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
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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

<table>
<thead>
<tr>
<th>Ref</th>
<th>Source</th>
<th>Description of Issue/Loss scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC005</td>
<td>Brainstorming</td>
<td>Swamp deterioration (vegetation composition and health, hydrology, fire susceptibility and erosion)</td>
</tr>
<tr>
<td>HC013</td>
<td>Brainstorming</td>
<td>Surface water quality - local and reservoir (including electrical conductivity impacts)</td>
</tr>
<tr>
<td>HC025</td>
<td>Brainstorming</td>
<td>Water loss from reservoir¹</td>
</tr>
<tr>
<td>HC105</td>
<td>Additional Issues</td>
<td>Cracking of Waratah Rivulet</td>
</tr>
<tr>
<td>HC012</td>
<td>Brainstorming</td>
<td>Diversion of surface flow</td>
</tr>
<tr>
<td>HC038</td>
<td>Brainstorming</td>
<td>Impacts on aquatic biota - invertebrates, fish, etc.</td>
</tr>
<tr>
<td>HC062</td>
<td>Brainstorming</td>
<td>Loss or modification of aquatic habitat</td>
</tr>
<tr>
<td>HC002</td>
<td>Brainstorming</td>
<td>Waratah Rivulet remediation</td>
</tr>
<tr>
<td>HC037</td>
<td>Brainstorming</td>
<td>Loss of stream connectivity</td>
</tr>
<tr>
<td>HC006</td>
<td>Brainstorming</td>
<td>Noise – amenity and fauna</td>
</tr>
<tr>
<td>HC007</td>
<td>Brainstorming</td>
<td>Dust - amenity and health</td>
</tr>
<tr>
<td>HC044</td>
<td>Brainstorming</td>
<td>Reduction of groundwater resource</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Cause</th>
<th>Loss Scenario</th>
<th>Risk Ranking</th>
</tr>
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<tbody>
<tr>
<td>Cracking of base of an upland swamp.</td>
<td>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.</td>
<td>L-22</td>
</tr>
<tr>
<td>Cracking of base of Waratah Rivulet.</td>
<td>Impacts without mining (for reference purposes only) – natural high variability of water flow, loss of connectivity and dependence on refugia.</td>
<td>M-15</td>
</tr>
<tr>
<td></td>
<td>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).</td>
<td>M-10</td>
</tr>
<tr>
<td></td>
<td>Impact with mining and remediation – high variability of water flow, loss of connectivity and dependence on refugia.</td>
<td>M-15</td>
</tr>
<tr>
<td>Dust liberated from on site coal handling operations.</td>
<td>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.</td>
<td>M-10</td>
</tr>
<tr>
<td></td>
<td>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).</td>
<td>L-18</td>
</tr>
<tr>
<td>Pit top noise (including transport).</td>
<td>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).</td>
<td>M-10</td>
</tr>
</tbody>
</table>

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).

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.
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"](image)

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Company and Position</th>
<th>Relevant Qualifications and Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthur Waddington</td>
<td>Director – Mine Subsidence Engineering Consultants Pty Ltd</td>
<td>BEng, CEng, MIC, MIEAust, RPEQ: 45 years experience as a civil and structural engineer; 30 years experience in mine subsidence.</td>
</tr>
<tr>
<td>Shane Lakmaker</td>
<td>Senior Environmental Scientist – Holmes Air Sciences Pty Ltd</td>
<td>BTech (Atmos. Sc): Air dispersion modelling and assessment; 10 years experience as air quality consultant with Holmes Air Sciences.</td>
</tr>
<tr>
<td>Noel Merrick</td>
<td>Principal – Heritage Computing Pty Ltd</td>
<td>PhD, MSc, G.Dip (DP), BS: Groundwater modeller, hydrogeologist and geophysicist; 35 years experience.</td>
</tr>
<tr>
<td>Greg Tarrant</td>
<td>Technical Services Manager – HCPL</td>
<td>BS (Hon), M Eng Sc, PhD: 24 years experience in mining industry geomechanics; 2 years at HCPL managing mining impacts on natural surface features.</td>
</tr>
<tr>
<td>Rod Hailstone</td>
<td>Environmental and Community Manager – HCPL</td>
<td>BA AppSc (Nat Res Mngt), Ass Dipl Env Science; BA Laws (currently studying): Hydrographer 5 years and environmental compliance 3 years.</td>
</tr>
<tr>
<td>Peter Doyle</td>
<td>General Manager – Corporate and Operations Support – Peabody Pacific Pty Limited</td>
<td>BS, BE (Mining), M Eng Sc, MBA: Certificate of Competency as Coal Mine Manager, over 20 years experience in the mining industry.</td>
</tr>
<tr>
<td>David Goldney</td>
<td>Principal Consulting Ecologist – Western Research Institute</td>
<td>BSc, DipEd, PhD: 36 years experience in natural resource assessment and management, environmental assessment, specialising in fauna assessment and surveys.</td>
</tr>
<tr>
<td>Colin Bower</td>
<td>Consultant Botanist, Principal – FloraSearch</td>
<td>BS, PhD: 15 years of flora survey, vegetation analysis.</td>
</tr>
<tr>
<td>Lindsay Gilbert</td>
<td>Director – Gilbert &amp; Associates Pty Ltd</td>
<td>BE (Civil), M Eng Sc, M App Sc: 30 years experience in water management with 26 years water resource consultancy experience.</td>
</tr>
<tr>
<td>Name</td>
<td>Company and Position</td>
<td>Relevant Qualifications and Experience</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Glenn Thomas</td>
<td>Principal – Heggies Pty Ltd</td>
<td>BSc: 20 years experience in mining and infrastructure noise impact assessment and control.</td>
</tr>
<tr>
<td>Dan Roberts</td>
<td>Director – Bio-Analysis Pty Ltd</td>
<td>BSc; PhD in aquatic biology and impact assessment; 26 years experience in aquatic ecology in freshwater and marine ecosystem.</td>
</tr>
<tr>
<td>Josh Hunt</td>
<td>Principal – Resource Strategies Pty Ltd</td>
<td>BE (Civil): 14 years experience in engineering and environmental studies; preparation of environmental assessments for major projects (mining).</td>
</tr>
<tr>
<td>Clive Berry</td>
<td>Environmental Project Manager – Resource Strategies Pty Ltd</td>
<td>BE (Environmental): 6 years experience environmental management and project approvals in the resources industry.</td>
</tr>
<tr>
<td>Jules Blunt</td>
<td>Environmental Project Manager – Resource Strategies Pty Ltd</td>
<td>BE (Mining), M Env Mgt: 6 years operational experience mining engineering; 2.5 years experience environmental management and project approvals in the resources industry.</td>
</tr>
<tr>
<td>Stacey Braund</td>
<td>Senior Environmental Manager – Resource Strategies Pty Ltd</td>
<td>BA (Marine Biology): 11 years experience, focusing on ecological aspects of environmental assessments.</td>
</tr>
<tr>
<td>Peter Standish</td>
<td>SP Solutions – Facilitator</td>
<td>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.</td>
</tr>
<tr>
<td>Todd Parkes</td>
<td>SP Solutions – Co-facilitator</td>
<td>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.</td>
</tr>
</tbody>
</table>

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

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

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

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

<table>
<thead>
<tr>
<th>Rank (P)</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Almost Certain Happens often</td>
</tr>
<tr>
<td>B</td>
<td>Likely Could easily happen</td>
</tr>
<tr>
<td>C</td>
<td>Possible Could happen and has occurred elsewhere</td>
</tr>
<tr>
<td>D</td>
<td>Unlikely Hasn’t happened yet but could</td>
</tr>
<tr>
<td>E</td>
<td>Rare Conceivable, but only in extreme circumstances</td>
</tr>
</tbody>
</table>
### Table 5 – Qualitative Measures of Maximum Reasonable Consequence

<table>
<thead>
<tr>
<th>Ref (C)</th>
<th>Consequence</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Extreme environmental harm</td>
<td>e.g. widespread catastrophic impact on environmental values of an area.</td>
</tr>
<tr>
<td>2</td>
<td>Major environmental harm</td>
<td>e.g. widespread substantial impact on environmental values of an area.</td>
</tr>
<tr>
<td>3</td>
<td>Serious environmental harm</td>
<td>e.g. widespread and considerable impact on environmental values of an area.</td>
</tr>
<tr>
<td>4</td>
<td>Material environmental harm</td>
<td>e.g. localised and considerable impact on environmental values of an area.</td>
</tr>
<tr>
<td>5</td>
<td>Minimal environmental harm</td>
<td>e.g. minor impact on environmental values of an area.</td>
</tr>
</tbody>
</table>

### Table 6 – Risk Ranking Table

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

**Notes:**
- L = Low; M = Moderate, H = High
- Risk Numbering:
  - 1 = highest risk, 25 = lowest risk

**Legend:**
- **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>
<thead>
<tr>
<th>Cause</th>
<th>Loss Scenario</th>
<th>p¹</th>
<th>c²</th>
<th>r³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracking of base of an upland swamp.</td>
<td>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.</td>
<td>C</td>
<td>5</td>
<td>L-22</td>
</tr>
<tr>
<td>Cracking of base of Waratah Rivulet.</td>
<td>Impacts without mining (for reference purposes only) – natural high variability of water flow, loss of connectivity and dependence on refugia.</td>
<td>A</td>
<td>5</td>
<td>M-15</td>
</tr>
<tr>
<td></td>
<td>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).</td>
<td>A</td>
<td>4</td>
<td>M-10</td>
</tr>
<tr>
<td></td>
<td>Impact with mining and remediation – high variability of water flow, loss of connectivity and dependence on refugia.</td>
<td>A</td>
<td>5</td>
<td>M-15</td>
</tr>
<tr>
<td>Dust liberated from on site coal handling operations.</td>
<td>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.</td>
<td>A</td>
<td>4</td>
<td>M-10</td>
</tr>
<tr>
<td></td>
<td>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).</td>
<td>C</td>
<td>4</td>
<td>L-18</td>
</tr>
<tr>
<td>Pit top noise (including transport).</td>
<td>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).</td>
<td>A</td>
<td>4</td>
<td>M-10</td>
</tr>
</tbody>
</table>

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


8 APPENDICES

8.1 Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALARP</td>
<td>“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.</td>
</tr>
<tr>
<td>AS4360</td>
<td>Australian Standard on Risk Management (see references).</td>
</tr>
<tr>
<td>MDG1010</td>
<td>Department of Primary Industries guideline on risk management (see references).</td>
</tr>
<tr>
<td>Personnel</td>
<td>Includes all people working in and around the site (e.g. all contractors, sub-contractors, visitors, consultants, project managers etc.).</td>
</tr>
<tr>
<td>Practicable</td>
<td>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.</td>
</tr>
<tr>
<td>Residual Risk</td>
<td>The risk associated with an unwanted event after consideration of the existing control measures is taken into account.</td>
</tr>
<tr>
<td>Review</td>
<td>An examination of the effectiveness, suitability and efficiency of a system and its components.</td>
</tr>
<tr>
<td>Risk</td>
<td>The combination of the potential consequences arising from a specified hazard together with the likelihood of the hazard actually resulting in an unwanted event.</td>
</tr>
</tbody>
</table>

8.2 Issue Identification Results

The output from the team’s “brainstorming” is presented in Table 8.

Table 8 – Brainstorming Results

<table>
<thead>
<tr>
<th>Ref</th>
<th>Source</th>
<th>Description of Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC001</td>
<td>Brainstorming</td>
<td>Greenhouse gas emissions – scope 1, 2 and 3</td>
</tr>
<tr>
<td>HC002</td>
<td>Brainstorming</td>
<td>Waratah Rivulet remediation</td>
</tr>
<tr>
<td>HC003</td>
<td>Brainstorming</td>
<td>Mining under reservoir</td>
</tr>
<tr>
<td>HC004</td>
<td>Brainstorming</td>
<td>Project environmental management</td>
</tr>
<tr>
<td>HC005</td>
<td>Brainstorming</td>
<td>Swamp deterioration (vegetation composition and health, hydrology, fire susceptibility and erosion)</td>
</tr>
<tr>
<td>HC006</td>
<td>Brainstorming</td>
<td>Noise – amenity and fauna</td>
</tr>
<tr>
<td>HC007</td>
<td>Brainstorming</td>
<td>Dust – amenity and health</td>
</tr>
<tr>
<td>HC008</td>
<td>Brainstorming</td>
<td>Transport – local (Helensburgh) and regional area</td>
</tr>
<tr>
<td>HC009</td>
<td>Brainstorming</td>
<td>Impacts on vegetation – dust</td>
</tr>
<tr>
<td>HC010</td>
<td>Brainstorming</td>
<td>Subsidence impacts on heritage buildings</td>
</tr>
<tr>
<td>HC011</td>
<td>Brainstorming</td>
<td>Subsidence impacts on infrastructure (e.g. F6 Freeway)</td>
</tr>
<tr>
<td>HC012</td>
<td>Brainstorming</td>
<td>Diversion of surface flow</td>
</tr>
<tr>
<td>HC013</td>
<td>Brainstorming</td>
<td>Surface water quality – local and reservoir (including electrical conductivity impacts)</td>
</tr>
<tr>
<td>HC014</td>
<td>Brainstorming</td>
<td>Water use at the mine site</td>
</tr>
<tr>
<td>HC015</td>
<td>Brainstorming</td>
<td>Site water discharges</td>
</tr>
<tr>
<td>HC016</td>
<td>Brainstorming</td>
<td>Impacts on archaeological sites</td>
</tr>
<tr>
<td>Ref</td>
<td>Source</td>
<td>Description of Issue</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>HC017</td>
<td>Brainstorming</td>
<td>Site waste management</td>
</tr>
<tr>
<td>HC018</td>
<td>Brainstorming</td>
<td>Impacts on riparian vegetation</td>
</tr>
<tr>
<td>HC019</td>
<td>Brainstorming</td>
<td>Impacts on native vegetation communities and fauna habitat</td>
</tr>
<tr>
<td>HC020</td>
<td>Brainstorming</td>
<td>Impacts on endangered ecological communities, populations, threatened species and their habitats</td>
</tr>
<tr>
<td>HC021</td>
<td>Brainstorming</td>
<td>Rail – impact of increased rail usage</td>
</tr>
<tr>
<td>HC022</td>
<td>Brainstorming</td>
<td>Ecosystem function</td>
</tr>
<tr>
<td>HC023</td>
<td>Brainstorming</td>
<td>Environmental flows</td>
</tr>
<tr>
<td>HC024</td>
<td>Brainstorming</td>
<td>Water loss from stream</td>
</tr>
<tr>
<td>HC025</td>
<td>Brainstorming</td>
<td>Water loss from reservoir</td>
</tr>
<tr>
<td>HC026</td>
<td>Brainstorming</td>
<td>Soil degradation (sedimentation and erosion) due to construction</td>
</tr>
<tr>
<td>HC027</td>
<td>Brainstorming</td>
<td>Rock fall/ground cracking</td>
</tr>
<tr>
<td>HC028</td>
<td>Brainstorming</td>
<td>Mine closure works</td>
</tr>
<tr>
<td>HC029</td>
<td>Brainstorming</td>
<td>Southern Coalfield inquiry findings (affect on Director General’s Environmental Assessment Requirements)</td>
</tr>
<tr>
<td>HC030</td>
<td>Brainstorming</td>
<td>Management of the relationship with interest groups (stakeholders)</td>
</tr>
<tr>
<td>HC031</td>
<td>Brainstorming</td>
<td>Potential for change in surface fire frequency</td>
</tr>
<tr>
<td>HC032</td>
<td>Brainstorming</td>
<td>Introduction or spread of weeds or feral animals</td>
</tr>
<tr>
<td>HC033</td>
<td>Brainstorming</td>
<td>Phytophthora and chytrid fungus</td>
</tr>
<tr>
<td>HC034</td>
<td>Brainstorming</td>
<td>Gas emissions from underground mine workings</td>
</tr>
<tr>
<td>HC035</td>
<td>Brainstorming</td>
<td>Employment throughout construction, operation and closure</td>
</tr>
<tr>
<td>HC036</td>
<td>Brainstorming</td>
<td>Downstream impacts</td>
</tr>
<tr>
<td>HC037</td>
<td>Brainstorming</td>
<td>Loss of stream connectivity</td>
</tr>
<tr>
<td>HC038</td>
<td>Brainstorming</td>
<td>Impacts on aquatic biota – invertebrates, fish, etc.</td>
</tr>
<tr>
<td>HC039</td>
<td>Brainstorming</td>
<td>Stormwater management</td>
</tr>
<tr>
<td>HC040</td>
<td>Brainstorming</td>
<td>Security of long term water supply requirements</td>
</tr>
<tr>
<td>HC041</td>
<td>Brainstorming</td>
<td>Surface disturbance – vent shaft, monitoring equipment, exploration and remediation</td>
</tr>
<tr>
<td>HC042</td>
<td>Brainstorming</td>
<td>Short term versus long term impacts</td>
</tr>
<tr>
<td>HC043</td>
<td>Brainstorming</td>
<td>Increased number of people – accessing the surface</td>
</tr>
<tr>
<td>HC044</td>
<td>Brainstorming</td>
<td>Reduction of groundwater resource</td>
</tr>
<tr>
<td>HC045</td>
<td>Brainstorming</td>
<td>Groundwater dependent ecosystems</td>
</tr>
<tr>
<td>HC046</td>
<td>Brainstorming</td>
<td>Impacts on Royal National Park and Garawarra State Conservation Area</td>
</tr>
<tr>
<td>HC047</td>
<td>Brainstorming</td>
<td>Changes to surface water and groundwater interactions</td>
</tr>
<tr>
<td>HC048</td>
<td>Brainstorming</td>
<td>Impacts from exploration activities</td>
</tr>
<tr>
<td>HC049</td>
<td>Brainstorming</td>
<td>Amenity impacts resulting from installation of monitoring equipment</td>
</tr>
<tr>
<td>HC050</td>
<td>Brainstorming</td>
<td>Visual impacts, including lighting at the surface facilities</td>
</tr>
<tr>
<td>HC051</td>
<td>Brainstorming</td>
<td>Increased power demand</td>
</tr>
<tr>
<td>HC052</td>
<td>Brainstorming</td>
<td>Impacts at Glenlee washery</td>
</tr>
<tr>
<td>HC053</td>
<td>Brainstorming</td>
<td>Vibration impacts – minor excavation blasting and heavy vehicle movement</td>
</tr>
<tr>
<td>HC054</td>
<td>Brainstorming</td>
<td>Risk of studies not meeting regulatory expectations</td>
</tr>
<tr>
<td>HC055</td>
<td>Brainstorming</td>
<td>Community impacts, appropriate communication with key stakeholders</td>
</tr>
</tbody>
</table>
The modified HAZOP process identified some additional issues. These are presented in Table 9.

<table>
<thead>
<tr>
<th>Ref</th>
<th>Source</th>
<th>Description of Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC069</td>
<td>Process Map – 1</td>
<td>Land contamination – resulting from surface facility activities and rejects emplacement</td>
</tr>
<tr>
<td>HC070</td>
<td>Process Map – 1</td>
<td>Construction and longer term vibration impacts on heritage buildings</td>
</tr>
<tr>
<td>HC071</td>
<td>Process Map – 1</td>
<td>Noise impacts from rail loading construction</td>
</tr>
<tr>
<td>HC072</td>
<td>Process Map – 1</td>
<td>Release of paste fill from the paste backfill facility</td>
</tr>
<tr>
<td>HC073</td>
<td>Process Map – 1</td>
<td>Air quality (positive) impact with rail load out¹</td>
</tr>
<tr>
<td>HC074</td>
<td>Process Map – 1</td>
<td>Noise level (positive) impact with rail load out¹</td>
</tr>
<tr>
<td>HC075</td>
<td>Process Map – 1</td>
<td>Mine closure planning</td>
</tr>
<tr>
<td>HC076</td>
<td>Process Map – 1</td>
<td>Flooded mine releasing contaminated water</td>
</tr>
<tr>
<td>HC077</td>
<td>Process Map – 1</td>
<td>Asbestos risks during demolition</td>
</tr>
<tr>
<td>HC078</td>
<td>Process Map – 1</td>
<td>Revegetation failure and rehabilitation of damaged lands</td>
</tr>
<tr>
<td>HC079</td>
<td>Process Map – 1</td>
<td>Lead based paint (exposure during demolition)</td>
</tr>
<tr>
<td>HC080</td>
<td>Process Map – 1</td>
<td>Remediation of contaminated soils and ground water</td>
</tr>
<tr>
<td>HC081</td>
<td>Process Map – 2</td>
<td>Social impacts (e.g. availability of suitable accommodation)</td>
</tr>
<tr>
<td>HC082</td>
<td>Process Map – 3</td>
<td>Vegetation and habitat disturbance associated with the new ventilation shaft</td>
</tr>
<tr>
<td>HC083</td>
<td>Process Map – 3</td>
<td>Ventilation shaft – air and noise emissions during construction and operation</td>
</tr>
<tr>
<td>HC084</td>
<td>Process Map – 3</td>
<td>Opportunistic rehabilitation during construction</td>
</tr>
<tr>
<td>HC085</td>
<td>Process Map – 3</td>
<td>Changes to pool dynamics in streams/creeks</td>
</tr>
<tr>
<td>HC086</td>
<td>Process Map – 3</td>
<td>Impacts on iconic species e.g. platypus</td>
</tr>
<tr>
<td>HC087</td>
<td>Process Map – 3</td>
<td>Increased gradient in creeks leads to erosion</td>
</tr>
<tr>
<td>HC088</td>
<td>Process Map – 3</td>
<td>Road kill on tracks/roads in Woronora Special Area</td>
</tr>
<tr>
<td>HC089</td>
<td>Process Map – 3</td>
<td>Stepping or buckling of road surface and damage to bridges, culverts or other features</td>
</tr>
<tr>
<td>HC090</td>
<td>Process Map – 3</td>
<td>Subsidence impacts on dam wall</td>
</tr>
</tbody>
</table>
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

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

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**

- **Cause**: Cracking of upland swamp
  - Relatively low level of cracking
  - Ability of cracks to heal

- **Preventative Controls**: Subsidence modelling and mine design

- **Incident**: Natural capacity of swamps to deal with seasonal perturbations

- **Reactive Controls**: Impacts on freshwater upland swamps leading to adverse changes in vegetation composition, health, swamp function, fire susceptibility or erosion; the impact of subsidence is to change the available water outside of normal seasonal perturbations. Change in area for a longer period – but no significant change in vegetation.

- **Outcomes**:
  - Rank – Low 2
  - Probability C
  - Consequence 5

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

- **Cause**: Cracking of base of embank
  - Dry period (drought)

- **Preventative Controls**: No controls identified

- **Incident**: Loss of environmental flow and system connectivity

- **Reactive Controls**: Impacts without mining – natural high variability of water flow, loss of connectivity and dependence on refugia.

- **Outcomes**: Impacts with mining – natural high variability of water flow, loss of connectivity and dependence on refugia.

- **Risk Ranking**:
  - Rank – Medium 15
  - Probability A
  - Consequence 5
  - Rank – Medium 15
  - Probability A
  - Consequence 5
  - Rank – Medium 10
  - Probability A
  - Consequence 5
Figure 6 – Risk and Control Chart for Dust Emissions

Figure 7 – Risk and Control Chart – Noise Impacts
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