



Abel Mine SMP Area 1 Application-Written Report

APPENDIX G

Abel Mine Subsidence Risk Assessment

HMS Consultants



**DONALDSON COAL PTY LTD
ABEL UNDERGROUND COAL MINE**

**SUBSIDENCE MANAGEMENT PLAN
AREA 1 RISK ASSESSMENT**

**FINAL REPORT
AUGUST 2009**

Hawcroft Miller Swan Consultants Pty Ltd
ABN 90 075 032 441

Level 5
6 Bolton Street
NEWCASTLE NSW 2300
AUSTRALIA

Phone: (02) 4926 2855
Fax: (02) 4926 1508



DONALDSON COAL PTY LTD ABEL UNDERGROUND COAL MINE SUBSIDENCE MANAGEMENT PLAN AREA 1 RISK ASSESSMENT FINAL REPORT AUGUST 2009

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This Report was prepared on the basis of information recorded by Hawcroft Miller Swan Consultants Pty Ltd during the risk assessment workshop held on 2nd July 2009, being group consensus opinion of the Abel Underground Mine Area 1 subsidence issues.

Client: Mr Tony Sutherland
Technical Services Manager- Underground
Operations
Donaldson Coal Pty. Ltd.

Authors: Jarrod Smith & David Swan
HMS Consultants Pty. Ltd.

File	Report	Prepared By	Reviewed By	Date
20090706 HMS837 Abel Subsidence Management Plan RA Draft Report.doc	Draft	J.Smith & D.Swan	T. Sutherland, K. Price, S. Ditton & A. Dawkins	6 th July 2009
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1 EXECUTIVE SUMMARY

In June 2009, Hawcroft Miller Swan Consultants Pty Ltd (HMS) was engaged by Donaldson Coal to facilitate a qualitative risk assessment to examine Abel Mine's (Abel) Area 1 mining plan, to identify and assess mine subsidence-related risk issues. The assessment considers potential loss impacts including effects on Abel's operational objectives as well as third party and environmental aspects.

This assessment was carried out to support the development of the Abel - Subsidence Management Plan.

Abel Mine is an underground mine located approximately 25km north-west of Newcastle, NSW. Mining operations commenced adjacent to the Donaldson Open Cut Coal Mine in March 2008. The mine utilises existing surface infrastructure and the Bloomfield Coal Handling and Preparation Plant, rail loader and rail loop for coal processing and loading on trains for transport to the Newcastle Coal Port for export.

A significant subsidence risk control for the mining of Area 1 is the adoption of a proven pillar extraction method as shown in Plan A9P0001. This method of mining will provide flexibility in mine design as subsidence and environmental monitoring data is analysed. The Mine plan can then be optimised to provide the best outcome for subsidence impacts and resource recovery.

This report details the methods used and the recommendations resulting from a risk assessment which was conducted at the Abel Mine Offices on the 2nd July 2009.

Risk ranking was undertaken in accordance with the Abel Mine Risk Matrix shown in *Appendix A – Abel Mine Risk Matrix*.

In accordance with the scope, risk issues were considered / recorded by the Risk Assessment Team. The reader should refer to Section 3 of this report for details regarding the objectives, scope, assumptions and limitations of this Risk Assessment.

1.1 Distribution of Risks

In total thirty-five (35) risk issues were identified. Of those risks assessed, there were nil "High" risks identified, and six (6) "Significant" risk issues identified by the risk assessment team. There were nil "Catastrophic" consequences identified, and one (1) "Major" consequence identified by the risk assessment team.

Full details of all risks identified by the risk assessment team can be found in *Appendix B – Abel Mine, SMP Area 1 Risk Table, July 2009 (Assessment Order)*.

- Chart 1 – Summary of Identified Risks by Loss Category*
- Table 1 – Summary of Identified Risks by Loss Category*
- Chart 2 – Summary of Identified Risks by Risk Level*
- Table 2 – Summary of Identified Risks by Risk Level*

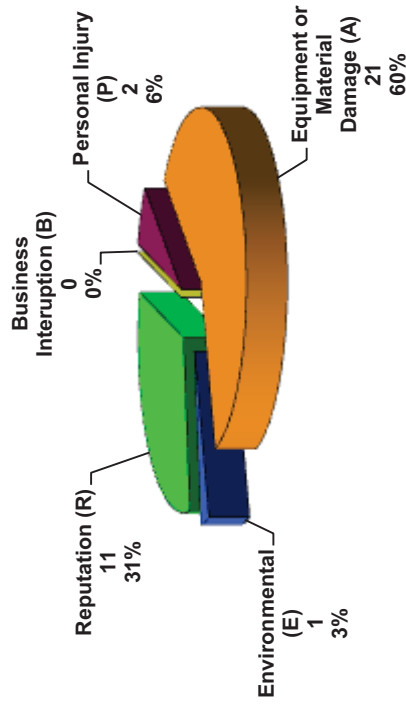


Chart 1 – Summary of Identified Risk by Loss Category

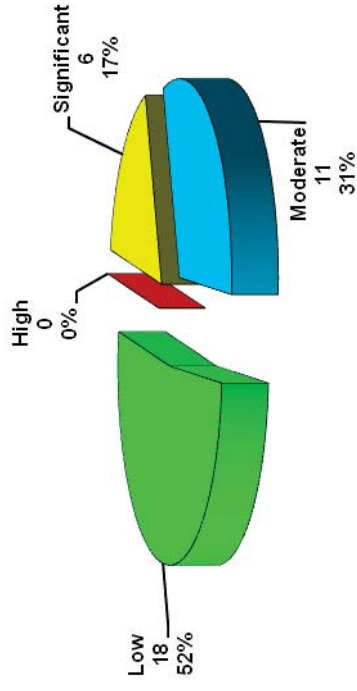


Chart 2 – Summary of Identified Risk by Risk Level

Loss Category	ABEL MINE SMP AREA 1 RISK ASSESSMENT Identified Risks	
	No.	%
Personal Injury (P)	2	6
Equipment or Material Damage (A)	21	60
Environmental (E)	1	3
Reputation (R)	11	31
Business Interruption (B)	0	0
Total	35	100

Table 1 - Summary of Identified Risks by Loss Category

ABEL MINE SMP AREA 1 RISK ASSESSMENT Residual Risk Rating		
Risk	No.	%
High	0	0
Significant	6	17
Moderate	11	31
Low	18	51
Total	35	100

Table 2 – Summary of Identified Risk by Risk Level

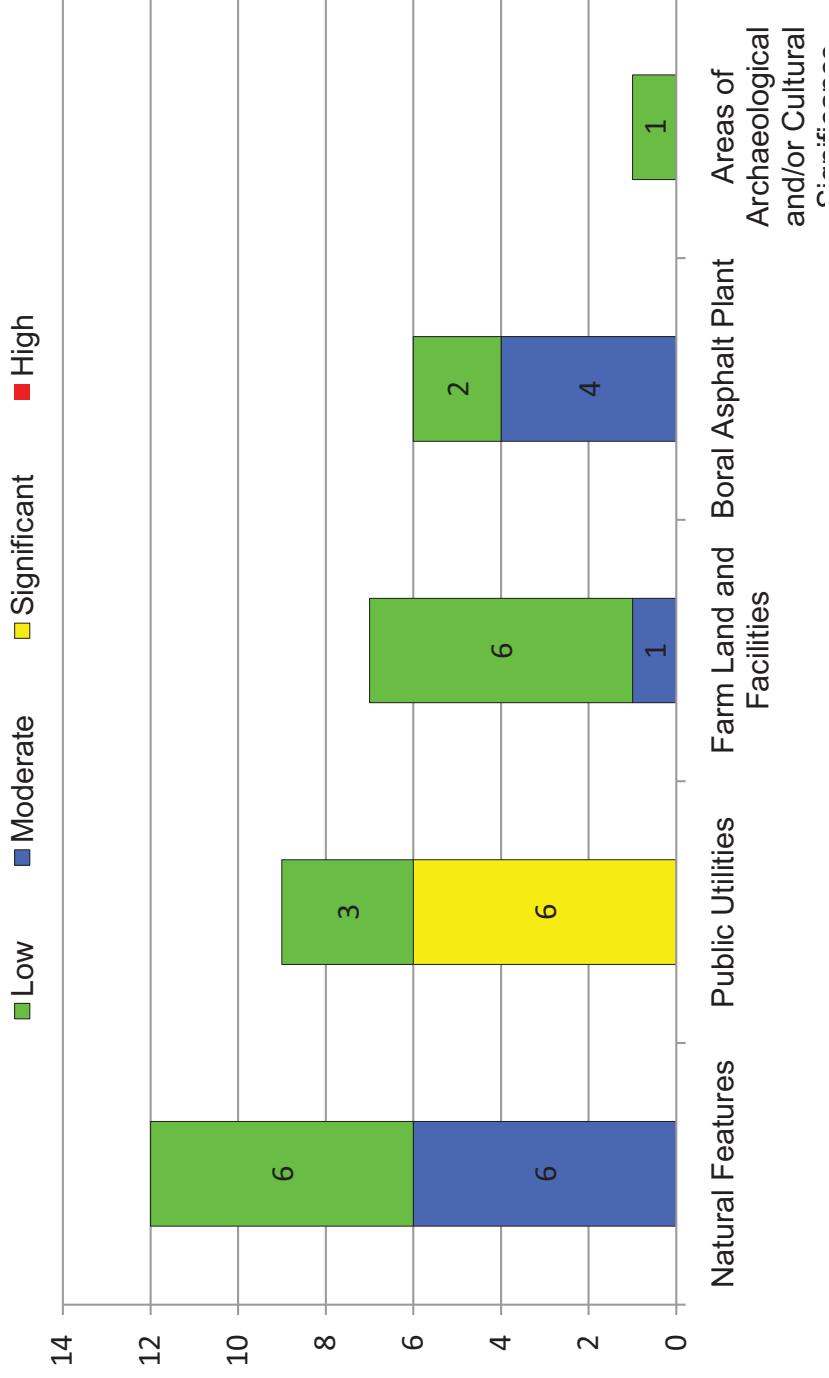


Chart 3 – Summary of Risk Level per Process Area

1.2 Identified “High” Risks

There were nil “High” risks identified by the risk assessment team.

1.3 List of “Catastrophic” and “Major” consequences

There were nil “Catastrophic” consequences identified, and one (1) “Major” consequence (Consequence rating 2) identified by the risk assessment team. A summary of the “Major” consequence identified is shown in Table 3 below.

Process / Subprocess	Risk Issue	Existing Controls	Further Actions
Public Utilities / Electricity transmission lines (overhead/underground) and associated plants	Damage to 330kV Transgrid Powerline	<ol style="list-style-type: none"> 1. Cruciform footings 2. Conductor strings 	<ol style="list-style-type: none"> 1. Transgrid to review structural integrity and design of cruciforms 2. Continue dialogue with Transgrid to develop management plan 3. Investigate need for installation of pulleys on earth wires 4. Check conductor clearance 5. Pre-mining surveys 6. Subsidence data from Panels 1-4 will be available prior to mining under Transgrid 330kV powerlines

Table 3 – Summary of “Major” consequence risks

1.4 Further Actions

Table 4, below provides a composite list of Further Actions that the Risk Assessment Team nominated to further reduce risk levels for the risks ranked as Significant.

Risk Issue	Further Actions
Damage to access road to Boral	<ol style="list-style-type: none"> 1. Management Plan to be implemented
Damage to Hunter Water Corporation (HWC) 200mm UPVC pipeline	<ol style="list-style-type: none"> 1. Continue dialogue with HWC to develop management plan
Damage to 330kV Transgrid Powerline	<ol style="list-style-type: none"> 1. Transgrid to review structural integrity and design of cruciforms 2. Continue dialogue with Transgrid to develop management plan 3. Investigate need for installation of pulleys on earth wires 4. Check conductor clearance 5. Pre-mining surveys 6. Subsidence data from Panels 1-4 will be available prior to mining under Transgrid 330kV powerlines
Damage to 132kV Energy Australia Powerline	<ol style="list-style-type: none"> 1. Check conductor clearance 2. Survey pole locations 3. Continue dialogue with Energy Australia to develop management plan 4. Pre-mining surveys 5. Investigate need for installation of pulleys on earth wires
Damage to 11kV Energy Australia Powerline	<ol style="list-style-type: none"> 1. Check conductor clearance 2. Continue dialogue with Energy Australia to develop management plan 3. Pre-mining surveys 4. Investigate need for installation of pulleys on earth wires 5. Energy Australia to review requirement for power line
Damage to Optus Optical Fibre Cables	<ol style="list-style-type: none"> 1. Assess Optus MP 2. Investigate durability of Optus cable 3. Subsidence data from Panels 1-4 will be available prior to mining under Optus Optical Fibre cable 4. Continue dialogue with Optus to confirm appropriate management plan

Table 4 – Further Actions, “Significant” Consequence

2 INTRODUCTION

In June 2009, Hawcroft Miller Swan Consultants Pty Ltd (HMS) was engaged by Donaldson Coal to facilitate a qualitative risk assessment to examine Abel Mine's (Abel) Area 1 mining plan, to identify and assess mine subsidence-related risk issues. The assessment considers potential loss impacts including effects on Abel's operational objectives as well as third party and environmental aspects.

This assessment was carried out to support the development of the Abel - Subsidence Management Plan.

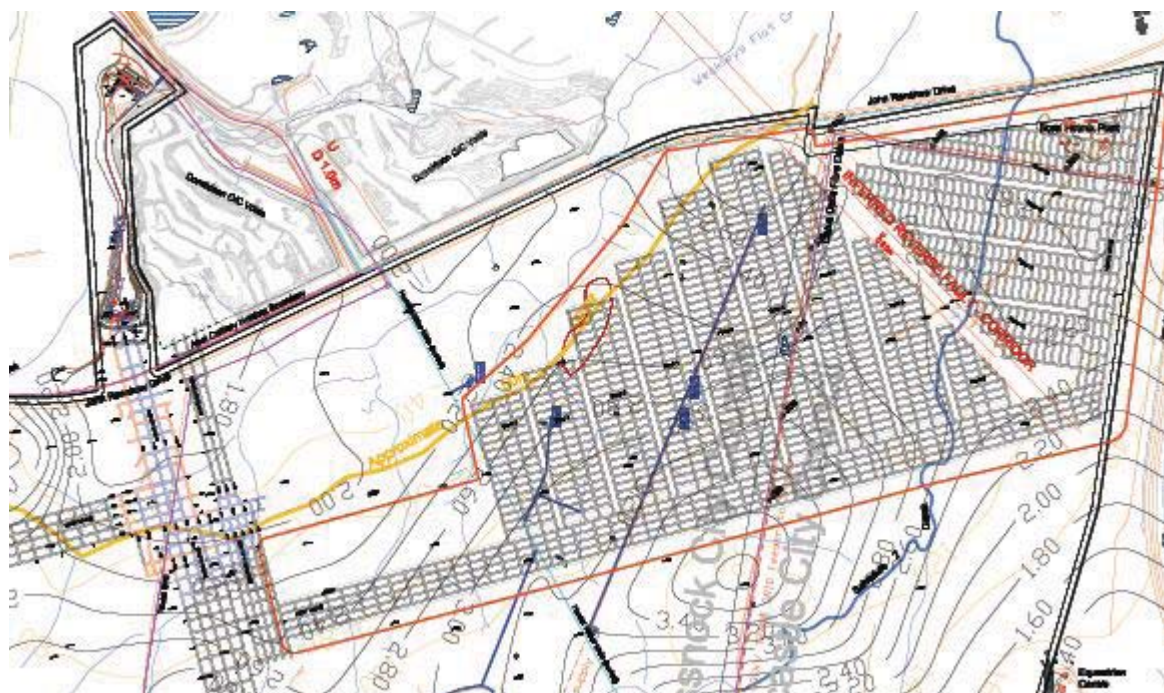
This report details the methods used and the recommendations resulting from a risk assessment which was conducted at the Abel Mine Offices on the 2nd July 2009.

3 CONTEXT

3.1 Background

Abel Mine is an underground bord and pillar mine located approximately 25km north-west of Newcastle, NSW. Mining operations commenced adjacent to the Donaldson Open Cut Coal Mine in March 2008. The mine utilises existing surface infrastructure and the Bloomfield Coal Handling and Preparation Plant, rail loader and rail loop for coal processing and loading on trains for transport to the Newcastle Coal Port for export.

Subsidence Management Plan Area 1



3.2 Purpose

The purpose of this risk assessment is to identify and assess the risks associated with mining of SMP Area 1 surface and sub surface subsidence, and identify management priorities.

3.3 Scope

The scope of this risk assessment included:

- Identify subsidence risks from all potential sources for Abel SMP Area 1 proposed pillar extraction both during and after mining for:
 - Surface:
 - Surface improvements / structures including; private, public and mine assets, roads, tracks, power lines, utilities, etc
 - Natural features, e.g. watercourses, catchment areas, swamps, flora and fauna, drainage patterns and hydrology
 - Features of cultural and heritage significance
 - Sub-surface, geo-hydrology, water table, etc
- The risk assessment considered loss scenarios, quantified risk and identified controls to eliminate or mitigate risk, as appropriate, in terms of:
 - Personal Injury (P)
 - Equipment or Material Damage (A)
 - Business Interruption (BI)
 - Environment (E)
 - Reputation (R)

3.4 Objectives

The aim of this risk assessment is to provide a structured and systematic process whereby the proposed SMP Area 1 layout undergoes critical yet objective assessment to ensure potential risk issues are identified and controlled to an acceptable level.

The Objectives of the risk assessment are to:

- Assist Abel in the identification and control of subsidence risks associated with pillar extraction in accordance with:
 - Australian Standards
 - Planning, Environmental, OH&S, Mining and other Legislation
- Facilitate and record the risk assessment for the identification of hazards and assessment of risk in accordance with AS4360:2004 and MDG1010
- Provide a report detailing the outcomes of the risk assessment, including:
 - Risk Issues and causes
 - Identification of existing risk mitigation controls
 - Further actions to reduce risk

3.5 Assumptions & Limitations

The assumptions of the risk assessment are as follows:

- Impacts will be similar to those previously observed in comparable areas
- Rigorous monitoring can identify anomalous subsidence which can be used to manage impacts through early intervention strategies
- Surface features and land use remains substantially constant during the mining period
- The focus of this risk assessment is on subsidence only
- Risk evaluation is based on the highest impact for the risk being assessed
- ACARP 2003 model used for subsidence predictions
- Department of Mineral Resources 1987 – Holla
- 85% panel extraction in areas where there are no subsidence constraints
- This risk assessment is for the current mine design only
- Completion of subsidence by June 2013
- Accurate location of surface features known
- Location of fault known from drilling data and geological interpretation

The limitations of the risk assessment are as follows:

- The area covered by the risk assessment is limited to SMP Area 1
- Greenfields site
- No prior subsidence experience in the Upper Donaldson Seam

3.6 Definitions

Consequence

The outcome of an event or situation expressed qualitatively or quantitatively, being loss, injury disadvantage or gain.

Hazard

A source of potential harm or a situation with a potential to cause loss.

Likelihood

Used as a qualitative description of probability and frequency.

Monitor

To check, supervise, observe critically, or record the progress of an activity, action or system on a regular basis in order to identify change.

Principal hazard

A source of potential harm or a situation with a potential to result in multiple fatalities.

Probability

The likelihood of a specific outcome, measured by the ratio of specific outcomes to the total number of possible outcomes.

Risk

The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood.

Risk Analysis

A systematic use of available information to determine how often specified events may occur and the magnitude of their likely consequences.

Risk Assessment

The overall process of risk analysis and risk evaluation.

Risk Control

The part of risk management that involves the provision of policies, standards and procedures to eliminate, avoid or minimise adverse risks facing an enterprise.

Risk Management

The systematic application of management policies, procedures and practices to the tasks of identifying, analysing, evaluation, treating and monitoring risk.

4 THE WORKSHOP TEAM

A key factor in the effectiveness of the risk assessment is the availability of relevant information and expertise. A workshop team made up of Donaldson Coal operational, technical and management personnel and technical and environmental consultants as well as an independent facilitator were assembled to achieve 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 scope and objectives. The Facilitator assisted the team by providing a systematic process of critical and objective assessment of the subject matter. HMS documented the workshop process and outcomes, and will offer post-workshop feedback to the Client and Team.

The team members are listed in Table 4 following:

Name	Position	Company/ Mine	Industry Years	Site Years	2/07/2009
Phillip Brown	Environment Manager	Donaldson	12	6	X
Peter Dundon	Senior Principal	Aquaterra	36	-	X
Doug Hunt	Principal	Aquaterra	12	-	X
Tony Sutherland	Technical Services Manager- Underground Operations	Donaldson	25	0.5	X
David Walker	Project Manager- Abel Mine	Donaldson	32	0.5	X
Kevin Price	Mine Surveyor	Brunskill / Donaldson	43	2	X
Steven Ditton	Principal Engineer	Ditton Geotech	20	10	X
Andrew Dawkins	Managing Geoscientist	Geoterra	25	3	X
David Swan	Managing Director (Facilitator)	HMS	30	-	X
Jarrod Smith	Consultant (Assisting)	HMS	2	-	X

Table 5 – Team Members

5 METHOD

5.1 Risk Assessment

Assessment of the risks was conducted in accordance with the Australian/ New Zealand Standard for Risk Management AS/ NZS 4360:2004 and MDG1010.

5.2 Preliminaries

- A meeting was held with Tony Sutherland, Technical Services Manager prior to the risk assessment to gather background information on the area to be assessed.
- A workshop team of Donaldson Coal operational, technical and management personnel, technical and environmental consultants and an independent facilitator were assembled. The name, position/ title and experience of each team member was recorded.
- The team was taken through a detailed presentation of mine design as well as subsidence modelling and anticipated impacts.
- The objectives and scope, assumptions and limitations of the risk identification workshop were discussed, agreed and recorded.
- The Abel Mine Risk Matrix was used and definitions and its application discussed.

5.3 Process Areas & Sub-Areas

The risk assessment process followed the structure presented in *Table 5 – Areas & Sub-Areas*, below, being those identified by the Team as the main areas and sub-areas for the Area 3 Subsidence.

Note: The NSW Department of Mineral Resources Guideline for Application for Subsidence Management Approvals – Appendix B listing was utilised as a basis of identification of Areas & Sub-Areas for consideration for the risk assessment. The list in its entirety is shown in Appendix E – NSW Department of Mineral Resources Guideline for Subsidence Management Approvals – Appendix B.

Area	#	Sub-Area
Natural Features	1.01	Creeks
	1.02	Aquifers, known groundwater resources
	1.03	Springs
	1.04	Land prone to flooding or inundation
	1.05	Swamps, wetlands, water related ecosystems
	1.06	Threatened and protected species
	1.07	Natural vegetation
	1.08	Any other feature considered significant
Public Utilities	2.01	Roads (all types)
	2.02	Culverts associated with Black Hill land
	2.03	Water/gas/sewerage pipelines
	2.04	Electricity transmission lines (overhead/underground) and associated plants
	2.05	Telecommunication lines (overhead/underground) and associated plants
	2.06	Any other infrastructure items
Farm Land and Facilities	3.01	Agricultural utilisation or agricultural suitability of farm land
	3.02	Internal access tracks
	3.03	Fences

Area	#	Sub-Area
	3.04	Farm dams
	3.05	Wells, bores
	3.06	Any other feature considered significant
Boral Asphalt Plant	4.01	Workshops
	4.02	Site Offices
	4.03	Gas and / or fuel storages and associated plants
	4.04	Waste storages and associated plants
	4.05	Buildings, equipment and operations (general)
	4.06	Buildings, equipment and operations that are sensitive to surface movements
	4.07	Any other feature considered significant
Areas of Archaeological and/or Heritage Significance	5.01	Areas of Archaeological and/or Heritage Significance

Table 6 – Process Areas & Sub-Process Areas

5.4 Identification of Risk Issues

The Risk Assessment Team systematically considered each Area and Sub-Area in turn to identify subsidence risk issues, causes and its effects on Abel's strategic, business and operational objectives as well as third party and environmental aspects.

5.5 Existing Controls

Once the risk issues were identified, the Risk Assessment Team identified existing controls that were in place to control the risk issues.

5.6 Residual Risk Evaluation

Having identified the risk issues, causes and existing controls, the team was then asked to undertake a risk ranking exercise on the identified risk issues in consideration of the existing controls. The ranking of risk issues with existing controls, in consideration of their effectiveness is known as **Residual Risk Ranking**.

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

- Consequence**, and;
- Likelihood**

The actual impact type that the risk issue was rated on was recorded in the column headed "Loss Type", being the most severe risk level.

5.7 Risk Reduction Strategy

During this stage of the assessment the Risk Assessment Team nominated further actions and additional controls that in order to eliminate or control the identified risk issue to an acceptable level.

5.8 Post Implementation Review/ Audit

It is strongly recommended that the Abel SMP Area 1 team undertakes post implementation review/ auditing at times as appropriate to the action and level of risk to check/ evaluate the adequacy of implementation of controls.

6 MINERAL RESOURCES MDG 1014 CHECKLIST

To ensure this total 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 Abel 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 (Please highlight)				
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 Tony Sutherland

Position: Technical Services Manager- Underground Operations

Signature:



Date: 10.8.09

APPENDIX A

Abel Mine Site Risk Matrix

DONALDSON COAL RISK MATRIX

						Likelihood				
						A Certain	B Probable	C Possible	D Remote	E Improbable
ABEL MINE RISK MATRIX Note: Consequence may consist of a single event or may represent a cumulative impact over a period of 12 months						Consequence Note: Consequence may consist of a single event or may represent a cumulative impact over a period of 12 months				
						Personal Injury	Equipment or Material Damage	Business Interruption	Environment	Reputation
1. Catastrophic	Multiple Fatalities	>\$5M	>3 months	Massive leak or spill	International Impact	1 (H)	2 (H)	5 (H)	7 (S)	11 (S)
2. Major	Single Fatality	\$1M to \$5M	1 – 3 months	Major leak or spill	National Impact	3 (H)	4 (H)	8 (S)	12 (S)	16 (M)
3. Moderate	Serious/Disabling Injury	\$100K to \$1M	1 week to 1 month	Localised leak or spill	Regional Public Impact	6 (H)	9 (S)	13 (S)	17 (M)	20 (L)
4. Minor	Lost Time Injury	\$10K to \$100K	1 day to 1 week	Minor leak or spill	Some Public Concern	10 (S)	14 (S)	18 (M)	21 (L)	23 (L)
5. Insignificant	First Aid Treatment Only	Up to \$10K	Up to 1 day	Slight leak or spill	No Public Concern	15 (S)	19 (M)	22 (L)	24 (L)	25 (L)

APPENDIX B

**Abel Mine
SMP Area 1 Risk Table, July 2009
(Assessment Order)**

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.01	Creeks	1.01.01	Disruption of stream flow to Viney Creek	<ol style="list-style-type: none"> 1. Cracking of stream bed 2. Development of ponding and storage areas 	<ol style="list-style-type: none"> 1. Mine design and layout (1,2) 2. Provision of an exclusion zone (1,2) 3. Baseline stream monitoring as per Surface Water Management Plan (EMP) 4. Natural healing of cracks 5. Size of cracks will be limited by soil cover 	R	3	D	17	M	<ol style="list-style-type: none"> 1. Subsidence and stream flow monitoring 2. Refine model based on monitoring results 3. Consider surveying creek location 	Yes
1	Natural Features	1.01	Creeks	1.01.02	Associated loss of flow to Weakley's Flat Creek	<ol style="list-style-type: none"> 1. Disruption of stream flow to Schedule 1 streams 2. Cracking of stream bed 3. Development of ponding and storage areas 	<ol style="list-style-type: none"> 1. Post mining remediation as per Project Approval 2. Natural healing of cracks 3. Size of cracks will be limited by soil cover 4. Sufficient surface gradients to minimise ponding potential and prevent stream capture 5. Baseline stream flow monitoring of Weakley's Flat Creek as per SWMP 	R	5	C	22	L	<ol style="list-style-type: none"> 1. Refine model based on monitoring results 	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.01	Creeks	1.01.03	Erosion and bed and bank instability (Schedule 2)	1. Changing gradient 2. Surface cracking	1. Dense native and introduced vegetation along creek beds 2. Mine design Schedule 2 (Viney Creek)	R	3	D	17	M	1. Refine model based on monitoring results	Yes
1	Natural Features	1.01	Creeks	1.01.04	Erosion and bed and bank instability (Schedule 1)	1. Changing gradient 2. Surface cracking	1. Dense native and introduced vegetation along creek beds	R	4	C	18	M		Yes
1	Natural Features	1.01	Creeks	1.01.05	Decline in water quality (Schedule 2)	1. Increased erosion	1. Dense native and introduced vegetation along creek beds 2. Mine design 3. Water quality monitoring	R	4	D	21	L	1. Monitoring	Yes
1	Natural Features	1.01	Creeks	1.01.06	Decline in water quality (Schedule 1)	1. Increased erosion	1. Dense native and introduced vegetation along creek beds 2. Water quality monitoring	R	5	C	22	L	1. Monitoring	Yes
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.01	Drainage of groundwater from perched regolith aquifer	1. Cracking of surface and subsurface	1. Monitoring 2. Mine design	R	4	C	18	M	1. Continued Monitoring	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.02	Depressurisation of coal measures aquifer impacting on groundwater users	1. Mine inflows 2. Cracking	1. Remoteness from other users 2. High salinity of water 3. Low value groundwater resource	R	4	D	21	L	1. Continued Monitoring	Yes
1	Natural Features	1.03	Springs	1.03.01	Nil identified						n/a	n/a		
1	Natural Features	1.04	Land prone to flooding or inundation	1.04.01	Subsidence increases the extent of flooding	1. Quantity of subsidence	1. Mine design				n/a	n/a	1. Review flood studies undertaken by Coal & Allied	
1	Natural Features	1.05	Swamps, wetlands, water related ecosystems	1.05.01	Increased inundation of swamp	1. Subsidence	1. Mine design 2. Swamp is on the edge of the subsidence area	A	4	C	18	M	1. Monitoring review (Panel 13)	Yes
1	Natural Features	1.05	Swamps, wetlands, water related ecosystems	1.05.02	Drainage of swamp	1. Cracking	1. Mine design 2. Swamp is on the edge of the subsidence area	A	4	D	21	L		Yes
1	Natural Features	1.05	Swamps, wetlands, water related ecosystems	1.05.03	Harm to groundwater dependent ecosystems	1. Cracking and drainage of shallow groundwater	1. Self-healing of cracks over time	A	5	C	22	L		Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.06	Threatened and protected species	1.06.01							n/a	n/a	Investigate threatened and protected species in SMP Area 1	
1	Natural Features	1.07	Natural Vegetation	1.07.01	Falling trees striking person	1. Cracking and tilting 2. Low soil cover	1. Public Safety Management Plan, includes signage 2. Private property - no public access	P	3	D	17	M		
1	Natural Features	1.08	Any other area considered significant	1.08.01	Nil identified						n/a	n/a		
2	Public Utilities	2.01	Roads (all types)	2.01.01	Damage to public road (F3 freeway, John Renshaw Drive)	1. Subsidence 2. Far field movement	1. Roads outside angle of draw (1) 2. Roads outside area of measurable horizontal displacement (2) 3. Roads not within SMP area	A	4	D	21	L	1. Investigate Monitoring of John Renshaw Dr and F3 as part of SMP approval monitoring process	Yes
2	Public Utilities	2.01	Roads (all types)	2.01.02	Damage to access road to Boral	1. Subsidence	1. Low speed road	A	4	B	14	S	1. Management Plan to be implemented	Yes
2	Public Utilities	2.02	Culvert associated with Black Hill land	2.02.01	Damage to culvert on Viney Creek	1. Subsidence	1. Mine design and layout 2. Provision of an exclusion zone	A	4	E	23	L		Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
2	Public Utilities	2.03	Water pipeline	2.03.01	Damage to HWC 200mm UPVC pipeline	1. Subsidence	Nil identified	A	3	C	13	S	1. Continue dialogue with HWC to develop management plan	Yes
2	Public Utilities	2.04	Electricity transmission lines (overhead / underground) and associated plants	2.04.01	Damage to 330kV Transgrid Powerline	1. Subsidence	1. Cruciform footings 2. Conductor strings	A	2	C	8	S	1. Transgrid to review structural integrity and design of cruciforms 2. Continue dialogue with Transgrid to develop management plan 3. Investigate need for installation of pulleys on earth wires 4. Check conductor clearance 5. Pre-mining surveys 6. Subsidence data from Panels 1-4 will be available prior to mining under Transgrid 330kV powerlines	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
2	Public Utilities	2.04	Electricity transmission lines (overhead / underground) and associated plants	2.04.02	Damage to 132kV Energy Australia Powerline	1. Subsidence	1. Timber poles more resilient to subsidence impacts	A	3	C	13	S	1. Check conductor clearance 2. Survey pole locations 3. Continue dialogue with Energy Australia to develop management plan 4. Pre-mining surveys 5. Investigate need for installation of pulleys on earth wires	Yes
2	Public Utilities	2.04	Electricity transmission lines (overhead / underground) and associated plants	2.04.03	Damage to 11kV Energy Australia Powerline	1. Subsidence	1. Timber poles more resilient to subsidence impacts	A	3	C	13	S	1. Check conductor clearance 2. Continue dialogue with Energy Australia to develop management plan 3. Pre-mining surveys 4. Investigate need for installation of pulleys on earth wires 5. Energy Australia to review requirement for power line	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
2	Public Utilities	2.05	Tele-communication lines (overhead / underground) and associated plants	2.05.01	Damage to Optus Optical Fibre Cables	1. Subsidence	1. Optus have own internal management plan 2. Location of cable confirmed	R	3	C	13	S	1. Assess Optus MP 2. Investigate durability of Optus cable 3. Subsidence data from Panels 1-4 will be available prior to mining under Optus Optical Fibre cable 4. Continue dialogue with Optus to confirm appropriate management plan	Yes
2	Public Utilities	2.05	Tele-communication lines (overhead / underground) and associated plants	2.05.02	Damage to Telstra Local Copper Cables	1. Subsidence	1. Location of cable confirmed	R	5	C	22	L	1. Confirm extent of current service 2. Continue dialogue with Telstra to develop management plan	Yes
2	Public Utilities	2.06	Any other infrastructure items	2.06.01	Nil identified						n/a	n/a		
3	Farm Land and Facilities	3.01	Agricultural utilisation or agricultural suitability of farm land	3.01.01	Temporary loss of access to grazing area	1. Need for mitigation work		A	5	C	22	L	1. Review agistment arrangements within the Property Management Plan	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
3	Farm Land and Facilities	3.02	Internal Access tracks	3.02.01	Cracking of road surface resulting in potential vehicle accident	1. Subsidence	1. Speed limited road 2. Property Management Plan for the site 3. Restricted access	P	4	D	21	L	1. Appropriate signage 2. Develop MP	
3	Farm Land and Facilities	3	Fences	3.03.01	Fences become unserviceable due to damage	1. Subsidence	1. Existing Property Management Plan for the site	A	5	C	22	L	1. Review agistments arrangements within the Property Management Plan	Yes
3	Farm Land and Facilities	3.04	Farm dams	3.04.01	Water loss from dam adjacent to Transgrid Tower 31B	1. Tilting 2. Cracking of dam, wall or floor	1. Empty dam - no longer used	A	5	D	24	L		Yes
3	Farm Land and Facilities	3.05	Wells, bores	3.05.01	Physical loss of monitoring bores	1. Subsidence 2. Cracking	Nil identified	A	4	C	18	M	1. Replace bores if required	Yes
3	Farm Land and Facilities	3.05	Wells, bores	3.05.02	Loss of water supply from bore (GW51353)	1. Regional depressurisation	Nil identified	A	4	D	21	L	1. Provide replacement water supply if needed	Yes
3	Farm Land and Facilities	3.06	Any other feature considered significant	3.06.01	Nil identified - Derelict cottages to be demolished						n/a	n/a		

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
3	Farm Land and Facilities	3.07	Water Reticulation systems	3.07.01	Temporary loss of water supply to particular areas	1. Subsidence	1. Multiple troughs	A	5	C	22	L	1. Sufficient repair supplies onsite	Yes
4	Boral Asphalt plant	4.01	Workshops	4.01.01	Damage to workshop structure as a result of exceeding tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	4	D	21	L	1. Property Management Plan 2. Develop First Workings MP	Yes
4	Boral Asphalt plant	4.02	Site offices	4.02.01	Damage to site offices as a result of exceeding tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	5	D	24	L	1. Property Management Plan 2. Develop First Workings MP	Yes
4	Boral Asphalt plant	4.03	Gas and fuel storages and associated plants	4.03.01	Damage to gas and fuel storages and associated plants as a result of exceeding tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
4	Boral Asphalt plant	4.04	Waste storages and associated plants	4.04.01	Damage to Oil separator as a result of exceed tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	E	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes
4	Boral Asphalt plant	4.05	Buildings, equipment and operations (general)	4.05.01	Damage to buildings generally and Asphalt plant as a result of exceed tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes
4	Boral Asphalt plant	4.06	Buildings, equipment and operations that are sensitive to surface movements	4.06.01	Damage to items sensitive to surface movement (tower, burner, conveyors) as a result of exceed tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes
5	Areas of Archaeological and/or Cultural Significance	5.01	Areas of Archaeological and/or Heritage Significance	5.01.01	Loss or damage of scatter artefact	1. Subsidence 2. Remediation works	1. Archaeological survey of SMP area conducted	R	4	D	21	L	1. Review of Archaeological survey information 2. Locations plotted on SMP plans	Yes

APPENDIX C

**Abel Mine
SMP Area 1 Risk Table, July 2009
(Risk Order)**

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
2	Public Utilities	2.04	Electricity transmission lines (overhead / underground) and associated plants	2.04.01	Damage to 330kV Transgrid Powerline	1. Subsidence	1. Cruciform footings 2. Conductor strings	A	2	C	8	S	1. Transgrid to review structural integrity and design of cruciforms 2. Continue dialogue with Transgrid to develop management plan 3. Investigate need for installation of pulleys on earth wires 4. Check conductor clearance 5. Pre-mining surveys 6. Subsidence data from Panels 1-4 will be available prior to mining under Transgrid 330kV powerlines	Yes
2	Public Utilities	2.03	Water pipeline	2.03.01	Damage to HWC 200mm UPVC pipeline	1. Subsidence	Nil identified	A	3	C	13	S	1. Continue dialogue with HWC to develop management plan	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
2	Public Utilities	2.04	Electricity transmission lines (overhead / underground) and associated plants	2.04.02	Damage to 132kV Energy Australia Powerline	1. Subsidence	1. Timber poles more resilient to subsidence impacts	A	3	C	13	S	<ol style="list-style-type: none"> 1. Check conductor clearance 2. Survey pole locations 3. Continue dialogue with Energy Australia to develop management plan 4. Pre-mining surveys 5. Investigate need for installation of pulleys on earth wires 	Yes
2	Public Utilities	2.04	Electricity transmission lines (overhead / underground) and associated plants	2.04.03	Damage to 11kV Energy Australia Powerline	1. Subsidence	1. Timber poles more resilient to subsidence impacts	A	3	C	13	S	<ol style="list-style-type: none"> 1. Check conductor clearance 2. Continue dialogue with Energy Australia to develop management plan 3. Pre-mining surveys 4. Investigate need for installation of pulleys on earth wires 5. Energy Australia to review requirement for power line 	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
2	Public Utilities	2.05	Tele-communication lines (overhead / underground) and associated plants	2.05.01	Damage to Optus Optical Fibre Cables	1. Subsidence	1. Optus have own internal management plan 2. Location of cable confirmed	R	3	C	13	S	1. Assess Optus MP 2. Investigate durability of Optus cable 3. Subsidence data from Panels 1-4 will be available prior to mining under Optus Optical Fibre cable 4. Continue dialogue with Optus to confirm appropriate management plan	Yes
2	Public Utilities	2.01	Roads (all types)	2.01.02	Damage to access road to Boral	1. Subsidence	1. Low speed road	A	4	B	14	S	1. Management Plan to be implemented	Yes
1	Natural Features	1.01	Creeks	1.01.01	Disruption of stream flow to Viney Creek	1. Cracking of stream bed 2. Development of ponding and storage areas	1. Mine design and layout (1,2) 2. Provision of an exclusion zone (1,2) 3. Baseline stream monitoring as per Surface water management plan (EMP) 4. Natural healing of cracks 5. Size of cracks will be limited by soil cover	R	3	D	17	M	1. Subsidence and stream flow monitoring 2. Refine model based on monitoring results 3. Consider Surveying creek location	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.01	Creeks	1.01.03	Erosion and bed and bank instability (Schedule 2)	1. Changing gradient 2. Surface cracking	1. Dense native and introduced vegetation along creek beds 2. Mine design Schedule 2 (Viney Creek)	R	3	D	17	M	1. Refine model based on monitoring results	Yes
1	Natural Features	1.07	Natural Vegetation	1.07.01	Falling trees striking person	1. Cracking and tilting 2. Low soil cover	1. Public Safety Management Plan, includes signage 2. Private property - no public access	P	3	D	17	M		
4	Boral Asphalt plant	4.03	Gas and fuel storages and associated plants	4.03.01	Damage to gas and fuel storages and associated plants as a result of exceeding tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes
4	Boral Asphalt plant	4.04	Waste storages and associated plants	4.04.01	Damage to Oil separator as a result of exceed tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	E	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
4	Boral Asphalt plant	4.05	Buildings, equipment and operations (general)	4.05.01	Damage to buildings generally and Asphalt plant as a result of exceed tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes
4	Boral Asphalt plant	4.06	Buildings, equipment and operations that are sensitive to surface movements	4.06.01	Damage to items sensitive to surface movement (tower, burner, conveyors) as a result of exceed tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes
1	Natural Features	1.01	Creeks	1.01.04	Erosion and bed instability (Schedule 1)	1. Changing gradient 2. Surface cracking	1. Dense native and introduced vegetation along creek beds	R	4	C	18	M		Yes
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.01	Drainage of groundwater from perched regolith aquifer	1. Cracking of surface and subsurface	1. Monitoring 2. Mine design	R	4	C	18	M	1. Continued Monitoring	Yes
1	Natural Features	1.05	Swamps, wetlands, water related ecosystems	1.05.01	Increased inundation of swamp	1. Subsidence	1. Mine design 2. Swamp is on the edge of the subsidence area	A	4	C	18	M	1. Monitoring review (Panel 13)	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
3	Farm Land and Facilities	3.05	Wells, bores	3.05.01	Physical loss of monitoring bores	1. Subsidence 2. Cracking	Nil identified	A	4	C	18	M	1. Replace bores if required	Yes
1	Natural Features	1.01	Creeks	1.01.05	Decline in water quality (Schedule 2)	1. Increased erosion	1. Dense native and introduced vegetation along creek beds 2. Mine design 3. Water quality monitoring	R	4	D	21	L	1. Monitoring	Yes
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.02	Depressurisation of coal measures aquifer impacting on groundwater users	1. Mine inflows 2. Cracking	1. Remoteness from other users 2. High salinity of water 3. Low value groundwater resource	R	4	D	21	L	1. Continued Monitoring	Yes
1	Natural Features	1.05	Swamps, wetlands, water related ecosystems	1.05.02	Drainage of swamp	1. Cracking	1. Mine design 2. Swamp is on the edge of the subsidence area	A	4	D	21	L		Yes
2	Public Utilities	2.01	Roads (all types)	2.01.01	Damage to public road (F3 freeway, John Renshaw Drive)	1. Subsidence 2. Far field movement	1. Roads outside angle of draw (1) 2. Roads outside area of measurable horizontal displacement (2) 3. Roads not within SMP area	A	4	D	21	L	1. Investigate Monitoring of John Renshaw Dr and F3 as part of SMP approval monitoring process	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
3	Farm Land and Facilities	3.02	Internal Access tracks	3.02.01	Cracking of road surface resulting in potential vehicle accident	1. Subsidence	1. Speed limited road 2. Property Management Plan for the site 3. Restricted access	P	4	D	21	L	1. Appropriate signage 2. Develop MP	
3	Farm Land and Facilities	3.05	Wells, bores	3.05.02	Loss of water supply from bore (GW51353)	1. Regional depressurisation	Nil identified	A	4	D	21	L	1. Provide replacement water supply if needed	Yes
4	Boral Asphalt plant	4.01	Workshops	4.01.01	Damage to workshop structure as a result of exceeding tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	4	D	21	L	1. Property Management Plan 2. Develop First Workings MP	Yes
5	Areas of Archaeological and/or Cultural Significance	5.01	Areas of Archaeological and/or Heritage Significance	5.01.01	Loss or damage of scatter artefact	1. Subsidence 2. Remediation works	1. Archaeological survey of SMP area conducted	R	4	D	21	L	1. Review of Archaeological survey information 2. Locations plotted on SMP plans	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.01	Creeks	1.01.02	Associated loss of flow to Weakley's Flat Creek	<ol style="list-style-type: none"> 1. Disruption of stream flow to Schedule 1 streams 2. Cracking of stream bed 3. Development of ponding and storage areas 	<ol style="list-style-type: none"> 1. Post mining remediation as per Project Approval 2. Natural healing of cracks 3. Size of cracks will be limited by soil cover 4. Sufficient surface gradients to minimise ponding potential and prevent stream capture 5. Baseline stream flow monitoring of Weakley's Flat Creek as per SWMP 	R	5	C	22	L	1. Refine model based on monitoring results	Yes
1	Natural Features	1.01	Creeks	1.01.06	Decline in water quality (Schedule 1)	<ol style="list-style-type: none"> 1. Increased erosion 	<ol style="list-style-type: none"> 1. Dense native and introduced vegetation along creek beds 2. Water quality monitoring 	R	5	C	22	L	1. Monitoring	Yes
1	Natural Features	1.05	Swamps, wetlands, water related ecosystems	1.05.03	Harm to groundwater dependent ecosystems	<ol style="list-style-type: none"> 1. Cracking and drainage of shallow groundwater 	<ol style="list-style-type: none"> 1. Self-healing of cracks over time 	A	5	C	22	L		Yes
2	Public Utilities	2.05	Tele-communication lines (overhead / underground) and associated plants	2.05.02	Damage to Telstra Local Copper Cables	<ol style="list-style-type: none"> 1. Subsidence 	<ol style="list-style-type: none"> 1. Location of cable confirmed 	R	5	C	22	L	<ol style="list-style-type: none"> 1. Confirm extent of current service 2. Continue dialogue with Telstra to develop management plan 	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
3	Farm Land and Facilities	3.01	Agricultural utilisation or agricultural suitability of farm land	3.01.01	Temporary loss of access to grazing area	1. Need for mitigation work		A	5	C	22	L	1. Review agistment arrangements within the Property Management Plan	Yes
3	Farm Land and Facilities	3	Fences	3.03.01	Fences become unserviceable due to damage	1. Subsidence	1. Existing property management plan for the site	A	5	C	22	L	1. Review agistment arrangements within the Property Management Plan	Yes
3	Farm Land and Facilities	3.07	Water Reticulation systems	3.07.01	Temporary loss of water supply to particular areas	1. Subsidence	1. Multiple troughs	A	5	C	22	L	1. Sufficient repair supplies onsite	Yes
2	Public Utilities	2.02	Culvert associated with Black Hill land	2.02.01	Damage to culvert on Viney Creek	1. Subsidence	1. Mine design and layout 2. Provision of an exclusion zone	A	4	E	23	L		Yes
3	Farm Land and Facilities	3.04	Farm dams	3.04.01	Water loss from dam adjacent to Transgrid Tower 31B	1. Tilting 2. Cracking of dam, wall or floor	1. Empty dam - no longer used	A	5	D	24	L		Yes
4	Boral Asphalt plant	4.02	Site offices	4.02.01	Damage to site offices as a result of exceeding tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	5	D	24	L	1. Property Management Plan 2. Develop First Workings MP	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.03	Springs	1.03.01	Nil identified						n/a	n/a		
1	Natural Features	1.04	Land prone to flooding or inundation	1.04.01	Subsidence increases the extent of flooding	1. Quantity of subsidence	1. Mine design				n/a	n/a	1. Review flood studies undertaken by Coal & Allied	
1	Natural Features	1.06	Threatened and protected species	1.06.01							n/a	n/a	Investigate threatened and protected species in SMP Area 1	
1	Natural Features	1.08	Any other area considered significant	1.08.01	Nil identified						n/a	n/a		
2	Public Utilities	2.06	Any other infrastructure items	2.06.01	Nil identified						n/a	n/a		
3	Farm Land and Facilities	3.06	Any other feature considered significant	3.06.01	Nil identified - Derelict cottages to be demolished						n/a	n/a		

APPENDIX D

**Abel Mine
SMP Area 1 Risk Table, July 2009
(Consequence Order)**

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
2	Public Utilities	2.04	Electricity transmission lines (overhead / underground) and associated plants	2.04.01	Damage to 330kV Transgrid Powerline	1. Subsidence	1. Cruciform footings 2. Conductor strings	A	2	C	8	S	1. Transgrid to review structural integrity and design of cruciforms 2. Continue dialogue with Transgrid to develop management plan 3. Investigate need for installation of pulleys on earth wires 4. Check conductor clearance 5. Pre-mining surveys 6. Subsidence data from Panels 1-4 will be available prior to mining under Transgrid 330kV powerlines	Yes
2	Public Utilities	2.03	Water pipeline	2.03.01	Damage to HWC 200mm UPVC pipeline	1. Subsidence	Nil identified	A	3	C	13	S	1. Continue dialogue with HWC to develop management plan	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
2	Public Utilities	2.04	Electricity transmission lines (overhead / underground) and associated plants	2.04.02	Damage to 132kV Energy Australia Powerline	1. Subsidence	1. Timber poles more resilient to subsidence impacts	A	3	C	13	S	<ol style="list-style-type: none"> 1. Check conductor clearance 2. Survey pole locations 3. Continue dialogue with Energy Australia to develop management plan 4. Pre-mining surveys 5. Investigate need for installation of pulleys on earth wires 	Yes
2	Public Utilities	2.04	Electricity transmission lines (overhead / underground) and associated plants	2.04.03	Damage to 11kV Energy Australia Powerline	1. Subsidence	1. Timber poles more resilient to subsidence impacts	A	3	C	13	S	<ol style="list-style-type: none"> 1. Check conductor clearance 2. Continue dialogue with Energy Australia to develop management plan 3. Pre-mining surveys 4. Investigate need for installation of pulleys on earth wires 5. Energy Australia to review requirement for power line 	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
2	Public Utilities	2.05	Tele-communication lines (overhead / underground) and associated plants	2.05.01	Damage to Optus Optical Fibre Cables	1. Subsidence	1. Optus have own internal management plan 2. Location of cable confirmed	R	3	C	13	S	1. Assess Optus MP 2. Investigate durability of Optus cable 3. Subsidence data from Panels 1-4 will be available prior to mining under Optus Optical Fibre cable 4. Continue dialogue with Optus to confirm appropriate management plan	Yes
1	Natural Features	1.01	Creeks	1.01.01	Disruption of stream flow to Viney Creek	1. Cracking of stream bed 2. Development of ponding and storage areas	1. Mine design and layout (1,2) 2. Provision of an exclusion zone (1,2) 3. Baseline stream monitoring as per Surface water management plan (EMP) 4. Natural healing of cracks 5. Size of cracks will be limited by soil cover	R	3	D	17	M	1. Subsidence and stream flow monitoring 2. Refine model based on monitoring results 3. Consider Surveying creek location	Yes
1	Natural Features	1.01	Creeks	1.01.03	Erosion and bed instability (Schedule 2)	1. Changing gradient 2. Surface cracking	1. Dense native and introduced vegetation along creek beds 2. Mine design Schedule 2 (Viney Creek)	R	3	D	17	M	1. Refine model based on monitoring results	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.07	Natural Vegetation	1.07.01	Falling trees striking person	1. Cracking and tilting 2. Low soil cover	1. Public Safety Management Plan, includes signage 2. Private property - no public access	P	3	D	17	M		
4	Boral Asphalt plant	4.03	Gas and fuel storages and associated plants	4.03.01	Damage to gas and fuel storages and associated plants as a result of exceeding tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes
4	Boral Asphalt plant	4.04	Waste storages and associated plants	4.04.01	Damage to Oil separator as a result of exceed tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	E	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes
4	Boral Asphalt plant	4.05	Buildings, equipment and operations (general)	4.05.01	Damage to buildings generally and Asphalt plant as a result of exceed tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
4	Boral Asphalt plant	4.06	Buildings, equipment and operations that are sensitive to surface movements	4.06.01	Damage to items sensitive to surface movement (tower, burner, conveyors) as a result of exceed tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	3	D	17	M	1. Property Management Plan 2. Develop First Workings MP	Yes
2	Public Utilities	2.01	Roads (all types)	2.01.02	Damage to access road to Boral	1. Subsidence	1. Low speed road	A	4	B	14	S	1. Management Plan to be implemented	Yes
1	Natural Features	1.01	Creeks	1.01.04	Erosion and bed and bank instability (Schedule 1)	1. Changing gradient 2. Surface cracking	1. Dense native and introduced vegetation along creek beds	R	4	C	18	M		Yes
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.01	Drainage of groundwater from perched regolith aquifer	1. Cracking of surface and subsurface	1. Monitoring 2. Mine design	R	4	C	18	M	1. Continued Monitoring	Yes
1	Natural Features	1.05	Swamps, wetlands, water related ecosystems	1.05.01	Increased inundation of swamp	1. Subsidence	1. Mine design 2. Swamp is on the edge of the subsidence area	A	4	C	18	M	1. Monitoring review (Panel 13)	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
3	Farm Land and Facilities	3.05	Wells, bores	3.05.01	Physical loss of monitoring bores	1. Subsidence 2. Cracking	Nil identified	A	4	C	18	M	1. Replace bores if required	Yes
1	Natural Features	1.01	Creeks	1.01.05	Decline in water quality (Schedule 2)	1. Increased erosion	1. Dense native and introduced vegetation along creek beds 2. Mine design 3. Water quality monitoring	R	4	D	21	L	1. Monitoring	Yes
1	Natural Features	1.02	Aquifers, known groundwater resources	1.02.02	Depressurisation of coal measures aquifer impacting on groundwater users	1. Mine inflows 2. Cracking	1. Remoteness from other users 2. High salinity of water 3. Low value groundwater resource	R	4	D	21	L	1. Continued Monitoring	Yes
1	Natural Features	1.05	Swamps, wetlands, water related ecosystems	1.05.02	Drainage of swamp	1. Cracking	1. Mine design 2. Swamp is on the edge of the subsidence area	A	4	D	21	L		Yes
2	Public Utilities	2.01	Roads (all types)	2.01.01	Damage to public road (F3 freeway, John Renshaw Drive)	1. Subsidence 2. Far field movement	1. Roads outside angle of draw (1) 2. Roads outside area of measurable horizontal displacement (2) 3. Roads not within SMP area	A	4	D	21	L	1. Investigate Monitoring of John Renshaw Dr and F3 as part of SMP approval monitoring process	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
3	Farm Land and Facilities	3.02	Internal Access tracks	3.02.01	Cracking of road surface resulting in potential vehicle accident	1. Subsidence	1. Speed limited road 2. Property Management Plan for the site 3. Restricted access	P	4	D	21	L	1. Appropriate signage 2. Develop MP	
3	Farm Land and Facilities	3.05	Wells, bores	3.05.02	Loss of water supply from bore (GW51353)	1. Regional depressurisation	Nil identified	A	4	D	21	L	1. Provide replacement water supply if needed	Yes
4	Boral Asphalt plant	4.01	Workshops	4.01.01	Damage to workshop structure as a result of exceeding tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	4	D	21	L	1. Property Management Plan 2. Develop First Workings MP	Yes
5	Areas of Archaeological and/or Cultural Significance	5.01	Areas of Archaeological and/or Heritage Significance	5.01.01	Loss or damage of scatter artefact	1. Subsidence 2. Remediation works	1. Archaeological survey of SMP area conducted	R	4	D	21	L	1. Review of Archaeological survey information 2. Locations plotted on SMP plans	Yes
2	Public Utilities	2.02	Culvert associated with Black Hill land	2.02.01	Damage to culvert on Viney Creek	1. Subsidence	1. Mine design and layout 2. Provision of an exclusion zone	A	4	E	23	L		Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.01	Creeks	1.01.02	Associated loss of flow to Weakley's Flat Creek	<ol style="list-style-type: none"> 1. Disruption of stream flow to Schedule 1 streams 2. Cracking of stream bed 3. Development of ponding and storage areas 	<ol style="list-style-type: none"> 1. Post mining remediation as per Project Approval 2. Natural healing of cracks 3. Size of cracks will be limited by soil cover 4. Sufficient surface gradients to minimise ponding potential and prevent stream capture 5. Baseline stream flow monitoring of Weakley's Flat Creek as per SWMP 	R	5	C	22	L	1. Refine model based on monitoring results	Yes
1	Natural Features	1.01	Creeks	1.01.06	Decline in water quality (Schedule 1)	<ol style="list-style-type: none"> 1. Increased erosion 	<ol style="list-style-type: none"> 1. Dense native and introduced vegetation along creek beds 2. Water quality monitoring 	R	5	C	22	L	1. Monitoring	Yes
1	Natural Features	1.05	Swamps, wetlands, water related ecosystems	1.05.03	Harm to groundwater dependent ecosystems	<ol style="list-style-type: none"> 1. Cracking and drainage of shallow groundwater 	<ol style="list-style-type: none"> 1. Self-healing of cracks over time 	A	5	C	22	L		Yes
2	Public Utilities	2.05	Tele-communication lines (overhead / underground) and associated plants	2.05.02	Damage to Telstra Local Copper Cables	<ol style="list-style-type: none"> 1. Subsidence 	<ol style="list-style-type: none"> 1. Location of cable confirmed 	R	5	C	22	L	<ol style="list-style-type: none"> 1. Confirm extent of current service 2. Continue dialogue with Telstra to develop management plan 	Yes

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
3	Farm Land and Facilities	3.01	Agricultural utilisation or agricultural suitability of farm land	3.01.01	Temporary loss of access to grazing area	1. Need for mitigation work		A	5	C	22	L	1. Review agistment arrangements within the Property Management Plan	Yes
3	Farm Land and Facilities	3	Fences	3.03.01	Fences become unserviceable due to damage	1. Subsidence	1. Existing property management plan for the site	A	5	C	22	L	1. Review agistment arrangements within the Property Management Plan	Yes
3	Farm Land and Facilities	3.07	Water Reticulation systems	3.07.01	Temporary loss of water supply to particular areas	1. Subsidence	1. Multiple troughs	A	5	C	22	L	1. Sufficient repair supplies onsite	Yes
3	Farm Land and Facilities	3.04	Farm dams	3.04.01	Water loss from dam adjacent to Transgrid Tower 31B	1. Tilting 2. Cracking of dam, wall or floor	1. Empty dam - no longer used	A	5	D	24	L		Yes
4	Boral Asphalt plant	4.02	Site offices	4.02.01	Damage to site offices as a result of exceeding tolerable limits set for Principal Residences	1. Subsidence	1. Regarded as a Principal Residence under Project Approval	A	5	D	24	L	1. Property Management Plan 2. Develop First Workings MP	Yes
1	Natural Features	1.03	Springs	1.03.01	Nil identified						n/a	n/a		

Abel Mine – Subsidence Management Plan Area 1 Risk Assessment

P#	Process	S#	Subprocess	H#	Risk Issue	Causes	Existing Controls	Loss Type	Consequence	Likelihood	Risk Rank	Risk Level	Further Actions	ALARP (Yes/No)
1	Natural Features	1.04	Land prone to flooding or inundation	1.04.01	Subsidence increases the extent of flooding	1. Quantity of subsidence	1. Mine design				n/a	n/a	1. Review flood studies undertaken by Coal & Allied	
1	Natural Features	1.06	Threatened and protected species	1.06.01							n/a	n/a	Investigate threatened and protected species in SMP Area 1	
1	Natural Features	1.08	Any other area considered significant	1.08.01	Nil identified						n/a	n/a		
2	Public Utilities	2.06	Any other infrastructure items	2.06.01	Nil identified						n/a	n/a		
3	Farm Land and Facilities	3.06	Any other feature considered significant	3.06.01	Nil identified - Derelict cottages to be demolished						n/a	n/a		

APPENDIX E

Abel Mine NSW Department of Mineral Resources Guideline for Subsidence Management Approvals – Appendix B

Area	#	Sub-Area
Natural Features	1.01	Catchment areas and declared Special Areas
	1.02	Rivers and creeks
	1.03	Aquifers, known groundwater resources
	1.04	Springs
	1.05	Sea/lake
	1.06	Shorelines
	1.07	Natural dams
	1.08	Cliffs / pagodas
	1.09	Steep slopes
	1.10	Escarments
	1.11	Land prone to flooding or inundation
	1.12	Swamps, wetlands, water related ecosystems
	1.13	Threatened and protected species
	1.14	National parks
	1.15	State recreation areas
	1.16	State forests particularly areas zoned FMZ 1, 2 and 3
	1.17	Natural vegetation
	1.18	Areas of significant geological interest, and
	1.19	Any other feature considered significant
Public Utilities	2.01	Railways
	2.02	Roads (all types)
	2.03	Bridges
	2.04	Tunnels
	2.05	Culverts
	2.06	Water/gas/sewerage pipelines
	2.07	Liquid fuel pipelines
	2.08	Electricity transmission lines (overhead/underground) and associated plants
	2.09	Telecommunication lines (overhead/underground) and associated plants
	2.10	Water tanks, water and sewage treatment works
	2.11	Dams, reservoirs and associated works
	2.12	Air strips
	2.13	Any other infrastructure items
Public Amenities	3.01	Hospitals
	3.02	Places of worship
	3.03	Schools
	3.04	Shopping centres
	3.05	Community centres
	3.06	Office buildings
	3.07	Swimming pools

Area	#	Sub-Area
	3.08	Bowling greens
	3.09	Ovals and cricket grounds
	3.10	Race courses
	3.11	Golf courses
	3.12	Tennis courts
	3.13	Any other amenities considered significant
Farm Land and Facilities	4.01	Agricultural utilisation or agricultural suitability of farm land
	4.02	Farm buildings / sheds
	4.03	Gas and / or fuel storages
	4.04	Poultry sheds
	4.05	Glass houses
	4.06	Hydroponic systems
	4.07	Irrigation systems
	4.08	Fences
	4.09	Farm dams
	4.10	Wells, bores
	4.11	Any other feature considered significant
Industrial, Commercial and Business Establishments	5.01	Factories
	5.02	Workshops
	5.03	Business or commercial establishments
	5.04	Gas and / or fuel storages and associated plants
	5.05	Waste storages and associated plants
	5.06	Buildings, equipment and operations that are sensitive to surface movements
	5.07	Surface mining (open cut) voids and rehabilitated areas
	5.08	Mine infrastructure including tailings dams and emplacement areas
	5.09	Any other feature considered significant
Areas of Archaeological and/or Heritage Significance	6.01	Areas of Archaeological and/or Heritage Significance
Items of Architectural Significance	7.01	Items of Architectural Significance
Permanent Survey Control Marks	8.01	Permanent Survey Control Marks
Residential Establishments	9.01	Houses
	9.02	Flats / Units
	9.03	Caravan parks
	9.04	Retirement/aged care villages
	9.05	Associated structures such as workshops, garages, on-site waste water systems, water or gas tanks, swimming pools and tennis courts
	9.06	Any other feature considered significant