequency of Stability Class
A	0.0%
B	0.0%
C	0.0%
D	70.8%
E	15.1%
F	10.7%
G	3.4%
F & G	14.1%

This assessment found that the frequency of occurrence of F and G atmospheric stability categories is less than 30 per cent of the winter evening and night time periods. Therefore, the effects of temperature inversions have not been considered in this NIA.

Drainage Flow

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.

5 PROJECT-SPECIFIC NOISE LEVELS

5.1 OPERATIONAL NOISE CRITERIA

Noise emission design criteria for the Project have been established with reference to the INP as outlined in *Annex B*. This involved assessment of amenity noise criteria based on land use and the intrusiveness of proposed industrial noise sources.

The acoustic environment in the vicinity of the study area is classified as suburban by the NSW INP. A suburban environment typically has intermittent traffic flows with some limited commerce or industry. This area has the following characteristics:

- decreasing noise levels in the evening period ;and
- evening ambient noise levels defined by the natural environment and infrequent human activity.

Therefore the 'suburban' assessment criteria have been adopted at the potentially affected receivers nearest the proposed development area.

The relevant intrusive and amenity noise criterion and resulting operational project-specific noise levels for the residential receivers surrounding the Russell Vale site, with respect to the background noise monitoring locations, are presented in *Table 5.1*

Table 5.1 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 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night 10.00 pm to 7.00 am. On Sundays and Public Holidays, Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am; and
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.

5.2 *SLEEP DISTURBANCE*

The OEH has acknowledged that the relationship between maximum noise levels and sleep disturbance is not currently well defined. While the INP does not specify a criterion for assessing sleep disturbance, the Environmental Noise Control Manual (ENCM, 1994) recommends that the $L_{1,\,1min}$ noise level from a source should not exceed the existing background noise by more than 15 dB. Depending on the measured background noise, the sleep disturbance criteria for the quietest location could be as low as 45 dB(A) $L_{1,\,1min}$.

The relevant sleep disturbance criterion for the residential receivers surrounding the area is presented in *Table 5.2*.

Table 5.2 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			

5.3 *ROAD TRAFFIC NOISE CRITERIA*

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

Due to the recent extension of Memorial Drive to Bulli, Bellambi Lane would now be considered 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 5.3*.

Table 5.3 ECRTN Road Traffic Noise Criteria

Type of Development	Criteria: Day 7.00am - 10.00pm	Criteria: Night 10.00pm - 7.00am	Where Criteria are Already Exceeded
Land use developments with the potential to create additional traffic on existing freeways/arterials (e.g. Northern Distributor)	60 dB(A) LAeq, 15hr	55 dB(A) LAeq, 9hr	Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.
Land use developments with the potential to create additional traffic on collector roads (eg Bellambi Lane)	60 dB(A) LAeq, 1hr	55 dB(A) LAeq, 1hr	
Land use developments with the potential to create additional traffic on local roads	55 dB(A) LAeq, 1hr	50 dB(A) LAeq, 1hr	

5.4 CONSTRUCTION NOISE

5.4.1 *Justification for the Application of the ICNG*

The aim of the Interim Construction Noise Guideline (ICNG, 2009) is to provide guidance on managing construction works to minimise noise, including air and ground borne noise and blasting, from construction works noise regulated by OEH, and is used to assist OEH in setting statutory conditions in licences. Construction regulated by OEH under the *Protection of the Environment Operations Act 1997* (POEO Act) includes development work that will enable scheduled activities to be carried out (Section 47 of the POEO Act). The ICNG criteria are presented in *Table 5.4*.

Normally, noise from construction associated with quarrying and mining is not assessed by the ICNG, and would be assessed in accordance with the NSW INP (EPA 2000). It is understood that the ICNG is not intended to be applied to construction associated with quarrying and large open cut mines.

However, the type of construction activities to be undertaken as part of this project would be considered as "normal construction" activities and is the focus of the ICNG. Hence, for this assessment the noise goals have been determined in accordance with the ICNG.

A quantitative assessment methodology has been adopted for the potential construction noise impacts associated with the proposed development. This methodology is detailed in Section 4 of the Guideline and involves the prediction of construction noise levels associated with the proposed development and assessment against the criteria defined in the Guideline.

Where construction noise is audible at residential premises, Section 2.2 of the Guideline recommends that construction should be limited to the following times:

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

Although not mandatory these operational hours are a primary form of construction noise management adopted by the OEH. In conjunction with typical 'feasible' and 'reasonable' measures (refer the Guideline) to minimise noise impacts – "feasible work practices are practical to implement, while reasonable work practices take into account the balance of costs and benefits and community views".

The criteria for noise from construction are assessed at residential properties and the noise management levels described in *Section 5.4.2*, derived in accordance with the Guideline, would be applicable during the proposed construction works.

5.4.2 Construction Noise Criteria

The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses. It does this by presenting assessment approaches that are tailored to the scale of construction projects and indicating how work practices can be modified to minimise noise. The ICNG provides detailed advice on the range of work practices and regulatory approaches to manage construction noise.

Table 5.4 ICNG Construction Noise Criteria at Residential Receivers

Noise Management Level	Noise Level
Noise affected	RBL + 10dB
Highly noise affected	75 dB(A)

Therefore, the L_{Aeq} noise level during construction should not exceed the background L_{A90} level by more than 10 dB. The proposed project specific construction noise criteria are presented in *Table 5.5*.

Table 5.5 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

5.5 VIBRATION CRITERIA

Environmental Noise Management - Assessing vibration: a technical guideline (DECCW 2006) presents preferred and maximum values for use in assessing human responses to vibration from continuous, impulsive and intermittent sources. Potential vibration sources include the day time movement of coal trucks. This type of vibration is assessed on the basis of vibration dose levels for intermittent events.

The acceptable vibration dose values for intermittent vibration at residences during daytime periods are presented in *Table 5.6*.

Table 5.6 Acceptable Vibration Dose Values for Intermittent Vibration

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

6 *EQUIPMENT DESIGN AND MITIGATION*

6.1 *EQUIPMENT DESIGN*

Due to the close proximity of the Russell Vale site to residences in Russell Vale and the Corrimal area, the implementation of low noise equipment will be essential to meet the appropriate INP noise goals. The acoustic design parameters for acoustically significant plant and equipment for the Project are shown in *Table 6.1*.

Table 6.1 Sound Power Levels by Equipment Type

Equipment	SWL dB(A)
New Conveyors	70 dB(A) per metre
Stackout conveyors	74
Conveyor Drive Assemblies (enclosed, inclusive of motor, coupling, gearbox and oil coolers)	93
Shuttle	90
Mine Ventilation Fan & Outlet	103
Sizing Tower (enclosed)	99
Existing Reclaim tunnel Fans	108
Compressor House	80
Pumphouse	84
Dozer (mitigated)	109

6.2 *ADDITIONAL MITIGATION MEASURES*

The following mitigation measures have been included, assuming construction of Stage 1 operations:

- a 3 m high barrier to south of Broker Street, Russell Vale near the intersection with West Street; and
- a 3.6 m high roadside type barrier to the north of the internal access road from weighbridge to the Princes Hwy.

The locations of these mitigation measures are presented in *Figure 6.1*.

In addition NRE is proposing to construct an additional noise bund to the south of the site. This will provide further screening to residents located to the south. This noise bund was not included in the modelling and therefore the model results in *Chapter 10* are conservative.

Legend

Project Application Area

Barrier Location

Figure 6.1

Locations of Mitigation Measures

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE No.1 Colliery Noise Assessment		
Drawing No:	0079383s_NA_G002_R0.mxd		
Date:	11/01/2011	Drawing Size:	A4
Drawn By:	NS	Reviewed By:	PM
Projection:	GDA 1994 MGA Zone 56		
Scale:	Refer to scale bar		

N

0 80 160 240m

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7 NOISE MODELLING METHODOLOGY

7.1 NOISE MODELLING

Noise level predictions must take into account all significant noise sources associated with the operation of the proposed coal handling facility. One method of determining the impact of numerous noise sources at a receiver is to develop a computer noise model of the proposed operations using a commercially available software package. The model used for this assessment was Version 7.01 of Brüel & Kjær Predictor Type 7810 computer noise modelling software using ISO 9613.1 and 9613.2 Industry (International method for general purpose) noise propagation algorithms with CONCAWE meteorological factors for predicting noise impacts from industrial noise sources.

The model incorporated identifiable and significant noise source data, meteorological data, surrounding terrain characteristics and the barrier 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.

7.2 METEOROLOGICAL PARAMETERS

The noise model was used to predict noise levels based on the meteorological conditions presented in *Table 7.1*.

Table 7.1 Site Specific Meteorological Conditions

Assessment Conditions	Temperature °C	Wind Speed & Direction	Relative Humidity	Temperature Gradient
Daytime – Calm	15 °C	n/a	60%	n/a
Evening – Calm	15 °C	n/a	80%	n/a
Night – Calm	10 °C	n/a	90%	n/a

7.3 OPERATIONAL NOISE SOURCES

Sound Power Levels (SWL) of acoustically significant plant and equipment associated with the proposed development as presented in *Table 6.1* have been incorporated into the noise model.

7.4 *OPERATING EQUIPMENT*

The operation will involve material handling facilities including the run of mine (ROM) coal delivery system, stacking, stockpiling and reclaim system and the truck loading facilities.

7.5 *OPERATIONAL MODELLING SCENARIOS*

The noise model was run for daytime, evening and night time operations based on peak production operations. The modelling incorporated the assumptions outlined in *Table 7.2*.

Table 7.2 Peak Operations – Equipment Utilisation and Operating Hours

Equipment	Hours of operation	% of time operating	Comment
1x dozer	7 am to 6 pm Mon to Fri, 8 am to 6 pm 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	7 am to 10 pm Mon to Fri, 8 am to 6 pm Sat, Sun & P/hol	100% of operational hours	26 trucks per hour
ROM stockpile	24x7	100%	Dust suppression spray system

The model assumes that all acoustically significant plant and equipment operates simultaneously.

8 *OPERATIONAL NOISE ASSESSMENT*

8.1 *OPERATIONAL NOISE ASSESSMENT*

8.1.1 *Operational Noise Levels*

The noise model was used to calculate noise levels from operations, as outlined in *Section 7.5,* at the nearest residential receiver locations under the meteorological conditions described in *Table 7.1*. This scenario represents the worst-case scenario of surface operations as all plant and equipment is operational. The predicted noise contours around the mining area for each operating period are presented in *Figure 8.1*.

The single point calculation results for the proposed operational scenarios are presented in *Table 8.1* and are compared to the respective PSNLs.

Table 8.1 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

1. All levels are dB(A);
2. Exceedances presented in bold text.

The results in *Table 8.1* 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 or equal to 2 dB(A) are predicted at three (3) receivers during evening periods in Russell Vale. For the purposes of assessing potential noise impacts project-specific, management and affectation criteria have been developed with due regard to the INP. In this case the INP Noise Management Zone (≤ 5 dB above project-specific criteria) applies.

29 West Street (R2) is predicted to experience noise levels up to 2 dB(A) over the PSNLs. This location is the closest to the site operations. Assuming implementation of the barriers as proposed, the major contributing noise sources at 29 West Street (R2) are as follows:

- trucks;
- stackout conveyor; and
- tunnel fans.

The received noise level at R2 is due to the contribution of existing and proposed operations and trucks. In this case the INP Noise Management Zone (≤ 5 dB above project-specific criteria) applies with regard to the implementation of a noise management plan as discussed in *Section 13*.

8.1.2 Sleep Disturbance

Noise levels associated with the Project are predicted to be less than or equal to 41 dB(A) at all receivers during night time periods, which complies with the limiting sleep disturbance criteria of 47 dB(A) for each representative area as outlined in *Table 5.2*.

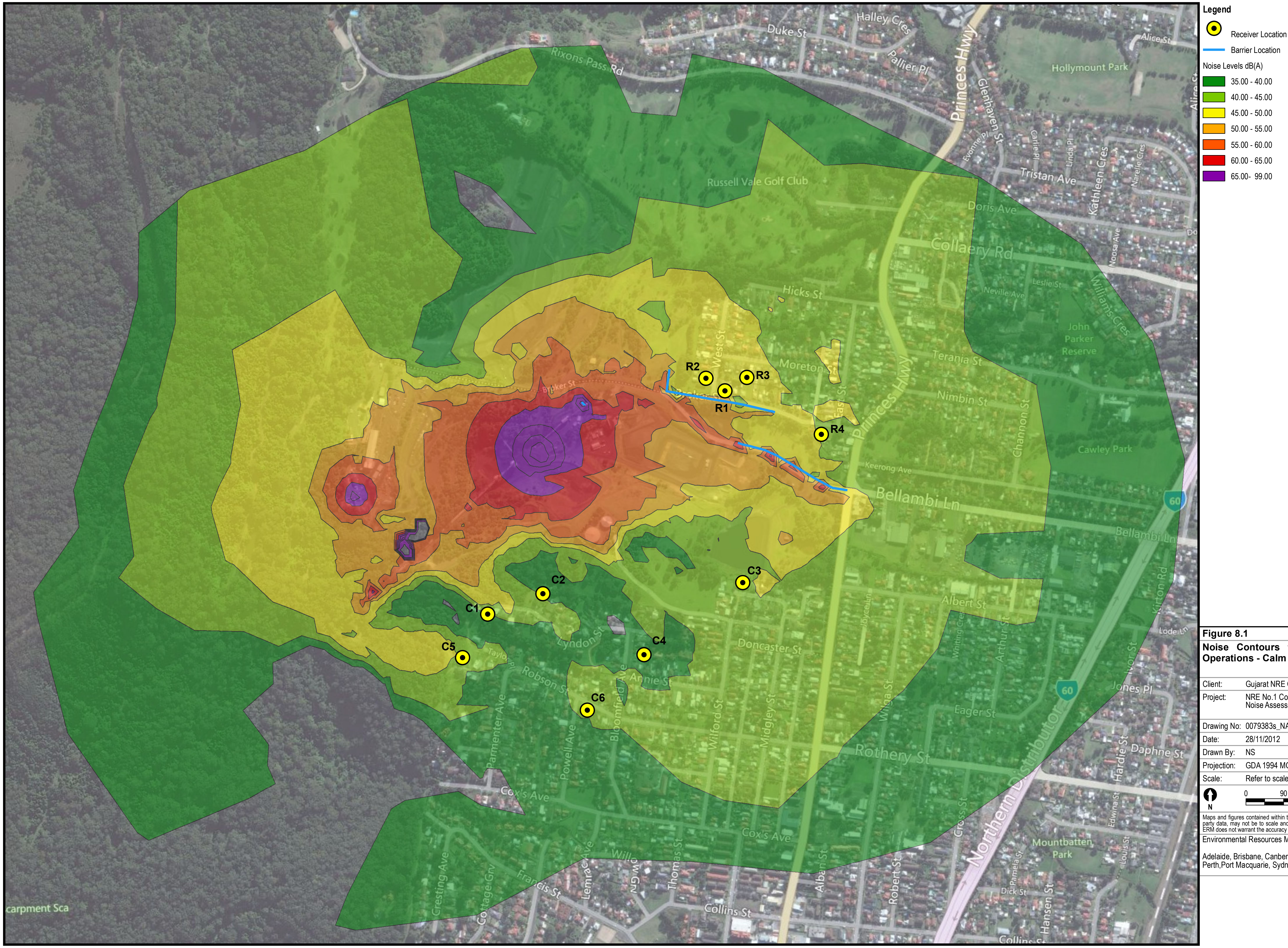

Figure 8.1

Noise Contours for Daytime Peak Operations - Calm Conditions

Client:	Gujarat NRE Coking Coal Limited
Project:	NRE No.1 Colliery Noise Assessment
Drawing No:	0079383s_NA_G003_R0.mxd
Date:	28/11/2012 — Drawing Size: A3
Drawn By:	NS — Reviewed By: PM
Projection:	GDA 1994 MGA Zone 56
Scale:	Refer to scale bar

N 0 90 180 270m

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9 *ROAD TRAFFIC NOISE ASSESSMENT*

9.1 *ASSESSMENT OVERVIEW*

Unattended noise monitoring was undertaken to determine existing road traffic noise levels for receivers along Bellambi Lane in near and far proximity to the road alignment, before the commencement of Stage 1 Preliminary Works Project (refer *Section 4.2*). Monitoring was conducted between 22 February 2010 and 4 March 2010 at 63 Bellambi Lane and 99 Bellambi Lane.

The measured existing road traffic noise levels recorded (67 dB $L_{Aeq, 1\text{-}hour}$ at 63 Bellambi Lane and 64 dB $L_{Aeq, 1\text{-}hour}$ at 99 Bellambi Lane) indicate that the closest and/or potentially most affected receivers along Bellambi Lane currently exceed the relevant ERCTN criteria. Therefore any increase in existing levels due to Project-related traffic should be less than 2 dB(A) (refer *Section 5.3*) to comply with relevant criteria.

To assess the effect of traffic associated with the Preliminary Works Project, ERM developed a detailed noise model to predict road traffic noise levels in Bellambi Lane and adjacent streets. Noise modelling has been completed 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.

9.2 *TRAFFIC VOLUMES*

On average, coal delivery is predicted to generate 512 trips per day (256 coal truck loads). This is an increase of 126% compared to the number of coal trucks 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 – 10:00pm) period. No coal trucks are expected to operate during the ECRTN night-time period (10:00pm – 07:00am) and impacts during this period are not considered in the assessment.

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.

9.3 *ROAD TRAFFIC NOISE LEVELS*

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). This procedure is referenced in the ECRTN[2].

The predicted 'average' and 'peak' ($L_{Aeq,\ 1\ hour}$) road traffic noise levels associated with 3mtpa are presented in *Table 9.1* and *Table 9.2*; the same data set is presented as noise contour maps, in *Figure 9.1* and *Figure 9.2*.

---

[2] The CoRTN prediction methodology presents results in terms of $L_{10,\ 18\text{-hour}}$. Accordingly, ERM has utilised the Brüel & Kjær Predictor 7810 computer noise modelling software CoRTN calculation module, which enables the predicted of CoRTN $L_{10,18\text{-hour}}$ levels to be converted to $L_{Aeq,1\text{-hour}}$ levels for comparison with the baseline noise measurements (refer *Section 4.2*) and assessment in accordance with the relevant 1 hour ECRTN criteria.

Table 9.1 Predicted 'Average' Road Traffic Noise Levels

Receiver						
Name	**Location**	**Measured Existing Road Traffic Noise Level LAeq, 1-hour**	**Calculated Road Traffic Noise Level associated with Project LAeq, 1-hour**	**Cumulative[2] Road Traffic Noise Level LAeq, 1-hour**	**Traffic Noise Criteria**	**Comply?**
63 BL	63 Bellambi Lane	67	64	69	69	Yes
35 BL	35 Bellambi Lane	67	64	69	69	Yes
87 BL	87 Bellambi Lane	67	63	69	69	Yes
45 BL	45 Bellambi Lane	67	63	69	69	Yes
73 BL	73 Bellambi Lane	67	63	69	69	Yes
67 BL	67 Bellambi Lane	67	63	68	69	Yes
29 BL	29 Bellambi Lane	67	63	68	69	Yes
99 BL	99 Bellambi Lane	64	62	66	66	Yes
109 BL	109 Bellambi Lane	64	62	66	66	Yes
97 BL	97 Bellambi Lane	64	62	66	66	Yes
55 BL	55 Bellambi Lane	64	60	65	66	Yes
85 BL	85 Bellambi Lane	64	59	65	66	Yes
79 BL	79 Bellambi Lane	64	59	65	66	Yes
49 BL	49 Bellambi Lane	64	59	65	66	Yes
59 BL	59 Bellambi Lane	64	59	65	66	Yes
69 BL	69 Bellambi Lane	64	59	65	66	Yes
31 BL	31 Bellambi Lane	64	59	65	66	Yes
21 BL	21 Bellambi Lane	64	58	65	66	Yes
41 BL	41 Bellambi Lane	64	57	65	66	Yes
64 KA	64 Keerong Avenue	No Monitoring Data	50	50	55	Yes
24 KA	24 Keerong Avenue	No Monitoring Data	49	49	55	Yes
56 KA	56 Keerong Avenue	No Monitoring Data	48	48	55	Yes
50 KA	50 Keerong Avenue	No Monitoring Data	47	47	55	Yes
32 KA	32 Keerong Avenue	No Monitoring Data	47	47	55	Yes

12 KA	12 Keerong Avenue	No Monitoring Data	46	46	55	Yes
32 AS	32 Albert Street	No Monitoring Data	40	40	55	Yes
Cnr KA & C	Corner of Keerong Av & Channon St	No Monitoring Data	36	36	55	Yes
50 AS	50 Albert Street	No Monitoring Data	36	36	55	Yes
40 KA	40 Keerong Avenue	No Monitoring Data	33	33	55	Yes
58 AS	58 Albert Street	No Monitoring Data	20	20	55	Yes
68 AS	68 Albert Street	No Monitoring Data	19	19	55	Yes

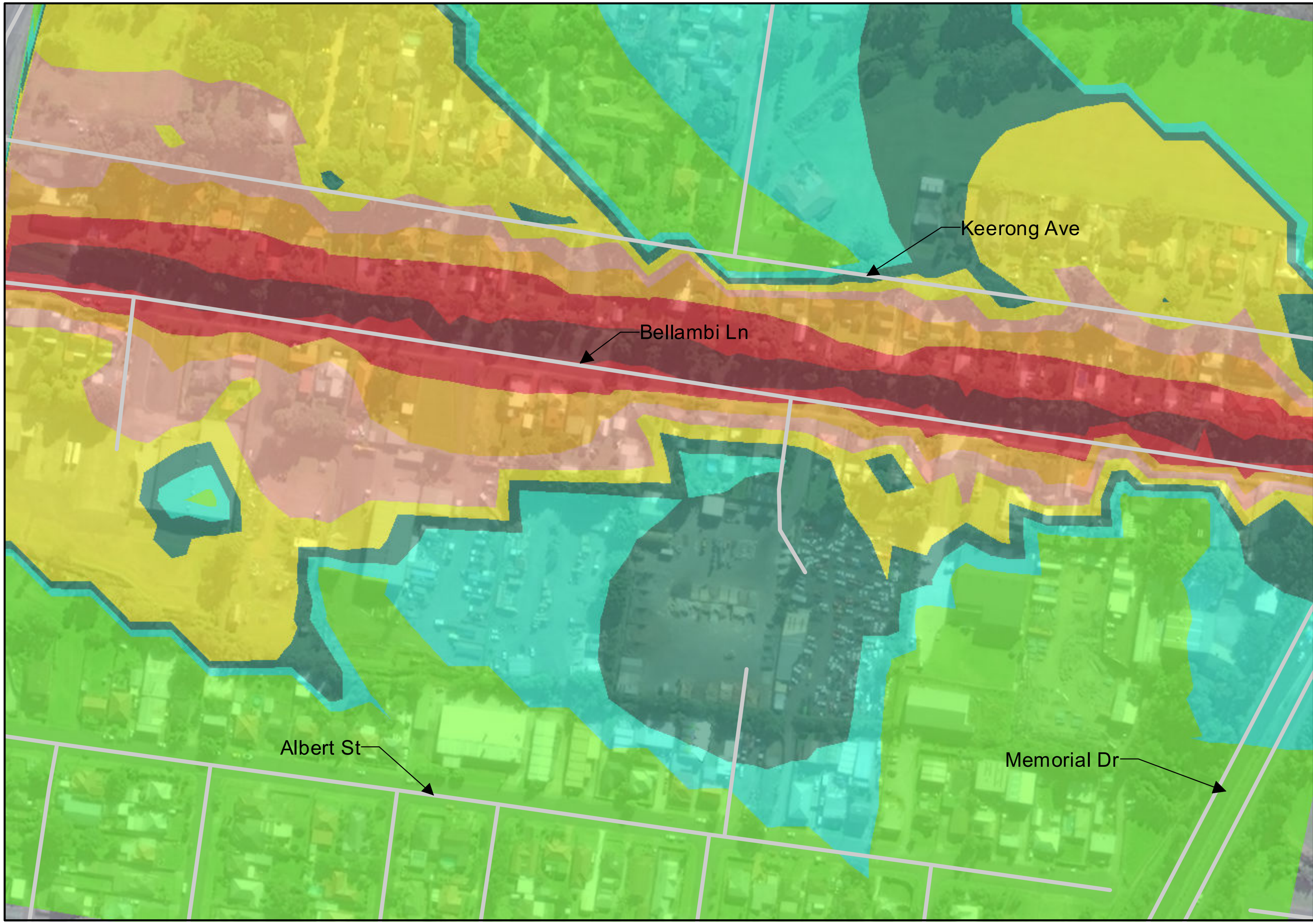
1. Exceedences (if any) are highlighted in **bold**.
2. Existing traffic noise and traffic noise associated with the Project

Table 9.2 Predicted 'Peak' Road Traffic Noise Levels

Receiver		Measured Existing Road Traffic Noise Level LAeq, 1-hour	Calculated Road Traffic Noise Level associated with Project LAeq, 1-hour	Cumulative[2] Road Traffic Noise Level LAeq, 1-hour	Traffic Noise Criteria	Comply?
Name	Location					
63 BL	63 Bellambi Lane	67	65	69	69	Yes
35 BL	35 Bellambi Lane	67	65	69	69	Yes
87 BL	87 Bellambi Lane	67	65	69	69	Yes
45 BL	45 Bellambi Lane	67	65	69	69	Yes
73 BL	73 Bellambi Lane	67	65	69	69	Yes
67 BL	67 Bellambi Lane	67	64	69	69	Yes
29 BL	29 Bellambi Lane	67	64	69	69	Yes
99 BL	99 Bellambi Lane	64	63	67	66	**+1**
109 BL	109 Bellambi Lane	64	63	67	66	**+1**
97 BL	97 Bellambi Lane	64	63	66	66	Yes
55 BL	55 Bellambi Lane	64	61	66	66	Yes
85 BL	85 Bellambi Lane	64	61	66	66	Yes
79 BL	79 Bellambi Lane	64	61	66	66	Yes
49 BL	49 Bellambi Lane	64	60	66	66	Yes
59 BL	59 Bellambi Lane	64	60	66	66	Yes
69 BL	69 Bellambi Lane	64	60	66	66	Yes
31 BL	31 Bellambi Lane	64	60	65	66	Yes
21 BL	21 Bellambi Lane	64	59	65	66	Yes
41 BL	41 Bellambi Lane	64	59	65	66	Yes
64 KA	64 Keerong Avenue	No Monitoring Data	52	52	55	Yes
24 KA	24 Keerong Avenue	No Monitoring Data	50	50	55	Yes
56 KA	56 Keerong Avenue	No Monitoring Data	49	49	55	Yes
50 KA	50 Keerong Avenue	No Monitoring Data	49	49	55	Yes
32 KA	32 Keerong Avenue	No Monitoring Data	48	48	55	Yes
12 KA	12 Keerong Avenue	No Monitoring Data	48	48	55	Yes
32 AS	32 Albert Street	No Monitoring Data	41	41	55	Yes
Cnr KA & C	Corner of Keerong Av & Channon St	No Monitoring Data	38	38	55	Yes

50 AS	50 Albert Street	No Monitoring Data	37	37	55	Yes
40 KA	40 Keerong Avenue	No Monitoring Data	34	34	55	Yes
58 AS	58 Albert Street	No Monitoring Data	21	21	55	Yes
68 AS	68 Albert Street	No Monitoring Data	21	21	55	Yes

1. Exceedences (if any) are highlighted in **bold**.
2. Existing traffic noise and traffic noise associated with the Project



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 9.1

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_G001_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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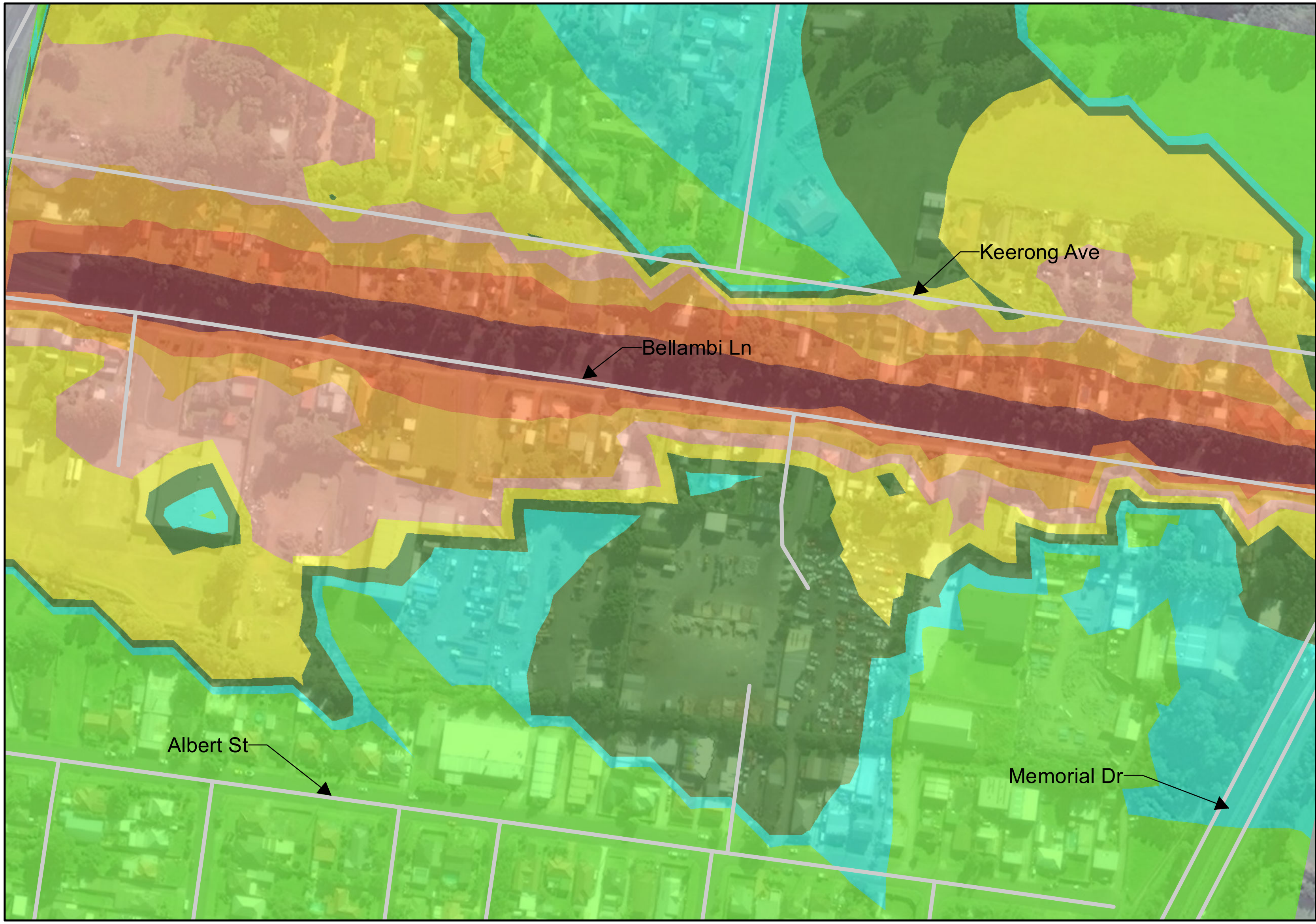

Legend

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 9.2

Peak Road Traffic Noise Levels

Client:	Gujarat NRE Coking Coal Limited		
Project:	NRE 1 Colliery Noise Assessment		
Drawing No:	0079383s_NAFeb2012_G002_R0.mxd		
Date:	28/11/2012	Drawing Size:	A4
Drawn By:	SQW	Reviewed By:	NL
Projection:	GDA 1994 MGA Zone 56		
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Environmental Resources Management Australia Pty Ltd

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

ERM

9.3.1 Discussion

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 ($L_{Aeq,\ 1\text{-hour}}$) are expected to increase the existing traffic noise level due to Project-related traffic (future coal haulage) by approximately 2.5 to 3 dB(A) at the following receptors:

    - 99 Bellambi Lane (99 BL); and

    - 109 Bellambi Lane (109 BL).

- 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 2 dB is considered significant.

Time of Day

Regarding the noted increase in noise levels during peak coal haulage periods, Section 3.5 of the ECRTN provides discussion around applying the criteria for land use developments that create traffic, and states that for developments that create additional traffic, 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 (the standard time delineating day and night) 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 3 dB 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. 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 2 dB. 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.

Based on these findings discussed above, ERM has made recommendations to measure actual 'peak' coal haulage noise levels and to apply appropriate noise mitigation/management measures as provided in *Chapter 13.6* of this report.

10 CUMULATIVE NOISE ASSESSMENT

The INP allows assessment of the potential cumulative noise impacts associated with existing and future developments by defining appropriate noise emission criteria with respect to maintaining the noise amenity at residential receivers and considering applicable consent limits. The cumulative impact of the Project has been assessed in relation to preserving the noise amenity at the nearest residential receivers.

As discussed in Appendix 2, the NSW Industrial Noise Policy (INP) prescribes detailed calculation routines for establishing "project specific" $L_{Aeq, 15min}$ intrusive criteria and $L_{Aeq, Period}$ amenity criteria at potentially affected receivers for a development (in isolation).

Potential cumulative noise impacts from existing and successive resource developments are embraced by the INP procedures by ensuring that the appropriate noise emission criteria (and approved limits) are established with a view to maintaining acceptable noise amenity levels for residences.

The recommended amenity noise levels for all receiver areas are 50 dB(A) $L_{Aeq, Day}$, 45 dB(A) $L_{Aeq, Eve}$ and 40 dB(A) $L_{Aeq, Night}$.

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

11 CONSTRUCTION NOISE ASSESSMENT

11.1 CONSTRUCTION PHASE

It is anticipated that the construction phase may extend over a period of approximately 36 months. This phase will involve the following activities:

- site preparation and construction earthworks;
- construction and sealing of haul roads; and
- construction of site facilities.

11.1.1 Construction Noise Sources

The model involved the simulation of typical construction methods for industrial developments, assuming construction hours are limited to those outlined by ICNG.

Construction activities will include site preparation, earthworks, construction of access roads and site facilities. The civil works phase activities will involve the use of typical machinery and equipment as shown in *Table 11.1*. Construction operations will occur during normal daytime hours only.

The predicted noise levels assume attenuation from geometrical spreading only and neutral meteorological conditions (zero wind and temperature gradients). The model incorporated the barrier effect of barriers assumed to be constructed as part of Stage 1 operations. Other factors such as ground effects, air absorption and shielding due to natural topography and other nearby buildings have not been considered, and hence the results are conservatively high.

Table 11.1 Typical Plant Noise Levels

Plant/ Activity	Sound Power Level , dB(A)
Grader (CAT 24H)	112
Dozer (CAT D6R)	110
Excavator (CAT 345B)	106
Dump truck	110
Mobile Crane	105

11.1.2 *Predicted Construction Noise Levels*

Noise emissions from construction were incorporated into the noise model to determine potential noise impacts at the nearest residential receivers during the daytime period.

The sources were modelled at locations to present worst-case construction activities, with sources associated with construction of the new truck loadout facility closest to the receivers in Russell Vale.

The single point calculation results for the proposed construction activities are presented in *Table 11.2* and are compared to the respective construction noise criteria.

Table 11.2 ***Predicted Construction Noise Levels***

Representative Area	Predicted Level, LAeq, 15min dB(A)	Construction Noise Criteria LAeq, 15min dB(A)
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

The results presented in *Table 11.2* 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 13.6.2*.

12 VIBRATION ASSESSMENT

Potential vibration sources include the day time movement of heavy vehicles as part of coal delivery operations.

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 0.2 mm/s. This level represents 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.

13 *CONCLUSION*

13.1 *OPERATIONAL NOISE*

The operational noise levels from the Project incorporating low noise design and additional noise mitigation measures would generally comply with relevant PSNLs at most receivers for day, evening and night time periods. According to the computer model minor exceedences of less than 2 dB(A) are predicted at three (3) receivers during evening periods in Russell Vale.

These exceedences are not expected to be noticeable and are expected to be quantified during compliance monitoring as part of the ongoing noise management plan for the site.

The cumulative noise impact of the Project is considered to comply with INP criteria.

13.2 *SLEEP DISTURBANCE*

The predicted noise levels meet the recommended OEH sleep disturbance noise goals at the nearest residential receivers.

13.3 *ROAD TRAFFIC NOISE*

'Average' road traffic noise levels for future coal haulage at NRE 1 are shown to comply with the relevant ECRTN daytime (7am to 10pm) road traffic noise criteria at all receivers considered in this assessment.

During 'Peak' road traffic, noise levels are shown to comply with the daytime road traffic noise criteria at the majority of receivers, except at 99 Bellambi Lane, and 109 Bellambi Lane where road traffic noise levels ($L_{Aeq,\ 1\text{-hour}}$) are expected to increase due to Project-related traffic (future coal haulage) by approximately 2.5 to 3 dB(A).

13.4 *CONSTRUCTION NOISE*

Construction noise levels are predicted to comply with the requirements of OEH's ICNG construction noise criteria (2009) at all residential receiver locations.

13.5 *VIBRATION*

Vibration impacts associated with onsite and offsite coal haulage are predicted to comply with the requirements of OEH's intermittent vibration criteria (2006).

13.6 RECOMMENDATIONS

13.6.1 *Operational Noise*

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 may be achievable by the implementation of noise management methods outlined below.

It is considered that these noise levels would need to be confirmed upon the commencement of operations from attended noise monitoring as further measures to be undertaken would involve mitigation of existing plant and coal trucks.

Operational Noise Management Plan

It is recommended that an operational Noise Management Plan (NMP) be developed to specifically address potential noise impacts associated with the proposed operations at the nearest receivers.

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

- results of the regular noise monitoring program on-site and within the surrounding area;
- response to any complaints or issues raised by the owner of the affected residence; and
- noise mitigation measures and operating procedures to ensure compliance with noise goals.

Noise monitoring data from the early stages of Project operations should 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 the preliminary works in 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 during the worst case operational scenario.

Operational Noise Monitoring Program

It is recommended that an operational noise monitoring program 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 should be implemented during periods of maximum production to confirm the acoustic performance of the proposed operations.

The results of the noise monitoring program should be reviewed by the operations manager to assess compliance with the goals outlined in *Section 5* and reported in accordance with any requirements of the Project approval or Environment Protection Licence required for the Project under the POEO Act.

13.6.2 *Road Traffic Noise*

At 99 Bellambi Lane and 109 Bellambi Lane where 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 3 dB(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.

13.6.3 *Construction Noise*

It is recommended that a construction NMP 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 OEH's Interim Construction Noise Guideline (2009).

Construction will be limited 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 should 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 should be reviewed by the operations manager to assess compliance with the goals outlined in *Section 5* and reported in accordance with any requirements of the development consent or Environment Protection Licence required for the Project under the POEO Act.

REFERENCES

NSW Environment Protection Authority 1994, **Environmental Noise Control Manual**.

NSW Environment Protection Authority – NSW Environmental Noise Management – **Industrial Noise Policy**, January 2000 and relevant application notes.

NSW Environment Protection Authority – NSW Environmental Noise Management – **Environmental Criteria for Road Traffic Noise**, May 1999.

NSW Department of Environment and Climate Change – NSW **Interim Construction Noise Guideline**, July 2009.

Annex A

Glossary of Terms, Definitions And Abbreviations

A.1 *GLOSSARY AND DEFINITIONS - ACOUSTICS*

1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment background level - A single-figure background level representing each assessment period – day, evening and night (that is, three assessment background levels are determined for each 24-h period of the monitoring period). It is determined by taking the lowest 10th percentile of the L_{90} level for each assessment period.
Airblast	Sound wave from blasting (overpressure).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dB(A), dBA	Decibels A-weighted.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Decibel (dB)	The units of sound level and noise exposure measurement where a step of 10 dB is a ten-fold increase in intensity or sound energy and actually sounds a little more than twice as loud.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
L_{A10}	The percentile sound pressure level exceeded for 10% of the measurement period with 'A' frequency weighting calculated by statistical analysis. Typically used to assess the impact of an existing operation on a receiver area and is referred to as the cumulative noise levels at the receiver attributable to the noise source.
L_{A90}	Background Noise Level. The percentile sound pressure level exceeded for 90% of the measurement period with 'A' frequency weighting calculated by statistical analysis.
L_{Max}	The maximum of the sound pressure levels recorded over an interval of 1 second.

$L_{A1,\,1min}$	The measure of the short duration high-level noises that cause sleep arousal. The noise level is measured as the percentile sound pressure level that is exceeded 1 per cent of measurement period with 'A' frequency weighting calculated by statistical analysis during a measurement time interval of 1 minute.
$L_{Aeq,t}$	Equivalent continuous sound pressure level - The value of the sound pressure level of a continuous steady noise that, a measurement interval of time (t), has the same mean square sound pressure as the sound under consideration whose level varies with time. Usually measured in dB with 'A' weighting.
L_{An}	Percentile level - A measure of the fluctuation of the sound pressure level which is exceeded 'n' per cent of the observation time.
MIC	Maximum explosive charge mass (kg) detonated per delay (any 8ms interval).
PVS (mm/s)	Peak Vector Sum.
PPV (mm/s)	Peak Particle Velocity.
RBL	Rating background level - The overall single figure background level representing each assessment period over the whole monitoring period determined by taking the median of the ABLs found for each assessment period.
SD (m)	The scaled distance for airblast and ground vibration from the charge to the receiver.
SPL, Lp	Sound pressure level - The basic measure of noise loudness. The level of the root-mean-square sound pressure in decibels given by:

$$SPL = 10.\log10\,(p/p_o)^2$$

where p is the rms sound pressure in pascals and p_o is the sound reference pressure at 20 μPa. decibels.

SWL, Lw — Sound power level - A measure of the energy emitted from a source as sound and is given by:

$$SWL = 10.\log10\,(W/W_o)$$

where W is the sound power in watts and W_o is the sound reference power at 10^{-12} watts.

Annex B

INP Assessment Methodology

B.1 NOISE IMPACT ASSESSMENT PROCEDURES

B.1.1 *Industrial Noise Policy*

Responsibility for the control of noise emissions in NSW is vested in Local Government and the DECC. The Industrial Noise Policy (INP) released by DECC in December 2000, provides a framework and methodology for deriving limit conditions for consent and licence conditions. Using this policy the DECC regulates premises that are scheduled under the *Protection of the Environment Operations Act, 1997* (POEO Act).

The specific INP objectives are:

- to establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses;
- to use the criteria as the basis for deriving project-specific noise levels;
- to promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects;
- to outline a range of mitigation measures that could be used to minimise noise impacts;
- to provide a formal process to guide the determination of feasible and reasonable noise limits for consent or licence conditions that reconcile noise impacts with the economic, social and environmental considerations of industrial development; and
- to carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the POEO Act.

The INP is designed for large and complex industrial sources and outlines processes designed to strike a feasible and reasonable balance between the operation of industrial activities and the protection of the community from noise levels that are intrusive or unpleasant.

The application of the INP involves the following processes:

- determining the project-specific noise levels (PSNL) from intrusiveness and amenity based measurement of the existing background and ambient noise levels;
- predicting or measuring the noise levels produced by the development; and
- comparing the predicted noise levels with the project-specific noise levels and assessing impacts.

Where the project-specific noise levels are predicted to be exceeded the INP provides guidelines on the assessment of feasible and reasonable noise mitigation strategies, including:

- 'weighing up' the benefit of the development against the social and environmental costs resulting from the noise impacts;
- establishment of achievable and agreed noise limits for the development in consultation with the consent authority; and
- undertaking performance monitoring of environmental noise levels to determine compliance with the consent and licence conditions.

B.1.2 OEH Assessment Methodology

There are two criteria to consider when establishing project-specific noise levels for the assessment of industrial noise sources. These criteria are:

- the intrusive noise criterion, which is based on the background noise level plus 5 dB. The background noise level, or Rating Background Level (RBL), is determined in accordance with Section 3 of the INP and is based on the use of noise monitoring data to establish the assessable background noise levels; and
- the noise amenity criterion, which is based on the recommended noise levels in the INP for prescribed land use. The recommended acceptable and maximum ambient noise levels are outlined in Table 2.1 of the INP. Table 2.2 of the INP outlines the requirements for developments where the existing noise level from industrial noise sources is close to the acceptable noise level.

The relevant tables in Section 2 of the INP relating to the amenity criteria relevant to the project are presented in *Table B.13.1*.

Table B.13.1 Amenity Criteria – Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended LAeq Noise Level: Acceptable	Recommended LAeq Noise Level: Recommended Maximum
Residence	Rural	Day	50 dB(A)	55 dB(A)
		Evening	45 dB(A)	50 dB(A)
		Night	40 dB(A)	45 dB(A)
	Suburban	Day	55 dB(A)	60 dB(A)
		Evening	45 dB(A)	50 dB(A)
		Night	40 dB(A)	45 dB(A)
	Urban	Day	60 dB(A)	65 dB(A)
		Evening	50 dB(A)	55 dB(A)
		Night	45 dB(A)	50 dB(A)
	Urban/Industrial Interface - for existing situations only	Day	65 dB(A)	70 dB(A)
		Evening	55 dB(A)	60 dB(A)
		Night	50 dB(A)	55 dB(A)
Area specifically reserved for passive recreation	All	When in use	50 dB(A)	55 dB(A)
Active recreation area (School playground, golf course)	All	When in use	55 dB(A)	60 dB(A)
Commercial premises	All	When in use	65 dB(A)	70 dB(A)
Industrial premises	All	When in use	70 dB(A)	75 dB(A)

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.
2. The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Table B.13.2 Modification to Acceptable Noise Level (ANL) to Account for Existing Levels of Industrial Noise

Total Existing LAeq Noise Level from Industrial Noise Sources	Maximum LAeq Noise Level for Noise from New Sources Alone, dB
≥ Acceptable noise level plus 2 dB	If existing noise level is likely to decrease in future acceptable noise level minus 10 dB If existing noise level is unlikely to decrease in future existing noise level minus 10 dB
Acceptable noise level plus 1 dB	Acceptable noise level minus 8 dB
Acceptable noise level	Acceptable noise level minus 8 dB
Acceptable noise level minus 1 dB	Acceptable noise level minus 6 dB
Acceptable noise level minus 2 dB	Acceptable noise level minus 4 dB
Acceptable noise level minus 3 dB	Acceptable noise level minus 3 dB
Acceptable noise level minus 4 dB	Acceptable noise level minus 2 dB
Acceptable noise level minus 5 dB	Acceptable noise level minus 2 dB
Acceptable noise level minus 6 dB	Acceptable noise level minus 1 dB
< Acceptable noise level minus 6 dB	Acceptable noise level

1. ANL = recommended acceptable LAeq noise level for the specific receiver.

In assessing the noise impacts from industrial sources at residential receivers both criteria are considered. For each period (day, evening and night) the most stringent of either the intrusive or amenity criteria becomes the limiting criterion and forms the project-specific noise level for the industrial source.

If the existing ambient noise level is close to the acceptable noise level, a new source must be controlled to preserve the amenity of the surrounding area. If the overall noise level from the industrial source already exceeds the acceptable noise level for the affected area, the L_{Aeq} noise level from a new source should meet the conditions set out in Table 2.2 of the INP.

B.1.3 *INP Project-Specific Criteria*

The INP states that the criteria outlined in *Table B.13.1*and

Table B.13.2 have been selected to protect at least 90 per cent of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90 per cent of the time. Provided the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

Table B.13.3 presents a methodology for assessing noise levels which may exceed the INP project-specific noise assessment criteria.

Table B.13.3 Noise Impact Assessment Methodology

Assessment Criterion	Project-Specific Criteria	Noise Management Zone	Noise Affectation Zone
Intrusive	Rating background level plus 5 dB	≤ 5 dB above project-specific criteria	≥ 5 dB above project-specific criteria
Amenity	INP based on existing industrial level	≤ 5 dB above project-specific criteria	≥ 5 dB above project-specific criteria

For the purposes of assessing the potential noise impacts the project-specific, management and affectation criteria are further defined in the following sections.

Project-Specific Criteria

Most people in the broader community would generally consider exposure to noise levels that achieve the project-specific criteria acceptable.

Noise Management Zone

Depending on the degree of exceedance of the project-specific criteria (1 dB to 5 dB) noise impacts in this zone could range from negligible to moderate. It is recommended that management procedures be implemented including:

- prompt response to any issues of concern raised by community;
- noise monitoring on-site and within the community;
- refinement of on-site noise mitigation measures and plant operating procedures where practical;
- consideration of acoustical mitigation at receivers; and
- consideration of negotiated agreements with property holders.

Noise Affectation Zone

Exposure to noise levels corresponding to this zone (more than 5 dB above project-specific criteria) may be considered unacceptable by some property holders and implementation of the following measures may be required:

- discussions with relevant property holders to assess concerns and provide solutions;
- implementation of acoustical mitigation at receivers; and
- negotiated agreements with property holders.

B.1.4 Assessing Sleep Disturbance

The OEH has acknowledged that the relationship between maximum noise levels and sleep disturbance is not well defined. Criteria for assessing sleep disturbance have not been defined under the INP but it is assumed that compliance with the INP will minimise the potential for sleep arousal. Notwithstanding, sleep arousal has been assessed using the guidelines set out in Section 19-3 of the OEH's Environmental Noise Control Manual (ENCM) (DECC, 1994).

To avoid the potential for sleep disturbance the ENCM recommends that the $L_{A1,\,1min}$ of the noise source should not exceed the background noise level (L_{A90}) by more than 15 dB(A). This is based on measurement outside the bedroom window of the receiver during the night-time hours (10.00 pm to 7.00 am).

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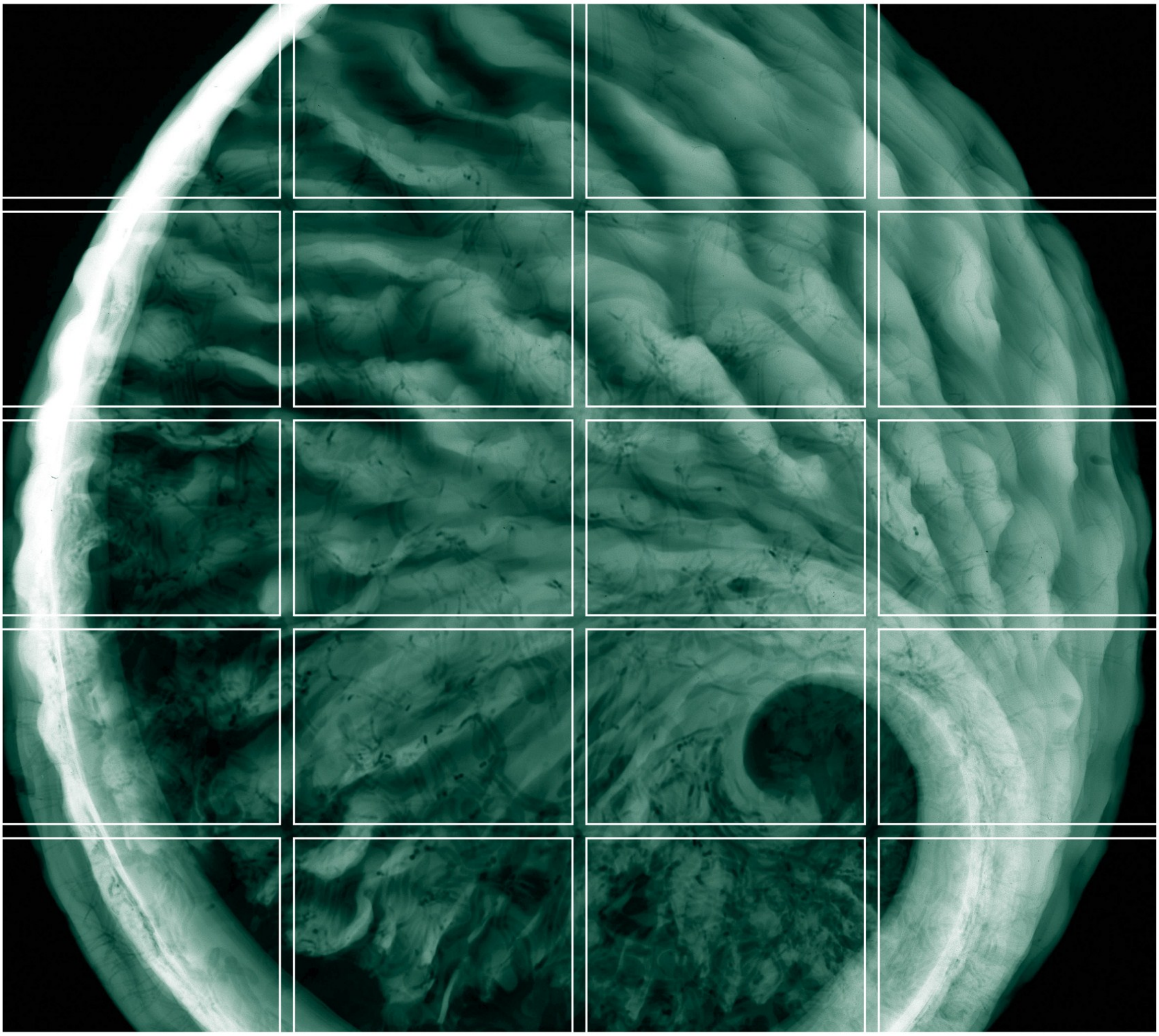
Annex I

Air Quality Assessment



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Air Quality Assessment

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Environmental Resources Management Australia Pty Ltd Quality System

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1 BACKGROUND

1.1 INTRODUCTION

Environmental Resources Management Pty Ltd (ERM) was engaged by Gujarat NRE Coking Coal Ltd (NRE) to prepare an air quality assessment as part of the Environmental Assessment Report for the NRE No. 1 Colliery Stage 2 Project (the Project).

NRE seeks approval for the continuation of its existing operations, upgrade of associated surface facilities and to establish new mining domains at NRE No.1 Colliery in the Southern Coalfield (*Figure 1.1*).

This report has been developed in accordance with the Director-General's Requirements (DGRs) and Office of Environment and Heritage (OEH) assessment requirements, which are as follows:

- a consideration of the air quality impacts that the infrastructure operations could have on the local airshed; and
- a consideration of the air quality impacts that coal haulage by trucks could have in the areas along the coal transport corridor.

1.1.1 *Project Overview*

The project will include the following activities:

- coal extraction increasing coal production up to three million tonnes per annum (Mpta) with a projected mine life of at least 18 years. This will involve:
  - longwall mining in the Wongawilli seam and first workings in the Balgownie and Bulli seams;
  - upgrade of existing mine infrastructure and services at Russell Vale, including surface conveyors and coal handling infrastructure, coal sizing, screening, crushing and load-out facilities, site noise and dust controls, a stockpile for run-of-mine (ROM) coal and new bath house;
  - continued use of No.4 Shaft for mine access (for personnel and material), bath house, offices and parking area;
  - essential maintenance and refurbishment of existing ventilation shafts and power and water supply arrangements;

- upgrade of site water management including, but not limited to, mine water and stormwater controls;

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

- trucking fleet upgrades in line with current standards with suitable braking systems and covers for all loads.

1.1.2 Related Projects

This Project represents Stage 2 of the Colliery upgrade (MP 09_0013). A separate application for Stage 1, the Preliminary Works Project (MP 10_0046) was recently approved by the Department of Planning and Infrastructure (DoPI). Stage 1 involves continuing operation of the Colliery including:

- augmenting, upgrading and using the existing infrastructure;

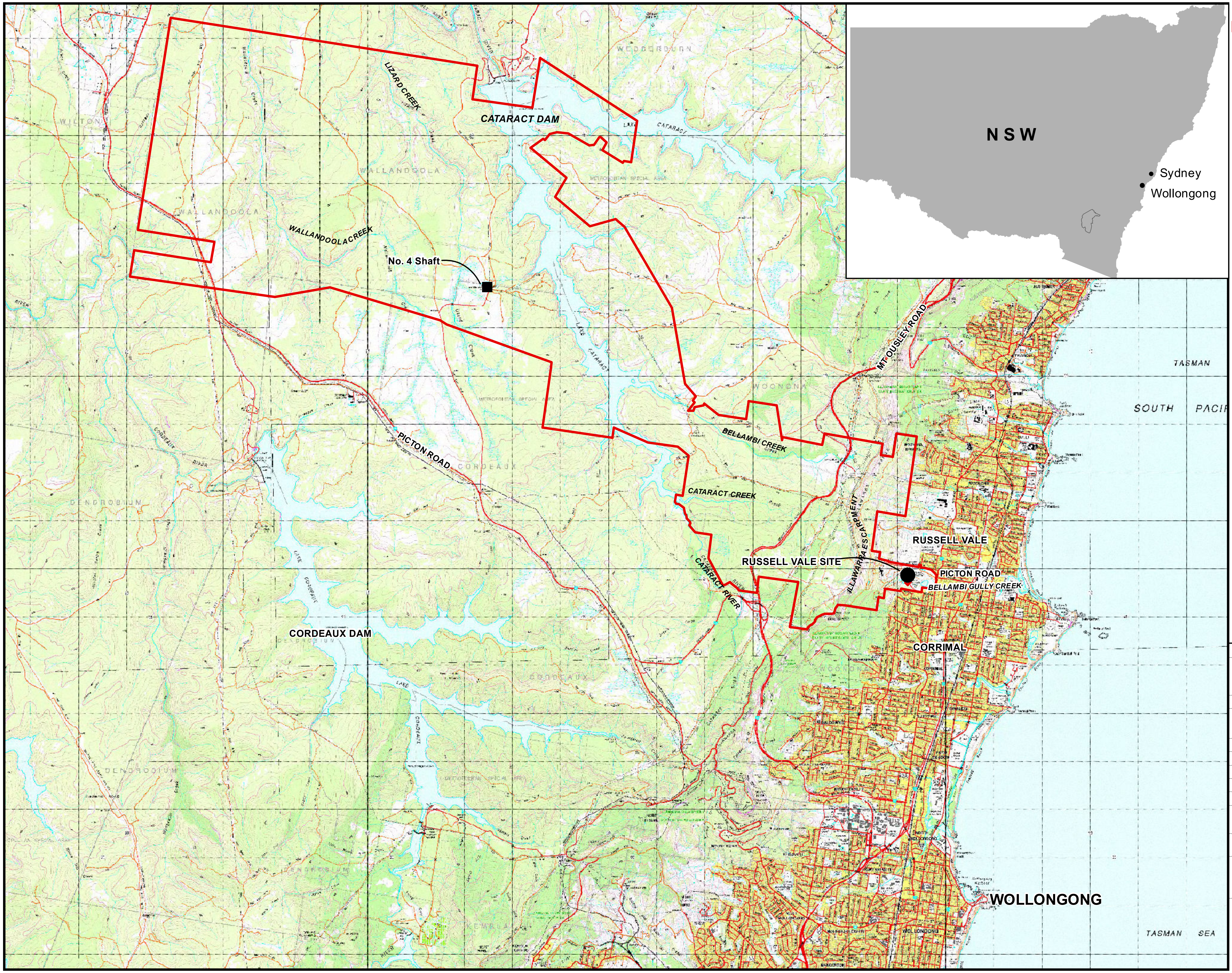
- extracting up to 1 Mtpa of ROM coal from remnant coal reserves within existing mining areas; and

- transporting ROM coal from the mine via truck haulage.

NRE lodged a Subsidence Management Plan (SMP) application for the extraction of Longwalls 4 and 5 in Wonga East with the Department of Trade and Investment, Division of Resources and Energy (DRE) in March 2012. Approval for extraction of Longwall (LW) 4 was granted on 26 March 2012.

A separate application to modify the Preliminary Work Project (MP 10_0046), was prepared by Cardno (2012) and lodged with DoPI in May 2012. The modification application seeks to amend the approval for maingates 4 and 5 in the Wonga East mining domain from exploratory driveages to operational gateroads and the extraction of coal from longwall panels 4 and 5; and, development of maingates 6, 7 and 8 in Wonga East.

Given that Stage 1 (including modifications) and Stage 2 will operate independently of each other with no overlap in operations, a cumulative assessment with the two stages operating simultaneously was not performed. Since sources from the two stages will not be emitting during the same periods in time, modelled impacts will not be cumulative.



Legend

Project Application Area

Figure 1.1
Locality Map

Client:	Gujarat NRE Coking Coal Limited
Project:	NRE No. 1 Colliery EAR Post Adequacy 2012 Air Quality Assessment
Drawing No:	0079383s_AQA_GIS001_R0.mxd
Date:	27/11/2012 — Drawing Size: A3
Drawn By:	NS — Reviewed By: MK
Projection:	GCS GDA 1994
Scale:	Refer to scale bar

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2 PROJECT DESCRIPTION

2.1 EXISTING OPERATIONS

2.1.1 Underground Mining

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

There are no current workings in the Balgownie seam.

Current workings in the Wongawilli seam constitute the Wonga Mains driveage and longwall panel 4 in Wonga East. The development of the Wonga Mains driveage commenced at the Russell Vale site in 2007. The Wonga Mains driveage will connect the proposed Wonga East and Wonga West longwall areas. With approval of the SMP in March 2012, longwall mining of panel 4 in Wonga East mining domain commenced in April 2012.

2.1.2 ROM Coal Handling

Current production at NRE No.1 Colliery is approximately 1 Mtpa ROM coal transported from the working face to the surface via an underground belt conveyor/ vibrating feeder system. There are two decline conveyors, which transport coal from the portal to the stockpile area at the Russell Vale site. These belts are referred to as the Bulli decline belt and the Balgownie decline belt. Both belt conveyors are partially enclosed to reduce dust emissions.

Coal from the Bulli decline belt is deposited into a coal bin at the base of the decline then deposited on the ground. Coal is then managed using a dozer to form the stockpile. The stockpile area has a capacity of up to 80 000t. From the stockpile, coal is processed through the vibrating screen sizer and delivered via a series of conveyors to the truck loading bins. The truck loading bin consists of three separate bins, of which only one is currently used.

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

- an automatically controlled fixed stockpile spray system around the ROM stockpile area;
- a mobile water truck that is used throughout the site;
- roadside sprays;

- truck washing facilities that are used for all heavy vehicles prior to departure from site;
- a bobcat mounted road sweeper that can be used on all sealed surfaces; and
- fixed water sprays at selected points on a number of surface and underground conveyor systems.

Water used for these purposes is supplied from recycled water sources including mine water and treated stormwater. Sprays are used daily across the site and where required, depending on demands.

2.1.3 Product Transport

Coal is currently transported, unwashed, by truck from NRE No.1 Colliery to PKCT for shipment to India. Coal transport trucks generally operate between the hours of 7.00am and 10.00pm five days per week (Monday to Friday) and 8.00am to 6.00pm Saturdays, Sundays and public holidays Average truck loads are approximately 34 tonnes, with up to 134 loaded trucks leaving the site each day.

Trucks leave the site travelling east via Bellambi Lane to the Memorial Drive. Trucks then travel south along the Memorial Drive and on to the Southern Freeway. From the Freeway trucks travel east along Masters Road and Springhill Road to PKCT. The transport route from NRE No.1 Colliery to PKCT is shown on *Figure 2.1*.

2.2 PROPOSED OPERATIONS

2.2.1 Underground Mining

Bulli Seam

Following development of the V Mains area (part of Stage 1), development of the 'Bulli West' area, a new mining area in the western part of CCL 745, is proposed via first workings. The 'Bulli West' development is for underground access roadways only and hence secondary pillar extraction of the Bulli seam in the 'Bulli West' area does not form part of this proposal.

Legend

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

Client:	Gujarat NRE Coking Coal Limited
Project:	NRE No. 1 Colliery EAR Post Adequacy 2012 Air Quality Assessment
Drawing No:	0079383s_AQA_GIS002_R1.mxd
Date:	22/09/2010 — Drawing size: A4
Drawn by:	SQW — Reviewed by: MK
Scale:	Refer to Scale Bar

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Figure 2.1

Coal Transport Route

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Balgownie Seam

Following development of 'S-mains' (existing workings), to access the Wonga West area, limited first workings are proposed in the Balgownie seam beneath existing Bulli seam workings. Secondary extraction does not form part of this application.

Wongawilli Seam

The project includes the continuation (from Stage 1) of the westward development of the existing 'Wonga Mains' driveage from Russell Vale to access the underground working areas in Wonga East and Wonga West.

Mining is proposed in the Wongawilli seam in two areas identified as Wonga East and Wonga West. Wonga East area is located to the west of the Illawarra Escarpment either side of Mount Ousley Drive. The Wonga West area is located to the west of Cataract Reservoir.

2.2.2 *ROM Coal Handling*

Stage 1

This Project is Stage 2 of a major upgrade to NRE No.1 Colliery. Stage 1 (MP10_0046) involves the following coal handling facility upgrades, which will feed into Stage 2:

- removal of the existing Balgownie decline conveyor and storage bin and replacement with a newly designed Wongawilli decline conveyor on a similar alignment,;
- decommissioning of the existing Bulli decline conveyor;
- construction of a stackout conveyor and tripper system;
- construction of a new screening and sizing station; and
- construction of a partial temporary and partial permanent new internal haul road.

Stage 2

Coal handling infrastructure will be further upgraded to improve operational efficiency and minimise impacts on the environment and local community. New coal handling facilities and surface infrastructure upgrades are illustrated in *Figure 2.2*.

Coal exiting the mine will be screened and sized to a maximum top size of 150 mm, 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 50 mm.

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 newly constructed Wongawilli decline belt (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.

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 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.

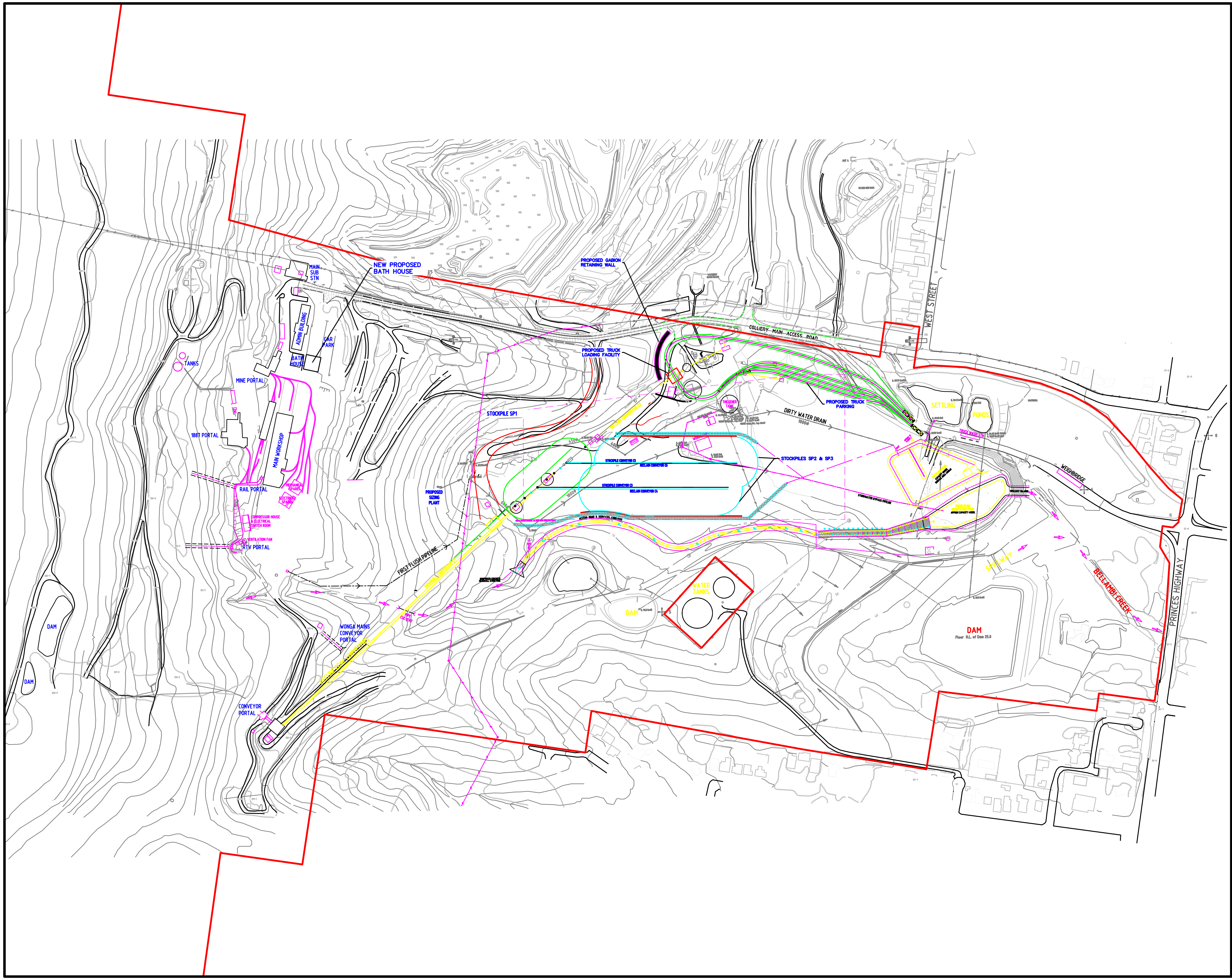
The new truck loading facility will be installed in close proximity to the current facility. During the time which the new truck loading facility is constructed trucks will be loaded directly from the ROM coal stockpile. Once the new facility is implemented and operational, trucks will continue to access the site from the Bellambi Lane and Princes Highway intersection. Upon arrival at site, empty trucks will travel along the Colliery access road then verge 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. Trucks pass through the area in a clockwise direction.

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 powerlines, pipelines and site access constraints.



Legend

Project Application Area

Figure 2.2

Proposed Surface Facility Upgrades

Client: Gujarat NRE Coking Coal Limited

Project: NRE No.1 Colliery
Air Quality Assessment

Drawing No: 0079383s_AQA_CAD001_RO.dwg

Date: 11/01/2011 Drawing Size: A3

Drawn By: NS Reviewed By: MK

Source: -

Scale: Refer to scale bar

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2.2.3 *Product Transport*

In accordance with existing operations, unwashed coal will continue to be loaded into trucks for haulage to PKCT and loading into ships.

Trucking hours from NRE No.1 Colliery will be 7.00am to 10.00 pm Monday to Friday and 8.00am to 6.00 pm for weekends and public holidays, giving 95 hours of coal haulage per week.

The truck fleet is being progressive upgraded and it is proposed that all trucks will have a minimum capacity of 44 tonnes; specially designed trailers with noise dampening to prevent metal on metal impact and current best practice suspension and braking systems. All trucks are equipped with purpose built covers that will enhance containment of the load whilst in transit.

3 AIR QUALITY LEGISLATION AND ASSESSMENT GUIDELINES

3.1 POTENTIAL AIR QUALITY ISSUES

The main potential air quality issues resulting from this Project are particulate emissions associated with the:

- handling of coal on site;
- wind erosion from coal stockpiles; and
- haulage of coal offsite.

Both major and minor emission sources are addressed in *Chapter 5*. The following sections outline the air quality pollutants assessed for this Project and the regulatory framework associated with these potential emissions.

The main potential air quality issues as a result of the project are:

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

3.2 RELEVANT NSW REGULATORY FRAMEWORK

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*, DEC (DEC are now known as OEH), August 2005.

3.3 NATIONAL ENVIRONMENT PROTECTION MEASURES

The National Environment Protection Measure (Ambient Air Quality) 1998 (NEPM) is a Commonwealth Government initiative which aims to achieve nominated standards of air quality within ten years. Air quality standards for six major air pollutants (carbon monoxide, nitrogen dioxide, photochemical oxidants, sulfur dioxide, lead and small airborne particles) have been set.

All states and territories, including NSW, have adopted the NEPM air quality goals for pollutants. The criterion relating to potential emissions from the Project are outlined in *Table 3.1*. 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.

Table 3.1 ***NEPM (Ambient Air Quality) Standards***

Pollutant	Averaging Period	Maximum Concentration	Maximum Allowable Exceedances
Particles as PM_{10}	24 hour	50 µg/m^3	5 days in a year
Deposited Dust	Annual	4 g/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)*. This document is referred to in *Part 4: Emission of Air Impurities from Activities and Plant* in the *Protection of the Environment Operations (Clean Air) Regulation (2002)*. 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 3.2*. These are the criteria, against which the predicted ground level concentrations of pollutants generated by the Project are compared.

Table 3.2 ***OEH Impact Assessment Criteria***

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

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

Source: *"National Environnent Protection Measure (Ambient Air)" (Amendment 2003)*

These criteria levels include background level

4 EXISTING ENVIRONMENT

4.1 LOCAL AREA

The Project Application Area (PAA) is approximately eight kilometres (km) north of Wollongong and 70 km south of Sydney, within the local government areas (LGAs) of Wollongong and Wollondilly in the Illawarra region of NSW.

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

The Russell Vale site is located on the lower slopes and foothills of the Escarpment at approximately 140 m AHD. The Princes Highway bound the Russell Vale site to the east, with residential areas of Russell Vale and Corrimal to the east and south respectively.

4.2 GENERAL METEOROLOGICAL CONDITIONS

Meteorology plays a major role in determining the location and scale of off-site impacts of air pollutant activities. Air dispersion modelling requires information about the dispersion characteristics of the area. In particular, data is required on wind direction, wind speed, temperature, atmospheric stability and mixing height.

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 6 km south of the site.

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

4.3 CLIMATE

Long term climatic data is available from the Bellambi Bureau of Meteorology (BoM) weather station located, approximately 1.2 km south of the site.

Table 4.1 presents temperature, humidity and rainfall data from this weather station, which consists of monthly average 9am and 3pm readings.

Monthly averages of maximum and minimum temperatures are also presented. Rainfall data consists of mean monthly rainfall and the average number of rain days per month.

On average, January is the warmest month in Bellambi with a mean daily maximum of 24.7ºC. The coolest month is July with a mean daily minimum temperature of 10ºC.

The mean annual rainfall in Bellambi is 1039 mm. The mean number of annual rain days over this period is 94.8 days. On average, February is the wettest month with a mean monthly rainfall of 137.7 mm, while September is the driest month with an average of 57.6 mm.

Table 4.1 Climatic Data for Bellambi (1988 – 2009)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Maximum Temperature													
Mean (°C)	24.7	24.9	23.9	22.2	19.7	17.7	16.8	17.9	20.1	21.7	22.0	24.1	21.3
Daily Minimum Temperature													
Mean (°C)	19.0	19.2	18.0	15.4	13.0	11.0	10.0	10.4	12.4	14.0	15.4	17.5	14.6
9 am Mean													
Temperature (°C)	21.8	21.9	20.7	19.4	16.6	14.4	13.4	14.4	16.7	18.4	18.7	20.8	18.1
Humidity (%)	75	76	74	66	63	62	60	57	59	61	72	71	66
3 pm Mean													
Temperature (°C)	23.1	23.3	22.5	20.7	18.4	16.5	15.8	16.5	18.1	19.2	20.1	22.3	19.7
Humidity (%)	72	74	71	67	61	59	56	55	61	64	70	69	65
Rainfall													
Mean (mm)	62.1	137.7	85.1	100.8	93.4	93.9	85.8	98.8	57.6	74.9	87.3	63.9	1039
Raindays													
Mean (Number)	9.3	9.4	9.3	7.7	7.0	7.5	6.8	5.9	6.8	7.4	9.5	8.2	94.8

1. Station number 068228; Latitude 34.37 S; Longitude 150.93 E
2. Source - Bureau of Meteorology, Commonwealth of Australia.

4.4 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 man made) other than the site. It is important to consider background air quality when considering cumulative impacts on sensitive receptors in the area.

4.4.1 *Particulate Matter*

The OEH 2005 guidelines detail the need to obtain ambient monitoring data that includes at least one year of continuous measurement and is contemporaneous with the meteorological data used in the dispersion modelling.

In the absence of daily monitoring data for Russell Vale, the closest site at which the OEH monitors particulate matter is at Wollongong, approximately 6 km south of the site. The station is located on Gipps Street, just north of the Wollongong city centre. It is anticipated that in lieu of site specific measurements, that the Wollongong monitoring data will be representative of ambient particulate concentrations at Russell Vale.

The Wollongong station continuously measures PM_{10} concentrations. Daily data for January to December 2011 has been provided by the OEH.

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

A background concentration for TSP has been estimated at 41.9 $\mu g/m^3$, based on a particle size distribution with PM_{10} being approximately 39.1% of TSP (SPCC, 1986, see *Section 6.2.8*).

4.4.2 *Dust Deposition*

Due to the lack of OEH provided dust deposition data in the area, background concentrations have not been included in the model. There is data available at existing monitors very close to the mine, but ERM considers that this data would not have given an appropriate background given the potential for dust from existing operations at the site.

5 EMISSIONS INVENTORY

5.1 OVERVIEW

This impact assessment predicts the potential particulate impacts from the Project. These impacts are considered in isolation and in the context of existing sources in the area (cumulative impacts). Due to the operational decision not to utilise an excavator on the stockpile, which is a large source of potential emissions, projected emissions have dropped slightly for Stage 2. The sections below outline the activities, which have the potential to generate dust emissions.

5.2 ESTIMATED EMISSIONS FROM NRE NO.1 COLLIERY

The following sections provide an outline of activities on site, which are expected to generate particulate emissions. A detailed emission inventory is presented in *Annex B*, while the emission estimation of onsite activities is presented in *Annex C*.

5.2.1 ROM Coal Stockpile

The ROM coal extracted from underground mining is transferred to the stockpile area via conveyor. The ROM coal is then stockpiled at the stockpile area before being transferred to the truck loader via conveyor. Water sprays will continue to be used on these stockpiles to minimise dust on an as needed basis.

Wind erosion is expected to generate dust from the ROM coal stockpile, which has been included in the dispersion model.

5.2.2 Loading Trucks

Dust will be generated as a result of dumping coal into trucks via overhead loaders for transport offsite.

5.2.3 On Site Roads

Dust will be generated as a result of the movement of trucks around the site particularly for unsealed roads.

5.2.4 *Off Site Roads*

There is potential for dust to be generated as a result of trucks hauling coal offsite along the transport route. Since NRE trucks make up a larger proportion of heavy vehicular traffic along Bellambi Lane and a small proportion along the rest of the transport 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, entrained dust and drip waste. These are only potential sources and will not necessarily occur.

Following discussions with OEH this emissions source has not been included in modelling. This issue will be dealt with through management measures as described in *Section 8.3*.

5.2.5 *Conveyor Transfer of Coal to the Stockpile Area*

The conveyor will be fully enclosed, minimising the potential for dust generation. Emissions from the conveyor are anticipated to be minor compared to other sources considered and have therefore not been included in the model.

5.2.6 *Screening and Sizing Plant*

The screening and sizing plant will be fully enclosed, minimising the potential for dust generation. Emissions from the screening and sizing plant are anticipated to be minor compared to other sources considered and have therefore not been included in the model.

5.2.7 *Transfer and Handling of Coal at the Stockpile Area*

ROM coal will be conveyed from the surface stockpile area to the truck load out using uncovered conveyors. The truck load outs are covered on the sides and top only. As it is a drive through open front and back, batch loading bin arrangement, emissions are likely to occur. Emissions will also occur at the stockpile area, all of this has been included in the dispersion modelling.

5.2.8 *Bulldozing at the Stockpile Area*

Bulldozers will generate particulate emissions as a result of disturbance and moving of material within the stockpile area and have been included in the dispersion modelling.

5.2.9 Emissions from Blasting

Blasting for this Project is undertaken occasionally underground at a low maximum instantaneous charge. Blasting is episodic and minor in magnitude and therefore emissions from blasting have not been included in the dispersion model.

5.2.10 Ventilation Shafts

Ventilation shafts are located in a catchment area away from any sensitive receptors (the OEH define a sensitive receptor as a location where people are likely to work or reside; this may include dwellings, schools, hospitals, churches or offices), and only minor emissions are expected, therefore these emissions have not been included in the dispersion model.

6 DISPERSION MODELLING ASSESSMENT

6.1 MODELLING METHODOLOGY

The AMS/EPA Regulatory Model (AERMOD) is a state of the science local scale model widely used around the world. AERMOD serves as a replacement for ISCST3 and is applicable to rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources (including, point, area and volume sources). Every effort has been made to avoid model formulation discontinuities wherein large changes in calculated concentrations result from small changes in input parameters.

AERMOD is a steady-state plume model. In the stable boundary layer (SBL), the concentration distribution is assumed to be Gaussian in both the vertical and horizontal. In the convective boundary layer (CBL), the horizontal distribution is assumed to be Gaussian, but the vertical distribution is described with a bi-Gaussian probability density function. Additionally, in the CBL, AERMOD treats "plume lofting" whereby a portion of plume mass, released from a buoyant source, rises to and remains near the top of the boundary layer before becoming mixed into the CBL. AERMOD also tracks any plume mass that penetrates into elevated stable layer, and then allows it to re-enter the boundary layer when and if appropriate.

AERMOD incorporates, with a new simple approach, current concepts about flow and dispersion in complex terrain. Where appropriate the plume is modelled as either impacting and/or following the terrain. This approach has been designed to be physically realistic and simple to implement while avoiding the need to distinguish among simple, intermediate and complex terrain; as is required by present regulatory models. As a result, AERMOD removes the need for defining complex terrain regimes; all terrain is handled in a consistent and continuous manner that is simple, while still considering the dividing streamline concept in stable stratified conditions.

One of the major improvements that AERMOD brings to applied dispersion modelling is its ability to characterize the planetary boundary layer (PBL) through both surface and mixed layer scaling. AERMOD constructs vertical profiles of required meteorological variables based on measurements and extrapolations of those measurements using similarity (scaling) relationships. Vertical profiles of wind speed, wind direction, turbulence, temperature, and temperature gradient are estimated using all available meteorological observations.

AERMOD was designed to run with a minimum of observed meteorological parameters. AERMOD requires only a single surface (generally, 10 m) measurement of wind speed (reference wind speed), direction and ambient temperature (reference temperature). Like ISC3, AERMOD also needs observed cloud cover. However, AERMOD also requires the full morning upper air sounding (RAWINSONDE).

ISC3 required only the morning and afternoon mixing heights derived from that sounding. In addition, AERMOD needs surface characteristics (surface roughness, Bowen ratio, and albedo) in order to construct its PBL profiles.

Unlike existing regulatory models, AERMOD accounts for the vertical inhomogeneity of the PBL. This is accomplished by "averaging" the parameters of the actual PBL into "effective" parameters of an equivalent homogenous PBL.

Surface characteristics in the form of albedo, surface roughness and Bowen ratio, plus standard meteorological observations (wind speed, wind direction and temperature) are input to AERMET. AERMET then calculates the PBL parameters: friction velocity (u*); Monin-Obukhov length (L); convective velocity scale (w*); temperature scale (θ*); mixing height (zi); and surface heat flux (H). These parameters are then passed to the AERMOD interface where similarity expressions (in conjunction with measurements) are used to calculate vertical profiles of wind speed (u), lateral and vertical turbulent fluctuations (σv, σw), potential temperature gradient (dθ/dz), potential temperature (θ), and the horizontal Lagrangian time scale (TLy). AERMET was used in the present study to create model-ready input files (as described in *Annex A*).

The AERMIC terrain pre-processor AERMAP uses gridded terrain data (where requested) to calculate a representative terrain-influence height (hc), also referred to as the terrain height scale. The terrain height scale, which is uniquely defined for each receptor location, is used to calculate the streamline height. Terrain data was not included due to the nature of the sources. There will be no point sources located at the mine; and, volume and area source contributions to overall concentrations, are not influenced by terrain features.

Building wake effects are flow lines that cause a plume to be forced downwards much sooner than it would have had the building not been there. This can result in higher ground level concentrations on the leeward side of obstructions. AERMOD contains algorithms to determine the effects of building downwash on plume dispersion. AERMOD cannot account for building wakes from area and volume sources. As such, building wakes have not been included in this modelling assessment and in any event are not expected to generate a significant effect at this mine site.

6.1.1 Model Receptors

A Cartesian grid has been set-up with the centre positioned at 306000E, 6196000N and grid receptors at regularly spaced intervals starting at 50 metres, and increasing to intervals of 500 m, out to a distance of five kilometres from the mine.

The OEH define a sensitive receptor as a location where people are likely to work or reside; this may include dwellings, schools, hospitals, churches or offices.

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 6.1*.

Table 6.1 Discrete Receptor Locations

Receptor	Description	Coordinates (MGA zone 56)	
		X co-ordinates	Y Co-ordinates
R1	6 Broker St.	306516	6196055
R2	29 West St.	306470	6196085
C5	Taylor Place	305889	6195417
C1	48 Lyndon St – West	305949	6195521
C2	48 Lyndon St.	306081	6195570
C3	Midgley St.	306558	6195596
R4	4 Broker St.	306746	6195951
C6	Robson St., Logger 2	306187	6195291
C4	Bloomfield Ave., Logger 3	306322	6195424
R3	Moreton St., Logger 1	306568	6196087

The locations of the sensitive receptors are shown in *Figure 6.1*.

Legend

Project Application Area

Monitoring Locations

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

Dust Gauges

- G1 Rear No 2 Broker St
- G2 North end Midgley St
- G3 Sydney Water Compound
- G4 SW cnr 30 West St
- G5 Rear No 22 West St
- G6 Lyndon Drive
- G7 Cnr Bellambi Lane and Princes Hwy
- G8 95 Keerong Ave

HVAS

- HV1 Site Boundary Lyndon St
- HV2 East of settling ponds

TEOM

- T1 Site Boundary Lyndon St
- T2 East of settling ponds

Weather Station

- W1 NE of Corrimall Reservoir No 2

Figure 6.1
Sensitive Receptor Locations

Client:	Gujarat NRE Coking Coal Limited
Project:	NRE No. 1 Colliery EAR Post Adequacy 2012 Air Quality Assessment
Drawing No:	0079383s_AQA_GIS003_R1.mxd
Date:	15/10/2012 — Drawing size: A3
Drawn by:	SQW — Reviewed by: NB
Scale:	Refer to Scale Bar

N 0 40 80 120m

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6.1.2 *Background Concentrations*

A discussion of background concentrations included in this assessment is presented in *Section 4.4.*

6.1.3 *Dust Depositions*

Assessment of dust deposition requires information relating to particle size and density, to enable AERMOD to account for gravitational settling. It is anticipated that the particle size distribution would be as follows:

- 7.9µm – PM_{10}; and
- 79µm – TSP PM.

Particle density is assumed to be 1.0 grams per cubic centimetre.

Dust deposition has been estimated for the one month averaging period to allow comparison with the OEH impact assessment criteria, as specified in *Table 3.2*.

6.1.4 *Model Input Data*

The following information was collected for volume sources:

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

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

7 RESULTS

7.1 SHORT TERM (24 HOUR) IMPACTS - PM_{10}

The dispersion modelling assessment uses 'contemporaneous' meteorological and monitoring data – they 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.

The maximum 24 hour PM_{10} concentration recorded at Wollongong between the January and December 2011 was 48.5 μg/m^3, on 1 February 2011.

Table 7.1 details the highest predicted 24 hour incremental ground level concentrations of PM_{10} for each sensitive receptor, with the corresponding background concentration recorded at the Wollongong monitoring station on that day.

Table 7.1 Maximum Predicted Incremental 100th Percentile Ground Level Concentrations for PM_{10} (24 hour average)

Receptor	Date	Incremental Concentration Modelled (μg/m^3)	Background Concentration Measured (μg/m^3)	Cumulative Concentration (μg/m^3)	Criterion (μg/m^3)
R1	24-Aug	13.70	14.20	27.90	50
R2	24-Aug	13.04	14.20	27.24	50
C5	9-Nov	4.75	25.80	30.55	50
C1	19-Feb	5.79	37.80	43.59	50
C2	3-Aug	8.27	22.50	30.77	50
C3	23-Aug	7.40	14.40	21.80	50
R4	31-Aug	10.40	16.60	27.00	50
C6	3-Aug	4.90	22.50	27.40	50
C4	8-Oct	4.77	15.00	19.77	50
R3	24-Aug	13.46	14.20	27.66	50

1. Background is recorded at the Wollongong OEH monitoring station
2. Incremental – ground level concentration from the development in isolation
3. Cumulative – ground level concentrations from the development including background concentrations
4. Bold figures indicate an exceedance of the criterion

Table 7.2 details the periods during the year that the predicted 24 hour incremental ground level concentrations of PM_{10}, including the background concentration, exceeded the NSW criterion at sensitive receptors. Most of these events occurred on 1 February, when the background concentration was 97% of the criterion level. The total number of exceedances at a given receptor was one, less than the allowable five exceedances.

Table 7.2 Predicted Exceedances of the NSW Criterion for PM_{10} (24 hour average)

Receptor	Date	Incremental Concentration Modelled (µg/m³)	Background Concentration Measured (µg/m³)	Cumulative Concentration (µg/m³)	Criterion (µg/m³)
R1	1-Feb	3.46	48.50	**51.96**	50
R2	1-Feb	3.04	48.50	**51.54**	50
C1	1-Feb	2.08	48.50	**50.58**	50
C2	1-Feb	1.70	48.50	**50.20**	50
R4	1-Feb	2.66	48.50	**51.16**	50
R3	1-Feb	3.29	48.50	**51.79**	50

1. Background is recorded at the Wollongong OEH monitoring station
2. Incremental – ground level concentration from the development in isolation
3. Cumulative – ground level concentrations from the development including background concentrations
4. Bold figures indicate an exceedance of the criterion

7.2 *LONG TERM (MONTHLY AND ANNUAL) IMPACTS – PM_{10} AND TSP*

Table 7.3 shows the incremental (site only) and cumulative (site + background) concentrations for pollutants, which are assessed against an annual averaging period in accordance with the DEC guidelines on the sensitive receptors.

Table 7.3 *Annual Average Dispersion Modelling Pollutant Concentration and Deposition Rates, at Sensitive Receptors*

Receptor	PM_{10} Incremental	PM_{10} Cumulative (incremental +background 16.4 μg/m³)	TSP Incremental	TSP Cumulative (incremental + background – 41.9 μg/m³)	Dust Deposition Incremental
	μg/m³	μg/m³	μg/m³	μg/m³	g/m²/month
R1	2.09	18.49	6.1	48.0	0.13
R2	2.02	18.42	6.0	47.9	0.14
C5	0.68	17.08	1.9	43.8	0.06
C1	0.97	17.37	2.7	44.6	0.12
C2	1.02	17.42	3.0	44.9	0.13
C3	0.92	17.32	2.9	44.8	0.05
R4	1.63	18.03	4.7	46.6	0.08
C6	0.47	16.87	1.4	43.3	0.02
C4	0.60	17.00	1.8	43.7	0.04
R3	2.16	18.56	5.9	47.8	0.12
Criteria	**-**	**30**	**-**	**90**	**2.0**

1. Increment – Concentration resulting from site activities at a modelled sensitive receptors
2. Cumulative – Concentration resulting from site activities plus ambient background concentration

7.3 RESULTS SUMMARY

The results presented in *Table 7.3* show that the predicted air quality impacts of the site are below the OEH nominated criteria when considered in isolation. Air quality impacts have dropped for Phase 2 due to the removal of the excavator, which was a large source of emissions and a major contributor to modelled concentrations. The PM_{10} 24 hour criterion is exceeded when emissions are considered in conjunction with existing background concentrations, but the maximum number of exceedances (one at sensitive receptors) are less than the allowable five annual exceedances. The model presents a conservative estimate of the air quality impacts. Nearby dust deposition monitors show values that are well below criteria and particulate concentration monitors would likely show the same.

In addition, the concentration contours presented in *Figures 7.1* to *7.3* show that the predicted concentrations are localised around the site and decrease rapidly with distance.

The dust deposition rates at the identified receptors are all below the OEH impact assessment criterion of $2g/m^2/month$. Given the nature of the surrounding environment, with a lack of significant dust generating sources, it is unlikely that the receptors would experience dust impacts that exceed the cumulative impact assessment criterion annual average of $4g/m^2/month$.

Legend

PM10 Concentration ($\mu g/m^3$)

- 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 7.1
Concentration Contours – PM10 Maximum 24 hour Average

Client: Gujarat NRE Coking Coal Limited
Project: NRE No. 1 Colliery EAR Post Adequacy 2012 Air Quality Assessment

Drawing No: 0079383s_AQA_GIS004_R1.mxd
Date: 18/09/2012 Drawing size: A3
Drawn by: SQW Reviewed by: MK
Scale: Refer to Scale Bar

N 0 50 100 150m

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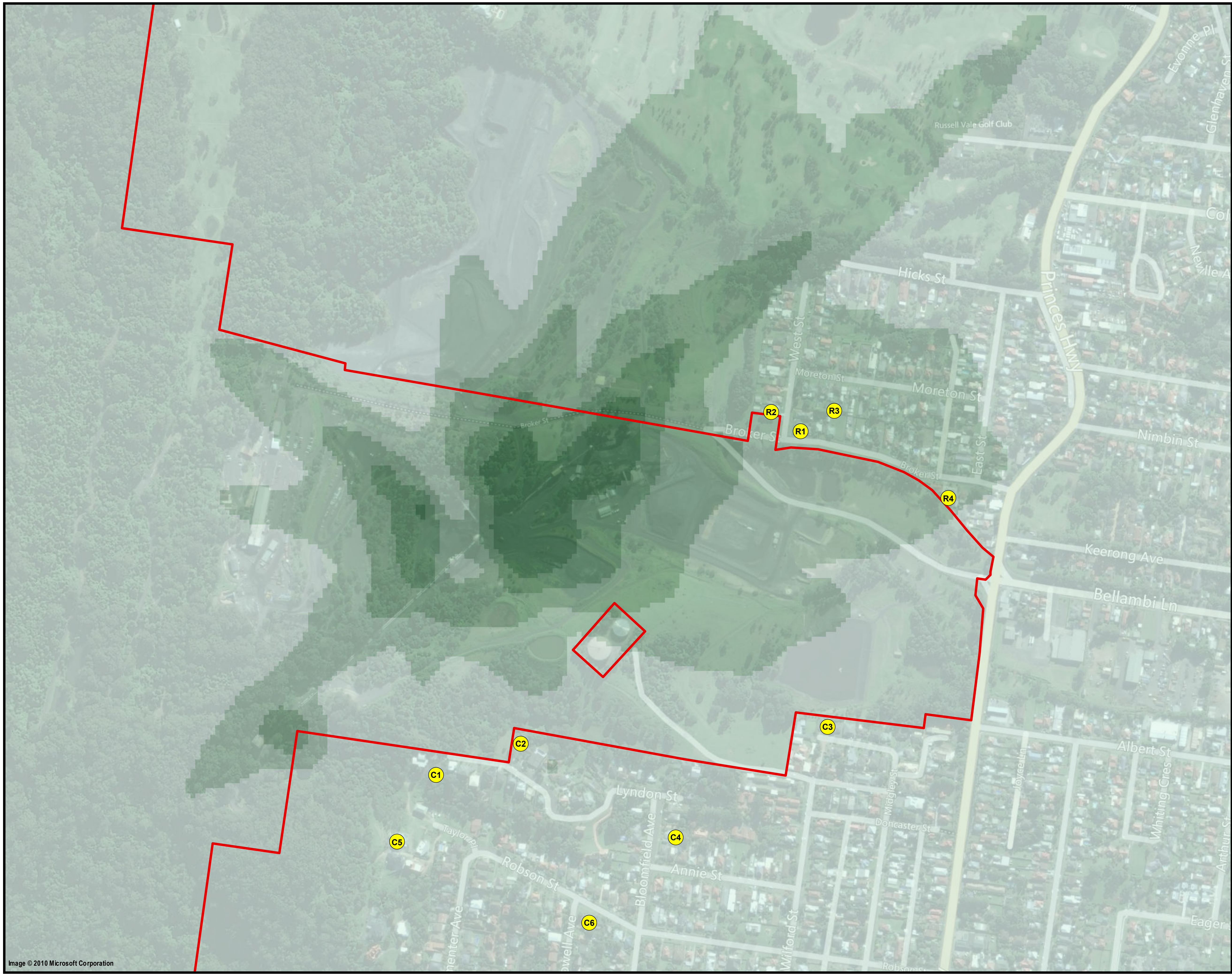

Legend

Project Application Area

PM10 Concentration (μg/m³)
- 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 7.2

Concentration Contours – PM10 Annual Average

Client: Gujarat NRE Coking Coal Limited

Project: NRE No. 1 Colliery EAR Post Adequacy 2012 Air Quality Assesment

Drawing No: 0079383s_AQA_GIS005_R1.mxd

Date: 27/11/2012 Drawing size: A3

Drawn by: SQW Reviewed by: MK

Scale: Refer to Scale Bar

N 0 40 80 120m

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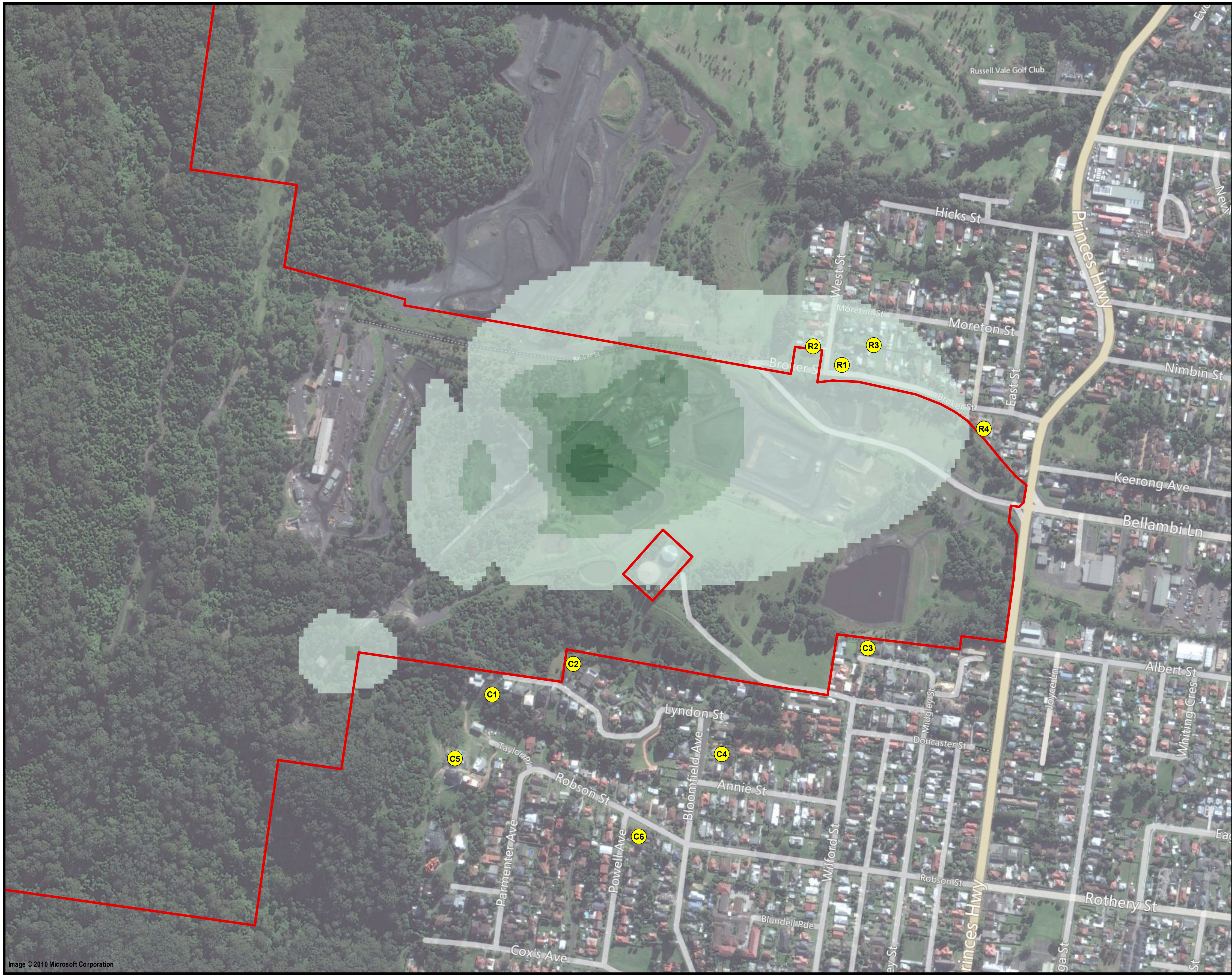

Legend

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 7.3
Concentration Contours – TSP Annual Average

Client: Gujarat NRE Coking Coal Limited

Project: NRE No. 1 Colliery EAR Post Adequacy 2012 Air Quality Assessment

Drawing No: 0079383s_AQA_GIS006_R1.mxd

Date: 27/11/2012 Drawing size: A3

Drawn by: SQW Reviewed by: MK

Scale: Refer to Scale Bar

N

0 50 100 150m

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8 DISCUSSION AND CONCLUSIONS

8.1 OVERVIEW

Table 8.1 presents a summary of the maximum predicted incremental ground level concentrations for the modelled receptor where highest concentrations were predicted.

Table 8.1 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 OEH (2005) "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW"
4. Predicted concentration on day of maximum background (contemporaneous data presented in *Table 7.1*)
5. Predicted concentration on day of maximum incremental concentration

8.2 RESULTS SUMMARY

8.2.1 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 48.5 $\mu g/m^3$, and the maximum increment predicted by the modelling on that day was 3.46 $\mu g/m^3$ (at Receptor 1), giving a cumulative impact of 51.96 $\mu g/m^3$, representing 104% of the OEH criteria.

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

The NEPM guidance for PM_{10} 24 hour concentrations indicates that the criterion of 50 µg/m^3 may be exceeded 5 times in a calendar year. Given the extents 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.

8.2.2 *Long Term (Annual and Monthly Average) Impacts*

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

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

The maximum predicted incremental TSP concentration was 6.1 µg/m^3. The background level derived from monitoring data at Wollongong for 2011 was 41.0 µg/m^3, and the cumulative impact of 48.0 µg/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 2.16 µg/m^3 at Receptor 1. The average background recorded at Wollongong for 2011 was 16.4 µg/m^3, and the cumulative impact of 18.56 µg/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 sensitive receptors. The maximum predicted increment was 0.14 g/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%.

8.3 *MANAGEMENT AND MITIGATION*

A number of management measures are already in place at this facility to reduce the generation of particulate emissions.

Nature of the Material

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

Materials Handling

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

Management of Exposed Areas

Exposed areas will consist of one main stockpile area up to a maximum of two hectares in area 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.

Offsite 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.

Best Practice Dust Control Assessment

Annex D compares the proposed dust controls at NRE No. 1 against best practice dust controls. NRE No. 1 will be incorporating best practice dust controls.

8.4 CONCLUSIONS

A review and assessment has been conducted of the potential impacts to air quality associated with the current operation and throughput of the NRE No. 1 Colliery. The assessment has been conducted in accordance with the relevant OEH guidelines.

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 13.70 µg/m3 representing 27.4% of the nominated criteria (50 µg/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 50 $\mu g/m^3$ 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;

- 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 site, with the predicted concentrations decreasing rapidly beyond the site boundary, with minimal impacts predicted beyond one kilometre. 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.

REFERENCES

Bureau of Meteorology (2009). *Station Number 068228*. Commonwealth of Australia.

Commonwealth of Australia (1998). *Best Practice Environmental Management in Mining - Dust Control*. Australian Government.

Department of Environment and Conservation (2005). *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.* New South Wales Government.

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

Office of Environnent and Heritage. *Wollongong TEOM monitoring data*. New South Wales Government.

Annex A

Meteorological Data

AERMET is the meteorological pre-processor for AERMOD. AERMET uses surface and upper air sounding data from nearby weather stations to develop two files — a surface parameters file (.sfc) and a profile file (.pfl). Most of the parameters contained in the surface file and required for the AERMOD modelling analysis are calculated internally by AERMET. These include mixing heights (convective and mechanical) and boundary layer scaling parameters related to atmospheric stability (friction velocity, convective velocity scale, Monin-Obukhov length scale). The profile file contains measured parameters including wind speed and direction, temperature, and turbulence parameters including sigma-theta (horizontal turbulence) and sigma-w (vertical turbulence). The profile file is designed to accommodate measurements at multiple levels, but in the present case contains only one measurement level.

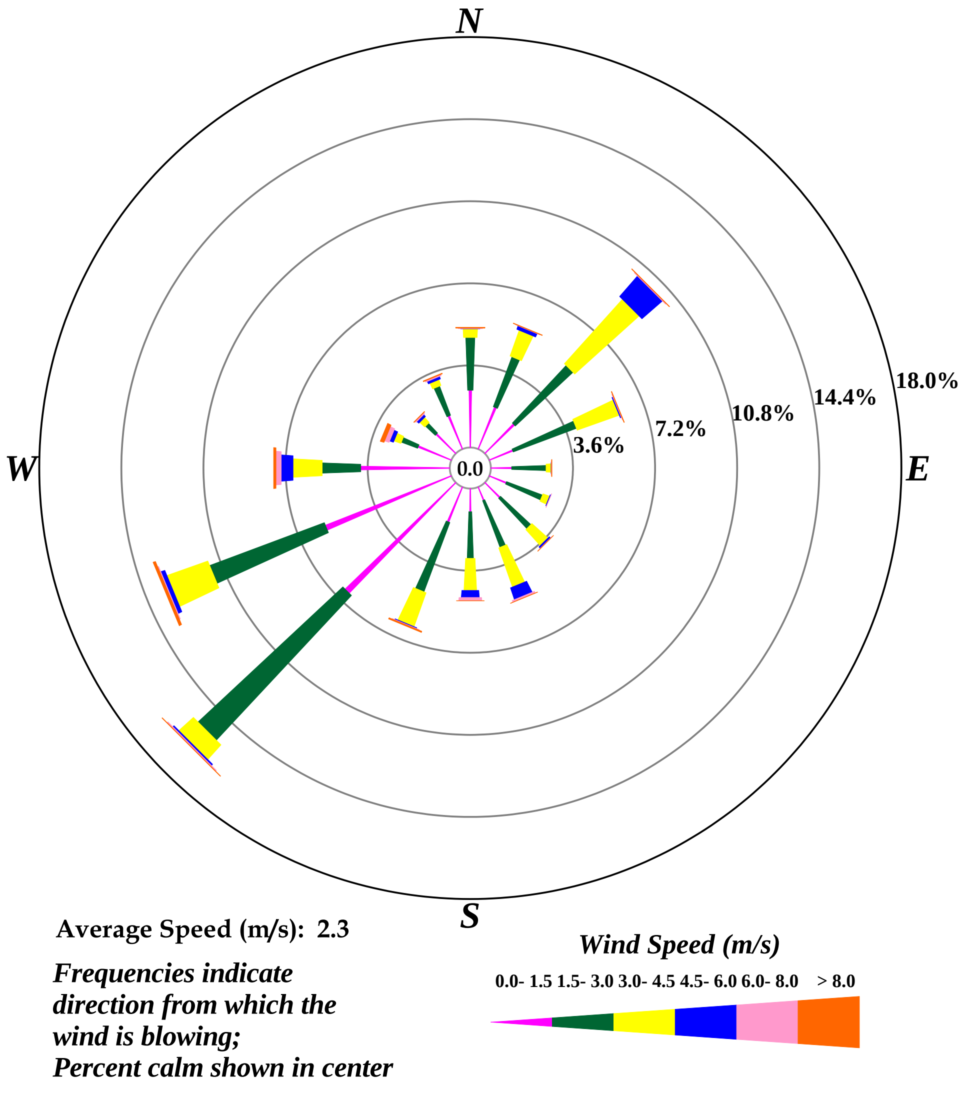
Data on wind speed, wind direction, ambient temperature, and sigma-theta were obtained from an Automatic Weather Station (AWS) operated and maintained by the OEH located in Wollongong, approximately 6 kilometres (km) south of the site for calendar year 2007. AERMET also uses a single upper air sounding on a daily basis to determine convective boundary layer parameters including the convective mixing height. Mixing height calculations are accomplished in AERMET by estimating heat flux, and then estimating the degree to which the stable night-time boundary layer suppresses mixing height growth. AERMET furthermore requires cloud cover information to assist in making heat flux calculations. ERM looked for the closest available sounding station to the site for which soundings are available for the correct time period representing the required morning sounding. The Sydney International Airport is a sounding station but did not have sufficient data available; Williamstown, further up the coast to the northeast of the site, was found to have sufficient data and was used as input to AERMET. Cloud cover data were available from the Sydney airport, and these data were used to complete the inputs to AERMET.

AERMET requires that surface characteristics surrounding the meteorological data collection site be quantified and input into the model. Specifically, values of surface roughness, albedo, and bowen ratio must be characterized in order for AERMET to calculate the necessary parameters that are used to determine boundary layer stability. EPA published suggested values of surface roughness, albedo, and bowen ratio for a variety of land use classifications. These suggested values are found in the AERSURFACE User's Guide. This guide was used to specify values for the Wollongong site, namely bowen ratio = 0.5; albedo = 0.6; rouchness length = 0.5.

AERMET was run with the inputs specified here, and the surface and profile files produced by AERMET were used in the modelling.

A wind rose based on the Wollongong 2007 data is displayed in *Figure A.1.*

Figure A.1 Wind Rose: Wollongong, 2007



Annex B

Model Inputs

Table B.1 Model Inputs

Model ID	Source Type	Description	Utm-East (m)	Utm-North (m)	Release Height (m)	Y-init (m)	Z-init (m)
A1	volume	Small Stockpile	306005	6195882	11.5	29.7	10.698
A2	volume	Large Stockpile	306153	6195897	12.6	47.6	11.721
B	volume	Conveyor Transfer - Portal	305677	6195576	5	2	4.65
C	volume	Conveyor Unloading to Small Stockpile	306005	6195882	11.5	2	10.698
D	volume	Conveyor Unloading to Large Stockpile	306021	6195909	12.6	2	11.721
E	volume	Conveyor Unloading to Large Stockpile	305979	6195869	12.6	2	11.721
F1	volume	Transfer - Loading Bins to Road Trucks	306176	6196019	5	2	4.65
F2	volume	Transfer - Loading Bins to Road Trucks	306171	6196025	5	2	4.65
1	volume	Road (unloaded)	306476	6195950	5	63.26	4.65
2	volume	Road (unloaded)	306365	6196014	5	63.26	4.65
3	volume	Road (unloaded)	306181	6196025	5	63.26	4.65
5	volume	Road (loaded)	306260	6196081	5	63.26	4.65
6	volume	Road (loaded)	306395	6196059	5	63.26	4.65
7	volume	Road (loaded)	306476	6195950	5	63.26	4.65
A1A	volume	Dozer on Small Stockpile	306005	6195882	11.5	29.7	10.698

Annex C

Emission Estimation

Table C.1 Emission Estimates

		Emission Factors			Activity Level (A)		OpHrs	Area		Emissions (kg/day)		Emissions (g/s)			Emissions (g/s)	
Source Description	**Source Type**	**TSP**	**PM10**	**Units**	**Rate**	**Units**	**hrs/day**	**m^2**	**ha**	**TSP**	**PM10**	**TSP**	**PM10**	**Mitigation**	**TSP**	**PM10**
Conveyor Transfer –	volume	0.00032	0.00015	kg/t	8219.2	tonnes/day	15	n/a	n/a	2.6	1.2	0.049	0.023	Water sprays	0.024	0.011
Conveyor unloading to small stockpile	volume	0.004	0.0017	kg/t	6575.36	tonnes/day	24	n/a	n/a	26.3	11.2	0.304	0.129	Water sprays	0.076	0.032
Conveyor unloading to large stockpile		0.004	0.0017	kg/t	1643.84	tonnes/day	24	n/a	n/a	6.6	2.8	0.076	0.032	Water sprays	0.019	0.008
Transfer - loading bins into road trucks [2]	volume	0.0004	0.00017	kg/t	11428.6	tonnes/day	15	n/a	n/a	4.6	1.9	0.085	0.036	Water sprays	0.042	0.018
Haulage from loading bins to site boundary - sealed road (loaded) [1]	volume	0.0157184	0.007606	kg/VKT	129.36	VKT/day	15	n/a	n/a	2.0	1.0	0.038	0.018	Water sprays	0.019	0.009
Haulage from site boundary to loading bins -sealed road (unloaded) [1]	volume	0.0114486	0.006579	kg/VKT	129.36	VKT/day	15	n/a	n/a	1.5	0.9	0.027	0.016	Water sprays	0.014	0.008

		Emission Factors			Activity Level (A)		OpHrs	Area		Emissions (kg/day)		Emissions (g/s)			Emissions (g/s)	
Dozer on small stockpile	volume	17	4	kg/hr	n/a	n/a	6.6	n/a	n/a	30.9	7.3	1.299	0.306	Water sprays	0.325	0.076
Wind erosion small –stockpile	volume	0.44	0.22	kg/ha/hr	0.729	hectares	24	7286	0.729	0.3	0.2	0.0037	0.0019	Water sprays	0.0019	0.0009
Wind erosion large - stockpile	volume	0.44	0.22	kg/ha/hr	1.982	hectares	24	19816	1.982	0.9	0.4	0.0101	0.0050	Water sprays	0.0050	0.0025

1. Assuming maximum 616 movements per day (308 trips per day) and based on 0.41 km each way from bins to Princes Highway 129.36 VKT/day
2. Emissions split between two load out points

Annex D

Best Practice Dust Controls

Table D.1 Dust Control

Source	Dust Control	Dust Suppression	NRE No. 1 Proposed Controls/Suppression
Whole plant	Enclosures/barriers	-	Various enclosures used for conveyors
Plant equipment	Dust proofing	-	Use of covers for trucks and truck washing equipment
Enclosure Structures	Regular Maintenance	-	Equipment will be maintained on a regular basis
Dump hopper	-	Three-sided, roofed sheds for truck dumping, with low volume high pressure adjustable water atomising sprays actuated at the time of dumping. If hoppers are open, fogger sprays at a higher level coupled with atomisers at dumping level will increase fall out rates and prevent dust surges due to the up-flow of displaced air. Wind breaks are also recommended.	Water sprays used to minimise dust
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 systems to increase fall out rates. Belt cleaning sprays in opposite direction to travel.	Conveyors will be covered
Stockpiles—discharge	-	Minimising discharge heights and conveyor speeds, use of rill tower, enclosure of stockpile, atomising water sprays to wet falling stream. Drainage often required at stockpile base and foundations.	Water sprays used to minimise dust
Stockpiles—storage	-	Fixed water cannons or vehicle based sprays for small stockpiles. Drainage often required at stockpile base and foundations.	Water sprays used to minimise dust

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

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