ENVIRONMENTAL ASSESSMENT

Duralie Extension Project

APPENDIX M
ENVIRONMENTAL RISK ASSESSMENT

GLOUCESTER COAL

ResourceStrategies

Duralie Extension Project

Environmental Risk Assessment

***Prepared for*:**	**Duralie Coal Pty Ltd**		
Prepared by:	**Safe Production Solutions**		
Date of Team Review:	**22 October 2009**		
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Duralie Extension Project – Environmental Risk Assessment

Document No.	D4172
Title	Duralie Extension Project – Environmental Risk Assessment
General Description	Report on the team based risk assessment
Key Supporting Documentation	• AS/NZS 4360:2004 *Risk Management* (Standards Australia, 2004); • HB 203:2006 *Environmental Risk Management – Principles and Process* (Standards Australia, 2006); • MDG1010 *Risk Management Handbook for the Mining Industry* (DPI, 1997); • Director-General's *Environmental Assessment Requirements the Duralie Extension Project* (2008); and • *Duralie Coal Mine Annual Environmental Management Reports*.

Versions

Version	Date	Description	Created By	Reviewed
A	26/10/09	Draft report for internal review	PNS / DGT	JB
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EXECUTIVE SUMMARY

This Environmental Risk Assessment (ERA) identifies risks associated with key potential environmental issues associated with the Duralie Extension Project (the Project). The Project is an extension of the existing Duralie Coal Mine (DCM). The DCM is located approximately 10 kilometres (km) north of the village of Stroud and approximately 20 km south of Stratford in the Gloucester Valley of New South Wales (NSW).

On 22 October 2009, a team consisting of Duralie Coal Pty Ltd and specialist consultants participated in a facilitated ERA workshop. The scope of the workshop was:

> *To conduct a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment.*

The ERA workshop included:

1. Establishing the context including review of supporting information and objectives.
2. Identifying risks via a brainstorming session.
3. Identifying risks using a modified hazard and operability analysis approach.
4. Analysis of identified risks and nomination of key potential environmental issues.
5. Ranking of the risks, including consideration of mitigation measures.

Key Potential Environmental Issues

Key potential environmental issues were identified by the ERA team using a voting system, whereby team members were assigned a number of 'votes' to their key issues. The key potential environmental issues identified by the ERA team (Table ES-1) were considered to be key issues for further assessment in the Environmental Assessment (EA).

The key potential environmental issues identified in this ERA will be addressed in the EA and the following specialists reports, included as appendices to the EA:

- Surface Water Assessment (Appendix A);
- Groundwater Assessment (Appendix B);
- Noise and Blasting Impact Assessment (Appendix C);
- Air Quality Assessment (Appendix D);
- Terrestrial Flora and Fauna Assessment (Appendix E);
- Aquatic Ecology Assessment (Appendix F);
- Socio-Economic Assessment (Appendix G);
- Road Transport Assessment (Appendix H);
- Geochemistry Assessment (Appendix I);
- Aboriginal Cultural Heritage Assessment (Appendix J);
- Non-Aboriginal Heritage Assessment (Appendix K);
- Preliminary Hazard Analysis (Appendix L);
- Rehabilitation and Landscape Management Strategy (Appendix N); and
- Visual Assessment (Appendix O).

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Table ES-1 – Key Potential Environmental Issues to be Further Assessed in the EA

Ref	Environmental Issue Subject Area	Description of Issue	EA Appendix/Section
IS046	Surface Water	Seepage of poor quality water from final void through waste rock emplacement to Coal Shaft Creek/Mammy Johnsons River	Appendix A and Section 4.4
IS044	Surface Water	Uncontrolled spill from the Main Water Dam (MWD) or auxiliary dams to Mammy Johnsons River during mine life	Appendix A and Section 4.4
IS002	Terrestrial Flora and Fauna	Loss of habitat for protected and threatened species under the NSW *Threatened Species Conservation Act, 1995* (TSC Act)	Appendix E and Sections 4.8 and 4.9
IS047	Rehabilitation Concepts	Long-term stability of Coal Shaft Creek Diversion	Appendix N and Section 5
IS001	Terrestrial Flora and Fauna	Loss of native vegetation due to clearing associated with the Project	Appendix E and Sections 4.8 and 4.9
IS037	Noise and Blasting	Night-time noise from the DCM shuttle train	Appendix C and Section 4.5
IS019	Surface Water	Spill of poor quality water from the final voids	Appendix A and Section 4.4
IS039	Visual Amenity	Visual impacts from The Bucketts Way and nearby residential receivers	Appendix O and Section 4.16
IS063	Noise and Blasting	The extent of the noise impact zone	Appendix C and Section 4.5
IS021	Surface Water	Rupture of irrigation pipelines leading to discharge of mine water to Mammy Johnsons River/Coal Shaft Creek	Appendix L and Section 4.17
IS023	Noise and Blasting	Effects of blasting (vibration and overpressure)	Appendix C and Section 4.5
IS042	Waste Rock Geochemistry[1]	Acid mine drainage (AMD) from potentially acid forming (PAF) material	Appendix I and Section 4.4
IS067	Air Quality	Dust (particulate matter less than 10 microns in size [PM_{10}]) impact to the north-west receivers	Appendix D and Section 4.6
IS003	Terrestrial Flora and Fauna	Loss of (or displacement) of native vertebrate fauna listed under the TSC Act	Appendix E and Sections 4.8 and 4.9
IS005	Surface Water	Re-mobilised irrigated solutes from irrigation areas reaching Mammy Johnsons River	Appendix A and Section 4.4
IS012	Surface Water	Additional water storage – construction timing and adequacy of additional storage capacity to contain water on-site	Appendix A and Section 4.4
IS018	Surface Water	Poor quality runoff from waste rock emplacement reaching Mammy Johnsons River	Appendix A and Section 4.4
IS028	Surface Water	Loss of base flow from Mammy Johnsons River	Appendix A and Section 4.4
IS051	Rehabilitation Concepts	Rehabilitation of the site	Appendix N and Section 5

[1] ROM coal geochemistry is considered to be a 'referred' issue and will be addressed separately to the Project EA (Section M3.3.4).

Risk Ranking

Risk ranking was undertaken by the team on loss scenarios based on a subset of the key potential environmental issues. A summary of the risk ranking results is presented in Table ES-2.

With the consideration of potential controls, all of the potential loss scenarios were ranked within the 'Medium - As Low As Reasonably Practicable' (ALARP) or the 'Low' range by the ERA team.

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Table ES-2 – Risk Ranking

Environmental Issue Subject Area	Potential Loss Scenario	Risk Ranking[1]
Surface Water	Unplanned release of mine water despite water managed on-site in accordance with current practices	**25 Low** **16/20 Low**[2]
	Failure of water management system leading to poor quality runoff from the waste rock emplacement reaching Mammy Johnsons River	**25 Low** **16/20 Low**[2]
	Failure of water management system leading to uncontrolled spill from MWD or auxiliary dams to Mammy Johnsons River	**25 Low**
	Unexpected structural dam failure	**20 Low**
	Stability of Coal Shaft Creek Diversion is compromised in the long-term	**21 Low**
Noise and Blasting	Noise and blasting impacts exceed criteria at nearby receivers consistent with predictions	**15 Medium**
	Noise/blasting impacts in exceedance of predictions and additional controls are undertaken	**18 Low**
	Noise/blasting impacts in exceedance of predictions and additional controls are not effective	**23 Low**
Terrestrial Flora and Fauna	Loss of flora and fauna habitat resulting from approved clearance of vegetation	**15 Medium**
	Loss of flora and fauna habitat greater than expected due to incorrect implementation of controls	**24 Low**
	Unsuccessful rehabilitation and long-term loss of biodiversity	**25 Low**
Waste Rock Geochemistry[3]	Unplanned release of AMD-affected water from potential acid-forming material despite waste rock managed in accordance with current site practices	**21 Low**
	AMD from waste rock emplacement following rehabilitation of the site resulting in the release of low pH water	**21 Low**
Visual Amenity	Visual impacts on The Bucketts Way and nearby receivers to the north of the Project	**14 Medium**
Aquatic Ecology	Potential detrimental effects on Mammy Johnsons River aquatic ecology	**23 Low**
Air Quality	Dust emissions exceed criteria at nearby receivers in accordance with predictions	**15 Medium**
Non Aboriginal Heritage	Potential vibration impacts on the Former Weismantels Inn	**21 Low**
Aboriginal Heritage	Potential loss of Aboriginal artefacts/sites	**24 Low**

[1] Risk - Ranking basis 1 (highest risk) to 25 (lowest risk). Risk rankings defined as 1 to 6 – High; 7 to 15 - Medium (or ALARP) and 16 to 25 - Low.
[2] Risk was determined for two different levels of consequence (i.e. a scenario with a higher consequence was considered to be less likely to occur).
[3] ROM coal geochemistry is considered to be a 'referred' issue and will be addressed separately to the Project EA (Section M3.3.4).

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M1 INTRODUCTION

This Environmental Risk Assessment (ERA) identifies risks associated with key potential environmental issues associated with the Duralie Extension Project (the Project). The Project is an extension of the existing Duralie Coal Mine (DCM). The DCM is located approximately 10 kilometres (km) north of the village of Stroud and approximately 20 km south of Stratford in the Gloucester Valley of New South Wales (NSW). A full description of the Project is provided in Section 2 in the Main Report of the Environmental Assessment (EA).

M1.1 Aim and Objectives

The aim of the ERA workshop was:

> *To identify key environmental issues for further assessment in the Environmental Assessment.*

The primary objectives of this ERA were to:

1. identify the key potential environmental issues associated with the Project; and
2. assess the level of risk for a selection of potential loss scenarios associated with the key potential environmental issues.

The ERA team identified the following items as desired outcomes from the process:

1. identification of key potential environmental issues to be addressed in the EA; and
2. a document suitable for inclusion in the EA and prepared in accordance with Australian Standard/ New Zealand Standard (AS/NZS) 4360:2004 *Risk Management* (Standards Australia, 2004).

A list of key words and their definitions is provided in Attachment MA.

M1.2 Client

The client for the ERA is Duralie Coal Pty Ltd (DCPL), a wholly owned subsidiary of Gloucester Coal Ltd (GCL).

M1.3 Scope

The Director-General's Environmental Assessment Requirements (EARs) for the Project include requirements for the ERA, as follows:

> *The Environmental Assessment of the project must include:*
>
> *...*
>
> - *a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment;*

Consistent with the EARs, the scope of the ERA was:

> *To conduct a risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment.*

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M1.4 Clarifying Points

The team discussion of the scope raised the following clarifying points:

- Safety issues were not intended to be covered.
- The geographical extent of the Project area was understood to include the Project Application Area which included Mining Lease (ML) 1427 (incorporating the existing open pit mining operations associated with the DCM), the new Mining Lease Application (MLA) area (MLA 1) and the DCM access road off The Bucketts Way (Figure M-1). In addition, the North Coast Railway between the DCM and the Stratford Coal Mine (SCM) was also considered to cover potential environmental issues associated with rail movements between the DCM and the SCM.

M1.5 Risk Assessment Process

The risk assessment process was based on the framework provided on Figure M-2 (based on AS/NZS 4360:2004 (Standards Australia, 2004), MDG1010 *Risk Management Handbook for the Mining Industry* [NSW Department of Primary Industries (DPI), 1997] and HB 203:2006 *Environmental Risk Management – Principles and Process* [Standards Australia, 2006]).

M1.6 Resourcing, Schedule and Accountabilities

The following resources were allocated in order to effectively conduct the ERA:

1. team of personnel with suitable experience and knowledge of coal mining operations and environmental issues in the area associated with the Project;
2. external facilitators for the risk assessment and write-up of results; and
3. aerial photographs, drawings, the EARs for the Project and other supporting information.

The outcomes of this ERA and associated accountabilities will be integrated into the EA and overall DCPL management systems so that they are effectively reviewed, implemented and monitored.

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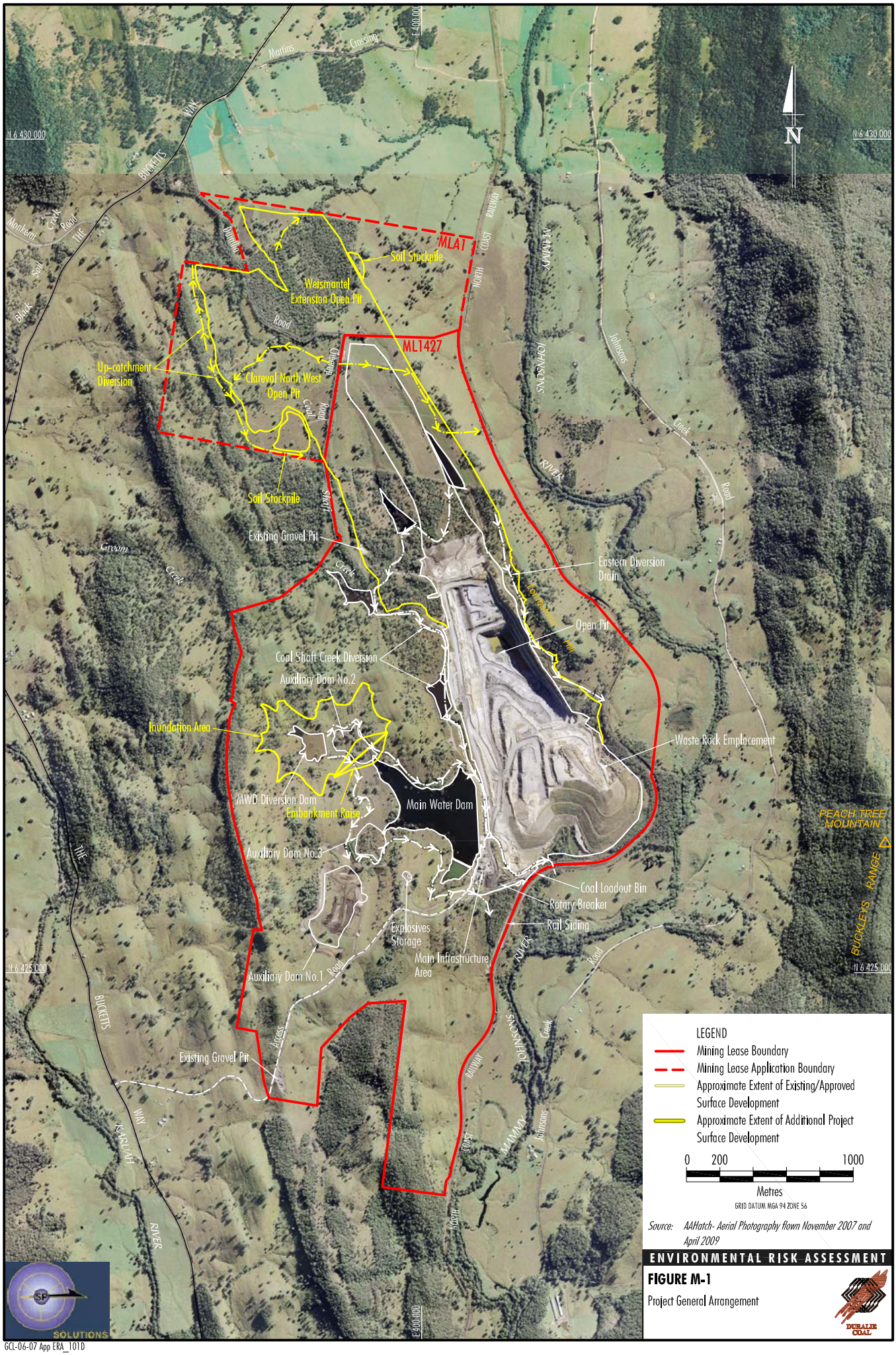

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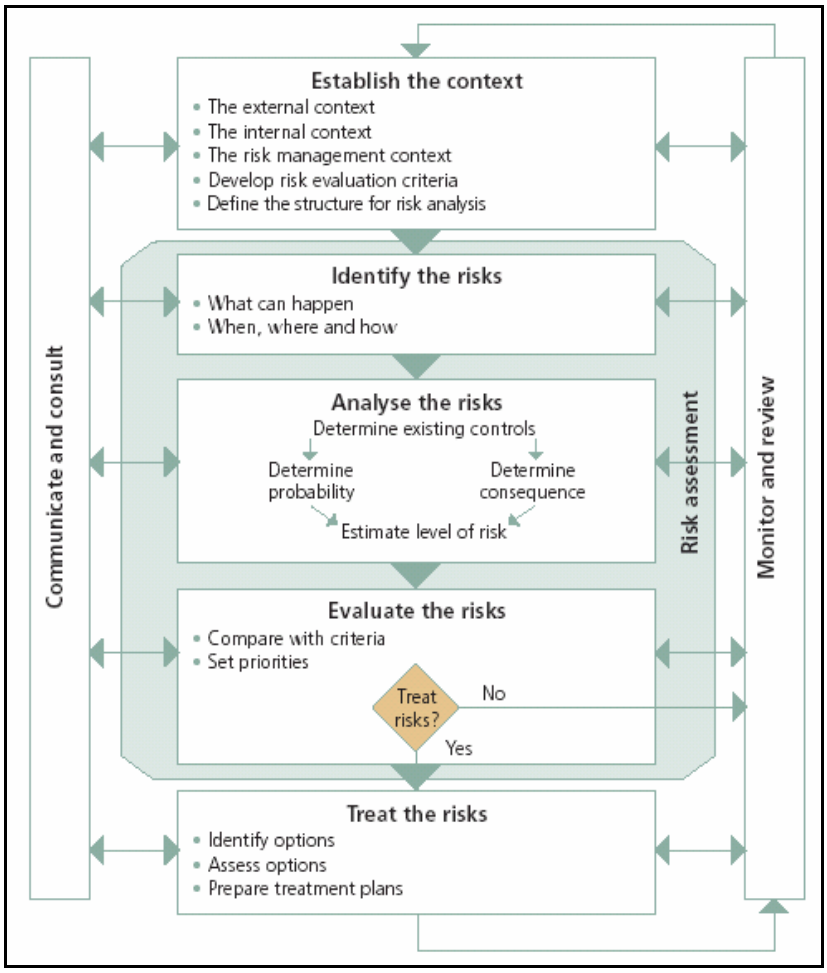
M1.7 Method

M1.7.1 Framework

Figure M-2 outlines the overall framework utilised for the ERA. This framework is further discussed in Section M1.7.2 with respect to the key steps involved in the ERA.



Source: after AS/NZS 4360:2004 (Standards Australia, 2004).

Figure M-2 – Risk Management Process (AS/NZS 4360:2004)

M1.7.2 Key Steps

The key steps in the process included:

1. confirm the scope of the ERA;
2. list the key assumptions on which the ERA is based;
3. review available data on the Project including reports, plans, maps and aerial photos (prior to the workshop);

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4. conduct a team-based risk assessment that:
   a) provided detailed descriptions of the tasks to be undertaken and the proposed method;
   b) identified hazards and assessed the level of risk; and
   c) developed a list of recommended controls to treat the risk (through prevention, monitoring, management and rehabilitation strategies);
5. prepare a draft report in accordance with AS/NZS 4360:2004 (Standards Australia, 2004) and MDG1010 *Risk Management Handbook for the Mining Industry* (DPI, 1997) standards for review by DCPL personnel and ERA team members;
6. incorporate comments from DCPL and the ERA team; and
7. finalise the report and issue as controlled copy for ongoing use.

With respect to the overall framework (Figure M-2), steps 1 to 3 above represent the 'establish the context' phase and step 4 represents the 'identify risks', 'analyse risks', 'evaluate risks' and 'treat risks' phases.

As described in Section M1.6, the outcomes of this ERA and associated accountabilities will be integrated into the EA and overall DCPL management systems so that they are effectively reviewed, implemented and monitored.

M1.7.3 External Facilitation

The team was facilitated through the process by ***SP Solutions*** – a company specialising in Risk Assessment and risk management programs. The facilitator, Peter Standish and co-facilitator, Deanne Toy, are experienced with open pit coal mining and aspects of environmental monitoring and rehabilitation.

The team was encouraged and "challenged" to identify a wide range of environmental impacts or hazards including consideration of far-field impacts (i.e. those impacts affecting the off-site environment).

It is important to understand that the outcomes of this ERA:

1. are process driven;
2. challenge current thinking and may not necessarily appear appropriate or reflect "pre-conceived" ideas; and
3. are the result of the team assembled to review the topic and not the result of any one individual or organisation.

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M2 ESTABLISH THE CONTEXT

M2.1 Organisational Context

The proponent is DCPL, a wholly owned subsidiary of GCL. The Project is an extension of the existing DCM.

The DCM is an open pit coal mining operation, which uses conventional hydraulic excavator and haul truck fleets. The DCM currently produces up to 1.8 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal and operates 24 hours per day. The ROM coal is initially sized at the DCM prior to being transported by rail to the SCM Coal Handling and Preparation Plant (CHPP).

ROM coal is loaded onto a dedicated train that runs between the two mines on the North Coast Railway. At the SCM, the coal is unloaded and processed at the CHPP. Blended product coal produced at the SCM is transported off-site by rail (primarily to the Port of Newcastle for export).

M2.2 Project Summary

The main activities associated with the development of the Project would include:

- continued development of open pit mining operations at the DCM to facilitate a ROM coal production rate of up to approximately 3 Mtpa, including:
  - extension of the existing approved open pit in the Weismantel Seam to the north-west (i.e. Weismantel Extension open pit) within ML 1427 and MLA 1; and
  - open pit mining operations in the Clareval Seam (i.e. Clareval North West open pit) within ML 1427 and MLA 1;
- ongoing exploration activities within existing exploration tenements;
- progressive backfilling of the open pits with waste rock as mining develops, and continued and expanded placement of waste rock in out-of-pit waste rock emplacements;
- increased ROM coal rail transport movements on the North Coast Railway between the DCM and SCM in line with increased ROM coal production;
- continued disposal of excess water through irrigation (including development of new irrigation areas within ML 1427 and MLA 1);
- raising of the existing approved Auxiliary Dam No. 2 from relative level (RL) 81 metres (m) to approximately RL 100 m to provide significant additional on-site storage capacity to manage excess water on-site;
- progressive development of dewatering bores, pumps, dams, irrigation infrastructure and other water management equipment and structures;
- development of new haul roads and internal roads;
- upgrade of existing facilities and supporting infrastructure as required in line with increased ROM coal production;
- continued development of soil stockpiles, laydown areas and gravel/borrow pits;
- establishment of a permanent Coal Shaft Creek alignment adjacent to the existing DCM mining area;
- ongoing monitoring and rehabilitation; and
- other associated minor infrastructure, plant, equipment and activities.

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A detailed description of the Project is provided in Section 2 in the Main Report of the EA.

M2.3 Risk Management Context

This ERA has been conducted in accordance with the EARs for the Project (Section M1.3).

In addition, the ERA was cognisant of the following documents:

- AS/NZS 4360:2004 *Risk Management* (Standards Australia, 2004);
- HB 203:2006 *Environmental Risk Management – Principles and Process* (Standards Australia, 2006); and
- MDG1010 *Risk Management Handbook for the Mining Industry* (DPI, 1997).

A Preliminary Assessment was undertaken for the Project in October 2009. The key potential environmental impacts identified in the assessment relating to the Project were also considered in this ERA.

M2.4 Risk Criteria

The risk criteria utilised is to reduce the risk to As Low As Reasonably Practicable (ALARP) or lower. Figure M-3 schematically shows the three risk management zones *viz*. intolerable, ALARP and tolerable. The middle zone is referred to as the ALARP zone.

Flying is an example of a risk considered by most people to be a tolerable risk; whilst smoking is generally considered to be an activity which cannot be justified on any grounds from a risk perspective. This can be considered quantitatively where smoking equates to a risk of 1 in 5,000 – 1 in 5,000 smokers who consume over 20 cigarettes a day will die each year from a smoking related illness, whereas flying in a commercial aircraft is a risk of 1 in 100,000 – some 20 times safer. This is shown graphically in Figure M-3. Intolerable items such as smoking are at the top of the pyramid where much lower risks, such as flying, sit at the lower end of the ALARP zone (close to tolerable).

The risk ranking matrices used during the ERA workshop are presented in Section M4.1.

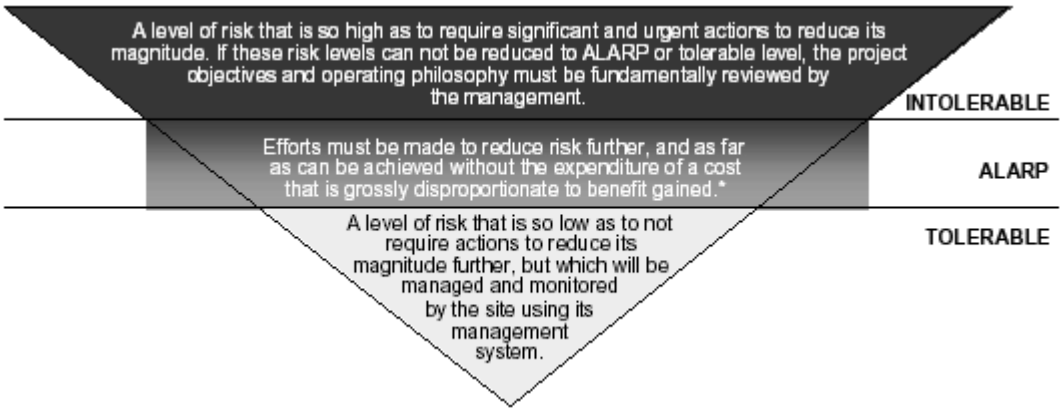

Figure M-3 – Risk Criteria "ALARP"

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M3 IDENTIFY RISKS

M3.1 Overview

The identification of risks involved the use of risk assessment "tools" appropriate for identifying potential loss scenarios associated with the Project. The tools used were:

- Introduction – Before the potential issues were brainstormed it was important that the whole team had a good understanding of the Project – and this was confirmed by the facilitator.
- Brainstorming – This was used to draw out the main issues using the understanding, relevant experience and knowledge of the team. This session also used prompt words to build on the experience base of the team and identify any potential environmental issues and potential loss scenarios.
- Modified Hazard and Operability (HAZOP) analysis – this involved the review of key words (drawn from the EARs for the Project and retrospective analyses of environmental/community related incidents) and aerial photographs, and the consequent identification of potential environmental issues at each location during each phase of operation.

M3.2 Environmental Risk Assessment Team

The team met for the ERA workshop at the SCM on 22 October 2009. A team based approach was utilised in order to have an appropriate mix of skills and experience to identify the potential environmental issues and potential loss scenarios. Details of the team members and their relevant qualifications and experience are included in Table M-1.

Table M-1 – ERA Team

Name	Company and Position	Relevant Qualifications and Experience
Noel Merrick[1]	Principal – Heritage Computing	BSc, MSc, PhD, Grad Dip Data Processing: 38 years experience in hydrogeology, groundwater modelling and geophysics.
David Goldney	Principal Consulting Ecologist – Cenwest Environmental Services	BSc, DipEd, PhD: 36 years experience in natural resource assessment and management, environmental assessment, specialising in fauna assessment and surveys.
Tony Marszalek	Principal Engineer – Gilbert & Associates	BEng (Civil) (Hons), MES: 23 years experience in water resource consultancy.
Glenn Thomas	Principal – Heggies	BSc: 19 years experience in noise, vibration, blasting and transportation consultancy and environmental assessments.
Peter Cribb	Principal – Resource Strategies	BAg Science (Land Resource Mgt): 17 years experience in environmental management, specialising in mining projects.
Clive Berry	Senior Environmental Manager – Resource Strategies	BEng (Env): 9 years experience in project approvals and environmental management in relation to the mining industry.
Tony Dwyer	Manager Approvals and Environment – Gloucester Coal	BSc (Ecology/Botany), Grad Dip Natural Resources, MEB: 10 years experience metal/coal mining.
Todd Hutchings	Manager Mining – Gloucester Coal	BSc (Hons Geology), Grad Cert Computing, Dip Financial Markets: 4 years experience exploration, 15 years mining.
Peter Standish	SP Solutions - Facilitator	BEng (Hon), Dip Bus Mgt, PhD, Risk Analysis Trained, Certificate of Competence (Manager): 27 years experience in mining operations with operating, managerial and contract management experience; reviewing environmental conditions and applications for 5 years; conducting risk analyses for 12 years.
Deanne Toy	SP Solutions, Senior Consultant, Co Facilitator	Master Risk Mgt, Grad Dip OHS: 7 years Mining/HSE/Risk and 6 years health industry experience, Cert IV Training and Assessment, HSE Auditor, G1, G2.

[1] Noel Merrick was unable to attend the workshop, but contributed to the brainstorming session and review of this report.

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M3.3 Risk Identification

M3.3.1 Brainstorming

The brainstorming process is intended to allow for a relatively unstructured, free flowing series of issues and ideas to be generated. It is enhanced through the use of key word association processes based on work by Edward de Bono and is intended to generate a wide range of data on losses, controls and general issues related to the Project area.

No "filtering" of the data is allowed during the process – and the reader should be conscious of the intent of not missing a potential "left field" loss when reading through the material.

Issues identified during the brainstorming session are presented in Table MB-1 in Attachment MB.

M3.3.2 Modified HAZOP

The next "tool" applied with the team was that of a modified HAZOP. In this process the Project general arrangement (e.g. Figure M-1) was referred to along with a consideration of the phases of operation and the potential impacts that could arise.

The generic key words used in the process representing environmental issue subject areas (generally based on the headings in the EARs for the Project) were:

- Surface Water;
- Groundwater;
- Noise and Blasting;
- Air Quality;
- Terrestrial Fauna and Flora;
- Aquatic Ecology;
- Road Transport;
- Geochemistry;
- Aboriginal Cultural Heritage;
- Non-Aboriginal Heritage;
- Visual;
- Socio-Economic;
- Waste Rock and ROM Coal Geochemistry; and
- Rehabilitation Concepts.

M3.3.3 Identification of Key Environmental Issue Types

In accordance with the EARs for the Project, the key potential environmental issues were identified through a 'voting' system whereby team members were assigned a number of "votes" to allocate to what they considered to be the key environmental issues. Key potential environmental issues are those issues with five or more assigned 'votes' and are shown in Table M-2.

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Table M-2 – Key Potential Environmental Issues

Ref	Environmental Issue Subject Area	Description of Issue	Votes
IS046	Surface Water	Seepage of poor quality water from final void through waste rock emplacement to Coal Shaft Creek/Mammy Johnsons River	5
IS044	Surface Water	Uncontrolled spill from the Main Water Dam (MWD) or auxiliary dams to Mammy Johnsons River during mine life	5
IS002	Terrestrial Flora and Fauna	Loss of habitat for protected and threatened species under the NSW *Threatened Species Conservation Act, 1995* (TSC Act)	4
IS047	Rehabilitation Concepts	Long-term stability of Coal Shaft Creek Diversion	4
IS001	Terrestrial Flora and Fauna	Loss of native vegetation due to clearing associated with the Project	3
IS037	Noise and Blasting	Night-time noise from the DCM shuttle train	3
IS019	Surface Water	Spill of poor quality water from the final voids	3
IS039	Visual Amenity	Visual impacts from The Bucketts Way and nearby residential receivers	3
IS063	Noise and Blasting	The extent of the noise impact zone	3
IS021	Surface Water	Rupture of irrigation pipelines leading to discharge of mine water to Mammy Johnsons River/Coal Shaft Creek	2
IS023	Noise and Blasting	Effects of blasting (vibration and overpressure)	2
IS042	Waste Rock Geochemistry[1]	Acid mine drainage (AMD) from potentially acid forming (PAF) material	2
IS067	Air Quality	Dust (particulate matter less than 10 microns in size [PM_{10}]) impact to the north-west receivers	2
IS003	Terrestrial Flora and Fauna	Loss of (or displacement) of native vertebrate fauna listed under the TSC Act	1
IS005	Surface Water	Re-mobilised irrigated solutes from irrigation areas reaching Mammy Johnsons River	1
IS012	Surface Water	Additional water storage - construction timing and adequacy of additional storage capacity to contain water on-site	1
IS018	Surface Water	Poor quality runoff from waste rock emplacement reaching Mammy Johnsons River	1
IS028	Surface Water	Loss of base flow from Mammy Johnsons River	1
IS051	Rehabilitation Concepts	Rehabilitation of the site	1

[1] ROM coal geochemistry is considered to be a 'referred' issue and will be addressed separately to the Project EA (Section M3.3.4).

The key potential environmental issues identified in this ERA will be addressed in appropriately detailed assessments in the Main Report of the EA and the specialist's reports (where relevant) included as appendices to the EA, as follows:

- Surface Water Assessment (Appendix A);
- Groundwater Assessment (Appendix B);
- Noise and Blasting Impact Assessment (Appendix C);
- Air Quality Assessment (Appendix D);
- Terrestrial Flora and Fauna Assessment (Appendix E);
- Aquatic Ecology Assessment (Appendix F);
- Socio-Economic Assessment (Appendix G);
- Road Transport Assessment (Appendix H);
- Geochemistry Assessment (Appendix I);
- Aboriginal Cultural Heritage Assessment (Appendix J);

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- Non-Aboriginal Heritage Assessment (Appendix K);
- Preliminary Hazard Analysis (Appendix L);
- Rehabilitation and Landscape Management Strategy (Appendix N); and
- Visual Assessment (Appendix O).

M3.3.4 Referred Issue

One of the issues identified by the team during the ERA was considered to be a 'referred' issue. This referred issue was considered to warrant particular consideration in the overall DCPL management systems. The referred issue was coal reject generation through the processing of Project ROM coal at the SCM which will be addressed separately to the Project EA.

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M4 ANALYSE RISKS

M4.1 Probability and Maximum Reasonable Consequence

Potential loss scenarios (primarily based on the identified key potential environmental issues) were ranked for risk by the ERA team. A tabular analysis was used for this risk ranking process, based on the probability and consequence of a loss scenario occurring as decided by the ERA team.

The following definition of risk was used:

- the combination of the probability of an unwanted event occurring; and
- the maximum reasonable consequences (MRCs) should the event occur.

Tables M-3 to M-6 present the ERA matrix tools that were utilised for ranking risks.

M-3 – Qualitative Measures of Probability

Rank (P)	Probability	Descriptor
A	Almost Certain	Happens often
B	Likely	Could easily happen
C	Possible	Could happen and has occurred elsewhere
D	Unlikely	Hasn't happened yet but could
E	Rare	Conceivable, but only in extreme circumstances

Table M-4 – Qualitative Measures of Maximum Reasonable Consequence[1]

Ref (C)	Consequence	Comment
1	Extreme environmental harm	E.g. widespread catastrophic impact on environmental values of an area.
2	Major environmental harm	E.g. widespread substantial impact on environmental values of an area.
3	Serious environmental harm	E.g. widespread and considerable impact on environmental values of an area.
4	Material environmental harm	E.g. localised and considerable impact on environmental values of an area.
5	Minimal environmental harm	E.g. minor impact on environmental values of an area.

[1] Notes: MRC: – The worst-case consequence that could reasonably be expected, given the scenario and based upon experience at the operation and within the mining industry.

The terms localised and widespread were defined for the team session as:

- localised – any effect or impact wholly contained within the Project area; and
- widespread – any effect or impact extending beyond the Project area.

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Table M-5 – Quantitative Measures of Maximum Reasonable Consequence

Asset/Infrastructure	
1	More than $50 million (M) loss or production delay
2	$10M to $50M loss or production delay
3	$1M to $10M loss or production delay
4	$100 thousand (k) to $1M loss or production delay
5	Less than $100k loss or production delay

Table M-6 – Risk Ranking Table

Consequence (C)	Probability (P)					
		A	B	C	D	E
	1	1 (H)	2 (H)	4 (H)	7 (M)	11 (M)
	2	3 (H)	5 (H)	8 (M)	12 (M)	16 (L)
	3	6 (H)	9 (M)	13 (M)	17 (L)	20 (L)
	4	10 (M)	14 (M)	18 (L)	21 (L)	23 (L)
	5	15 (M)	19 (L)	22 (L)	24 (L)	25 (L)

Notes:

L = Low; M = Moderate; H = High

Risk Numbering:
1 = highest risk, 25 = lowest risk

Legend:

Risk Levels:

	Tolerable
	ALARP
	Intolerable

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M4.2 Risk Ranking

Risk ranking was undertaken by the team on loss scenarios primarily based on the key potential environmental issues (provided in Table M-7).

Table M-7 – Risk Ranking

Environmental Issue Subject Area	Potential Loss Scenario	Probability	Consequence	Risk Ranking[1]
Surface Water	Unplanned release of mine water despite water managed on-site in accordance with current practices	**E** **E**	**5** **2/3**	**25 Low** **16/20 Low[2]**
	Failure of water management system leading to poor quality runoff from the waste rock emplacement reaching Mammy Johnsons River	**E** **E**	**5** **2/3**	**25 Low** **16/20 Low[2]**
	Failure of water management system leading to uncontrolled spill from the MWD or auxiliary dams to Mammy Johnsons River	**E**	**5**	**25 Low**
	Unexpected structural dam failure	**E**	**3**	**20 Low**
	Stability of Coal Shaft Creek Diversion is compromised in the long-term	**D**	**4**	**21 Low**
Noise and Blasting	Noise and blasting impacts exceed criteria at nearby receivers consistent with predictions	**A**	**5**	**15 Medium**
	Noise/blasting impacts in exceedance of predictions and additional controls are undertaken	**C**	**4**	**18 Low**
	Noise/blasting impacts in exceedance of predictions and additional controls are not effective	**E**	**4**	**23 Low**
Terrestrial Flora and Fauna	Loss of flora and fauna habitat resulting from approved clearance of vegetation	**A**	**5**	**15 Medium**
	Loss of flora and fauna habitat greater than expected due to incorrect implementation of controls	**D**	**5**	**24 Low**
	Unsuccessful rehabilitation and long-term loss of biodiversity	**E**	**5**	**25 Low**
Waste Rock Geochemistry[3]	Unplanned release of AMD affected water from potential acid forming material despite waste rock managed in accordance with current site practices	**D**	**4**	**21 Low**
	AMD from waste rock emplacement following rehabilitation of the site resulting in the release of low pH water	**D**	**4**	**21 Low**

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Table M-7 – Risk Ranking (Continued)

Environmental Issue Subject Area	Potential Loss Scenario	Probability	Consequence	Risk Ranking[1]
Visual Amenity	Visual impacts on the Bucketts Way and nearby receivers to the north of the Project	**B**	**4**	**14 Medium**
Aquatic Ecology	Potential detrimental effects on Mammy Johnsons River aquatic ecology	**E**	**4**	**23 Low**
Air Quality	Dust emissions exceed criteria at nearby receivers in accordance with predictions	**A**	**5**	**15 Medium**
Non Aboriginal Heritage	Potential vibration impacts on the Former Weismantels Inn	**D**	**4**	**21 Low**
Aboriginal Heritage	Potential loss of Aboriginal artefacts/sites	**D**	**5**	**24 Low**

[1] Risk - Ranking basis 1 (highest risk) to 25 (lowest risk). Risk rankings defined as 1 to 6 – High; 7 to 15 - Medium (or ALARP); and 16 to 25 - Low.

[2] Risk was determined for two different levels of consequence (i.e. a scenario with a higher consequence was considered to be less likely to occur).

[3] ROM coal geochemistry is considered to be a 'referred' issue and will be addressed separately to the Project EA (Section M3.3.4).

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M5 MONITOR AND REVIEW

M5.1 Nominated Co-ordinator

The nominated client review facilitator is Tony Dwyer, Manager Approvals and Environment (DCPL).

DCPL will co-ordinate the inclusion of the key potential environmental issues into the various studies undertaken as part of the EA and the overall DCPL management systems.

M5.2 Communication and Consultation

Consultation, involvement of personnel (DCPL and their specialists) and communication of the process and outcomes of the ERA are intended to be achieved by the inclusion of this report and the relevant specialist assessments addressing the key potential environmental issues in the EA and the overall DCPL management systems.

M5.3 Concluding Remarks

The risk assessment process conducted by the team was aligned with AS/NZS 4360:2004 (Standards Australia, 2004) and MDG1010 (DPI, 1997), with the intention of identifying the key potential environmental issues for the Project.

An appropriately detailed assessment of the key potential environmental issues will be included in the EA appendices/sections as presented in Table M-8.

Table M-8 – Key Potential Environmental Issues to be Further Assessed in the EA

Ref	Environmental Issue Subject Area	Description of Issue	EA Appendix/Section
IS046	Surface Water	Seepage of poor quality water from final void through waste rock emplacement to Coal Shaft Creek/Mammy Johnsons River	Appendix A and Section 4.4
IS044	Surface Water	Uncontrolled spill from the MWD or auxiliary dams to Mammy Johnsons River during mine life	Appendix A and Section 4.4
IS002	Terrestrial Flora and Fauna	Loss of habitat for protected and threatened species under the TSC Act	Appendix E and Sections 4.8 and 4.9
IS047	Rehabilitation Concepts	Long-term stability of Coal Shaft Creek Diversion	Appendix N and Section 5
IS001	Terrestrial Flora and Fauna	Loss of native vegetation due to clearing associated with the Project	Appendix E and Sections 4.8 and 4.9
IS037	Noise and Blasting	Night-time noise from the DCM shuttle train	Appendix C and Section 4.5
IS019	Surface Water	Spill of poor quality water from the final voids	Appendix A and Section 4.4
IS039	Visual Amenity	Visual impacts from The Bucketts Way and nearby residential receivers	Appendix O and Section 4.16
IS063	Noise and Blasting	The extent of the noise impact zone	Appendix C and Section 4.5
IS021	Surface Water	Rupture of irrigation pipelines leading to discharge of mine water to Mammy Johnsons River/Coal Shaft Creek	Appendix L and Section 4.17

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Table M-8 – Key Potential Environmental Issues to be Further Assessed in the EA (Continued)

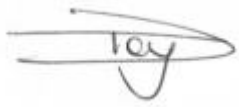
Ref	Environmental Issue Subject Area	Description of Issue	EA Appendix/Section
IS023	Noise and Blasting	Effects of blasting (vibration and overpressure)	Appendix C and Section 4.5
IS042	Waste Rock Geochemistry[1]	AMD from PAF material	Appendix I and Section 4.4
IS067	Air Quality	Dust (PM_{10}) impact to the north-west receivers	Appendix D and Section 4.6
IS003	Terrestrial Flora and Fauna	Loss of (or displacement) of native vertebrate fauna listed under the TSC Act	Appendix E and Sections 4.8 and 4.9
IS005	Surface Water	Re-mobilised irrigated solutes from irrigation areas reaching Mammy Johnsons River	Appendix A and Section 4.4
IS012	Surface Water	Additional water storage - construction timing and adequacy of additional storage capacity to contain water on-site	Appendix A and Section 4.4
IS018	Surface Water	Poor quality runoff from waste rock emplacement reaching Mammy Johnsons River	Appendix A and Section 4.4
IS028	Surface Water	Loss of base flow from Mammy Johnsons River	Appendix A and Section 4.4
IS051	Rehabilitation Concepts	Rehabilitation of the site	Appendix N and Section 5

[1] ROM coal geochemistry is considered to be a 'referred' issue and will be addressed separately to the Project EA (Section M3.3.4).

The risk rankings indicate that the loss scenarios ranked were within the "Medium - ALARP" or the "Low" range. An appropriately detailed assessment of the key potential environmental issues will be included in the EA.

SP Solutions would like to thank all of the personnel who contributed to the risk assessment in particular those personnel from DCPL and Resource Strategies who prepared source material for the team session.

Peter Standish, October 2009



Deanne Toy, October 2009

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M6 REFERENCES

Department of Primary Industries (1997) *MDG1010 Risk Management Handbook for the Mining Industry.* May, 1997.

Duralie Coal Pty Ltd (2009) *Duralie Extension Project - Project Description and Preliminary Assessment*.

Standards Australia (2004) *AS/NZS 4360:2004 Risk Management*.

Standards Australia (2006) *HB 203:2006 Environmental Risk Management – Principles and Process*.

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ATTACHMENT MA – DEFINITIONS

Term	Explanation
ALARP	"As Low As Reasonably Practicable". The level of risk between tolerable and intolerable levels that can be achieved without expenditure of a disproportionate cost in relation to the benefit gained.
AMD	Acid mine drainage.
AS/NZS 4360:2004	Australian Standard/New Zealand Standard on Risk Management (see references in Section M6).
Control	An intervention by the proponent intended to either Prevent a Cause from becoming an incident or to reduce the outcome should an incident occur.
DCPL	Duralie Coal Pty Ltd– the Project Proponent.
EARs	Director-General's Environmental Assessment Requirements.
ERA	Environmental Risk Assessment.
HB 203:2006	Handbook on Environmental Risk Management (see references in Section M6).
MDG1010	Department of Primary Industries guideline on risk management (see references in Section M6).
Outcome	The end result following the occurrence of an incident. Outcomes are analogous to impacts and have a risk ranking attached to them.
PAF	Potentially acid forming.
Personnel	Includes all people working in and around the site (e.g. all contractors, sub-contractors, visitors, consultants, project managers etc.).
Practicable	The extent to which actions are technically feasible, in view of cost, current knowledge and best practices in existence and under operating circumstances of the time.
Review	An examination of the effectiveness, suitability and efficiency of a system and its components.
Risk	The combination of the potential consequences arising from a specified hazard together with the likelihood of the hazard actually resulting in an unwanted event.
TSC Act	*Threatened Species Conservation Act, 1995*.

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ATTACHMENT MB - ISSUE IDENTIFICATION RESULTS

The output from the team's "brainstorming" is presented in Table MB-1. This list has been sorted according to the Incident Type – which were drawn, in part, from the EARs received for the Project.

Table MB-1– Brainstorming and Modified HAZOP Results

Ref	Environmental Issue Subject Area	Description of Issue
ISO1	Terrestrial Flora and Fauna	Loss of native vegetation due to clearing associated with the Duralie Extension Project (the Project)
ISO2	Terrestrial Flora and Fauna	Loss of habitat for protected and threatened species under the *Threatened Species Conservation Act, 1995* (TSC Act)
ISO3	Terrestrial Flora and Fauna	Loss of (or displacement) of native vertebrate fauna listed under the TSC Act
ISO4	Surface Water	Over-irrigation leading to salt build up in irrigation area soils and potentially compromising soil fertility
ISO5	Surface Water	Re-mobilised irrigated solutes from irrigation areas reaching Mammy Johnsons River
ISO6	Terrestrial Flora and Fauna	Loss of ecological connectivity
ISO7	Groundwater	Contamination of freshwater aquifer via introduction of poor quality water
ISO8	Terrestrial Flora and Fauna	Increase in weed species and feral vertebrate fauna
ISO9	Noise and Blasting	Night-time noise from operations
ISO10	Road Transport	Closure of Cheerup and Durallie Roads affecting property access for fire abatement
ISO11	Groundwater	Groundwater drawdown affects local water users
ISO12	Surface Water	Additional water storage - construction timing and adequacy of additional storage capacity to contain water on-site
ISO13	Visual Amenity	Lighting impacts
ISO14	Air Quality	Greenhouse gas emissions
ISO15	Surface Water	Hydrocarbon contamination of surface waters
ISO16	General Issue	General refuse disposal
ISO17	Socio Economic	Reduction in area of available agricultural lands
ISO18	Surface Water	Poor quality runoff from waste rock emplacement reaching the Mammy Johnsons River
ISO19	Surface Water	Spill of poor quality water from the final voids
ISO20	Surface Water	Seepage of poor quality water from final void through coal seams/pit floor to the Mammy Johnsons River
ISO21	Surface Water	Rupture of irrigation pipelines leading to discharge of mine water to the Mammy Johnsons River/Coal Shaft Creek
ISO22	Socio Economic	Positive socio-economic effects
ISO23	Noise and Blasting	Effects of blasting (vibration and overpressure)
ISO24	Noise and Blasting	Road transport noise
ISO25	Land Resources	Potential land contamination
ISO26	Aquatic Ecology	Effects on Mammy Johnsons River aquatic ecology
ISO27	Noise and Blasting	Potential flyrock impacts
ISO28	Surface Water	Loss of base flow from Mammy Johnsons River
ISO29	Terrestrial Flora and Fauna	Reduced native plant species diversity
ISO30	Surface Water	Modification/loss of creek systems, including natural flows, riparian and in-stream habitats
ISO31	Rehabilitation Concepts	Potential negative impact of supplementary irrigation on long-term regrowth native vegetation
ISO32	Surface Water	Over-irrigation leading to salt build-up in rehabilitation areas, potentially compromising rehabilitation revegetation

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Ref	Environmental Issue Subject Area	Description of Issue
ISO33	Terrestrial Flora and Fauna	Accumulative impacts (loss of creek lines, loss of native vegetation, loss of threatened species), since commencement of the Duralie Coal Mine (DCM), plus likely impacts of the Project
ISO34	Groundwater	Separation of and containment of internal mine water, from Mammy Johnsons River
ISO35	Groundwater	Potential reduction in water quality within mine site
ISO36	Terrestrial Flora and Fauna	Removal of Speckled Warbler habitat
ISO37	Noise and Blasting	Night-time noise from the DCM shuttle train
ISO38	Surface Water	Removal of Coal Shaft Creek catchment
ISO39	Visual Amenity	Visual impacts from The Bucketts Way and nearby residential receivers
ISO40	Aboriginal Heritage	Impacts on Aboriginal cultural heritage sites
ISO41	Air Quality	Dust fallout
ISO42	Waste Rock Coal Geochemistry[1]	Acid mine drainage from potentially acid forming material
ISO43	Non-Aboriginal Heritage	Impacts on Non-Aboriginal heritage (the Former Weismantels Inn)
ISO44	Surface Water	Uncontrolled spill from the Main Water Dam or auxiliary dams to Mammy Johnsons River
ISO45	Surface Water	Seepage from waste rock emplacement reaching the Mammy Johnsons River
ISO46	Surface Water	Seepage of poor quality water from final void through waste rock emplacement to Coal Shaft Creek/Mammy Johnsons River
ISO47	Rehabilitation Concepts	Long-term stability of Coal Shaft Creek Diversion compromised
ISO48	Surface Water	Coal spillage from trains potentially contaminating receiving waters
ISO49	Air Quality	Rail dust emissions
ISO50	Road Transport	Road transport impacts
ISO51	Rehabilitation Concepts	Rehabilitation of the site
ISO52	Noise and Blasting	Blasting effects on the Former Weismantels Inn
ISO53	Aboriginal Heritage	Indirect impacts on Mammy Johnson's grave
ISO54	Aboriginal Heritage	Potential impacts on Mammy Johnsons River Aboriginal heritage values
ISO55	Groundwater	Effect on groundwater dependent ecosystems due to reduction in base flow
ISO56	General Issue	Cumulative impacts
ISO57	Noise and Blasting	Blasting and other noise affecting poultry farming activities
ISO58	Surface Water	Unexpected structural dam failure
ISO59	Surface Water	Seepage from auxiliary dams
ISO60	Terrestrial Flora and Fauna	Vehicle fauna strike
ISO61	Terrestrial Flora and Fauna	Water logging of native vegetation regrowth areas affecting vegetation vigour
ISO62	Noise and Blasting	Risk of delayed delivery of noise mitigation measures (i.e. quieter haul trucks)
ISO63	Noise and Blasting	The extent of the noise impact zone
ISO64	Noise and Blasting	Potential sleep disturbance from night-time operations
ISO65	Noise and Blasting	Public access on Durallie Road (safety)
ISO66	General Issue	Rail movement public safety
ISO67	Air Quality	Dust (particulate matter less than 10 microns in size) impact to the north-west receivers
ISO68	Rehabilitation Concepts	Long-term geotechnical stability of waste rock emplacement
ISO69	Air Quality	Odour emissions from blast events

[1] ROM coal geochemistry is considered to be a 'referred' issue and will be addressed separately to the Project EA (Section M3.3.4).

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