

Tarrawonga Coal Project

Environmental
Assessment

APPENDIX 0

ENVIRONMENTAL RISK
ASSESSMENT

Tarrawonga Coal Project

Environmental Risk Assessment

Prepared for: Whitehaven Coal Pty Ltd

Prepared by: Safe Production Solutions
Author: Dr Peter Standish

Date of Team Review: 26 July 2011

Job Number: J3001

Doc No: D5459 **Version:** 1 **Date:** 10/10/2011



Tarrawonga Coal Project – Environmental Risk Assessment

DOCUMENT CONTROL AND DISTRIBUTION

| | |
|-------------------------------------|---|
| Document No. | D5459 |
| Title | Tarrawonga Coal Project – Environmental Risk Assessment |
| General Description | Report on the team based risk assessment |
| Key Supporting Documentation | <ul style="list-style-type: none"> • AS/NZ 31000:2009 <i>Risk Management – Principles and Guidelines</i> (Standards Australia, 2009); • HB 203:2006 <i>Environmental Risk Management – Principles and Process</i> (Standards Australia, 2006); • MDG1010 <i>Risk Management Handbook for the Mining Industry</i> (DPI, 1997); • Director-General's <i>Environmental Assessment Requirements the Tarrawonga Coal Project</i> (MP 11_0047 dated 7/7/2011); • <i>Tarrawonga Coal Annual Environmental Management Reports</i>; and • <i>Tarrawonga Coal Project Description and Preliminary Assessment</i> (February 2011). |

Versions

| Version | Date | Description | Created By | Reviewed |
|---------|----------|---|------------|----------|
| A | 19/08/11 | Draft report for internal review | PNS | BW |
| B | 3/10/11 | Revised draft report in accordance with review comments | PNS | BW |
| 1 | 10/10/11 | Finalised report | PNS | LP |

Distribution List of Latest Version

| User | No. Copies |
|---------------------|----------------|
| Resource Strategies | 1 (Electronic) |
| SP Solutions | 1 (Electronic) |



TABLE OF CONTENTS

| | |
|---|----|
| EXECUTIVE SUMMARY | 1 |
| 1 INTRODUCTION | 1 |
| 1.1 Aim and Objectives | 1 |
| 1.2 Client | 1 |
| 1.3 Scope | 1 |
| 1.4 Clarifying Points | 3 |
| 1.5 Risk Assessment Process | 3 |
| 1.6 Resourcing, Schedule and Accountabilities | 3 |
| 1.7 Methodology | 3 |
| 1.7.1 Framework | 3 |
| 1.7.2 Key Steps | 4 |
| 1.7.3 External Facilitation | 5 |
| 2 ESTABLISH THE CONTEXT | 6 |
| 2.1 Organisational Context | 6 |
| 2.2 Project Summary | 6 |
| 2.3 Risk Management Context | 7 |
| 2.4 Risk Criteria | 7 |
| 3 IDENTIFY RISKS | 10 |
| 3.1 Overview | 10 |
| 3.2 Environmental Risk Assessment Team | 10 |
| 3.3 Risk Identification | 11 |
| 3.3.1 Brainstorming | 11 |
| 3.3.2 Modified HAZOP | 11 |
| 3.3.3 Identification of Key Environmental Issue Types | 11 |
| 3.3.4 Referred Issue | 13 |
| 4 ANALYSE RISKS | 14 |
| 4.1 Probability and Maximum Reasonable Consequence | 14 |
| 4.2 Risk Ranking | 15 |
| 5 MONITOR AND REVIEW | 19 |
| 5.1 Nominated Co-ordinator | 19 |
| 5.2 Communication and Consultation | 19 |
| 5.3 Concluding Remarks | 19 |
| 6 REFERENCES | 21 |

List of Figures

- Figure 1 – Regional Location
- Figure 2 – Risk Management Process (AS/NZS 31000:2009)
- Figure 3 – Project General Arrangement
- Figure 4 – Risk Criteria “ALARP”

List of Tables

| | |
|--|------|
| Table ES-1 – Key Potential Environmental Issues to be Further Assessed in the EA | ES-2 |
| Table ES-2 – Risk Ranking Results | ES-3 |
| Table 1 – ERA Team | 10 |
| Table 2 – Key Potential Environmental Issues | 12 |
| Table 3 – Qualitative Measures of Probability | 14 |
| Table 4 – Qualitative Measures of Maximum Reasonable Consequence | 14 |
| Table 5 – Risk Ranking Table | 15 |
| Table 6 – Risk Ranking Results | 15 |
| Table 7 – Key Potential Environmental Issues to be Further Assessed in the EA | 19 |

List of Attachments

- Attachment A Definitions
- Attachment B Issue Identification Results

Tarrawonga Coal Project – Environmental Risk Assessment

EXECUTIVE SUMMARY

This document is an Environmental Risk Assessment (ERA) for the Tarrawonga Coal Project (the Project). The Project provides for the extension and continuation of operations at the existing Tarrawonga Coal Mine.

On 26 July 2011, a team consisting of Tarrawonga Coal Pty Ltd (TCPL) personnel 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 number of risk management techniques, including:
 - a. brain writing/storming;
 - b. modified hazard and operability analysis; and
 - c. keyword (loss generation) techniques.
3. Analysis of identified risks and nomination of key potential environmental issues.
4. 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 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 the ERA will be addressed in the EA and the following specialists reports, included as appendices to the EA:

- Appendix A Groundwater Assessment;
- Appendix B Surface Water Assessment;
- Appendix C Noise and Blasting Assessment;
- Appendix D Air Quality and Greenhouse Gas Assessment;
- Appendix E Fauna Assessment;
- Appendix F Flora Assessment;
- Appendix G Controlling Provisions of the EPBC Act Relevant to the Tarrawonga Coal Project Environmental Assessment;
- Appendix H Road Transport Assessment;
- Appendix I Agricultural Resources and Productivity Assessment;
- Appendix J Visual Assessment;
- Appendix K Aboriginal Cultural Heritage Assessment;
- Appendix L Non-Aboriginal Heritage Assessment;
- Appendix M Socio-Economic Assessment;
- Appendix N Geochemistry Assessment;
- Appendix P Preliminary Hazard Analysis;
- Appendix Q Land Contamination Assessment; and
- Appendix R Concept Design for Low Permeability Barrier and Permanent Goonbri Creek Alignment.

Tarrawonga Coal Project – Environmental Risk Assessment

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 |
|------|----------------------------------|---|----------------------------------|
| R002 | Groundwater | Potential impacts on alluvial groundwater. | Appendix A and Section 4 |
| R013 | Groundwater/Surface Water | Final void and associated surface and groundwater management. | Appendices A and B and Section 4 |
| R001 | Surface Water | Long term stability of the Permanent Goonbri Creek Alignment. | Appendix B and Section 4 |
| R011 | Surface Water | Potential for inadequate water supply – for dust suppression and consequent impacts on dust emissions. | Appendix B and Section 4 |
| R008 | Noise | Mine site noise emissions – in particular cumulative impacts. | Appendix C and Section 4 |
| R009 | Air Quality | Blasting effects – in particular fume and dust emissions. | Appendix D and Section 4 |
| R010 | Air Quality | Mine site dust emissions – in particular cumulative impacts. | Appendix D and Section 4 |
| R005 | Biodiversity | Permanent Goonbri Creek Alignment – failure to establish riparian habitat. | Appendices E and F and Section 4 |
| R006 | Biodiversity | Biodiversity impacts – in particular cumulative impacts of multiple mines in the Leard State Forest. | Appendices E and F and Section 4 |
| R007 | Biodiversity | Loss of biodiversity associated with clearing of a portion of Goonbri Creek (particularly the large trees). | Appendices E and F and Section 4 |
| R016 | Visual | Visual impacts from lighting and mine landforms. | Appendix J and Section 4 |
| R019 | Aboriginal Heritage | Effects of the Project on Aboriginal heritage. | Appendix K and Section 4 |
| R012 | Rehabilitation | Achieving appropriate integration with Boggabri Coal Mine landform. | Section 5 |

Risk Ranking

Risk ranking was undertaken by the team on loss scenarios based on a subset of the key potential environmental issues (Table ES-1). 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.

Tarrawonga Coal Project – Environmental Risk Assessment

Table ES-2 – Risk Ranking Results

| Environmental Issue Subject Area | Issue | Ranking Basis/Loss Scenario | Risk ¹ |
|----------------------------------|--|---|-------------------|
| Groundwater | Potential impacts on alluvial groundwater. | Considered the potential loss of groundwater from alluvium associated with Goonbri Creek (into the mine and in the long-term into the final void). Mitigated by the low permeability barrier to be included as part of the Permanent Goonbri Creek Alignment (similar barriers have been utilised in other locations). | 24 Low |
| | Potential impacts on alluvial groundwater. | Considered the potential loss of groundwater from alluvium associated with Goonbri Creek (into the mine and in the long-term into the final void). Mitigation <u>excluded</u> the low permeability barrier to be included as part of the Permanent Goonbri Creek Alignment. | 15 Medium |
| | Final void and associated surface and groundwater management. | Considered the depressurisation of groundwater and creation of a local pit lake in the final void. Considered that the pit lake is likely to be saline in the longer term with potential to affect adjoining water resources (i.e. potential for reduction of water quality). Risk evaluated on the assumption that the final void is a groundwater sink and that all controls (e.g. the flood bund and low permeability barrier included as part of the Permanent Goonbri Creek Alignment) work as planned. Noted that spills from the void are unlikely. | 15 Medium |
| | Final void and associated surface and groundwater management. | Considered the depressurisation of groundwater and creation of a local pit lake in the final void. Considered that the pit lake is likely to be saline in the longer term with potential to affect adjoining water resources (i.e. potential for reduction of water quality). Considered the failure of planned controls ² (e.g. failure of the flood bund and/or low permeability barrier included in the Permanent Goonbri Creek Alignment). Mitigation discussion did highlight the number of controls which would have to fail at the same time (e.g. Permanent Goonbri Creek Alignment and associated low permeability barrier) to lead to a significant release of saline water. | 21 Low |
| Surface Water | Long term stability of the Permanent Goonbri Creek Alignment. | Considered the loss of surface water into the open cut/final void (water permanently lost to downstream users). Considered the <u>failure of planned controls</u> (e.g. failure of the Permanent Goonbri Creek Alignment). Mitigation discussion highlighted the need for appropriate design and construction of the Permanent Goonbri Creek Alignment. | 21 Low |
| | Potential for inadequate water supply - for dust suppression and consequent impacts on dust emissions. | Considered constraints on dust suppression water supply during dry periods. Noted to be more of a Project risk (business-related risk because surfactants would be used to supplement water use at extra cost) - although could impact on nearby receivers if dust emissions increase. Mitigated by increased use of surfactants for dust suppression rather than water use only. | 18 Low |
| Surface Water/ Groundwater | Potential impacts on alluvial groundwater (and associated impacts on surface water management system). | Considered effects of increased mine-water make from open cut dewatering on the Project site water management system and the increased potential for discharge off-site. Mitigated by the water management structures on-site and the requirement that any discharge conforms to licence conditions. | 24 Low |
| Noise | Mine site noise emissions – in particular cumulative impacts. | Considered the additional trucks associated with the haulage of run-of-mine (ROM) coal to the Boggabri Coal Mine, together with cumulative impacts associated with Boggabri Coal Mine and Maules Creek Coal Project operations. Mitigated by bunding, strategic placement of noise sources, equipment selection, general maintenance of fleet/equipment, real-time noise monitoring and management, private agreements and property acquisition. | 14 Medium |

Tarrawonga Coal Project – Environmental Risk Assessment

Table ES-2 – Risk Ranking Results (Continued)

| Environmental Issue Subject Area | Issue | Ranking Basis/Loss Scenario | Risk ¹ |
|----------------------------------|---|--|-------------------|
| Air Quality | Blasting effects – in particular fume and dust emissions. | Considered the effects of blasting associated with the Project. Noted that the nearest non-mine owned receiver is approximately 3 kilometres away. Mitigated by restriction of blast times, use of appropriate blasting procedures, property acquisition, monitoring and reporting. | 22 Low |
| | Mine site dust emissions – in particular cumulative impacts. | Considered the additional trucks associated with the haulage of ROM coal to the Boggabri Coal Mine, together with cumulative impacts associated with Boggabri Coal Mine and Maules Creek Coal Project operations. Mitigated by haul road watering, use of surfactants, progressive rehabilitation, real time dust monitoring and management, private agreements and property acquisition. | 14 Medium |
| Biodiversity | Biodiversity impacts – in particular cumulative impacts of multiple mines in the Leard State Forest. | Considered the cumulative loss of biodiversity associated with proposed mining operations in Leard State Forest. Mitigated by the proposed integration of the Tarrawonga Coal Project and the Boggabri Coal Mine final landforms and planned rehabilitation and biodiversity offsets. | 18 Low |
| | Loss of biodiversity associated with clearing of a portion of Goonbri Creek (particularly the large trees). | Considered the loss of the older trees along the existing Goonbri Creek. Mitigated by the creation of the realigned section of Goonbri Creek and the proposed Willeroi offset. | 10 Medium |
| Traffic | Goonbri Road intersections and public road impacts. | Considered the potential for reducing the level of service on the local roads or the intersections. Mitigated by design of the new intersections on Goonbri Road to appropriate standards and proposed cessation of road haulage of ROM coal. Timing constraints applied to ROM coal transport and oversized load movement. | 15 Medium |
| Visual | Visual impacts from lighting and mine landforms. | Considered the effects on the amenity of nearby receivers (i.e. views of night lighting and disturbed surfaces). Mitigated by progressive rehabilitation and appropriate placement of lighting plants. Near field screen plantings at nearby receivers could also be implemented. | 10 Medium |
| Aboriginal Heritage | Effects of the Project on Aboriginal heritage. | Considered the loss of Aboriginal heritage - particularly along Goonbri Creek. Mitigated by Aboriginal heritage surveys, engagement with Aboriginal stakeholders and salvage of Aboriginal objects. | 14 Medium |
| Rehabilitation | Stability of the final landform - maintenance of stable drainage paths. | Considered the gross failure of the rehabilitated areas and associated water management structures. This could lead to potential for restriction on land use on the rehabilitated landforms and sediment release from the site. Mitigated by appropriate rehabilitation planning, implementation and monitoring. | 18 Low |
| Other | Potential impacts on agricultural resources. | Considered the temporary removal of agricultural land. Mitigated by the socio-economic benefits of the mine and post mining rehabilitation (i.e. restoration of agricultural areas). Also noted was the potential for improvement in agricultural production of TCPL-owned lands. | 15 Medium |
| Other | Increased bushfire risk. | Considered the increased fire risk due to increased activity near to the Leard State Forest. Mitigated by fire maintenance activities and first response capability on site. | 21 Low |
| Other | Disposal of waste – tyres, etc. | Considered the potential risks of contamination associated with the disposal of tyres, oils, etc. Mitigated by waste management strategies. This includes segregation, recording and use of appropriate disposal strategies. | 24 Low |
| Other | Spontaneous combustion of coal. (Potential for odourous emissions). | Considered the release of odourous products of combustion in to the surrounding environment. Mitigated by low propensity of self heating of Tarrawonga coal. | 22 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 This loss scenario is as per the scenario above, however assumes that the proposed controls fail. This scenario was considered by the team to have a low probability, hence its overall risk is lower than the scenario above (where all controls work as planned).

Tarrawonga Coal Project – Environmental Risk Assessment

1 INTRODUCTION

This document is an Environmental Risk Assessment (ERA) for the Tarrawonga Coal Project (the Project). The Project provides for the extension and continuation of operations at the existing Tarrawonga Coal Mine.

The Tarrawonga Coal Mine is an open cut mining operation located approximately 15 kilometres (km) north-east of Boggabri and 42 km north-northwest of Gunnedah in New South Wales (NSW) (Figure 1). Mining operations at the Tarrawonga Coal Mine are currently conducted in accordance with Development Consent (DA-88-4-2005), as modified by the NSW Minister for Planning on 15 October 2010 (DA-88-4-2005 MOD 1).

The Tarrawonga Coal Mine is owned and operated by Tarrawonga Coal Pty Ltd (TCPL), which is a joint venture between Whitehaven Coal Mining Pty Ltd (Whitehaven) (70% interest) and Boggabri Coal Pty Limited (BCPL) (a wholly owned subsidiary of Idemitsu Australia Resources Pty Ltd) (30% interest).

1.1 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:

- identify the key potential environmental issues associated with the Project; and
- 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) 31000:2009 *Risk Management – Principles and Guidelines* (Standards Australia, 2009).

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

1.2 CLIENT

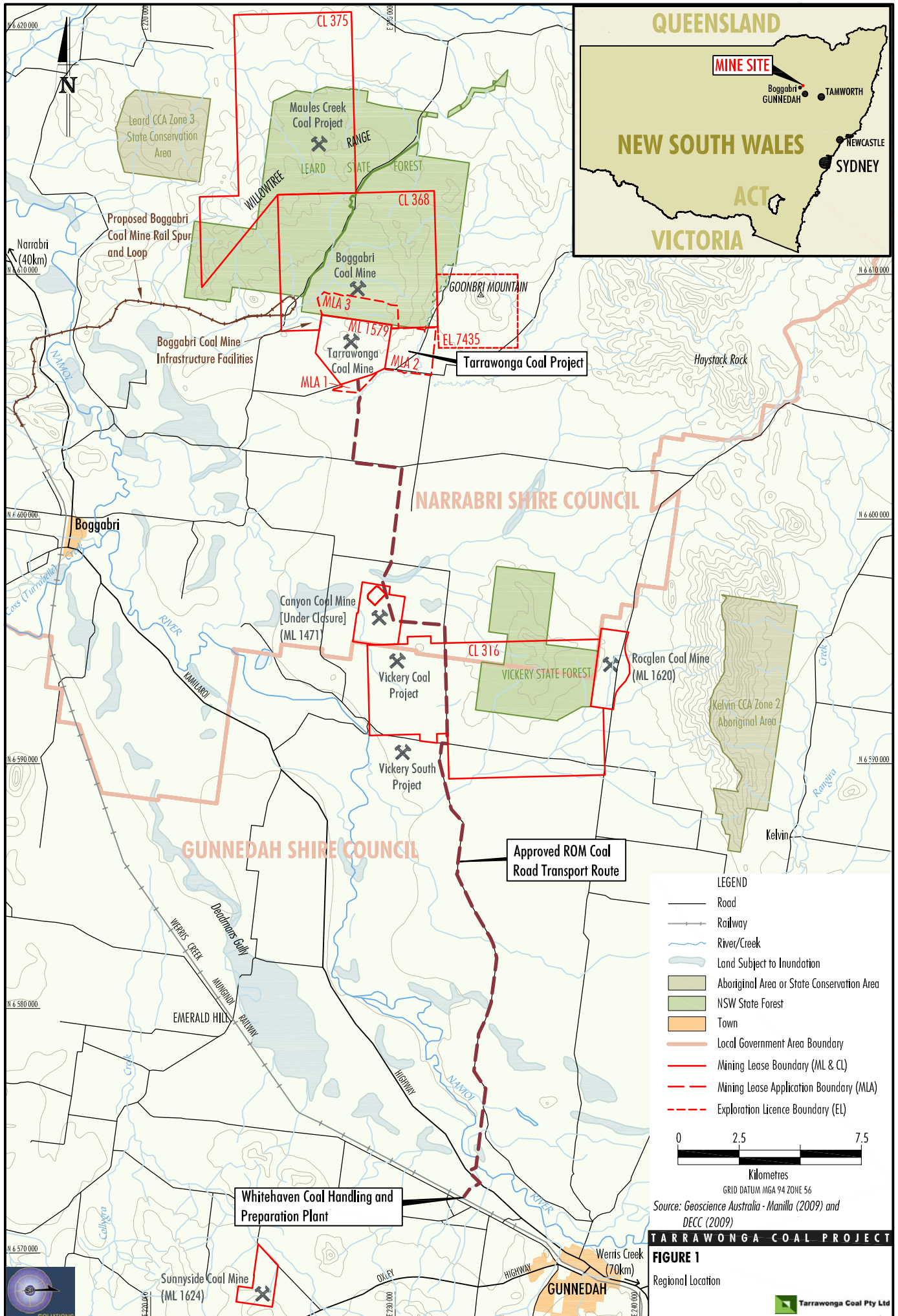
The client for the ERA is TCPL.

1.3 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.*



LEGEND

- Road
- +— Railway
- ~ River/Creek
- Land Subject to Inundation
- Aboriginal Area or State Conservation Area
- NSW State Forest
- Town
- Local Government Area Boundary
- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA)
- Exploration Licence Boundary (EL)



GRID DATUM MGA 94 ZONE 56
 Source: Geoscience Australia - Manila (2009) and DECC (2009)

TARRAWONGA COAL PROJECT

FIGURE 1
 Regional Location

Tarrawonga Coal Project – Environmental Risk 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.

1.4 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 is described in Section 2.2.

1.5 RISK ASSESSMENT PROCESS

The risk assessment process was based on the framework provided on Figure 2 (based on AS/NZS 31000:2009 (Standards Australia, 2009), 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]).

1.6 RESOURCING, SCHEDULE AND ACCOUNTABILITIES

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

1. a 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.

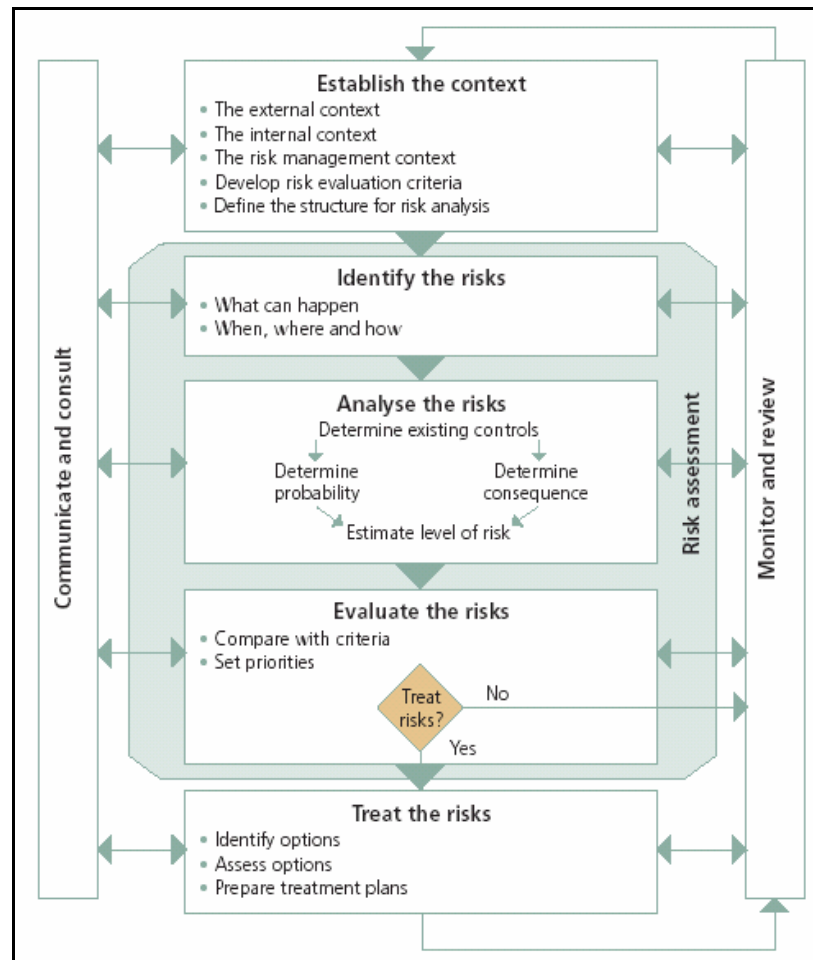
The outcomes of the ERA and associated accountabilities will be integrated into the EA and overall TCPL management systems so that they are effectively reviewed, implemented and monitored.

1.7 METHODOLOGY

1.7.1 Framework

Figure 2 outlines the overall framework utilised for the ERA. This framework is further discussed in Section 1.7.2 - Key Steps with respect to the subject area.

Tarrawonga Coal Project – Environmental Risk Assessment



Source: after AS/NZS 3100:2009 (Standards Australia, 2009).

Figure 2 - Risk Management Process (AS/NZS 3100:2009)

1.7.2 Key Steps

The key steps in the process included:

1. confirming the scope of the ERA;
2. listing the key assumptions on which the ERA is based;
3. reviewing available data on the Project including reports, plans, maps and aerial photos (both prior to and during the workshop);
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 3100:2009 (Standards Australia, 2009) and MDG1010 *Risk Management Handbook for the Mining Industry* (DPI, 1997) standards for review by TCPL personnel and ERA team members;
6. incorporate comments from TCPL and the ERA team; and
7. finalise the report and issue as controlled copy for ongoing use.

Tarrawonga Coal Project – Environmental Risk Assessment

With respect to the overall framework (Figure 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 1.1, the outcomes of the ERA and associated accountabilities will be integrated into the EA and overall TCPL management systems so that they are effectively reviewed, implemented and monitored.

1.7.3 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, is experienced with open cut coal mining and many aspects of environmental monitoring and rehabilitation.

The team was encouraged and “challenged” to identify a wide range of environmental impacts or hazards.

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.

2 ESTABLISH THE CONTEXT

2.1 ORGANISATIONAL CONTEXT

The proponent is TCPL and the Project is an extension to the existing Tarrawonga Coal Mine.

The Tarrawonga Coal Mine commenced operations in 2006 and currently produces up to approximately 2 million tonnes per annum (Mtpa) run-of-mine (ROM) coal.

Conventional open cut mining methods are used at the Tarrawonga Coal Mine. Mine waste rock (including overburden and interburden) generated from the open cut is placed in two adjoining out-of-pit mine waste rock emplacements, or as infill in the mine void, behind the advancing open cut mining operations.

The ROM coal is crushed and screened at the coal crushing and screening facility on-site, before being loaded onto trucks for transport via road to Whitehaven's coal handling and preparation plant (CHPP) (Figure 1). Some ROM coal is also sized at an on-site mobile crusher for collection at the mine site by customers.

At the Whitehaven CHPP, the coal is further crushed, screened and washed (or by-passed) before being loaded onto trains for dispatch and sale to customers as a low ash, thermal and/or semi-soft coking coal products.

2.2 PROJECT SUMMARY

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

- continued development of mining operations in the Maules Creek Formation to facilitate a Project ROM coal production rate of up to 3 Mtpa, including open cut extensions:
 - to the east within Mining Lease (ML) 1579 and Mining Lease Application (MLA) 2; and
 - to the north within Coal Lease (CL) 368 (MLA 3) which adjoins ML 1579;
- ongoing exploration activities;
- construction and use of a services corridor (including haul road link) directly from the Project open cut mining operation to the upgraded Boggabri Coal Mine Infrastructure Facilities¹;
- use of upgraded Boggabri Coal Mine Infrastructure Facilities for the handling and processing of Project coal and the loading of Project product coal to trains for transport on the Boggabri Coal Mine private rail spur to the Werris Creek Mungindi Railway¹;
- construction and use of a new mine facilities area including relocation of existing mine facilities infrastructure and service facilities;
- use of an existing on-site mobile crusher for coal crushing and screening of up to 150,000 tonnes of domestic specification coal per annum for direct collection by customers at the mine site;
- use an existing on-site mobile crusher to produce up to approximately 90,000 cubic metres of gravel materials per annum for direct collection by customers at the mine site;
- progressive backfilling of the mine void behind the advancing open cut mining operation with waste rock and minor quantities of coarse reject material;

¹ Subject to approvals and upgrades being in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities.

Tarrawonga Coal Project – Environmental Risk Assessment

- continued and expanded placement of waste rock in the Northern Emplacement (including integration with the Boggabri Coal Mine emplacement) and Southern Emplacement, as mining develops;
- progressive development of new haul roads and internal roads, as mining develops;
- realignment of sections of Goonbri Road and construction of new intersections;
- construction of an engineered low permeability barrier to the east and south-east of the open cut to reduce the potential for local drainage of alluvial groundwater into the open cut;
- removal of a section of Goonbri Creek within the Project open cut and the establishment of a permanent Goonbri Creek alignment and associated flood bund to the east and south-east of the open cut;
- progressive development of sediment basins and storage dams, pumps, pipelines and other water management equipment and structures;
- continued development of soil stockpiles, laydown areas and gravel/borrow areas;
- ongoing monitoring and rehabilitation; and
- other associated minor infrastructure, plant, equipment and activities.

The Project general arrangement is shown on Figure 3. A description of the Project is provided in Section 2 of the Main Report of the EA.

2.3 RISK MANAGEMENT CONTEXT

This ERA has been conducted in accordance with the EARs for the Project (Section 1.3).

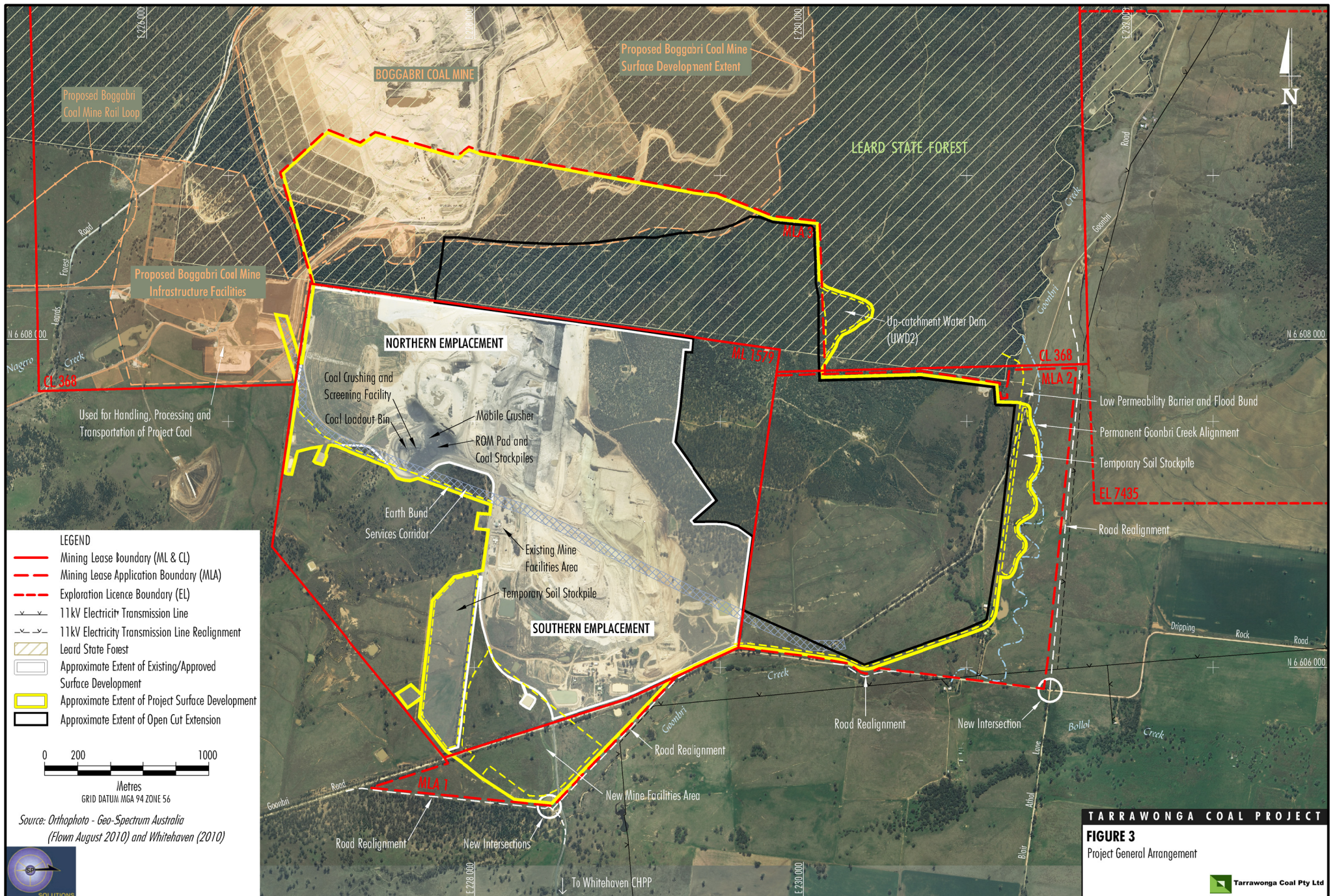
In addition, the ERA was prepared cognisant of the following documents:

- AS/NZ 31000:2009 (Standards Australia, 2009);
- 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 early 2011 (TCPL, 2011). The key potential environmental impacts identified in the assessment relating to the Project were also considered in this ERA.

2.4 RISK CRITERIA

The risk criteria utilised is to reduce the risk to As Low As Reasonably Practicable (ALARP) or lower. Figure 4 schematically shows the three risk management zones *viz.* intolerable, ALARP and tolerable. The middle zone is referred to as the ALARP zone.



Tarrawonga Coal Project – Environmental Risk Assessment

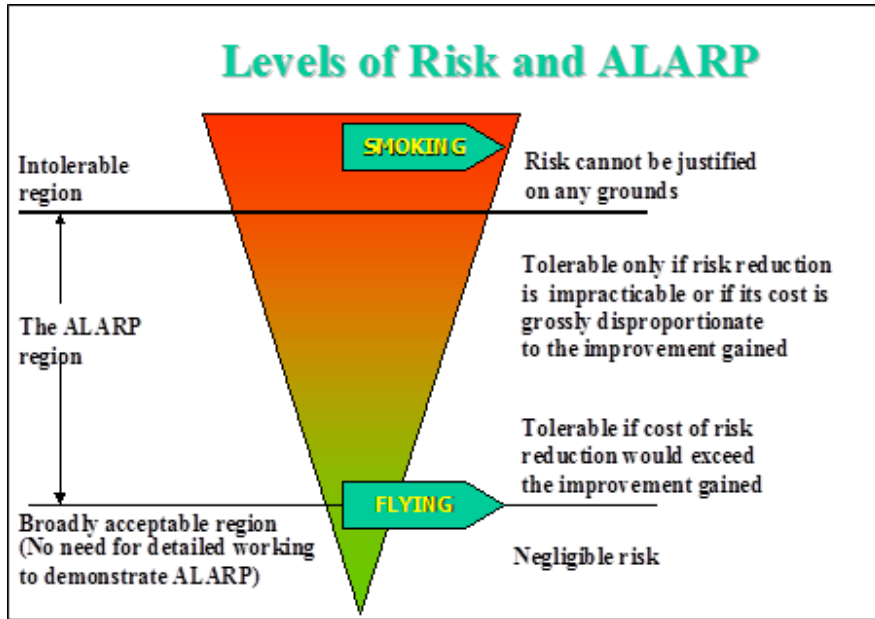


Figure 4 – Risk Criteria "ALARP"

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 from a risk perspective. This is shown graphically in Figure 4. 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 4.

Tarrawonga Coal Project – Environmental Risk Assessment

3 IDENTIFY RISKS

3.1 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.
- Brain/writing-storming – 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 aerial photographs, and the consequent identification of potential environmental issues at each location during each phase of operation.

3.2 ENVIRONMENTAL RISK ASSESSMENT TEAM

The team met for the ERA workshop in Sydney on the 26 July 2011. 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 1 – ERA Team

Table 1 – ERA Team

| Name | Position/Affiliation | Relevant qualifications and experience |
|-----------------|---|---|
| Peter Standish | Facilitator - SP Solutions | PhD, BE (Hon), Dip Bus Mgt, Risk Analysis Trained. Certificate of Competence as a Manager; 33 years experience in underground and open cut mining operations with operating, managerial and contract management experience. Involved in reviewing environmental conditions and applications for 6 years. Conducting Risk Analyses for 12 years. |
| Danny Young | Group Environmental Manager - Whitehaven | BSc Environmental; 5 years mining experience, 15 years total experience. |
| David Sharpe | Surveyor, Mine Designer - Whitehaven | 20 years engineering surveying training and experience. |
| Jill Scealy | Environmental Officer - Whitehaven | BNat Res (Hon); 6 years experience in mining. |
| Noel Merrick | Principal - Heritage Computing | PhD, MSc, Grad Diploma (DP), BSc; Groundwater modeller, hydrogeologist & geophysicist; 40 years experience. |
| David Goldney | Principal Consulting Ecologist – Cenwest Environmental Services | BSc DipEd PhD; 36 years experience in natural resource assessment and management, EA, specialising in fauna assessment, surveys, etc. |
| Colin Bower | Principal - Consultant Botanist - FloraSearch | BSc PhD; 15 years of flora survey, vegetation analysis. |
| Tony Marszalek | Principal Hydrologist - Gilbert & Associates | BE (Civil) MES; BE; 26 years experience in mining related waste and water resources. |
| Dayjil Fincham | Hydrologist - Gilbert & Associates | BE (Environmental); 2 years experience. |
| Richard Kirwood | Principal - Resource Strategies | BSc (Geology); Grad Dip Nat Res; 17 years experience in mining related environmental consulting. |
| Aaron Hagenbach | Senior Environmental Manager - Resource Strategies | BE (Environmental); 12 years experience environmental management and project approvals in resource industry. |
| Clive Berry | Senior Environmental Manager - Resource Strategies | BE (Environmental); 10 years experience environmental management and project approvals in resource industry. |
| Josh Peters | Senior Environmental Manager - Resource Strategies | BSc (Environment) Heritage and biodiversity related issues; 10 years consulting experience. |

3.3 RISK IDENTIFICATION

3.3.1 *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” issue/loss scenario when reading through the material.

Issues identified during the brainstorming session are presented in Attachment B.

3.3.2 *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 3) 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 HAZOP process representing environmental issue subject areas (generally based on the headings in the EARs for the Project) were:

- Surface Water;
- Groundwater;
- Noise;
- Air Quality;
- Biodiversity;
- Visual;
- Socio-Economic;
- Traffic;
- Aboriginal Heritage;
- Rehabilitation/Closure;
- Non-Aboriginal Heritage;
- Agriculture and Forestry; and
- Other.

3.3.3 *Identification of Key Environmental Issue Types*

In general 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 2.

Tarrawonga Coal Project – Environmental Risk Assessment

Table 2 – Key Potential Environmental Issues

| Ref | Environmental Issue Subject Area | Description of Issue / Loss scenario | Votes |
|------|-------------------------------------|--|-------|
| R002 | Groundwater | Potential impacts on alluvial groundwater. | 12 |
| R001 | Surface Water | Long term stability of the Permanent Goonbri Creek Alignment. | 9 |
| R006 | Biodiversity | Biodiversity - cumulative impacts of multiple mines in the Leard State Forest. | 9 |
| R008 | Noise | Mine site noise emissions – in particular cumulative impacts. | 9 |
| R007 | Biodiversity | Blasting effects – in particular fume and dust emissions. | 7 |
| R009 | Air Quality | Mine site dust emissions – in particular cumulative impacts. | 6 |
| R011 | Surface Water | Potential for inadequate water supply – for dust suppression and consequent impacts on dust emissions. | 6 |
| R012 | Rehabilitation | Achieving appropriate integration with Boggabri Coal Mine landform. | 6 |
| R019 | Aboriginal Heritage | Effects of the Project on Aboriginal heritage. | 6 |
| R005 | Biodiversity | Permanent Goonbri Creek Alignment - failure to establish riparian habitat. | 5 |
| R010 | Air Quality | Dust emission effects on surrounding receivers. | 5 |
| R013 | Surface Water/ Groundwater | Final void and associated surface and groundwater management. | 5 |
| R016 | Visual | Visual impacts from lighting and mine landforms. | 5 |

The key potential environmental issues identified in the 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:

- Appendix A Groundwater Assessment;
- Appendix B Surface Water Assessment;
- Appendix C Noise and Blasting Assessment;
- Appendix D Air Quality and Greenhouse Gas Assessment;
- Appendix E Fauna Assessment;
- Appendix F Flora Assessment;
- Appendix G Controlling Provisions of the EPBC Act Relevant to the Tarrawonga Coal Project Environmental Assessment;
- Appendix H Road Transport Assessment;
- Appendix I Agricultural Resources and Productivity Assessment;
- Appendix J Visual Assessment;
- Appendix K Aboriginal Cultural Heritage Assessment;
- Appendix L Non-Aboriginal Heritage Assessment;
- Appendix M Socio-Economic Assessment;
- Appendix N Geochemistry Assessment;
- Appendix P Preliminary Hazard Analysis;
- Appendix Q Land Contamination Assessment; and
- Appendix R Concept Design for Low Permeability Barrier and Permanent Goonbri Creek Alignment.

Tarrawonga Coal Project – Environmental Risk Assessment

3.3.4 *Referred Issue*

Where issues raised during the ERA workshop brainstorming were: outside the scope of the ERA; outside of the Project scope; and/or beyond the control of TCPL, and therefore not considered to be key potential environmental issues, these “referred issues” were considered to warrant consideration in the development of the EA.

Community concerns in relation to potential impacts on the Leard State Forest were noted as a referred issue. The environmental impacts related to this issue were assessed in this ERA, however it was noted that the perception of this issue in some aspects of the community may differ from the team. Community engagement issues are addressed in the Project stakeholder engagement strategy. The outcomes of stakeholder engagement undertaken for the Project are outlined in Section 3 of the Main Report of the EA.

4 ANALYSE RISKS

4.1 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 3 to 5 present the ERA matrix tools that were utilised for ranking risks.

Table 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 4 – Qualitative Measures of Maximum Reasonable Consequence

| 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. |

Note: 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.

Tarrawonga Coal Project – Environmental Risk Assessment

Table 5 – 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 |

4.2 RISK RANKING

Risk ranking was undertaken by the team on loss scenarios based on the key potential environmental issues (provided in Table 6).

Table 6 – Risk Ranking Results

| Environmental Issue Subject Area | Issue | Ranking Basis/Loss Scenario | Consequence | Probability | Risk ¹ |
|----------------------------------|---|---|-------------|-------------|-------------------|
| Groundwater | Potential impacts on alluvial groundwater. | Considered the potential loss of groundwater from alluvium associated with Goonbri Creek (into the mine and in the long-term into the final void). Mitigated by the low permeability barrier to be included as part of the Permanent Goonbri Creek Alignment (similar barriers have been utilised in other locations). | 5 | D | 24 Low |
| | Potential impacts on alluvial groundwater. | Considered the potential loss of groundwater from alluvium associated with Goonbri Creek (into the mine and in the long-term into the final void). Mitigation <u>excluded</u> the low permeability barrier to be included as part of the Permanent Goonbri Creek Alignment. | 5 | A | 15 Medium |
| | Final void and associated surface and groundwater management. | Considered the depressurisation of groundwater and creation of a local pit lake in the final void. Considered that the pit lake is likely to be saline in the longer term with potential to affect adjoining water resources (i.e. potential for reduction of water quality). Risk evaluated on the assumption that the final void is a groundwater sink and that all controls (e.g. the flood bund and low permeability barrier included as part of the Permanent Goonbri Creek Alignment) work as planned. Noted that spills from the void are unlikely. | 5 | A | 15 Medium |

Tarrawonga Coal Project – Environmental Risk Assessment

Table 6 – Risk Ranking Results (Continued)

| Environmental Issue Subject Area | Issue | Ranking Basis/Loss Scenario | Consequence | Probability | Risk ¹ |
|----------------------------------|--|---|-------------|-------------|----------------------|
| Groundwater (Continued) | Final void and associated surface and groundwater management. | <p>Considered the depressurisation of groundwater and creation of a local pit lake in the final void. Considered that the pit lake is likely to be saline in the longer term with potential to affect adjoining water resources (i.e. potential for reduction of water quality).</p> <p>Considered the failure of planned controls² (e.g. failure of the flood bund and/or low permeability barrier included in the Permanent Goonbri Creek Alignment).</p> <p>Mitigation discussion did highlight the number of controls which would have to fail at the same time (e.g. Permanent Goonbri Creek Alignment and associated low permeability barrier) to lead to a significant release of saline water.</p> | 4 | D | 21 Low |
| Surface Water | Long term stability of the Permanent Goonbri Creek Alignment. | <p>Considered the loss of surface water into the open cut/final void (water permanently lost to downstream users). Considered the <u>failure of planned controls</u> (e.g. failure of the Permanent Goonbri Creek Alignment).</p> <p>Mitigation discussion highlighted the need for appropriate design and construction of the Permanent Goonbri Creek Alignment.</p> | 4 | D | 21 Low |
| | Potential for inadequate water supply - for dust suppression and consequent impacts on dust emissions. | <p>Considered constraints on dust suppression water supply during dry periods. Noted to be more of a Project risk (business-related risk because surfactants would be used to supplement water use at extra cost) - although could impact on nearby receivers if dust emissions increase.</p> <p>Mitigated by increased use of surfactants for dust suppression rather than water use only.</p> | 4 | C | 18 Low |
| Surface Water/ Groundwater | Potential impacts on alluvial groundwater (and associated impacts on surface water management system). | <p>Considered effects of increased mine-water make from open cut dewatering on the Project site water management system and the increased potential for discharge off-site.</p> <p>Mitigated by the water management structures on-site and the requirement that any discharge conforms to licence conditions.</p> | 5 | D | 24 Low |
| Noise | Mine site noise emissions – in particular cumulative impacts. | <p>Considered the additional trucks associated with the haulage of ROM coal to the Boggabri Coal Mine, together with cumulative impacts associated with Boggabri Coal Mine and Maules Creek Coal Project operations.</p> <p>Mitigated by bunding, strategic placement of noise sources, equipment selection, general maintenance of fleet/equipment, real-time noise monitoring and management, private agreements and property acquisition.</p> | 4 | B | 14 Medium |

Tarrawonga Coal Project – Environmental Risk Assessment

Table 6 – Risk Ranking Results (Continued)

| Environmental Issue Subject Area | Issue | Ranking Basis/Loss Scenario | Consequence | Probability | Risk ¹ |
|----------------------------------|---|--|-------------|-------------|-------------------|
| Air Quality | Blasting effects – in particular fume and dust emissions. | Considered the effects of blasting associated with the Project. Noted that the nearest non-mine owned receiver is approximately 3 kilometres away. Mitigated by restriction of blast times, use of appropriate blasting procedures, property acquisition, monitoring and reporting. | 5 | C | 22 Low |
| | Mine site dust emissions – in particular cumulative impacts. | Considered the additional trucks associated with the haulage of ROM coal to the Boggabri Coal Mine, together with cumulative impacts associated with Boggabri Coal Mine and Maules Creek Coal Project operations. Mitigated by haul road watering, progressive rehabilitation, real time dust monitoring and management, private agreements and property acquisition. | 4 | B | 14 Medium |
| Biodiversity | Biodiversity impacts – in particular cumulative impacts of multiple mines in the Leard State Forest. | Considered the cumulative loss of biodiversity associated with proposed mining operations in Leard State Forest. Mitigated by the proposed integration of the Tarrawonga Coal Project and the Boggabri Coal Mine final landforms and planned rehabilitation and biodiversity offsets. | 4 | C | 18 Low |
| | Loss of biodiversity associated with clearing of a portion of Goonbri Creek (particularly the large trees). | Considered the loss of the older trees along the existing Goonbri Creek. Mitigated by the creation of the realigned section of Goonbri Creek and the proposed Willeroi offset. | 4 | A | 10 Medium |
| Traffic | Goonbri Road intersections and public road impacts. | Considered the potential for reducing the level of service on the local roads or the intersections. Mitigated by design of the new intersections on Goonbri Road to accepted standards and proposed cessation of road haulage of ROM coal. Timing constraints applied to ROM coal transport and oversized load movement. | 5 | A | 15 Medium |
| Visual | Visual impacts from lighting and mine landforms. | Considered the effects on the amenity of nearby receivers (i.e. views of night lighting and disturbed surfaces). Mitigated by progressive rehabilitation and appropriate placement of lighting plants. Near field screen plantings at nearby receivers could be implemented. | 4 | A | 10 Medium |
| Aboriginal Heritage | Effects of the Project on Aboriginal heritage. | Considered the loss of Aboriginal heritage - particularly along Goonbri Creek. Mitigated by Aboriginal heritage surveys, engagement with Aboriginal stakeholders and salvage of Aboriginal objects. | 4 | B | 14 Medium |
| Rehabilitation | Stability of the final landform - maintenance of stable drainage paths. | Considered the gross failure of the rehabilitated areas and associated water management structures. This could lead to potential to restriction on land use on the rehabilitated landforms and sediment release from the site. Mitigated by appropriate rehabilitation planning, implementation and monitoring. | 4 | C | 18 Low |

Tarrawonga Coal Project – Environmental Risk Assessment

Table 6 – Risk Ranking Results (Continued)

| Environmental Issue Subject Area Issue | Issue | Ranking Basis/Loss Scenario | Consequence | Probability | Risk ¹ |
|--|---|---|-------------|-------------|----------------------|
| Other | Potential impacts on agricultural resources. | Considered the temporary removal of agricultural land. Mitigated by the socio-economic benefits of the mine and post mining rehabilitation (i.e. restoration of agricultural areas). Potential for improvement in agricultural production of TCPL-owned lands. | 5 | A | 15 Medium |
| Other | Increased bushfire risk. | Considered the increased fire risk due to increased activity near to the Leard State Forest. Mitigated by fire maintenance activities and first response capability on site. | 4 | D | 21 Low |
| Other | Disposal of waste – tyres, etc. | Considered the potential risks of contamination associated with the disposal of tyres, oils, etc. Mitigated by waste management strategies. This includes segregation, recording and use of appropriate disposal strategies. | 5 | D | 24 Low |
| Other | Spontaneous combustion of coal. (Potential for odourous emissions). | Considered the release of odourous products of combustion in to the surrounding environment. Mitigated by low propensity of self heating of Tarrawonga coal. | 5 | C | 22 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 This loss scenario is as per the scenario above, however assumes that the proposed controls fail. This scenario was considered by the team to have a low probability, hence its overall risk is lower than the scenario above (where all controls work as planned).

5 MONITOR AND REVIEW

5.1 NOMINATED CO-ORDINATOR

The nominated client review facilitator is Danny Young, Group Environmental Manager, Whitehaven Coal.

It is understood the nominee will co-ordinate the inclusion of the key potential environmental issues into the various studies undertaken as part of the EA and the overall TCPL management systems.

5.2 COMMUNICATION AND CONSULTATION

Consultation, involvement of personnel (TCPL 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 consideration of the report's outcomes in the overall TCPL management systems.

5.3 CONCLUDING REMARKS

The risk assessment process conducted by the team was aligned with AS/NZS 31000:2009 (Standards Australia, 2009) 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 7.

Table 7 – Key Potential Environmental Issues to be Further Assessed in the EA

| Ref | Environmental Issue Subject Area | Description of Issue | EA Appendix / Section |
|------|----------------------------------|---|----------------------------------|
| R002 | Groundwater | Potential impacts on alluvial groundwater. | Appendix A and Section 4 |
| R013 | Groundwater/Surface Water | Final void and associated surface and ground water management. | Appendices A and B and Section 4 |
| R001 | Surface Water | Long term stability of the Permanent Goonbri Creek Alignment. | Appendix B and Section 4 |
| R011 | Surface Water | Potential for inadequate water supply – for dust suppression and consequent impacts on dust emissions. | Appendix B and Section 4 |
| R008 | Noise | Mine site noise emissions – in particular cumulative impacts. | Appendix C and Section 4 |
| R009 | Air Quality | Blasting effects – in particular fume and dust emissions. | Appendix D and Section 4 |
| R010 | Air Quality | Mine site dust emissions – in particular cumulative impacts. | Appendix D and Section 4 |
| R005 | Biodiversity | Permanent Goonbri Creek Alignment - failure to establish riparian habitat. | Appendices E and F and Section 4 |
| R006 | Biodiversity | Biodiversity - cumulative impacts of multiple mines in the Leard State Forest. | Appendices E and F and Section 4 |
| R007 | Biodiversity | Loss of biodiversity associated with clearing of a portion of Goonbri Creek (particularly the large trees). | Appendices E and F and Section 4 |
| R016 | Visual | Visual impacts from lighting and mine landforms. | Appendix J and Section 4 |
| R019 | Aboriginal Heritage | Effects of the project on Aboriginal heritage. | Appendix K and Section 4 |
| R012 | Rehabilitation | Achieving appropriate integration with Boggabri Coal Mine landform. | Section 5 |

Tarrawonga Coal Project – Environmental Risk Assessment

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 TCPL and Resource Strategies who prepared source material for the team session.



Peter Standish, October 2011

Tarrawonga Coal Project – Environmental Risk Assessment

6 REFERENCES

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

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

Standards Australia (2009) *AS/NZS 31000:2009 Risk Management – Principles and Guidelines*.

Tarrawonga Coal Pty Ltd (2011) *Tarrawonga Coal Project - Project Description and Preliminary Assessment*.

Tarrawonga Coal Project – Environmental Risk Assessment

ATTACHMENT A – 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/NSZ 31000:2009 | Australian Standard/New Zealand Standard on Risk Management (see references in Section 6). |
| Cause | A source of harm. |
| 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. |
| EARs | [Director-General's] Environmental Assessment Requirements. |
| ERA | Environmental Risk Assessment. |
| MDG1010 | Department of Primary Industries guideline on risk management (see references in Section 6). |
| 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. |
| Residual Risk | The risk associated with an unwanted event after consideration of the existing control measures is taken into account. |
| 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 | <i>Threatened Species Conservation Act, 1995.</i> |

Tarrawonga Coal Project – Environmental Risk Assessment

ATTACHMENT B - ISSUE IDENTIFICATION RESULTS

The output from the team’s “brainstorming” is presented below. This list has been sorted according to the Incident Type – which were drawn, in part, from the EARs received for the Project.

| Ref | Type of Issue | Description of Issue |
|------|---------------------|--|
| R001 | Surface Water | Long term stability of the Permanent Goonbri Creek Alignment. |
| R002 | Groundwater | Potential impacts on alluvial groundwater. |
| R005 | Biodiversity | Permanent Goonbri Creek Alignment - failure to establish riparian habitat. |
| R006 | Biodiversity | Biodiversity - cumulative impacts of multiple mines in the Leard State Forest. |
| R007 | Biodiversity | Loss of biodiversity associated with clearing of a portion of Goonbri Creek (particularly the large trees). |
| R008 | Noise | Mine site noise emissions – in particular cumulative impacts. |
| R009 | Air Quality | Blasting effects – in particular fume and dust emissions. |
| R010 | Air Quality | Mine site dust emissions – in particular cumulative impacts. |
| R011 | Surface Water | Potential for inadequate water supply – for dust suppression and consequent impacts on dust emissions. |
| R012 | Rehabilitation | Achieving appropriate integration with Boggabri Coal Mine landform. |
| R013 | Surface Water | Final void and associated surface and ground water management. |
| R013 | Ground Water | Final void and associated surface and ground water management. |
| R015 | Rehabilitation | Stability of the final land form - maintenance of stable drainage paths. |
| R016 | Visual | Visual impacts from lighting and mine landforms. |
| R017 | Socio-Economic | Inability to explain the values of the Project to stakeholders. |
| R018 | Traffic | Goonbri Road intersections and public road impacts |
| R019 | Aboriginal Heritage | Effects of the Project on Aboriginal heritage. |
| R020 | Other | Increased bushfire risk. |
| R021 | Other | Disposal of waste – tyres, etc. |
| R022 | Other | Spontaneous combustion of coal (potential for odorous emissions |
| R023 | Socio-Economic | Perceived social impacts in nearby towns (e.g. loss of skilled workforce to the mine). |
| R024 | Socio-Economic | Potential impacts on agricultural resources. |
| R026 | Noise | Noise, air quality and blasting effects on amenity. |
| R027 | Air Quality | Dust - ongoing water supply for dust suppression. |
| R028 | Noise | Noise - real time monitoring and Tarrawonga Coal Pty Ltd (TCPL) ability to work within the relevant criteria. |
| R029 | Noise | Potential effects of noise emissions on surrounding landowners. |
| R030 | Air Quality | Potential effects of dust emissions on surrounding landowners. |
| R031 | Noise | Potential for vibration effects on nearby buildings. |
| R032 | Noise | Potential for ground vibration and air blast effects on amenity of nearby receivers. |
| R033 | Other | Potential fly rock impacts. |
| R034 | Noise | Potential for increases in noise levels on the Werris Creek-Moree Railway from additional trains associated with the Project. |
| R035 | Noise | Potential for increases in noise along the Boggabri rail spur due to trains associated with the Project. |
| R036 | Noise | Potential for increases in industrial noise due to use of Boggabri Coal Mine's CHPP and train loading facilities. |
| R037 | Noise | Potential for increases in road traffic noise, particularly during the construction phase. |
| R038 | Noise | Cumulative mine site noise emissions and potential effects on surrounding landholders. |
| R039 | Other | Potential increase in greenhouse gas emissions. |
| R040 | Air Quality | Dust emissions from trains associated with the Project. |
| R041 | Air Quality | Potential for odorous emissions associated with coal self-heating (spontaneous combustion). |
| R042 | Air Quality | Cumulative dust impacts, particularly to the south-east as a consequence of cumulative development of Tarrawonga Coal Mine and Boggabri Coal Mine. |

Tarrawonga Coal Project – Environmental Risk Assessment

| Ref | Type of Issue | Description of Issue |
|------|------------------------|---|
| R043 | Air Quality | Blasting - fume and dust emissions, impacts on neighbours, evacuation of Boggabri Coal Mine pit if blasting fume enters their site. |
| R045 | Rehabilitation/Closure | Rehabilitation/closure of the site. |
| R046 | Rehabilitation/Closure | Waste rock management - in particular areas of waste rock with elevated elements. |
| R047 | Rehabilitation/Closure | Management of CHPP rejects backfilled in-pit. |
| R048 | Rehabilitation/Closure | Development of long term rehabilitation and mine closure concepts that balance land use and conservation objectives. |
| R049 | Rehabilitation/Closure | Long-term success/performance of the Permanent Goonbri Creek Alignment. |
| R050 | Rehabilitation/Closure | Success/performance of post-mine rehabilitation. |
| R051 | Rehabilitation/Closure | Mine closure and long-term land use, including final void management. |
| R052 | Rehabilitation/Closure | Rehabilitation failure due to deficient soil nutrients or seasonal impacts. |
| R053 | Rehabilitation/Closure | Long-term geotechnical stability of final landforms. |
| R054 | Rehabilitation/Closure | Rehabilitation failure due to drought. |
| R055 | Rehabilitation/Closure | Increase in weed species and feral vertebrate fauna. |
| R056 | Rehabilitation/Closure | Achieving appropriate integration of final landform with the Boggabri Coal Mine so that it blends with the surrounding natural topography. |
| R057 | Rehabilitation/Closure | Final void and associated water management to minimise adverse surface water and groundwater quality impacts. |
| R058 | Rehabilitation/Closure | Stability of final landform (erosion) and maintenance of stable drainage paths. |
| R059 | Rehabilitation/Closure | Seepage from final landform to final void increasing inflow to final void and reducing flow to receiving waters. |
| R060 | Rehabilitation/Closure | Final void risk of spill. |
| R061 | Rehabilitation/Closure | Failure of outer surfaces of rehabilitated mine landforms due to dispersive waste materials. |
| R062 | Rehabilitation/Closure | Generation of acid mine drainage from overburden/interburden identified as potentially acid forming (PAF). |
| R065 | Biodiversity | Loss of vegetation and fauna habitat and potential impacts on listed threatened species, in particular, clearing of native vegetation within Leard State Forest and associated loss of biodiversity. |
| R066 | Biodiversity | Cumulative impacts of multiple present and future mine developments on regional biodiversity loss in the Gunnedah Basin. |
| R067 | Biodiversity | Potential cumulative loss of all native vegetation on Permian landscapes in the Gunnedah Basin. |
| R068 | Biodiversity | Loss of habitat associated with Goonbri Creek, including very large old growth trees. |
| R069 | Biodiversity | Commonwealth <i>Environmental Protection and Biodiversity Conservation Act, 1999</i> threatened vertebrate species or those not located but with suitable habitat present in the Project area or the immediate surrounds. |
| R070 | Biodiversity | New South Wales (NSW) <i>Threatened Species Conservation Act, 1995</i> threatened vertebrate species present or those not located but with suitable habitat present in the Project area or the immediate surrounds. |
| R071 | Biodiversity | Loss of habitat within Project area and the immediate surrounds. |
| R072 | Biodiversity | Retention of habitat components from cleared area for future use to upgrade or to complement on-site restoration programs (future or existing). |
| R073 | Biodiversity | Loss of landscape connectivity (which enables movement of fauna across the landscape). |
| R074 | Biodiversity | Cumulative impacts from a number of mining projects on biodiversity values, particularly within Leard State Forest that have as yet not been appropriately described or quantified. |
| R075 | Biodiversity | Loss of sections of Goonbri Creek, albeit quite degraded in downstream sections but nevertheless with some important biodiversity values. |
| R076 | Biodiversity | Loss of agricultural land albeit degraded with little understanding as to how to optimise production and nature conservation outcomes in remaining TCPL-owned lands as alternative and viable offset propositions. |
| R077 | Biodiversity | Requirement for better geomorphological and current river-style understandings to be incorporated into Permanent Goonbri Creek Alignment. |
| R078 | Biodiversity | Exceedance of gross ecosystem and geomorphic thresholds (in relation to water, carbon, nutrient cycles and energy interception within the landscape). |

Tarrawonga Coal Project – Environmental Risk Assessment

| Ref | Type of Issue | Description of Issue |
|------|------------------------|---|
| R079 | Biodiversity | Inability to explain to stakeholders a long term vision of what values are being lost, what benefits are being gained from the Project and the long term biodiversity-landform-rehabilitation-offset outcomes. |
| R080 | Biodiversity | Impacts on threatened fauna, and ensuring offsets cater for threatened species (i.e. squirrel glider). |
| R081 | Biodiversity | Impacts on Leard State Forest from the northern extension area and ensuring adequate offsets are provided to counter expected submissions related to Leard State Forest and its value in the Liverpool Plains/Gunnedah Basin. |
| R082 | Biodiversity | Biodiversity offset - demonstrating proposed offset is fit for purpose and in sufficient quantity. |
| R085 | Surface Water | Redirection of surface flow due to creek diversions. |
| R086 | Groundwater | Potential impacts on Upper Namoi alluvial groundwater users. |
| R087 | Surface Water | Potential cumulative impacts on downstream surface water users. |
| R088 | Surface Water | Potential changes to adjacent floodplain regime (i.e. during flood events). |
| R089 | Groundwater | Potential impacts on aquifers and groundwater users - especially the risk of continual drainage of groundwater from Goonbri Creek alluvium to the mine. |
| R090 | Groundwater | Potential impacts on aquifers and groundwater users - and the consequent effects of reduced groundwater flow to down gradient alluvium. |
| R091 | Surface Water | Mine water containment. |
| R092 | Surface Water | Potential for mine water discharge in the event of extreme weather events. |
| R093 | Surface Water | Potential impact of loss of water downstream of the Project as a consequence of the Permanent Goonbri Creek Alignment. |
| R094 | Surface Water | Risk of excess water (due to increased surface area of disturbance) and potential for increased need to discharge via licensed discharge points. |
| R095 | Surface Water | Seepage/runoff from mine disturbance areas bypassing the water management system and migrating off-site with possible consequent contamination downstream. |
| R096 | Surface Water | Seepage from the waste emplacement and either contributing to mine water balance or causing further poor quality seepage off site. |
| R097 | Surface Water | Inability to comply with the Environmental Protection Licence water quality limits for sediment dam discharge. |
| R098 | Surface Water | Adverse impacts on downstream water quality parameters that are not in the Environmental Protection Licence that could have consequent effects on ecology or beneficial use. |
| R099 | Surface Water | Insufficient site water flow/use monitoring data to enable site water balance model calibration which could cast doubt over predictions of water excess or shortfall. |
| R100 | Surface Water | Reduction in surface water flows downstream of mine due to catchment excision during and post mining, including cumulative impacts with the Boggabri Coal Mine. |
| R101 | Surface Water | Stability of Permanent Goonbri Creek Alignment both in short term and long-term (post mining). |
| R102 | Surface Water | Flooding risk of proposed infrastructure area from flood flows in Goonbri Creek. |
| R103 | Surface Water | Potential for generation of erosion during construction and stripping activities. |
| R104 | Surface Water | Sediment - risk along the Permanent Goonbri Creek Alignment and soil stockpiles. |
| R105 | Groundwater | Potential for inundation of pit due to alluvial inflow. |
| R106 | Rehabilitation/Closure | Segregation of alluvium top/sub soils and areas to stockpile them. |
| R107 | Surface Water | Site access for personnel, fuel and coal transport - local flooding (Gins Gully) and major floods (Namoi River). |
| R108 | Groundwater | Intersection of the alluvium at eastern end of pit and potential for failure of proposed low permeability barrier and consequential impacts of water flows in pit and loss of water downstream. |
| R109 | Surface Water | Availability of adequate water licences to account for predicted water allocation requirements, particularly in the latter stages of the Project. |
| R110 | Surface Water | Potential for inadequate water supply on site for operational purposes - particularly if additional water application is necessary to reduce dust impacts. |
| R111 | Surface Water | Shortfall in water supply for dust suppression in dry times and consequent impacts on dust emissions. |
| R113 | Visual | Visual impact of waste rock emplacement and mining operations. |
| R114 | Traffic | Increased traffic on the public road network. |

Tarrawonga Coal Project – Environmental Risk Assessment

| Ref | Type of Issue | Description of Issue |
|------|--------------------------|--|
| R115 | Traffic | Potential impacts on public road network (i.e. Goonbri Road). |
| R116 | Socio-economics | Developing a community contribution plan that is fair and reasonable and achieves agreement with Narrabri Shire Council. |
| R117 | Socio-economics | Perception of surrounding properties being devalued as a consequence of ongoing mining operations. |
| R118 | Socio-economics | Perceived social impacts in nearby towns due to cumulative effects of mining. |
| R119 | Visual | Impacts from night-lighting. |
| R120 | Traffic | Potential for effects on the local road network due to additional traffic. |
| R121 | Traffic | Positive impacts from cessation of road haulage of run-of-mine (ROM) coal. |
| R122 | Socio-economics | Socio-economic benefits to the region and State. |
| R123 | Visual | Potential for increased visual impacts, particularly for residential receivers to the south. |
| R124 | Visual | Visual impacts from lighting from the Project site, particularly from elevated waste rock emplacement heights. |
| R126 | Heritage | Effects of the Project on Aboriginal heritage. |
| R127 | Heritage | Effects of the Project on non-Aboriginal heritage. |
| R128 | Agriculture and Forestry | Agriculture and Forestry. |
| R129 | Agriculture and Forestry | Potential impacts on agricultural resources. |
| R130 | Agriculture and Forestry | Potential impacts on forestry resources (i.e. Leard State Forest). |
| R131 | Agriculture and Forestry | Potential for loss of land capability. |
| R133 | Other | Increased bushfire risk. |
| R134 | Other | Combined cumulative risk from mining projects in the area. |

Tarrawonga Coal Project – Environmental Risk Assessment

About Your Report

Your report has been developed on the basis of your unique and specific requirements as understood by **SP Solutions** and only applies to the subject matter investigated. Your report should not be used or at a minimum it **MUST** be reviewed if there are any changes to the project and Key Assumptions. **SP Solutions** should be consulted to assess how factors that have changed subsequent to the date of the report affect the report's recommendations. **SP Solutions** cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

To avoid misuse of the information contained in the report it is recommended you confer with **SP Solutions** before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Costly problems can occur when other design professionals develop their plans based on misinterpretations of the report. To help avoid misinterpretations of the report, retain **SP Solutions** to work with other professionals who are affected by the report. Have **SP Solutions** explain the report implications to professional affected by them and then review plans and specifications produced to see how they have incorporated the report findings.

The report as a whole presents the findings of the site specific assessment and the report should not be copied in part or altered in any way.

SP Solutions is familiar with a variety of techniques and approaches that are used to identify and reduce a broad range of risks over the life of projects and operations. It is common that not all approaches will be necessarily dealt with in your report due to concepts proposed, recommendations by the team at the time or the scope determined by you. Speak with **SP Solutions** to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Reporting relies on:

- o interpretation of factual information based on judgement and opinion;
- o valid and factual inputs supplied by all third parties;
- o key assumptions outside the influence of **SP Solutions**; and
- o the result of any team based approach to review the topic and is therefore not the result of any one individual or organisation (including **SP Solutions**).

As such, any uncertainty may result in claims being lodged against consultants which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from **SP Solutions** to other parties but are included to identify where **SP Solutions'** responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from **SP Solutions** closely and do not hesitate to ask any questions that you may have.

No warranty of representation, either expressed or implied with respect to this document, its quality, accuracy, merchantability or fitness for a particular purpose is made. As a result, this document is provided "as is" and the reader assumes the entire risk as to its quality and accuracy.

In no event will **SP Solutions** be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or inaccuracy in the document, even if advised of the possibility of such damages.

The warranty and remedies set forth above are exclusive and in lieu of all others, oral or written or implied. No employee, associate, contractor or other representative of **SP Solutions** is authorised to make any modification, extension or addition to this warranty.

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission of **SP Solutions**.