



APPENDIX D

Subsidence Risk Assessment



**XSTRATA COAL NSW
BAAL BONE COLLIERY**

**LONGWALL MINING
SUBSIDENCE RISK ASSESSMENT**

**FINAL REPORT
DECEMBER 2006
HMS622**

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XSTRATA COAL NSW BAAL BONE COLLIERY

LONGWALL MINING SUBSIDENCE RISK ASSESSMENT

FINAL REPORT DECEMBER 2006

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TABLE OF CONTENTS

1	EXECUTIVE SUMMARY	4
1.1	Distribution of Risks.....	4
1.2	Follow-up Actions	6
2	INTRODUCTION	7
2.1	The Applicant.....	8
2.2	Description of the Proposal	9
2.3	Mining Method.....	10
3	CONTEXT	12
3.1	Scope	12
3.2	Objectives.....	12
3.3	Assumptions.....	12
4	WORKSHOP TEAM	13
5	METHOD OF APPROACH	14
5.1	Risk Assessment Procedure	14
5.2	Process Map.....	15
5.3	Identification of Potential Loss Scenarios.....	15
5.4	Existing Controls.....	15
5.5	Risk Evaluation.....	16
5.6	Post Implementation Review	16
6	CHECKLIST	17

APPENDIX A – Baal Bone Risk Matrix

APPENDIX B – Baal Bone Risk Table, October 2006

1 EXECUTIVE SUMMARY

In December 2006, Hawcroft Miller Swan Consultants Pty Ltd (“HMS”) was engaged by Mr Bernie McKinnon, Mine Manager, for Baal Bone Colliery, Lithgow (“Baal Bone”), to facilitate a risk assessment to investigate the potential impacts of subsidence at Baal Bone, relating to the planned longwall mining of panels 29, 30 and 31, within Consolidated Coal Lease 749 (“CCL 749”).

This report details the methods used and the recommendations resulting from the risk assessment workshop which was facilitated at Baal Bone on the 5th December 2006.

This Report will provide inputs for the development of the Baal Bone Subsidence Management Plan (“SMP”).

Risk ranking was undertaken in accordance with the Australian Standard for Risk Management AS4360:2004, using the Baal Bone Risk Assessment Matrix, shown in Appendix A.

1.1 Distribution of Risks

In total, twenty-seven (27) risks were identified during the risk assessment. The identified risks have been grouped according to risk rank and are summarised in the following:

- *Table 1 - Summary of Risks by Risk Rating*
- *Chart 1 - Risk Distribution by Risk Rating*

Risk Rating	No.	%
High	nil	0%
Medium	16	59%
Low	11	41%
Total	27	100%

Table 1 - Summary of Risks by Risk Rating

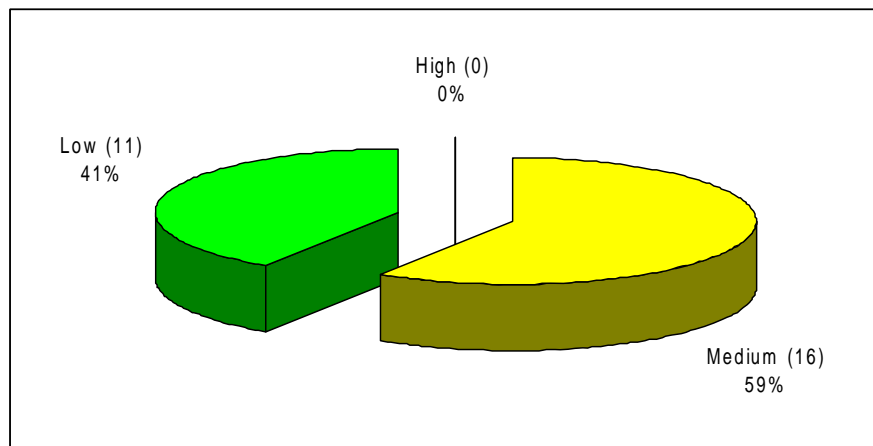


Chart 1 - Risk Distribution by Risk Rating

The lack of any potential high risk issues is mostly attributable to the proposed mine design layout where the longwall mining panels have been located between Cox's River and the Wolgan Escarpment, with evidence based angle of draw protection zones designed to minimise any impact from longwall mining operations.

This approach provides a high level of confidence that the subsidence impacts to these features from longwall mining will be minimal.

A summary of medium risk issues is shown in *Table 2 – Summary of Medium Risk Issues*, following:

A#	Aspect	C#	Consideration	R#	Risk Issue
1	Natural Features	1.01	Natural Water Courses/ Streams	1.01.01	Disruption to natural stream flow
		1.03		1.03.01	Damage to Endangered Ecological Community
		1.03		1.03.02	Damage to ecosystem
		1.05	Threatened & Protected Species	1.05.01	Partial loss of local population
		1.06	Wolgan Escarpment	1.06.01	Rock falls
		1.07	Internal Cliffs	1.07.01	
		1.07		1.07.02	Cracking
		1.08	Pagodas/ Rock Formations	1.08.01	
		1.09	State Forests/ Natural Vegetation/ Harvesting	1.09.02	
1.09	1.09.03	Loss of vegetation and soil disturbance			
2	Surface Improvements	2.01	Tracks / Roads	2.01.01	Damage to roads and drainage structures
		2.02	Survey Control Stations	2.02.01	Movement of Wolgan Gap survey trig.
3	Subsurface	3.01	Groundwater Resources/ Aquifer	3.01.01	Draining upper water bearing zones impacts on vegetation community
				3.01.02	Draining lower water bearing zones
		3.03	Increased mine water make	3.03.01	Increased pumping
4	Areas of Archaeological/ Heritage Significance	4.01	Aboriginal Artifacts	4.01.01	Damage/ disturbance to artifacts/ sites

Table 2 – Summary of Medium Risk Issues

1.2 Follow-up Actions

Resulting from the risk assessment process, an Action List was developed by the workshop team.

The summary list of agreed actions is shown in *Table 3 – Summary of Agreed Actions*, following;

#	Action Description	Risk Ref #	By Whom	By When
1	Finalise Aboriginal archaeological survey	4.01.01	OzArk	February 2007
2	Establish communications protocol between mine and Forests NSW	1.09.02	Environmental & Community Co-ordinator	Prior to commencement of LW29 extraction
3	Finalise flora monitoring	1.01.01	Gingra	February 2007
4	Inspections following rainfall events to be established	1.01.01	Environmental & Community Co-ordinator	Commencing August 2007
5	Mine to provide Forests NSW with mining progression plans	1.09.02	Environmental & Community Co-ordinator	Prior to commencement of LW29 extraction
6	Conduct Photographic monitoring	1.06.01, 1.07.01, 1.07.02, 1.08.01	Environmental & Community Co-ordinator	Baseline to be established a minimum of 4 months prior to extraction of each longwall
7	Proposed stress concentration monitoring program	1.06.01	SCT	Before commencement of LW29 extraction
8	Regular review and reporting of monitoring information	1.03.01, 1.03.02, 1.05.01, 3.01.01, 3.01.02	Mine Manager	Reports at four monthly intervals to relevant stakeholders
9	Rehabilitation following cessation of monitoring	1.09.03	Environmental & Community Co-ordinator	Within 3 months of cessation of monitoring
10	Remediation where required	1.01.01	Mine Manager	Following inspection and assessment with relevant authority
11	Repair/ Replace if required	2.02.01	Mine Manager	In consultation with Department of Lands
12	Review inspection frequency	2.01.01	Environmental & Community Co-ordinator	Increase during and immediately after undermining of area
13	Search of national Aboriginal heritage register	4.01.01	OzArk	Completed
14	3D survey monitoring approved by PSE DPI	1.06.01, 1.07.01	Mine Manager	In consultation with Principal Subsidence Engineer prior to commencement of each panel extraction.

Table 3 – Summary of Agreed Actions

2 INTRODUCTION

Baal Bone is one of a number of active mining operations within the Western Coalfields of New South Wales.

Baal Bone is a combination of underground and open cut operations and is located approximately 25km northwest of Lithgow and 4km north – northeast of Cullen Bullen in the Lithgow Local Government Area (LGA).

The Colliery is operated by The Wallerawang Collieries Limited.

Mining at Baal Bone commenced in the late 1940's with the operation of the Ben Bullen Open Cut mine by the NSW Mining Co Pty Ltd (a subsidiary of the Joint Coal Board). These operations consisted of shallow open box cut mining operations which ceased in 1952.

The Wallerawang Collieries Limited commenced underground mining at Baal Bone Colliery in 1982.

Coal mining operations at Baal Bone Colliery are carried out in the Lithgow seam with the underground production by longwall mining methods.

Normally production operations are carried out 24 hours per day, 5 days per week. Generally, only maintenance operations (eg stonedusting, roadway maintenance etc) are undertaken on weekends.

Export coal is washed and loaded onto trains at the site and transported to Port Kembla.

Road haulage is used for some domestic coal (Mt Piper and Wallerawang Power Stations and other minor contracts).

Baal Bone proposes to conduct "secondary workings" using longwall mining methods within CCL 749.

The proposed mining area is known as Longwall 29-31 area. This area is identified by red cross-hatching in *Diagram 1 – Longwall Panels 29 – 31 within CL749*, following:

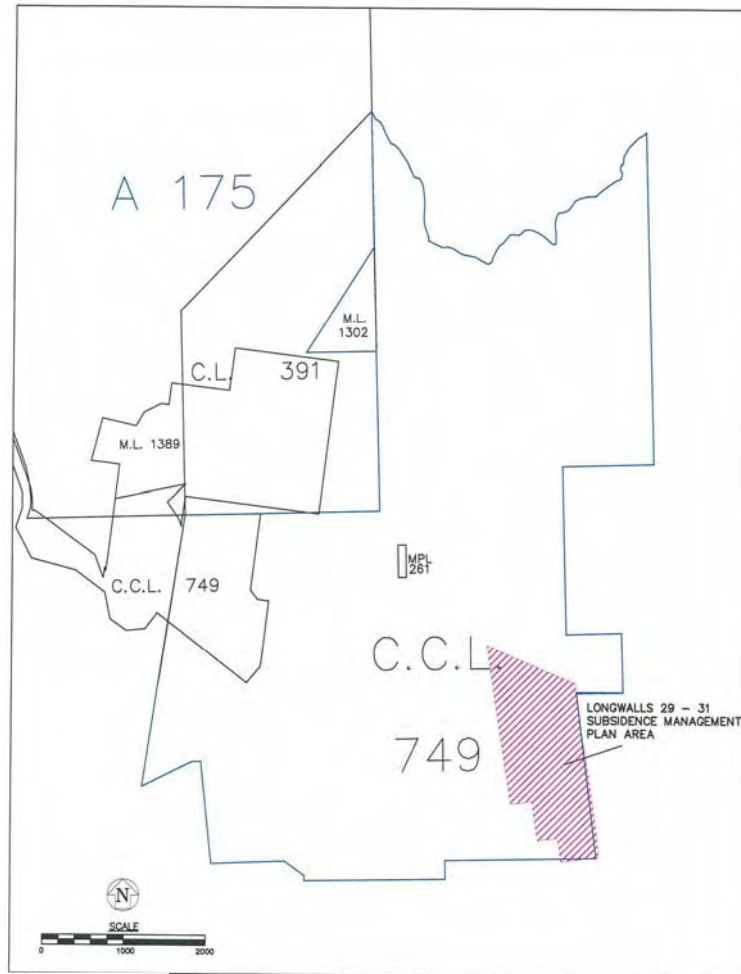


Diagram 1 – Longwall Panels 29 – 31 within CL749

The proposed longwall panels are located within CCL 749, Ben Bullen and Wolgan State Forest and Crown land to the west of the Wolgan Road and the east of Cox's River.

In developing an understanding of the approval requirements for this area and determining the appropriate approval path for this development, extensive consultation had been undertaken with Minter Ellison Lawyers. This advice has indicated that the proposed longwall mining, falls within ambit provisions of Clause 35 Schedule 1 of the Model provisions as adopted by the Lithgow City Local Environmental Plan, 1994.

A subsequent approval under the *Mining Act 1992*, in the form of the Subsidence Management Plan (SMP) is required.

2.1 The Applicant

Baal Bone is operated by The Wallerawang Collieries Limited a joint venture between Coalex Holdings (a fully owned subsidiary of Oakbridge Pty Limited) 95% and Sumitomo Corporation 5%.

2.2 Description of the Proposal

Longwall panels 29-31 are situated on a north-northwest to south-southeast axis, parallel to or at right angles to previously mined longwalls.

The panels have been located between the Cox's River and the Wolgan Escarpment and the layout has been designed, based on a combination of previous experience, monitoring results, as well as recommendations from geotechnical and subsidence engineering consultants, to maximise the efficiency of mining operations and resource recovery whilst minimising environmental impacts.

The panels have been located to avoid sensitive features, including the escarpment at the western edge of the Wolgan Valley, the Cox's River Swamp and the Cox's River Valley as well as several sensitive rock formations and faces in the Banks Wall sandstone member.

The mining section height will be in the range of 2.45 metres minimum to 2.55 metres maximum, which will include the total Lithgow seam (2.2 to 2.4 metre thickness).

The depth of cover in the extraction area ranges between 150 and 240 metres.

Based on investigations undertaken and results from previous monitoring as well as associated reviews by Strata Control Technology Operations Pty Ltd, the maximum subsidence is predicted to be in the order of 1.3 to 1.6 metres.

The theoretical maximum subsidence is 1.56 metres, based on 65% of a seam thickness of 2.4 metres.

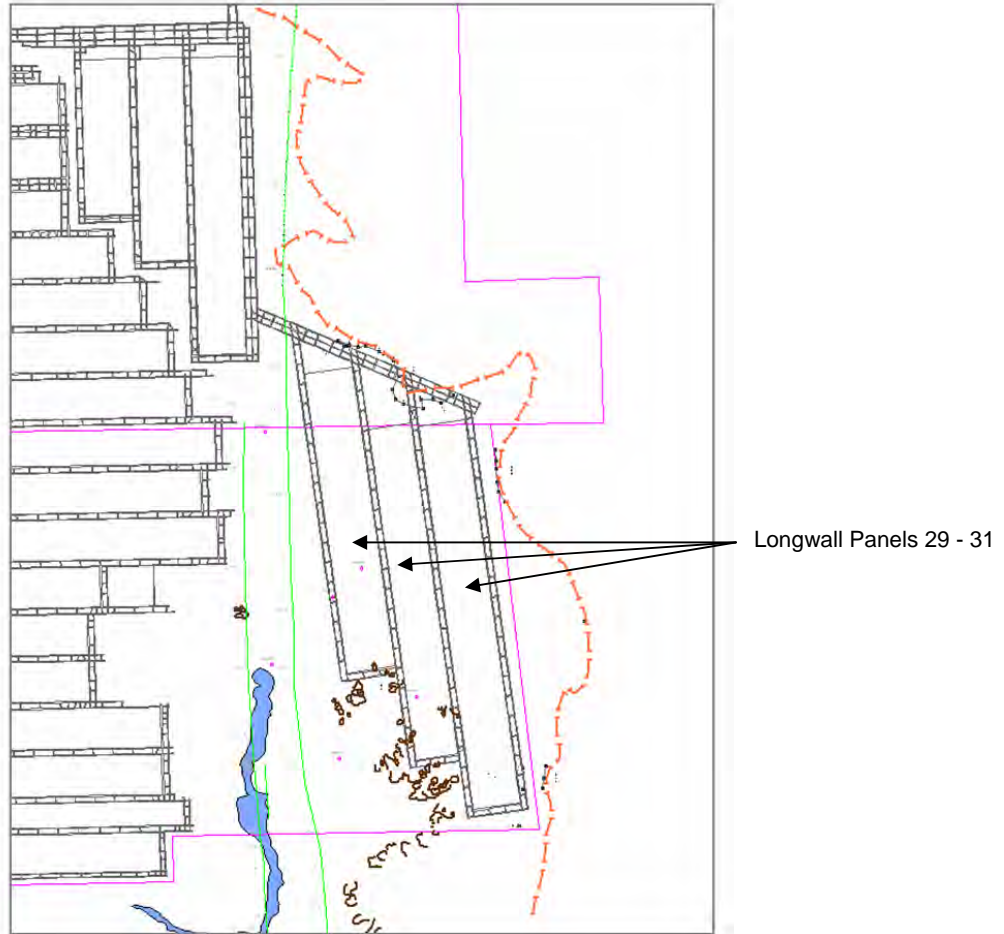


Diagram 2 – Longwall Panels 29-31

2.3 Mining Method

Longwall panels 29-31 will be extracted using the retreat longwall method of mining. This method has been successfully used for the extraction of 26 previous panels. The face equipment has been designed for mining in the proposed height range and seam.

The SMP Application Area, as well as the 17 and 26.5 degree angle of draw zones are shown in *Diagram 3 – Location of SMP Application Area*, following;



- **SMP Application Area**
- **26.5 Degree Angle of Draw**
- **17 Degree Angle of Draw**

Diagram 3 – Location of SMP Application Area

3 CONTEXT

3.1 Scope

The Scope of this risk assessment is to identify potential subsidence risk issues associated with the planned longwall mining of panels, known as 29, 30 and 31 within CCL 749.

Risk Issues identifying a material impact to the following criteria were considered;

- Impacts on people
- Property/ Asset damage
- Environmental impacts
- Community impacts

3.2 Objectives

The Objectives of this risk assessment are to:

- Assist Baal Bone to satisfy their duty of care obligations by facilitating and documenting a risk assessment in accordance with the scope and the Australian/ New Zealand Standard for Risk Management AS/NZS 4360
- Identify and assess subsidence risk issues associated with the longwall operation
- Develop controls to reduce risks to an acceptable risk level, including assigned actions
- Identify any gaps in existing documentation
- Generate a Report consistent with the scope as well as AS4360 specifications

3.3 Assumptions

The workshop agreed to the following assumptions:

- Mine Layout Plans were accurate
- Assessment was undertaken for the “current” mine design layout and did not consider the impacts of a change to mine design
- Design Assumptions were valid
- Surface Plans were accurate

4 WORKSHOP TEAM

A key factor in the effectiveness of this exercise is the availability of relevant information and expertise. A workshop team made up of representatives of key stakeholders achieved this.

The role of team members was to provide their expertise, experience and technical knowledge, and to respect that provided by others.

Outcomes were dependent upon group consensus.

The Facilitator's role was to understand the Client's requirements and offer advice as to the best approach to meet the workshop objectives. He assisted the team by providing a systematic process and maintaining focus on the scope and objectives.

The facilitator documented the workshop process and outcomes, and will offer post-workshop feedback to the Client, if requested.

The team members are listed in *Table 4 – Risk Assessment Workshop Team*, following:

Name	Position	Company/ Site	Years Site Experience	Years Industry Experience
Roger Lembit	Ecologist	Gingra	16	25 yrs
Ken Mills	Consultant	SCT	16	25+ yrs
Ian Forster	Hydro-geologist	Connell Wagner	5	30 yrs
Tony King	Env. & Community Co-ordinator	Baal Bone	3 months	26 yrs
Jillian Wright	Mining Engineer	Xstrata	5	8 yrs
Stephanie Hutchison	Planning Forester	Forests NSW	2	4 yrs
Kevin Price	Mine Surveyor	Brunskill	10	40 yrs
Sarah Caruana	Environmental Graduate	Xstrata		1 year
David Swan	Facilitator	HMS Consultants		30 yrs
Andrew Whalan	Technical Assistant	HMS Consultants		5 yrs

Table 4 - Risk Assessment Workshop Team

5 METHOD OF APPROACH

5.1 Risk Assessment Procedure

The risk assessment process identified the risk issues associated with aspects of subsidence management of Baal Bone, longwall panels 29 -31, then assessed the risks in accordance with the Australian/ New Zealand Standard for Risk Management AS/ NZS 4360:2004 and MDG 1010 Risk Management Handbook for the Mining Industry.

This method included the following:

- A workshop team of mine management, relevant external stakeholders as well as external subsidence expertise. The name and role of each team member was recorded (see Table 4 - Risk Assessment Workshop Team)
- The Scope and Objectives of the risk assessment was clearly identified and defined by the team (§3.1 & 3.2)
- The scales for risk ranking were discussed and explained to the team using definitions which are appropriate to the operation and the company (see Appendix A)
- The processes relating to this risk assessment were identified and listed as a flow sequence. (see following section)

5.2 Process Map

Prior to commencement of the risk assessment, the group identified and documented the relevant aspects within the agreed scope of the workshop.

The aspects are shown in *Table 5 – Risk Assessment Process Areas*, following:

#	Aspect	#	Consideration
1	Natural Features	1.01	Natural Water Courses/ Streams
		1.02	River Catchments
		1.03	Swamps & Water-related Ecosystems
		1.04	Steep Slopes
		1.05	Threatened & Protected Species
		1.06	Wolgan Escarpment
		1.07	Internal Cliffs
		1.08	Pagodas/ Rock Formations
		1.09	State Forests/ Natural Vegetation/ Harvesting
2	Surface Improvements	2.01	Tracks / Roads
		2.02	Survey Control Stations
		2.03	General Public/ Recreation
3	Subsurface	3.01	Groundwater Resources/ Aquifer
		3.02	Groundwater recharge
		3.03	Increased mine water make
		3.04	Sterilisation of Coal Resources
4	Areas of Archaeological/ Heritage Significance	4.01	Aboriginal Artifacts

Table 5 - Risk Assessment Process Areas

5.3 Identification of Potential Loss Scenarios

The risk assessment workshop team systematically considered each aspect in turn, with the purpose of identifying potential loss scenarios.

The group considered scenarios relating to; health and safety (surface only), the environment, community and property damage.

These identified scenarios (risk issues) were then recorded.

5.4 Existing Controls

The risk assessment team discussed inherent and current existing control methods for each risk issue. These controls were considered when risk ranking, and recorded as part of the workshop.

5.5 Risk Evaluation

Having identified the risk issues, the Team was then directed to undertake a risk ranking exercise on the identified risk issues in consideration of the existing controls and the data quality effectiveness.

Assessment was undertaken in accordance with the Baal Bone Risk Matrix, as presented in Appendix A, recording:

- Consequence
- Likelihood

The Risk Level is then derived from the risk matrix.

The Risk Level was compared to the scale shown in Appendix A and assigned a Risk Rating, which was recorded on the risk assessment table (see Appendix B).

5.6 Post Implementation Review

It is strongly recommended that mine management undertake post implementation review at a time as appropriate, to measure the effectiveness of existing risk controls.

6 MINERAL RESOURCES MDG 1014 CHECKLIST

To ensure this risk assessment complies with the Minerals Resources MDG 1010 Risk Management Handbook, the following checklist/ sign-off (MDG 1014) has been included.

Sub-sections 6.1, 6.2 and 6.3, are to be completed by Mine Management.

6.1 Report Checklist

1.	Is there a description of the operation or equipment being assessed?	Yes / No
2.	Is there a summary of the strategic, corporate and risk management context?	Yes / No
3.	Is there a list of the people involved in the risk identification step, together with their organisational roles and experience relevant to the risk assessment topic?	Yes / No
4.	Is there an adequately detailed outline of the approach used to identify the risks?	Yes / No
5.	Is there an outline of the method used for assessing the likelihood and consequences of the risks?	Yes / No
6.	Are there two lists of identified risks, ranked by: a) risk magnitude, and b) consequence magnitude	Yes / No
7.	Is there discussion of the basis for defining either the safety standard to be achieved, or the level of risk management expenditure?	Yes / No
8.	Is there a list of the main actions to be taken to reduce risks and to manage risks?	Yes / No
9.	Is there a timetable for implementing main actions?	Yes / No
10.	Does the report specify a requirement for a working audit required after completion of all implementation stages?	Yes / No

6.2 Risk Assessment Process Evaluation

How do you rate the following:		Poor		Good		
1.	The range of expertise of team which did the study	1	2	3	4	5
2.	The appropriateness of the degree of detail of the study	1	2	3	4	5
3.	The comprehensiveness of the systematic approach	1	2	3	4	5
4.	The identification of the key risk scenarios to be addressed	1	2	3	4	5
5.	The bases for deciding the required safety level or effort	1	2	3	4	5
6.	The method for assessing likelihood and consequences	1	2	3	4	5
7.	The thoroughness of consideration of planned risk reduction actions	1	2	3	4	5
8.	The thoroughness of consideration of existing or planned risk controls	1	2	3	4	5
9.	The objectivity and balance of the study (i.e. not unduly optimistic or pessimistic)	1	2	3	4	5

6.3 Risk Assessment Process Signoff

Name: Mr Bernie McKinnon

Position: Mine Manager

Signed: 

Date: 7th December, 2006

APPENDIX A – Baal Bone Risk Matrix

Xstrata Risk Matrix

Risk Matrix		Probability				
		A	B	C	D	E
Max Reasonable Consequence	1	1	2	4	7	11
	2	3	5	8	12	16
	3	6	9	13	17	20
	4	10	14	18	21	23
	5	15	19	22	24	25

Risk Groups

- 1-10 High
- 11-19 Medium
- 20-25 Low

Probability

- A – Almost certain to happen (Everyday/ weekly event)
- B – Likely to happen at some point (Once a month)
- C – Possible, head of so it might happen (Yearly)
- D – Unlikely, not likely to happen (Once every five years)
- E – Rare, practically impossible (Once every twenty-five years)

Maximum Reasonable Consequence

	People	Property	Environmental	Community
1	Multiple fatalities. Major permanent negative health impacts on a large number of people	> \$10M	Disastrous environmental impact, with long term effect, requiring major remediation, regulatory intervention or premature closure of the operation.	Public international condemnation. Major breakdown of social order in affected community
2	Single fatality. Severe irreversible disability or impairment (PDI)	\$1M - \$10M	Serious environmental impact with medium-term effect, requiring significant remediation or resulting in prosecution.	Loss of community's economic viability. Significant damage to reputation of the operations
3	Major injury to one or more people. Severe health impacts on a number of people	\$100K - \$1M	Moderate reversible environmental impact with short term effect, requiring moderate remediation such as a reportable incident not likely to result in prosecution (e.g. minor water discharge)	Significant public criticism (e.g. community complaints) NGO or Media "taking up the issue" Major negative impact on economic viability
4	Significant reportable injury (MTI or less than 5 days of RWI or LTI). Impact on health of several people	\$10K - \$100K	Minor, reversible environmental impact, requiring minor remediation such as non reportable environmental incident (eg. minor oil spill)	Flare up of issues in affected communities. Media criticism
5	Minor Injury. Slight negative impact on individual health.	< \$10K	Negligible, reversible environmental impact, requiring very little remediation	Slight negative impact on individuals in local community

APPENDIX B – Baal Bone Risk Table, December 2006

A#	Aspect	C#	Consideration	R#	Risk Issue	Causes	Impacts	Inherent & Existing Controls	C	L	Rank	Level
1	Natural Features	1.01	Natural Water Courses/ Streams	1.01.0	Disruption to natural stream flow	- Surface Cracking - Change in land profile	Environmental	- Natural gradient is much steeper than level of tilt from subsidence - 150m+ of overburden - Cracks will naturally heal	4	B	14	M
1	Natural Features	1.01	Natural Water Courses/ Streams	1.01	Disruption to natural stream flow	- Upsidence	Environmental	- Nature/ gradient of stream flows - Ephemeral streams - Stratigraphic environment	5	C	22	L
1	Natural Features	1.02	River Catchments	1.02.0	Loss of feed water	- Cracking reducing stream flow	Environmental	- 150m+ of overburden - Cracks will naturally heal - Proportionally small catchment area impacted	5	C	22	L
1	Natural Features	1.03	Swamps & Water-related Ecosystems	1.03.01	Damage to Endangered Ecological Community	- Loss of groundwater	Environmental	- Mine layout - Cracks will naturally heal - Dip orientation - Swamps not solely reliant on groundwater - Monitoring/ Baseline surveys	2	D	12	M
1	Natural Features	1.03	Swamps & Water-related Ecosystems	1.03.02	Damage to ecosystem	- Loss of groundwater	Environmental	- Mine layout - Cracks will naturally heal - Dip orientation - Swamps not solely reliant on groundwater - Monitoring - Small area of impact	2	D	12	M
1	Natural Features	1.04	Steep Slopes	1.04.0	Slope instability	- Subsidence phenomenon	Environmental	- 150m+ of overburden - Existing topography - Extraction thickness - Stratigraphy not conducive to slumping	4	E	23	L
1	Natural Features	1.04	Steep Slopes	1.04	Increased erosion	- Surface tilt - Increased slope gradient	Environmental	- 150m+ of overburden - Existing topography - Extraction thickness	5	D	24	L
1	Natural Features	1.04	Steep Slopes	1.04.0	Personal injury	- Ground instability - Cracking	Personal Injury	- Signage - Site safety plans - Risk assessments - Generally inaccessible	4	D	21	L
1	Natural Features	1.04	Steep Slopes	1.04	Dislodging boulders	- Ground instability - Surface tilt	Environmental	- Mine design identified boulders - Limited number of rock features within the subsidence area	5	E	25	L
1	Natural Features	1.05	Threatened & Protected Species	1.05.01	Partial loss of local population	- Damage to habitat	Environmental	- 150m+ of overburden - Nature of habitat in area (i.e.. Not sensitive to subsidence) - Fauna and flora monitoring - Low habitat quality - No threatened flora species identified in area	2	E	16	M

A#	Aspect	C#	Consideration	R#	Risk Issue	Causes	Impacts	Inherent & Existing Controls	C	L	Rank	Level
1	Natural Features	1.06	Wolgan Escarpment	1.06.01	Rock falls	- Subsidence movements	Community	- Mine layout taking account of previous monitoring/ experience - Survey conducted to establish top of rock features limit associated with Wolgan escarpment - 26.5 degrees AOD from top of features associated with Wolgan escarpment - 26.5 degree AOD defining the SMP area in alignment with DPI guidelines	2	D	12	M
1	Natural Features	1.06	Wolgan Escarpment	1.06.02	Cracking	- Subsidence movements	Community	- Mine layout taking account of previous monitoring/ experience - Survey conducted to establish top of rock features limit associated with Wolgan escarpment - 26.5 degrees AOD from top of features associated with Wolgan escarpment - 26.5 degree AOD defining the SMP area in alignment with DPI guidelines	4	D	21	L
1	Natural Features	1.07	Internal Cliffs	1.07.01	Rock falls	- Subsidence movements	Community	- Mine layout taking account of previous monitoring/ experience - Orientation and geometry of cliffs relative to mine layout - No extraction directly below cliffs - Historically evidence suggests high level of protection is provided by not mining directly under cliff	3	C	13	M
1	Natural Features	1.07	Internal Cliffs	1.07.02	Cracking	- Subsidence movements	Community	- Mine layout taking account of previous monitoring/ experience - Orientation and geometry of cliffs relative to mine layout - No extraction directly below cliffs	4	B	14	M
1	Natural Features	1.08	Pagodas/ Rock Formations	1.08.01	Cracking	- Subsidence movements	Community	- Mine layout taking account of previous monitoring/ experience - Size less than 10m high - Less than 20m diameter limits potential for cracking	4	C	18	M
1	Natural Features	1.09	State Forests/ Natural Vegetation/ Harvesting	1.09.01	Restriction of commercial resource	- Limited access due to subsidence impacts	Property Value	- Limited existing harvestable resource - Previous impacts temporary only	5	D	24	L

A#	Aspect	C#	Consideration	R#	Risk Issue	Causes	Impacts	Inherent & Existing Controls	C	L	Rank	Level
1	Natural Features	1.09	State Forests/ Natural Vegetation/ Harvesting	1.09.02	Personal injury to forest workers to Forest management & fire-fighting activities in LW mining area	- Subsidence impacts - Monitoring hardware	Personal Injury	- Signage - Forests NSW Site safety plans - Safe work procedures - Informal liaison with colliery	3	D	17	M
1	Natural Features	1.09	State Forests/ Natural Vegetation/ Harvesting	1.09.03	Loss of vegetation and soil disturbance	- Clearing For monitoring activities	Environmental	- Environmental review prior to clearing - Minimisation of cleared areas - Use of existing trails where possible	4	B	14	M
2	Surface Improvements	2.01	Tracks / Roads	2.01.01	Damage to roads and drainage structures	- Change in gradient - Cracking	Property Value	- Monitoring of roads - Inspections and repairs - Road closure plan - Internal systems	4	C	18	M
2	Surface Improvements	2.01	Tracks / Roads	2.01.02	Increased sedimentation into drainage lines	- Change in gradient - Cracking	Environmental	- Monitoring of roads - Inspections and repairs - Negligible gradient changes	4	D	21	L
2	Surface Improvements	2.02	Survey Control Stations	2.02.01	Movement of Wolgan gap survey trig	- Subsidence impacts	Property Value	- Awareness - Notification - Monitoring	5	B	19	M
2	Surface Improvements	2.03	General Public/ Recreation	2.03.01	Personal injury to users, including but not limited to: motorbike rider, bushwalking, orienteering, hunting, bicentennial trail user	- Surface cracks - Rock falls - Star pickets	Personal Injury	- Signage - Newspaper advertisements - Inspections and repairs	4	D	21	L
3	Subsurface	3.01	Groundwater Resources/ Aquifer	3.01.01	Draining upper water bearing zones impacts on vegetation community	- Fracturing of overburden strata due to LW mining	Environmental	- Reduction in flow temporary and insignificant - 150m+ of overburden reduces potential for drainage - No known threatened vegetation identified in SMP area relying on ground water flows - No major identified water bearing zones in SMP area	4	C	18	M
3	Subsurface	3.01	Groundwater Resources/ Aquifer	3.01.02	Draining lower water bearing zones	- Fracturing of overburden strata due to LW mining	Environmental	- No known important water bearing zones	5	A	15	M

A#	Aspect	C#	Consideration	R#	Risk Issue	Causes	Impacts	Inherent & Existing Controls	C	L	Rank	Level
3	Subsurface	3.02	Groundwater recharge	3.02.01	No Risks Identified							
3	Subsurface	3.03	Increased mine water make	3.03.01	Increased pumping	- Additional 0.5ML water make	Operational	- Potential to store water in North and South mine goafs - Relative volume small - Recycling stored water for use in CPP - Pumping plan developed for scenario - Sufficient pumping capacity	5	B	19	M
3	Subsurface	3.04	Sterilisation of Coal Resources	3.04.01	Loss of future coal resource	- Disruption to overlying seams caused by subsidence impacts	Property Value	- Geological investigations - No viable classifiable resource identified to JORC standard	5	C	22	L
4	Areas of Archaeological / Heritage Significance	4.01	Aboriginal Artifacts	4.01.01	Damage/ disturbance to artifacts/ sites	- Subsidence impacts - Surface cracks - Rock/ cliff fall	Community	- No known artifacts/ sites in application area (1992 survey) - Mine design avoid impact on potential areas (escarpment/ cliffs) - see also 1.06.01	2	D	12	M