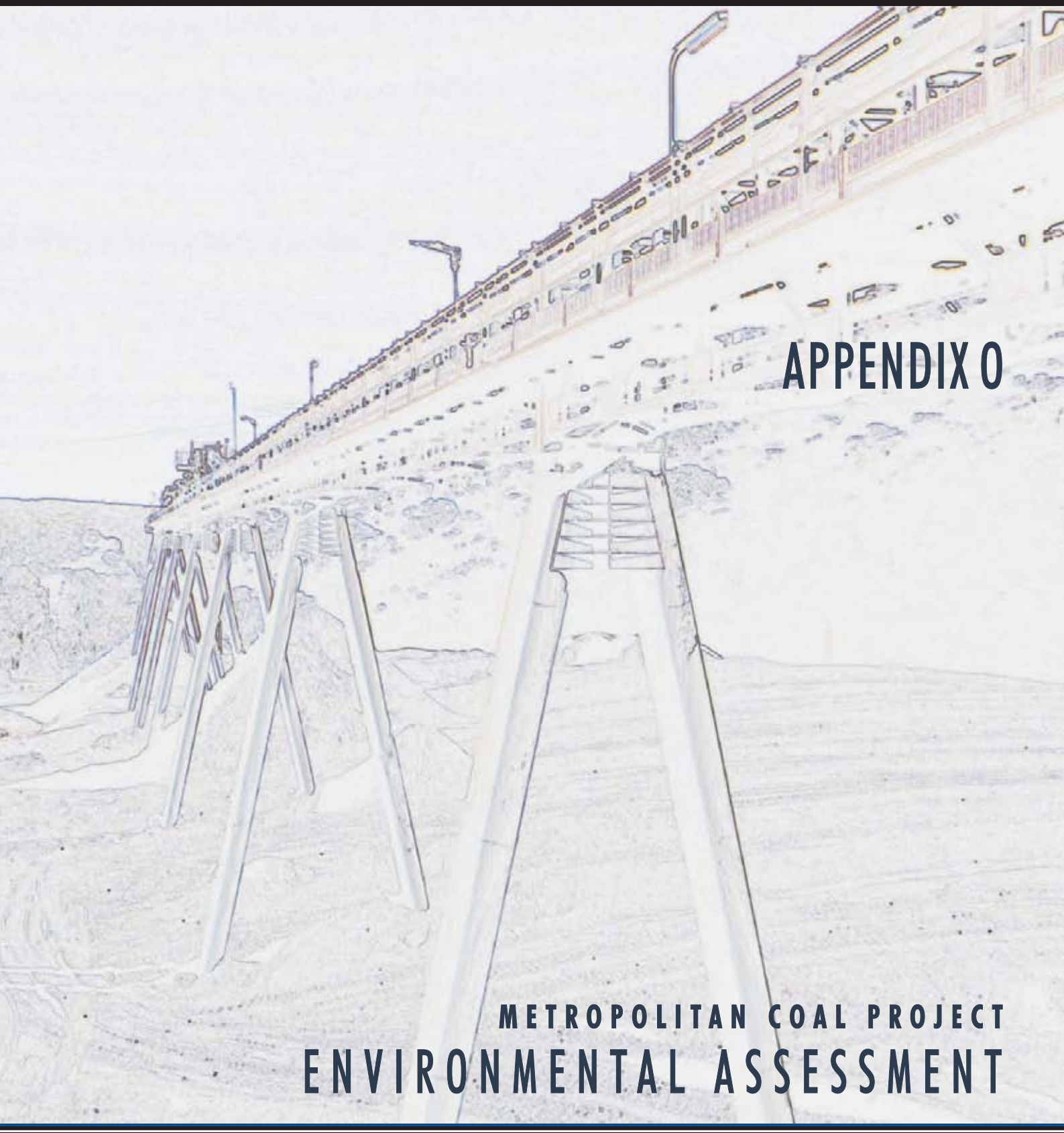


APPENDIX O

METROPOLITAN COAL PROJECT
ENVIRONMENTAL ASSESSMENT

Helensburgh Coal Pty Ltd Metropolitan Coal Project

Environmental Risk Analysis

***Prepared for*:**	**Helensburgh Coal Pty Ltd**		
Prepared by:	***SP Solutions Director***		
Date of Team Review:	**9th May 2008**		
Job Number:	**J2070**		
Doc No:	**D2203**	***Version: 2***	***Date: 07/08/2008***

SP SOLUTIONS
INTEGRATED HSE, QUALITY AND BUSINESS RISK MANAGEMENT

"Manage Complexity. Improve Outcomes. Feel in Control."©

Safe Production Solutions Pty. Ltd.
ABN : 16 097 038 296
155 Birch Avenue
Dubbo NSW 2830
NSW AUSTRALIA 2830

Tel : +61 2 6885 6611
Fax : +61 2 6885 6011
Web Site : www.spsolutions.com.au
E-mail: sps@spsolutions.com.au

Helensburgh Coal Pty Ltd
Metropolitan Coal Project
Environmental Risk Analysis

DOCUMENT CONTROL AND DISTRIBUTION

Document No.	D2580
Title	Helensburgh Coal Pty Ltd (HCPL), Metropolitan Coal Project Environmental Risk Analysis
General Description	Report on the team based risk analysis
Key Supporting Documentation	AS 4360:2004 Risk Management, MDG1010 Risk Management Handbook for the Mining Industry, MDG1014 Guide to Reviewing a Risk Assessment of Mine Equipment and Operations, draft DoP Director-General's Environmental Assessment Requirements (EARs), Risk Management Policy Framework for Dam Safety and HC 203:2006 Environmental Risk Management – Principles and Process

Versions

Version	Date	Description	Created By	Reviewed
A	16/5/2008	Draft report for internal review	P Standish	T Parkes
B	6/6/2008	Final Draft Report for Client and Team Review	P Standish	T Parkes
1	24/6/2008	Revised Draft for Wider Review	P Standish	T Parkes
2	7/08/2008	Amended version for Release	P Standish	T Parkes

Distribution List of Latest Version

User	Position	No. Copies
Helensburgh Coal Pty Ltd	Client	1 Electronic
SP Solutions Records	Records	1 Electronic

TABLE OF CONTENTS

List of Figures

List of Tables

EXECUTIVE SUMMARY

This Environmental Risk Analysis (ERA) identifies risks associated with key potential environmental issues associated with the Metropolitan Coal Project (the Project). The Project involves the continuation of longwall coal mining operations at the Metropolitan Colliery and is located in the town of Helensburgh, approximately 31 kilometres north of Wollongong in New South Wales (NSW).

On the 9th May 2008, a team consisting of Metropolitan Colliery personnel and specialist consultants conducted a facilitated ERA workshop. The aim of the workshop was:

To identify key potential environmental issues for inclusion in the Environmental 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 HAZOP 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 voted on what they considered to be the key issues. The key potential environmental issues, which would require consideration in the Environmental Assessment, are presented in Table ES-1.

Table ES-1 – Key Potential Environmental Issues

Ref	Source	Description of Issue/Loss scenario
HC005	Brainstorming	Swamp deterioration (vegetation composition and health, hydrology, fire susceptibility and erosion)
HC013	Brainstorming	Surface water quality - local and reservoir (including electrical conductivity impacts)
HC025	Brainstorming	Water loss from reservoir[1]
HC105	Additional Issues	Cracking of Waratah Rivulet
HC012	Brainstorming	Diversion of surface flow
HC038	Brainstorming	Impacts on aquatic biota - invertebrates, fish, etc.
HC062	Brainstorming	Loss or modification of aquatic habitat
HC002	Brainstorming	Waratah Rivulet remediation
HC037	Brainstorming	Loss of stream connectivity
HC006	Brainstorming	Noise – amenity and fauna
HC007	Brainstorming	Dust - amenity and health
HC044	Brainstorming	Reduction of groundwater resource

[1] Potential water loss from the reservoir would be further addressed during the preparation of the application for Dams Safety Committee approval, separate to the Part 3A approval process.

Risk Ranking

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

Table ES-2 – Risk Ranking

Cause	Loss Scenario	Risk Ranking[1]
Cracking of base of an upland swamp.	Impacts on upland swamps (headwater and in-valley) leading to adverse changes in vegetation composition, health, swamp function, fire susceptibility or erosion, due to subsidence-induced changes in available water outside of normal seasonal perturbations.	L-22
Cracking of base of Waratah Rivulet.	Impacts without mining (for reference purposes only) – natural high variability of water flow, loss of connectivity and dependence on refugia.	M-15
	Impact with mining and no remediation – loss of habitat for vertebrate and invertebrate fresh water organisms and increased frequency of loss of connection (note there is a possibility of self-healing).	M-10
	Impact with mining and remediation – high variability of water flow, loss of connectivity and dependence on refugia.	M-15
Dust liberated from on site coal handling operations.	Amenity and health affected by dust from the operation (e.g. coal dust from handling of product coal). Ranking basis did not include management/mitigation of dust impacts.	M-10
	Amenity and health affected by dust from the operation (e.g. coal dust from handling of product coal). Ranking basis included consideration of the Air Quality Management Plan (including use of water sprays, water trucks and monitoring to assess compliance with criteria).	L-18
Pit top noise (including transport).	Noise impacts at the nearby receptors exceed the relevant noise criteria, leading to amenity impacts and complaints. Ranking basis included consideration of noise mitigation initiatives that are part of the Project (e.g. noise control measures at the coal handling and preparation plant).	M-10

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

All of the above loss scenarios were ranked within the 'Medium - As Low As Reasonably Practicable' or the 'Low' range.

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

- Subsidence Assessment (Appendix A);
- Groundwater Assessment (Appendix B);
- Surface Water Assessment (Appendix C);
- Aquatic Ecology Assessment (Appendix D);
- Terrestrial Flora and Fauna Impact Assessment (Appendix G);
- Noise Impact Assessment (Appendix J); and
- Air Quality Impact Assessment (Appendix K).

1 INTRODUCTION

This Environmental Risk Analysis (ERA) identifies risks associated with key potential environmental issues associated with the Metropolitan Coal Project (the Project). The Project involves the continuation of longwall coal mining operations at the Metropolitan Colliery and is located in the town of Helensburgh, approximately 31 kilometres north of Wollongong in New South Wales (NSW).

1.1 *Aim and Objectives*

The aim of the ERA workshop was:

> *To identify key potential environmental issues for inclusion 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 key potential environmental issues.

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

(1) identification of key potential environmental issues to be addressed in the Environmental Assessment; and

(2) a document suitable for inclusion in the Environmental Assessment and aligned to Australian Standard (AS) 4360 *Risk Management* (Standards Australia, 2004).

1.2 *Client*

The client for the ERA is Helensburgh Coal Pty Ltd (HCPL).

1.3 *Scope*

The scope of the ERA was developed in general accordance with contemporary Director-General's requirements for Major Projects in NSW. The scope of the ERA was:

> *To conduct an environmental risk analysis to identify potential key environmental impacts associated with the Metropolitan Coal Project (construction and operation), and develop an appropriately detailed listing of the areas requiring assessment (both pre and post control) of these key environmental impacts for inclusion in the Environmental Assessment.*

The function and purpose for conducting the ERA was to identify the key potential environmental issues associated with the Project for inclusion in the Environmental Assessment.

The above scope is consistent with the draft Director-General's Environmental Assessment Requirements for the Project which states:

> *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.*

1.4 *Clarifying Points*

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

- Safety issues were not intended to be covered. Any issues related to on site injuries were expected to be addressed through subsequent work by the client.
- The geographical extent of the Project area was understood to include the proposed underground mining area, the surface facilities area and existing underground workings associated with the Metropolitan Colliery (Figure 1).
- The ERA scope does not cover engineering risks associated with potential subsidence of items of infrastructure. Detailed, engineering-focussed risk assessments for major infrastructure will be addressed through specific risk forums as required.

1.5 *Risk Assessment Process*

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

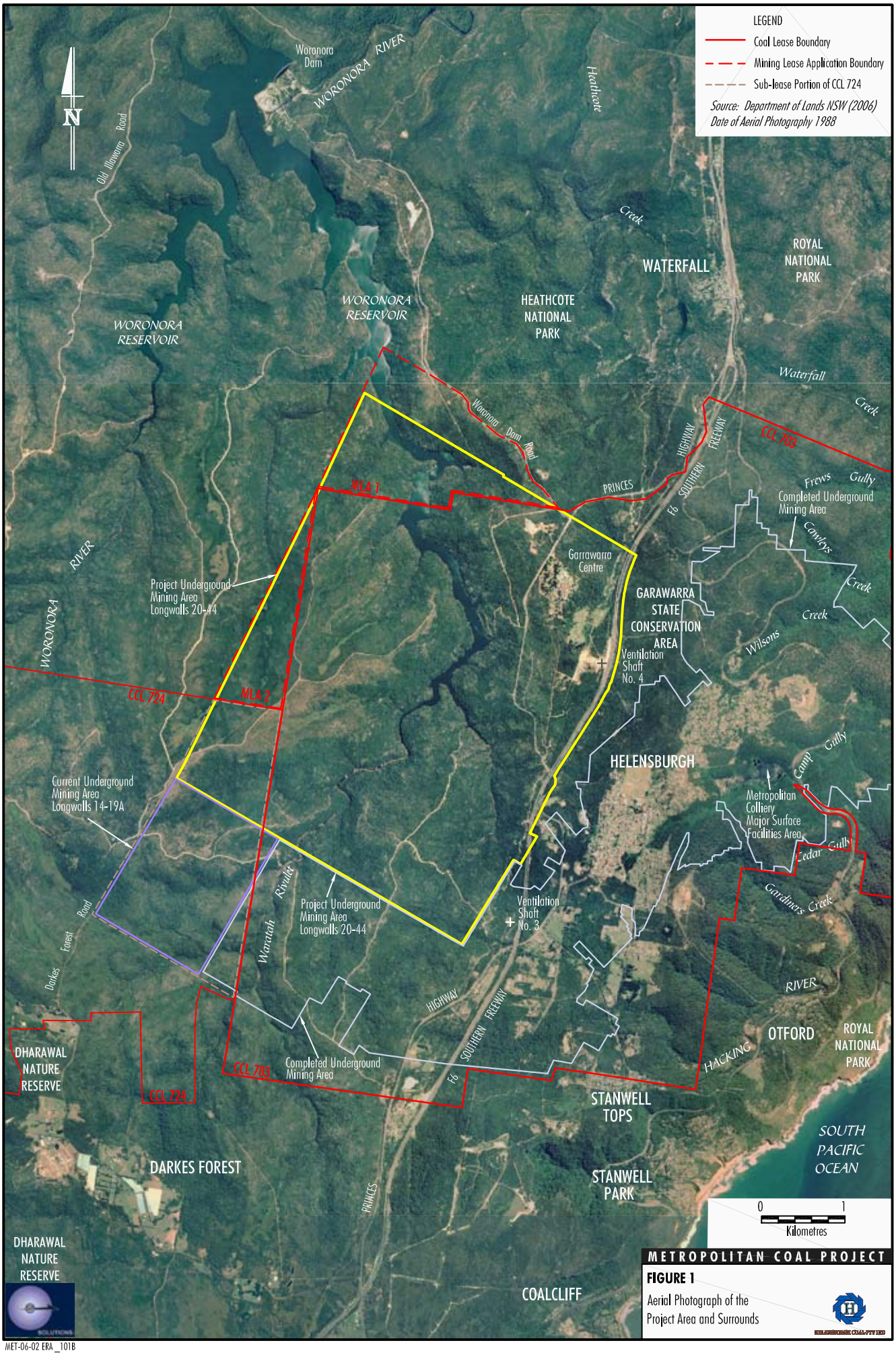
1.6 *Resourcing, Schedule and Accountabilities*

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

1. team of personnel with suitable experience and knowledge of subsidence and environmental issues in the area associated with the Project;
2. external facilitator for the risk assessment and write-up of results;
3. meeting room with electronic equipment for conduct of the team based session; and
4. copies of previous reports, risk assessments, technical reports, aerial photographs, drawings and management plans relevant to the topic.

The outcomes of the ERA and associated accountabilities will be integrated into the Environmental Assessment and overall HCPL management systems so that they are effectively reviewed, implemented and monitored to ensure the outcomes are sought.

[2] The Risk Management Policy Framework for Dam Safety (Dams Safety Committee) would be used during the preparation of the application for Dams Safety Committee approval, separate to the Part 3A approval process.



METROPOLITAN COAL PROJECT

FIGURE 1

Aerial Photograph of the Project Area and Surrounds

MET-06-02 ERA _101B

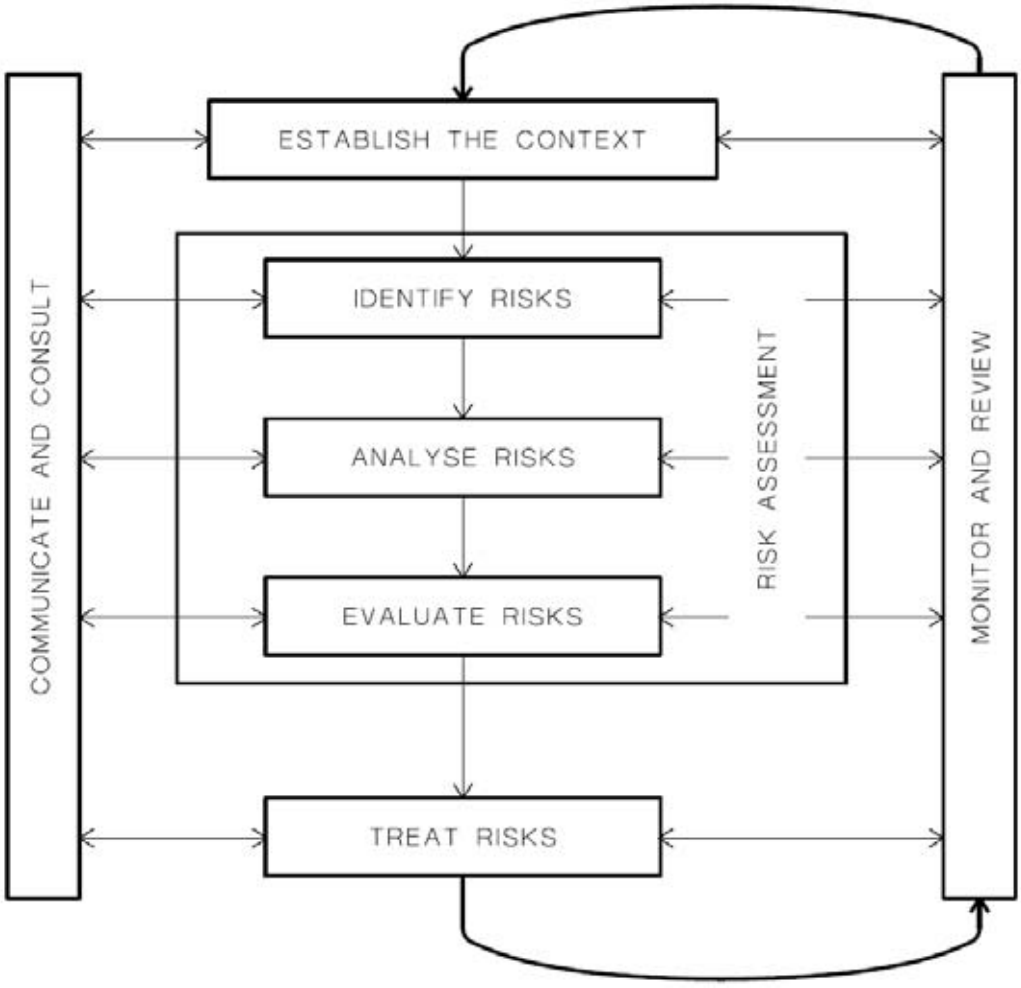


Figure 2 - Risk Management Process (AS/NZ 4360:2004)

1.7 *Method*

1.7.1 Framework

Figure 2 outlines the overall framework utilised for the ERA. This framework is further discussed in Section 1.7.2 with respect to the key steps involved in the ERA.

1.7.2 Key Steps

The key steps in the process were confirmed with HCPL prior to the team session and 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 and procedures (prior to the workshop);
4. conduct team-based risk review that:
   a) 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, first response and recovery strategies);
5. prepare a draft report in accordance with AS4360 and MDG1010 *Risk Management Handbook for the Mining Industry* (NSW Department of Mineral Resources, 1997) standards for review by HCPL personnel and team members;
6. incorporate comments from HCPL and the team; and
7. finalise the report and issue as controlled copy for ongoing use.

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 1.6, the outcomes of the ERA will be integrated into the Environmental Assessment and overall HCPL management systems so that they are effectively reviewed, implemented and monitored to ensure the outcomes are sought.

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 underground mining and familiar with subsidence related issues and aspects of environmental monitoring and remediation.

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). Other key issues taken into consideration were human and organisational error.

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 HCPL (a wholly owned subsidiary of Peabody Pacific Pty Limited), owner of Metropolitan Colliery.

The Project involves the continuation of longwall coal mining operations at the Metropolitan Colliery.

2.2 *Project Summary*

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

- ongoing surface and underground exploration activities in the Project underground mining area and surrounds;
- continued development of underground mining operations within existing HCPL mining and coal leases (and associated sub-leases) and two new Mining Lease Application areas (MLA 1 and MLA 2) (Figure 1);
- upgrades of the existing mining and materials handling systems (e.g. longwall machinery and conveyors) to facilitate an increased run-of-mine coal production rate (up to approximately 3.2 million tonnes per annum [Mtpa]);
- upgrades of the Coal Handling and Preparation Plant (CHPP) to facilitate increased production of washed coal (approximately 2.8 Mtpa), including the addition of a beneficiation circuit to produce a new thermal coal product;
- continued transport of coal reject to the Glenlee Washery for emplacement by Sada (with annual road movements capped at the existing maximum rate);
- continued transport of product coal by road to Coalcliff and Corrimal coking plants (with annual road movements capped at the existing maximum rate);
- construction of a coal reject paste backfill plant and associated coal reject stockpile, pumping, pipeline and underground delivery systems to facilitate the underground emplacement of coal reject materials as an integrated component of the longwall mining operation;
- train loading and train movements associated with the transport of product coal to Port Kembla 24 hours per day and seven days per week;
- surface access within the Woronora Special Area and surrounds that is required for the environmental monitoring, management and remediation of mine subsidence;

- upgrades and/or extension of the existing supporting infrastructure systems (e.g. underground access, water management, ventilation and electrical systems) as required;
- extension of the life of the Metropolitan Colliery by approximately 25 years; and
- other associated minor infrastructure, plant, equipment and activities.

2.3 *Risk Management Context*

The ERA has been conducted in accordance with contemporary Director-General's requirements for Major Projects in NSW and is consistent with the draft Director-General's Environmental Assessment Requirements for the Project (Section 1.3).

2.4 *Risk Criteria*

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

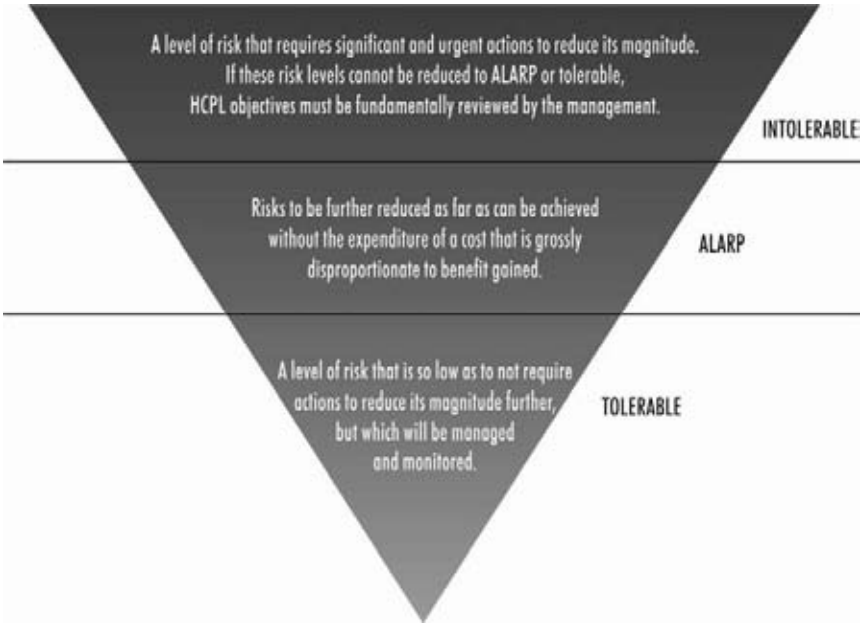


Figure 3 - Risk Criteria "ALARP"

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 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 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 are presented in Section 4.1.

3 IDENTIFY RISKS

3.1 *Overview*

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

- Introduction – Before the issues were brainstormed it was important that the whole team had a good understanding of the issues – 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 loss scenarios/issues.
- Modified HAZOP – this involved the review of key words and aerial photographs, and the consequent identification of potential environmental issues at each location during each phase of operation.

3.2 *The Team*

The team met on the 9th May 2008 in Sydney. A team based approach was utilised in order to have an appropriate mix of skills and experience to identify the potential loss scenarios/issues. Details of the team members and their relevant qualifications and experience are included in Table 1.

Table 1 – Review Team

Name	Company and Position	Relevant Qualifications and Experience
Arthur Waddington	Director – Mine Subsidence Engineering Consultants Pty Ltd	BEng, CPEng. MICE, MIEAust, RPEQ: 45 years experience as a civil and structural engineer; 30 years experience in mine subsidence.
Shane Lakmaker	Senior Environmental Scientist – Holmes Air Sciences Pty Ltd	BTech (Atmos. Sc): Air dispersion modelling and assessment; 10 years experience as air quality consultant with Holmes Air Sciences.
Noel Merrick	Principal – Heritage Computing Pty Ltd	PhD, MSc, G.Dip (DP), BSc: Groundwater modeller, hydrogeologist and geophysicist; 35 years experience.
Greg Tarrant	Technical Services Manager – HCPL	BSc (Hon), M Eng Sc, PhD: 24 years experience in mining industry geomechanics; 2 years at HCPL managing mining impacts on natural surface features.
Rod Hailstone	Environmental and Community Manager – HCPL	BA AppSc (Nat Res Mngt), Ass Dip Env Science; BA Laws (currently studying): Hydrographer 5 years and environmental compliance 3 years.
Peter Doyle[1]	General Manager – Corporate and Operations Support – Peabody Pacific Pty Limited	BSc, BE (Mining), M Eng Sc, MBA: Certificate of Competency as Coal Mine Manager, over 20 years experience in the mining industry.
David Goldney	Principal Consulting Ecologist – Western Research Institute	BSc, DipEd, PhD: 36 years experience in natural resource assessment and management, environmental assessment, specialising in fauna assessment and surveys.
Colin Bower	Consultant Botanist, Principal – FloraSearch	BSc, PhD: 15 years of flora survey, vegetation analysis.
Lindsay Gilbert	Director – Gilbert & Associates Pty Ltd	BE (Civil), M Eng Sc, M App Sc: 30 years experience in water management with 26 years water resource consultancy experience.

Helensburgh Coal Pty Ltd
Metropolitan Coal Project
Environmental Risk Analysis

Name	Company and Position	Relevant Qualifications and Experience
Glenn Thomas	Principal – Heggies Pty Ltd	BSc: 20 years experience in mining and infrastructure noise impact assessment and control.
Dan Roberts	Director – Bio-Analysis Pty Ltd	BSc; PhD in aquatic biology and impact assessment: 26 years experience in aquatic ecology in freshwater and marine ecosystem.
Josh Hunt	Principal – Resource Strategies Pty Ltd	BE (Civil): 14 years experience in engineering and environmental studies; preparation of environmental assessments for major projects (mining).
Clive Berry	Environmental Project Manager – Resource Strategies Pty Ltd	BE (Environmental): 6 years experience environmental management and project approvals in the resources industry.
Jules Blunt	Environmental Project Manager – Resource Strategies Pty Ltd	BE (Mining), M Env Mgt: 6 years operational experience mining engineering; 2.5 years experience environmental management and project approvals in the resources industry.
Stacey Braund	Senior Environmental Manager – Resource Strategies Pty Ltd	BA (Marine Biology): 11 years experience, focusing on ecological aspects of environmental assessments.
Peter Standish	SP Solutions – Facilitator	PhD, BEng (Hon), Dip Bus Mgt, Risk Analysis Trained. Certificate of Competence as a Manager: 27 years experience in underground and open cut mining operations with operating, managerial and contract management experience; involved in reviewing environmental conditions and applications for 5 years; conducting Risk Analyses for 12 years.
Todd Parkes	SP Solutions – Co-facilitator	B. OHS; Cert IV TAA: Graduate with broad knowledge and understanding of OHS; studied hygiene and toxicology, ergonomics, OHS law, business / HR, safety science and technology, health sociology, health promotion, environmental health and epidemiology.

[1] Attended for the 'establish the context' phase and initial brainstorming.

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 subject 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 8 in Appendix 8.2.

3.3.2 Modified HAZOP

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

This process was filtered – and no additional items were added that were already adequately identified through the brainstorming process.

The generic key words used in the process were:

- Noise.
- Air.
- Water.
- Subsidence.
- Soils/Ecology.
- Erosion.
- Land Contamination.

Each of these key words were considered for specific phases of the operation – construction, operation and decommissioning and the aerial photograph was "broken down" into three key operating areas:

- Process Map 1 - Surface Facilities Area.
- Process Map 2 - Regional Area.
- Process Map 3 - Woronora Special Area.

The application of these prompt words together with the aerial photograph led to the generation of the risks presented in Table 9 in Appendix 8.2.

3.3.3 Risk and Control Charting

To aid in the risk ranking process Risk and Control Charts were developed by the team. These show the basic cause(s), preventative control(s), incident, reactive control(s) and ultimate outcomes from the incident, and are presented in Figure 4 to Figure 7 in Appendix 8.3.

3.3.4 Additional Risks Identified

The specialist in each field of study was also given the chance to raise any additional risks they saw as appropriate that had not been previously raised in the brainstorming or modified HAZOP processes. This led to the generation of the additional risks presented in Table 10 in Appendix 8.2.

3.3.5 Identification of Key Potential Environmental Issues

The key potential environmental issues were identified through a 'voting' system whereby team members voted what they considered to be the key issues. Key potential environmental issues identified in the ERA are shown in Table 2.

Table 2 – Key Potential Environmental Issues

Ref	Source	Description of Issue/Loss scenario
HC005	Brainstorming	Swamp deterioration (vegetation composition and health, hydrology, fire susceptibility and erosion)
HC013	Brainstorming	Surface water quality - local and reservoir (including electrical conductivity impacts)
HC025	Brainstorming	Water loss from reservoir
HC105	Additional Issues	Cracking of Waratah Rivulet
HC012	Brainstorming	Diversion of surface flow
HC038	Brainstorming	Impacts on aquatic biota - invertebrates, fish, etc.
HC062	Brainstorming	Loss or modification of aquatic habitat
HC002	Brainstorming	Waratah Rivulet remediation
HC037	Brainstorming	Loss of stream connectivity
HC006	Brainstorming	Noise - amenity and fauna
HC007	Brainstorming	Dust - amenity and health
HC044	Brainstorming	Reduction of groundwater resource

3.3.6 Referred Issues

Some of the issues identified by the team during the ERA were not 'loss scenarios' and are therefore not considered to be key potential environmental issues. However, these referred issues were considered to warrant particular consideration in the development of the Environmental Assessment and directed to the overall HCPL management systems. The referred issues are listed in Table 3.

Table 3 – Referred Issues

Ref	Source	Description of Issue/Loss scenario
HC059	Brainstorming	Scientific uncertainty
HC093	Process Map - 3	Uncertainty of geological structures
HC029	Brainstorming	Southern Coalfield inquiry findings (affect on Director-General's Environmental Assessment Requirements)
HC030	Brainstorming	Management of the relationship with interest groups (stakeholders)

4 ANALYSE RISKS

4.1 *Probability and Maximum Reasonable Consequence*

Loss scenarios (based on the identified key potential environmental issues) were ranked for risk by the 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 team.

The following definition of risk was used:

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

Tables 4, 5 and 6 present the ERA matrix tools that were utilised for ranking risks.

Table 4 – Qualitative Measures of Probability

Rank (P)	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 5 – Qualitative Measures of Maximum Reasonable Consequence[3]

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.

Table 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 – As low as reasonably practicable
	Intolerable

[3] **Notes: Maximum Reasonable Consequence (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 – which could include from the upstream areas around Darkes Forest and downstream to the lower stored waters of the Woronora Reservoir near the Woronora Dam wall.

4.2 *Risk and Outcome Models*

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

Table 7 – Risk Ranking

Cause	Loss Scenario	P[1]	C[2]	R[3]
Cracking of base of an upland swamp.	Impacts on upland swamps (headwater and in-valley) leading to adverse changes in vegetation composition, health, swamp function, fire susceptibility or erosion, due to subsidence-induced changes in available water outside of normal seasonal perturbations.	C	5	L-22
Cracking of base of Waratah Rivulet.	Impacts without mining (for reference purposes only) – natural high variability of water flow, loss of connectivity and dependence on refugia.	A	5	M-15
	Impact with mining and no remediation – loss of habitat for vertebrate and invertebrate fresh water organisms and increased frequency of loss of connection (note there is a possibility of self-healing).	A	4	M-10
	Impact with mining and remediation – high variability of water flow, loss of connectivity and dependence on refugia.	A	5	M-15
Dust liberated from on site coal handling operations.	Amenity and health affected by dust from the operation (e.g. coal dust from handling of product coal). Ranking basis did not include management /mitigation of dust impacts.	A	4	M-10
	Amenity and health affected by dust from the operation (e.g. coal dust from handling of product coal). Ranking basis included consideration of the Air Quality Management Plan (including use of water sprays, water trucks and monitoring to assess compliance with criteria).	C	4	L-18
Pit top noise (including transport).	Noise impacts at the nearby receptors exceed the relevant noise criteria, leading to amenity impacts and complaints. Ranking basis included consideration of noise mitigation initiatives that are part of the Project (e.g. noise control measures at the coal handling and preparation plant).	A	4	M-10

[1] Probability
[2] Consequence
[3] 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.

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

- Subsidence Assessment (Appendix A);
- Groundwater Assessment (Appendix B);
- Surface Water Assessment (Appendix C);
- Aquatic Ecology Assessment (Appendix D);
- Terrestrial Flora and Fauna Impact Assessment (Appendix G);
- Noise Impact Assessment (Appendix J); and
- Air Quality Impact Assessment (Appendix K).

5 MONITOR AND REVIEW

5.1 *Nominated Coordinator*

The nominated client review facilitator is Neville McAlary, General Manager, HCPL.

This facilitator will co-ordinate the inclusion of the key potential environmental issues into the various studies required for the Environmental Assessment and the overall HCPL management systems.

5.2 *Communication and Consultation*

Consultation, involvement of personnel (HCPL 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 environmental issues in the Environmental Assessment and the overall HCPL management systems.

6 CONCLUDING REMARKS

The risk assessment process conducted by the team was aligned with AS 4360 and MDG1010, with the intention of identifying the key potential environmental issues for the Project.

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 Environmental Assessment. The outcomes of the ERA will be integrated into the overall HCPL management systems so that they are effectively reviewed, implemented and monitored.

SP Solutions would like to thank all personnel who contributed to the risk assessment.

7 REFERENCES

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

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

8 APPENDICES

8.1 *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.
AS4360	Australian Standard on Risk Management (see references).
MDG1010	Department of Primary Industries guideline on risk management (see references).
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.

8.2 *Issue Identification Results*

The output from the team's "brainstorming" is presented in Table 8.

Table 8 – Brainstorming Results

Ref	Source	Description of Issue
HC001	Brainstorming	Greenhouse gas emissions – scope 1, 2 and 3
HC002	Brainstorming	Waratah Rivulet remediation
HC003	Brainstorming	Mining under reservoir
HC004	Brainstorming	Project environmental management
HC005	Brainstorming	Swamp deterioration (vegetation composition and health, hydrology, fire susceptibility and erosion)
HC006	Brainstorming	Noise – amenity and fauna
HC007	Brainstorming	Dust – amenity and health
HC008	Brainstorming	Transport – local (Helensburgh) and regional area
HC009	Brainstorming	Impacts on vegetation – dust
HC010	Brainstorming	Subsidence impacts on heritage buildings
HC011	Brainstorming	Subsidence impacts on infrastructure (e.g. F6 Freeway)
HC012	Brainstorming	Diversion of surface flow
HC013	Brainstorming	Surface water quality – local and reservoir (including electrical conductivity impacts)
HC014	Brainstorming	Water use at the mine site
HC015	Brainstorming	Site water discharges
HC016	Brainstorming	Impacts on archaeological sites

Ref	Source	Description of Issue
HC017	Brainstorming	Site waste management
HC018	Brainstorming	Impacts on riparian vegetation
HC019	Brainstorming	Impacts on native vegetation communities and fauna habitat
HC020	Brainstorming	Impacts on endangered ecological communities, populations, threatened species and their habitats
HC021	Brainstorming	Rail – impact of increased rail usage
HC022	Brainstorming	Ecosystem function
HC023	Brainstorming	Environmental flows
HC024	Brainstorming	Water loss from stream
HC025	Brainstorming	Water loss from reservoir
HC026	Brainstorming	Soil degradation (sedimentation and erosion) due to construction
HC027	Brainstorming	Rock fall/ground cracking
HC028	Brainstorming	Mine closure works
HC029	Brainstorming	Southern Coalfield inquiry findings (affect on Director General's Environmental Assessment Requirements)
HC030	Brainstorming	Management of the relationship with interest groups (stakeholders)
HC031	Brainstorming	Potential for change in surface fire frequency
HC032	Brainstorming	Introduction or spread of weeds or feral animals
HC033	Brainstorming	Phytophthora and chytrid fungus
HC034	Brainstorming	Gas emissions from underground mine workings
HC035	Brainstorming	Employment throughout construction, operation and closure
HC036	Brainstorming	Downstream impacts
HC037	Brainstorming	Loss of stream connectivity
HC038	Brainstorming	Impacts on aquatic biota – invertebrates, fish, etc.
HC039	Brainstorming	Stormwater management
HC040	Brainstorming	Security of long term water supply requirements
HC041	Brainstorming	Surface disturbance – vent shaft, monitoring equipment, exploration and remediation
HC042	Brainstorming	Short term versus long term impacts
HC043	Brainstorming	Increased number of people – accessing the surface
HC044	Brainstorming	Reduction of groundwater resource
HC045	Brainstorming	Groundwater dependent ecosystems
HC046	Brainstorming	Impacts on Royal National Park and Garawarra State Conservation Area
HC047	Brainstorming	Changes to surface water and groundwater interactions
HC048	Brainstorming	Impacts from exploration activities
HC049	Brainstorming	Amenity impacts resulting from installation of monitoring equipment
HC050	Brainstorming	Visual impacts, including lighting at the surface facilities
HC051	Brainstorming	Increased power demand
HC052	Brainstorming	Impacts at Glenlee washery
HC053	Brainstorming	Vibration impacts – minor excavation blasting and heavy vehicle movement
HC054	Brainstorming	Risk of studies not meeting regulatory expectations
HC055	Brainstorming	Community impacts, appropriate communication with key stakeholders

Ref	Source	Description of Issue
HC056	Brainstorming	Aesthetic impacts, in particular cracking of Waratah Rivulet
HC057	Brainstorming	EPBC-related matters
HC058	Brainstorming	Aspects related to mine surface facilities layout
HC059	Brainstorming	Scientific uncertainty
HC060	Brainstorming	Ridge top tension cracks
HC061	Brainstorming	Legislative changes
HC062	Brainstorming	Loss or modification of aquatic habitat
HC063	Brainstorming	Odour from vent shaft
HC064	Brainstorming	Risks associated with additional rail traffic (noise)
HC065	Brainstorming	Increased demand on water usage
HC066	Brainstorming	Loss of Camp Creek gully near pit top
HC067	Brainstorming	Risk associated with waste emplacement/dump
HC068	Brainstorming	Economic contribution of mine

The modified HAZOP process identified some additional issues. These are presented in Table 9.

Table 9 – Modified HAZOP Output

Ref	Source	Description of Issue
HC069	Process Map – 1	Land contamination – resulting from surface facility activities and rejects emplacement
HC070	Process Map – 1	Construction and longer term vibration impacts on heritage buildings
HC071	Process Map – 1	Noise impacts from rail loading construction
HC072	Process Map – 1	Release of paste fill from the paste backfill facility
HC073	Process Map – 1	Air quality (positive) impact with rail load out[1]
HC074	Process Map – 1	Noise level (positive) impact with rail load out[1]
HC075	Process Map – 1	Mine closure planning
HC076	Process Map – 1	Flooded mine releasing contaminated water
HC077	Process Map – 1	Asbestos risks during demolition
HC078	Process Map – 1	Revegetation failure and rehabilitation of damaged lands
HC079	Process Map – 1	Lead based paint (exposure during demolition)
HC080	Process Map – 1	Remediation of contaminated soils and ground water
HC081	Process Map – 2	Social impacts (e.g. availability of suitable accommodation)
HC082	Process Map – 3	Vegetation and habitat disturbance associated with the new ventilation shaft
HC083	Process Map – 3	Ventilation shaft – air and noise emissions during construction and operation
HC084	Process Map – 3	Opportunistic rehabilitation during construction
HC085	Process Map – 3	Changes to pool dynamics in streams/creeks
HC086	Process Map – 3	Impacts on iconic species e.g. platypus
HC087	Process Map – 3	Increased gradient in creeks leads to erosion
HC088	Process Map – 3	Road kill on tracks/roads in Woronora Special Area
HC089	Process Map – 3	Stepping or buckling of road surface and damage to bridges, culverts or other features
HC090	Process Map – 3	Subsidence impacts on dam wall

Ref	Source	Description of Issue
HC091	Process Map – 3	Connection of subsurface water to mine workings
HC092	Process Map – 3	Unexpected height of fracturing above the mine
HC093	Process Map – 3	Uncertainty of geological structures
HC094	Process Map – 3	Impacts on steep slopes (potential for greater cracking at the head of slopes)
HC095	Process Map – 3	Failure to remediate water courses during decommissioning
HC096	Process Map – 3	Pillar creep
HC097	Process Map – 3	Long term changes in aquifer pressures following mining

[1] A rail load-out facility was under consideration by HCPL at the time of the ERA workshop, instead of loading trains via front-end loader. This was considered to have potential beneficial impacts in terms of air quality and noise.

Table 10 below presents additional issues by specialists raised during the ERA workshop.

Table 10 – Additional Issues Raised by Specialists During the Workshop

Ref	Source	Issue
HC098	Additional Issues	Explosives use - vibration, and dust/fume emissions
HC099	Additional Issues	Camp Creek construction activities - noise and vibration impacts
HC100	Additional Issues	Impacts from other approved (but not yet constructed) developments
HC101	Additional Issues	Cumulative impacts from old workings (e.g. historic Metropolitan Colliery workings)
HC102	Additional Issues	Pit top water management impacted by greater intensity of rainfall events predicted in global warming models
HC103	Additional Issues	Climate change exacerbating impacts on upland swamps
HC104	Additional Issues	Adaptive environmental management
HC105	Additional Issues	Cracking of Waratah Rivulet

It should be noted that some of the issues identified in the detailed studies were not ranked during the team session. This was to allow for more information on the issues to be collected so that subsequent more detailed reviews could occur in these studies (i.e. technical appendices in the Environmental Assessment).

8.3 *Risk and Control Charts*

The following charts were prepared by the team to assist in the risk ranking process.

Figure 4 – Risk and Control Chart – Cracking of Upland Swamps

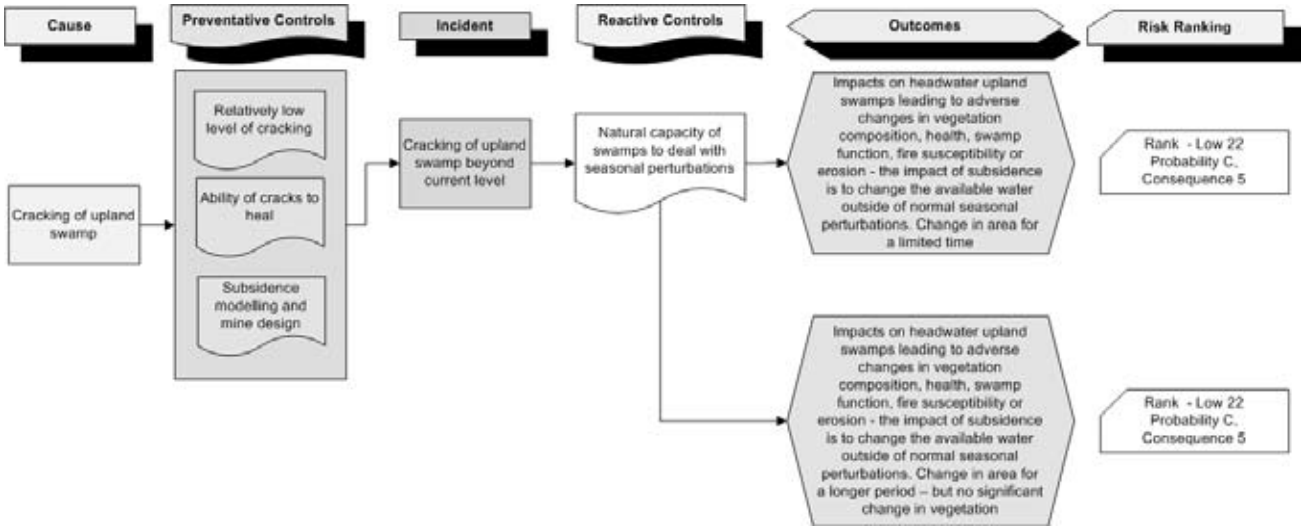


Figure 5 – Risk and Control Chart – Cracking of Stream Bed

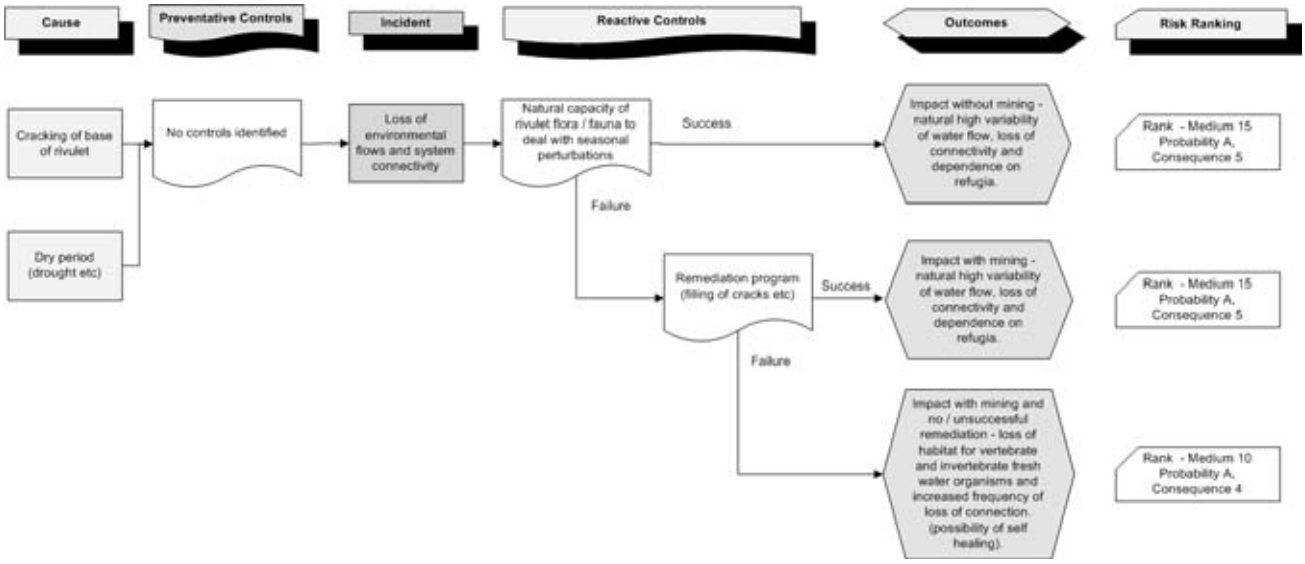


Figure 6 – Risk and Control Chart for Dust Emissions

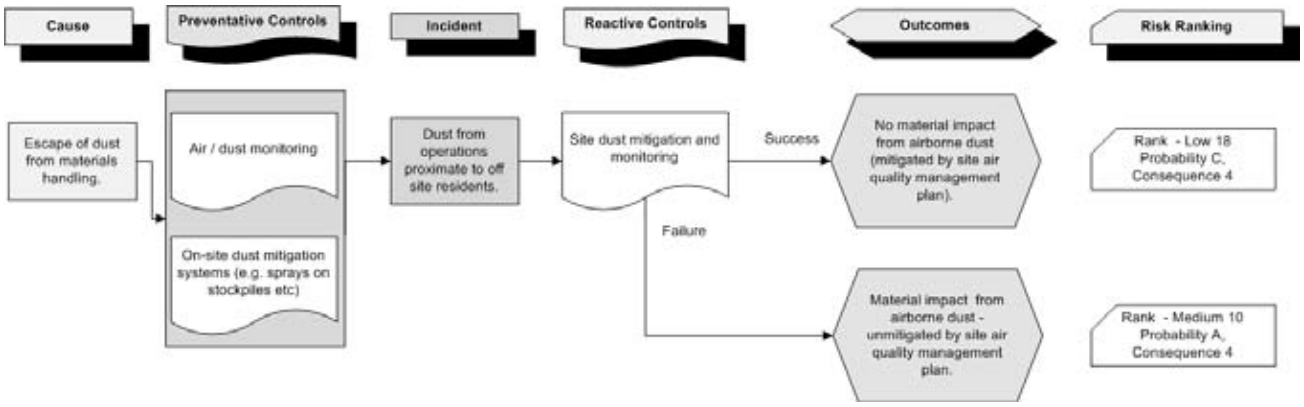
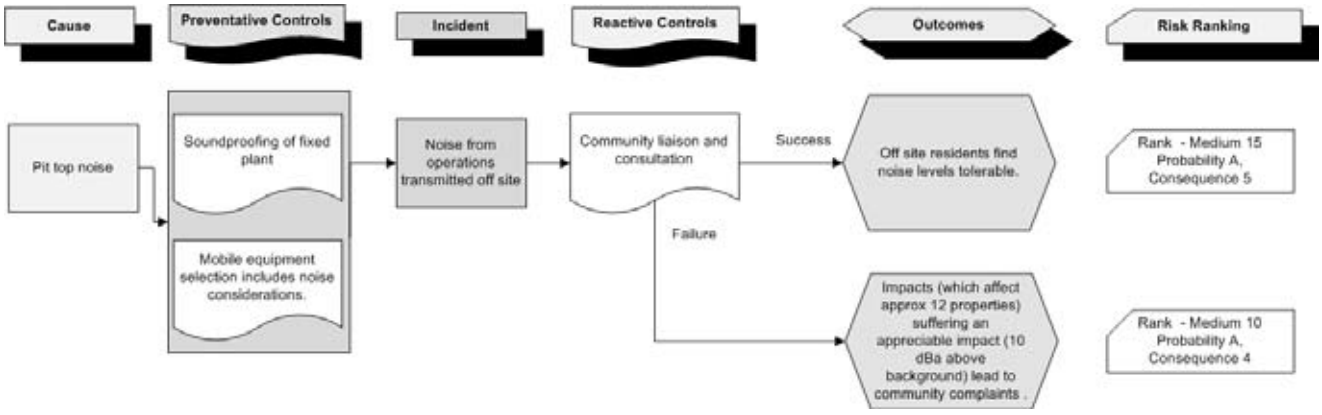


Figure 7 – Risk and Control Chart – Noise Impacts



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 of altered in any way.

SP Solutions is familiar with a variety of techniques and approaches that be 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 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:

- interpretation of factual information based on judgement and opinion;
- valid and factual inputs supplied by all third parties;
- key assumptions outside the influence of ***SP Solutions***; and
- 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.