

Vickery Coal Project

Environmental
Impact
Statement

APPENDIX M

ENVIRONMENTAL
RISK ASSESSMENT

Vickery Coal Project

Environmental Risk Assessment

Prepared for: Whitehaven Coal Limited

Prepared by: Safe Production Solutions
Author: Dr Peter Standish

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Vickery Coal Project – Environmental Risk Assessment

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Vickery Coal Project – Environmental Risk Assessment

1 INTRODUCTION

Whitehaven Coal Limited (Whitehaven) proposes to develop an open cut mining operation known as the Vickery Coal Project (the Project) approximately 25 kilometres (km) north of Gunnedah in New South Wales (NSW) (Figure 1).

The Project is located at the site of the previous Vickery Coal Mine which was commenced in 1986 with a small underground operation and continued until 1991. From 1991 to 1998 approximately 4 million tonnes of coal was extracted using open cut mining methods. Mining operations at the Vickery Coal Mine ceased in May 1998. Since mining ceased, rehabilitation activities have been completed and the site is currently under care and maintenance.

This document is an Environmental Risk Assessment (ERA) which identifies risks associated with key potential environmental issues associated with the Project.

1.1 AIM AND OBJECTIVES

The aim of the ERA workshop was:

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

The primary objectives of this ERA were to:

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

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

1. identification of key potential environmental issues to be addressed in the Environmental Impact Statement (EIS); and
2. a document suitable for inclusion in the EIS and prepared in accordance with Australian Standard/ New Zealand Standard International Standards Organisation (AS/NZS ISO) 31000:2009 *Risk Management – Principles and Guidelines* (AS/NZS ISO 31000:2009).

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

1.2 CLIENT

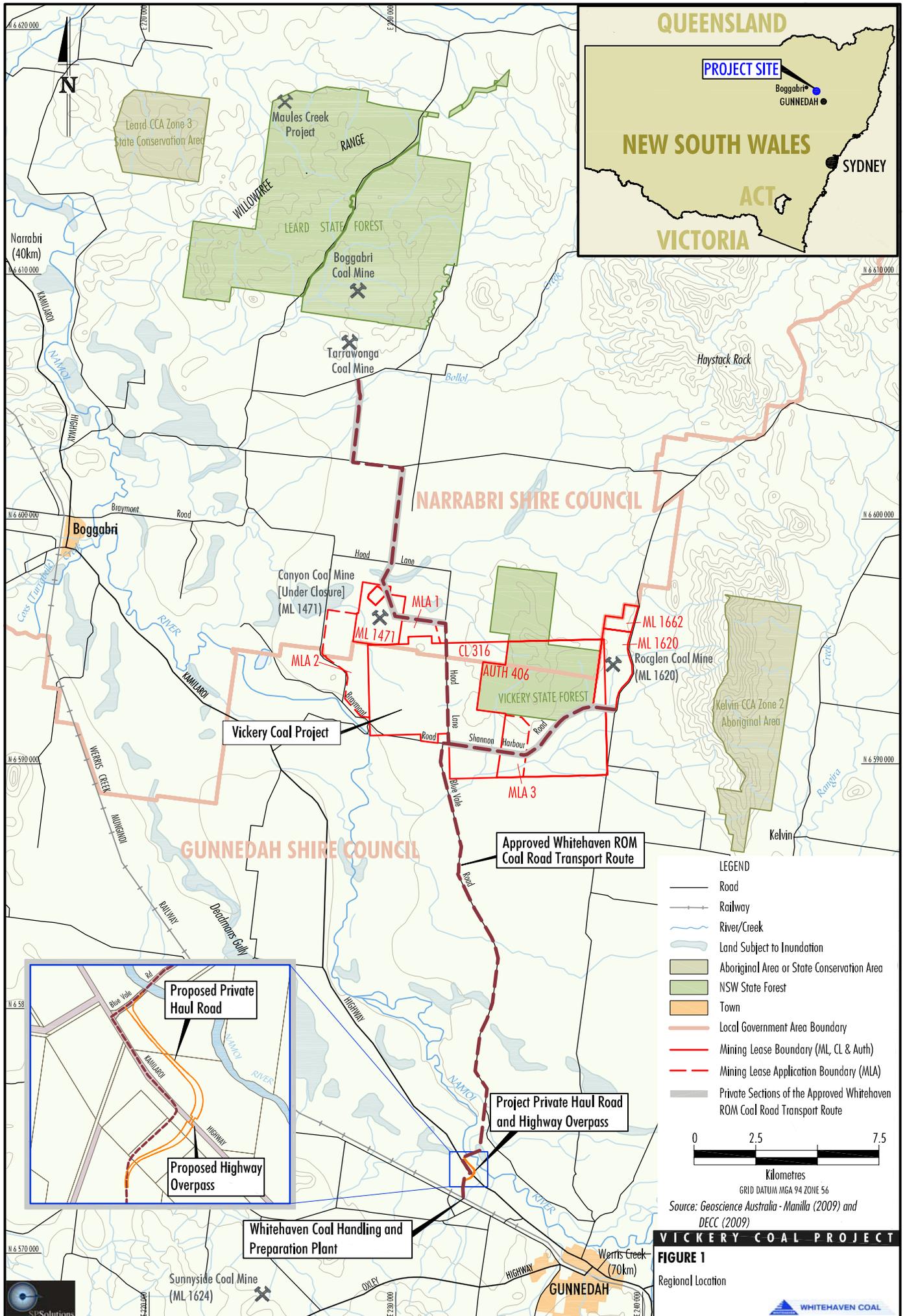
The client for the ERA is Whitehaven Coal Limited.

1.3 SCOPE

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

... the EIS must include:

- *risk assessment of the potential environmental impacts of the development, identifying the key issues for further assessment.*



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

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

1.4 CLARIFYING POINTS

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

- Safety issues were not intended to be covered.
- The geographical extent of the Project area was understood to include the Development Application area which is described in Attachment 2 in the Main Report of the EIS (including the private haul road and Kamilaroi Highway overpass).

1.5 RISK ASSESSMENT PROCESS

The risk assessment process was based on the framework provided on Figure 2 (based on AS/NZS ISO 31000:2009, MDG1010 *Minerals Industry Safety and Health Risk Management Guideline* [NSW Department of Trade and Investment), 2011] and HB 203:2006 *Environmental Risk Management – Principles and Process* [HB 2003:2006]).

1.6 RESOURCING, SCHEDULE AND ACCOUNTABILITIES

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

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

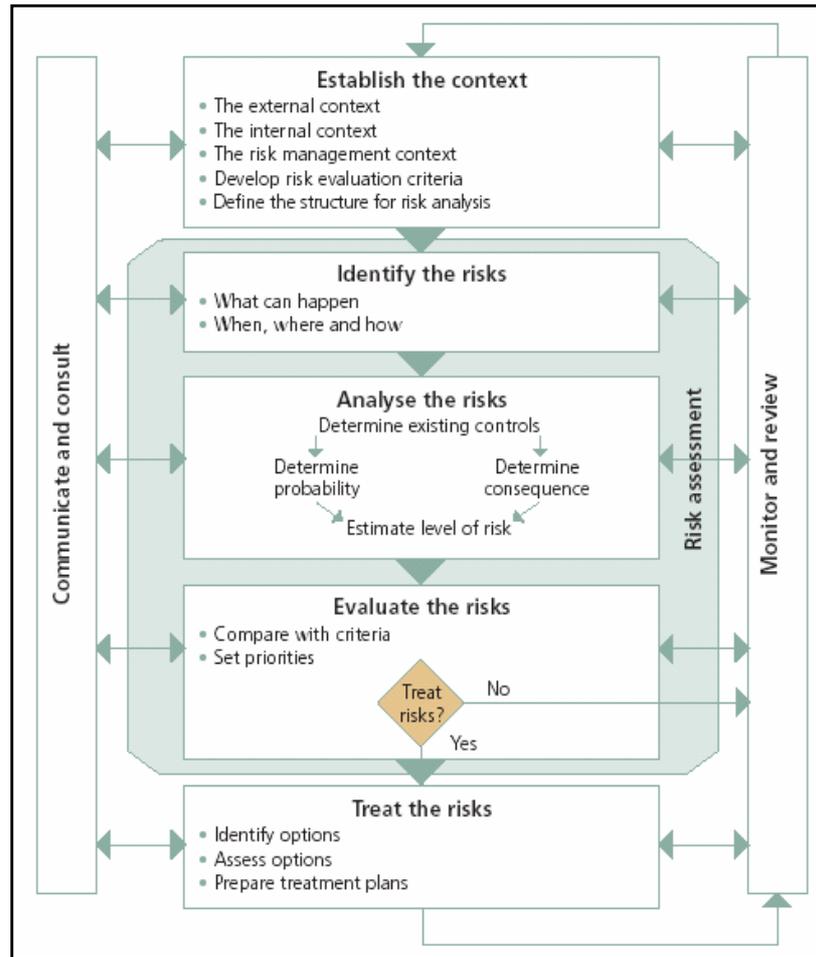
The outcomes of the ERA and associated accountabilities will be integrated into the EIS and overall Whitehaven management systems so that they are effectively reviewed, implemented and monitored.

1.7 METHODOLOGY

1.7.1 Framework

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

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Source: after AS/NZS ISO 31000:2009.

Figure 2 - Risk Management Process (AS/NZS ISO 31000:2009)

1.7.2 Key Steps

The key steps in the process included:

1. confirming the scope of the ERA;
2. listing the key assumptions on which the ERA is based;
3. reviewing available data on the Project including reports, plans, maps and aerial photos (both prior to and during the workshop);
4. conduct a team-based risk assessment that:
 - a) provided detailed descriptions of the tasks to be undertaken and the proposed method;
 - b) identified hazards and assessed the level of risk; and
 - c) developed a list of recommended controls to treat the risk (through prevention, monitoring, management and rehabilitation strategies);
5. prepare a draft report in accordance with AS/NZS ISO 31000:2009 and MDG1010 *Minerals Industry Safety and Health Risk Management Guideline* (Department of Trade and Investment, 2011) standards for review by Whitehaven personnel and ERA team members;
6. incorporate comments from Whitehaven and the ERA team; and
7. finalise the report and issue as controlled copy for ongoing use.

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

As described in Section 1.1, the outcomes of the ERA and associated accountabilities will be integrated into the EIS and overall Whitehaven management systems so that they are effectively reviewed, implemented and monitored.

1.7.3 External Facilitation

The team was facilitated through the process by **SP Solutions** – a company specialising in Risk Assessment and risk management programmes. The facilitator, Peter Standish, is experienced with open cut coal mining and many aspects of environmental monitoring and rehabilitation.

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

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

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

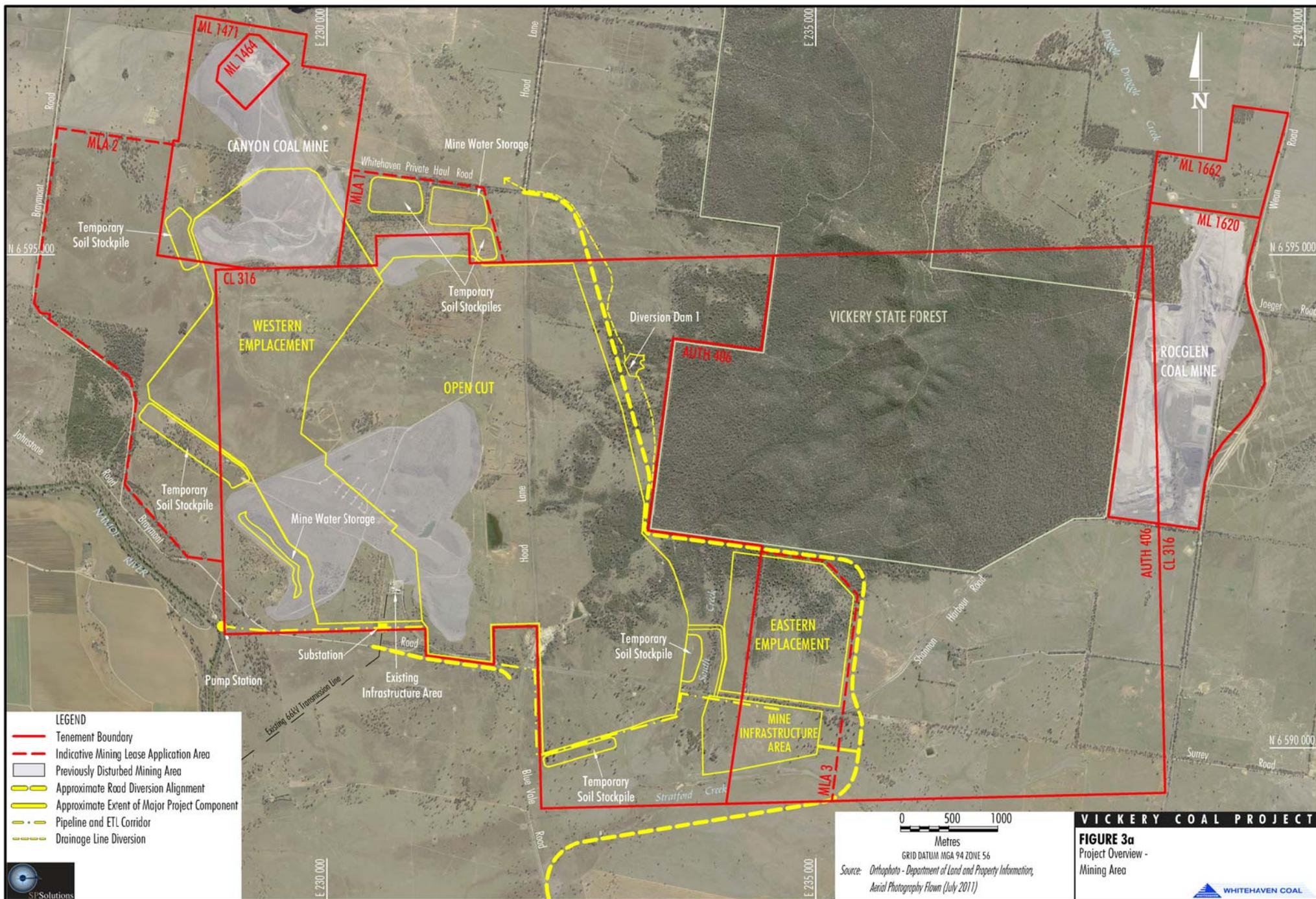
2 ESTABLISH THE CONTEXT

2.1 PROJECT SUMMARY

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

- development and operation of an open cut mine within Coal Lease 316, Authorisation 406, Mining Lease 1471, Mining Lease Application (MLA) 1, MLA 2 and MLA 3;
- use of conventional mining equipment, haul trucks and excavators to remove up to 4.5 million tonnes per annum of run-of-mine (ROM) coal and approximately 48 million bank cubic metres of waste rock per annum from the planned open cut;
- placement of waste rock (i.e. overburden and interburden/partings) within external emplacements to the west and east of the planned open cut (i.e. Western Emplacement and Eastern Emplacement) and within mined-out voids;
- construction and use of a Mine Infrastructure Area, including on-site coal crushing, screening and handling facilities to produce sized ROM coal, workshops, offices and services;
- transport of ROM coal by haulage trucks to the Whitehaven Coal Handling and Preparation Plant (CHPP) on the outskirts of Gunnedah (approximately 20 km to the south of the Project open cut) for processing;
- use of an on-site mobile crusher for coal crushing and screening of up to 150,000 tonnes of domestic specification coal per annum for direct collection by customers at the Project site;
- use an on-site mobile crusher to produce up to approximately 90,000 cubic metres of gravel materials per annum for direct collection by customers at the Project site;
- construction and use of water supply bores, and a surface water extraction point on the bank of the Namoi River and associated pump and pipeline systems;
- construction and use of new dams, sediment basins, channels, dewatering bores and other water management infrastructure required to operate the mine;
- construction and use of new soil stockpile areas, laydown areas and gravel/borrow areas;
- construction of a 66 kilovolt (kV)/11 kV electricity substation and 11 kV electricity transmission line;
- transport of coarse rejects generated within the Whitehaven CHPP via truck to the Project for emplacement within an in-pit emplacement area;
- transport of tailings (i.e. fine rejects) generated within the Whitehaven CHPP via truck to the Project for emplacement within co-disposal storage areas in the open cut and/or disposal in existing off-site licensed facilities (e.g. the Brickworks Pit);
- realignment of sections of Blue Vale Road, Shannon Harbour Road and Hoad Lane to the east and south of the open cut;
- realignment of the southern extent of Braymont Road to the south of the open cut;
- construction of an approximately 1 km long section of private haul road (including an overpass over the Kamilaroi Highway) between Blue Vale Road and the Whitehaven CHPP;
- ongoing exploration, monitoring and rehabilitation activities; and
- construction and use of other associated infrastructure, equipment and mine service facilities.

The Project general arrangement is shown on Figures 3a and 3b. A description of the Project is provided in Section 2 in the Main Report of the EIS.



VICKERY COAL PROJECT
FIGURE 3a
 Project Overview -
 Mining Area



2.2 RISK MANAGEMENT CONTEXT

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

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

- AS/NZ ISO 31000:2009;
- HB 203:2006; and
- MDG1010 *Minerals Industry Safety and Health Risk Management Guideline* (Department of Trade and Investment, 2011).

A Preliminary Environmental Assessment was submitted for the Project in November 2011 (Whitehaven, 2011). The key potential environmental impacts identified in the assessment relating to the Project were also considered in this ERA.

2.3 RISK CRITERIA

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

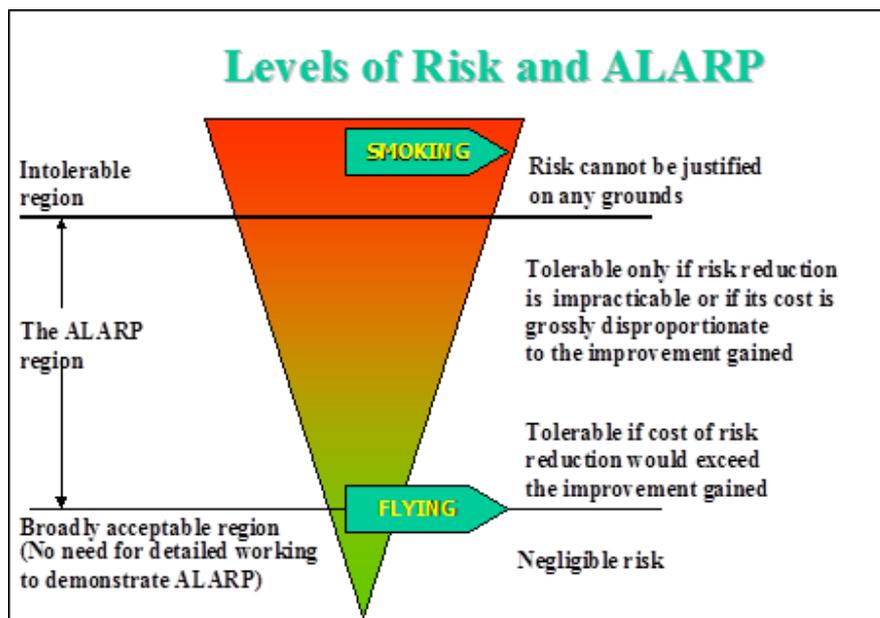


Figure 4 – Risk Criteria "ALARP"

Flying is an example of a risk considered by most people to be a tolerable risk; whilst smoking is generally considered to be an activity which cannot be justified from a risk perspective. This is shown graphically in Figure 4. Intolerable items such as smoking are at the top of the pyramid where much lower risks, such as flying, sit at the lower end of the ALARP zone (close to tolerable).

The risk ranking matrices used during the ERA workshop are presented in Section 4.

3 IDENTIFY RISKS

3.1 OVERVIEW

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

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

3.2 ENVIRONMENTAL RISK ASSESSMENT TEAM

The team met for the ERA workshop in Sydney on the 6th of July 2012. A team based approach was utilised in order to have an appropriate mix of skills and experience to identify the potential environmental issues and potential loss scenarios. Details of the team members and their relevant qualifications and experience are included in Table 1.

3.3 RISK IDENTIFICATION

3.3.1 *Brainstorming*

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

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

Issues identified during the brainstorming session are presented in the consolidated listing of issues identified in Attachment B.

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Table 1 – ERA Team

Name	Position / Affiliation	Relevant qualifications and experience
Peter Standish	Facilitator - SP Solutions	PhD, BE (Hons), Dip Bus Mgt, Risk Analysis Trained. Certificate of Competence as a Manager. 33 years experience in underground and open cut mining operations with operating, managerial and contract management experience. Involved in reviewing environmental conditions and applications for 5 years. Conducting Risk Analyses for 12 years.
Danny Young	Group Environmental Manager - Whitehaven Coal	BSc (Environmental). 5 years mining experience, 15 years total experience.
Ben Bomford	Vickery Project Development Manager - Whitehaven Coal	BE (Mechanical). Over 15 years industrial experience.
Noel Merrick	Principal - Heritage Computing	Phd, MSc, Gdip (DP), BSc, Groundwater modeller, hydrogeologist and geophysicist. 40 years experience.
Steve Perrins	Principal - Evans & Peck	BE, MEng (Sci), PhD. Over 40 years experience in water management and assessment.
Adam Koutsamanis	Consultant - Evans & Peck	BE (Environmental), MEnvLaw. Over 3 years experience in water management and assessment.
Chris Gippel	Director - Fluvial Systems	BSc (Hons), PhD. 30 years experience in hydrology and geomorphology.
David McKenzie	Director- McKenzie Soil Management	BNat Res, Msci(Ag), PhD. Over 30 years experience in soil resource assessment.
Rhidian Harrington	Director - Niche Environment and Heritage	BSc (Hons), MSC, PhD. Over 15 years experience in ecological assessment.
Richard Kirwood	Principal - Resource Strategies	BSc (Geology); Grad Dip Nat Res. 18 years experience in mining related environmental consulting.
Clive Berry	Senior Environmental Manager - Resource Strategies	BE (Environmental). 10 years experience environmental management and project approvals in resource industry.
Tom MacKillop	Environmental Manager - Resource Strategies	BE (Environmental); BSc. 5 years experience environmental management.
James Steele	Environmental Manager - Resource Strategies	BE (Environmental); BA. 5 years experience environmental management.

3.3.2 Modified HAZOP

The next “tool” applied with the team was that of a modified HAZOP. In this process the aerial photographs of the site were referred to along with a consideration of the phases of operation and the potential impacts that could arise.

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

- Surface Water;
- Noise and Blasting;
- Soil and Land Resource;
- Groundwater;
- Fauna (Terrestrial and Aquatic);
- Visual;
- Road Transport;
- Socio-Economic;
- Air Quality;
- Land Contamination;
- Flora;
- Aboriginal Cultural Heritage;
- Non-Aboriginal Cultural Heritage; and
- Geochemistry.

3.3.3 Identification of Key Environmental Issue Types

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

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Table 2 – Key Potential Environmental Issues

Ref	Environmental Issue Subject Area	Description of Issue/Loss scenario	Votes
V031	Noise and Blasting	Mine site noise emissions and potential effects on surrounding landholders.	9
V123	Surface Water	Increased leakage of, or reduced base flow to the Namoi River due to depressurisation of aquifers.	9
V025	Groundwater	Long-term changes to groundwater levels, flow direction and quality in the vicinity of the final void.	6
V089	Visual	Visual impact of waste rock emplacements and mining infrastructure.	6
V134	Groundwater	Seepage from waste emplacements to alluvial materials adjacent to the Canyon Coal Mine final void leading to potential groundwater and surface water quality impacts.	6
V007	Biodiversity	Cumulative impacts of multiple existing and proposed mine developments on regional biodiversity in the Gunnedah Basin.	5
V038	Noise and Blasting	Road noise impacts associated with 24 hours per day, seven days per week ROM coal haulage.	5
V059	Soil and Land Resource	Long-term geotechnical stability of final landforms.	5
V067	Soil and Land Resource	Success/performance of rehabilitation post-mining.	5
V096	Surface Water	Changes to flooding characteristics due to construction of private haul road and Kamilaroi Highway overpass.	5
V121	Soil and Land Resource	Suitable topsoil management and storage for future use in rehabilitation.	5
V002	Soil and Land Resource	Impacts on agricultural resources disturbed as a result of mining activities.	3
V005	Biodiversity	Demonstrating the proposed offset is fit for purpose and in sufficient quantity.	3
V069	Road Transport	Duration of ROM coal haulage (i.e. 24 hours per day, seven days per week ROM coal haulage).	3
V091	Surface Water	Adverse impacts on downstream water quality parameters, that could have consequential effects on ecology or beneficial use.	3
V111	Surface Water	Risk of seepage from storage within Blue Vale void towards the Namoi River.	3
V022	Biodiversity	Vegetation clearance related impacts on flora, fauna and their habitats.	2
V035	Air Quality	Potential effects of dust emissions on surrounding landowners.	2
V039	Noise and Blasting	Ground vibration and airblast effects on amenity of nearby receivers and buildings.	2
V074	Soil and Land Resource	Changes to the potential land uses directly disturbed or otherwise impacted as a result of mining activities.	2
V099	Surface Water	Insufficient site water flow/use monitoring data to enable model calibration which could cast doubt over predictions of water excess or shortfall.	2
V113	Surface Water	Seepage/runoff from mine disturbance areas bypassing water management systems and migrating offsite with possible downstream contamination.	2
V118	Surface Water	Mine water discharge in the event of extreme weather events.	2
V124	Surface Water	Licensed extraction from the Namoi River.	2

Vickery Coal Project – Environmental Risk Assessment

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

- Appendix A Groundwater Assessment;
- Appendix B Surface Water Assessment;
- Appendix C Noise and Blasting Assessment;
- Appendix D Air Quality and Greenhouse Gas Assessment;
- Appendix E Ecological Assessment;
- Appendix F Road Transport Assessment;
- Appendix G Agricultural Impact Statement;
- Appendix H Visual Assessment;
- Appendix I Aboriginal Cultural Heritage Assessment;
- Appendix J Non-Aboriginal Heritage Assessment;
- Appendix K Socio-Economic Assessment;
- Appendix L Geochemistry Assessment;
- Appendix N Preliminary Hazard Analysis; and
- Appendix O Land Contamination Assessment.

3.3.4 Referred Issue

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

The team did not identify any referred issues.

Community engagement issues are addressed in the Project stakeholder engagement strategy. The outcomes of stakeholder engagement undertaken for the Project are outlined in Section 3 in the Main Report of the EIS.

4 ANALYSE RISKS

4.1 PROBABILITY AND MAXIMUM REASONABLE CONSEQUENCE

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

The following definition of risk was used:

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

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

Table 3 – Qualitative Measures of Probability

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

Table 4 – Qualitative Measures of Maximum Reasonable Consequence

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

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

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Table 5 – Risk Ranking Table

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

Notes:

L = Low; M = Moderate; H = High

Risk Numbering:

1 = highest risk, 25 = lowest risk

Legend:

Risk Levels:

	Tolerable
	ALARP
	Intolerable

4.2 RISK RANKING

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

Table 6 – Risk Ranking Results

Environmental Issue Subject Area	Key Issue	Ranking Basis/Loss Scenario	C	P	R
Air Quality	Potential effects of dust emissions on surrounding landowners.	<p>Considered air quality and emissions associated with the mining fleet, mining method and crushing of ROM coal.</p> <p>Mitigated by haul road watering, progressive rehabilitation, real time dust monitoring and management, private agreements and property acquisition.</p>	4	C	18(L)
Biodiversity	Demonstrating the proposed offset is fit for purpose and in sufficient quantity.	<p>Considered the issue of securing land with suitable vegetation types and connectivity to other vegetated areas.</p> <p>Mitigated by strategically securing land with like for like vegetation types with a suitable offset ratio.</p>	4	C	18(L)
	Cumulative impacts of multiple existing and proposed mine developments on regional biodiversity in the Gunnedah Basin.	<p>Considered the cumulative loss of biodiversity associated with the existing and proposed mining operations in the Gunnedah Basin.</p> <p>Mitigated by the potential for integration of mining operations and/or associated infrastructure with future mining operations (e.g. Vickery South) and integration of biodiversity offsets.</p>	5	A	15(M)

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Table 6 – Risk Ranking Results (Cont.)

Environmental Issue Subject Area	Issue	Ranking Basis/Loss Scenario	C	P	R
Biodiversity (Cont.)	Vegetation clearance related impacts on flora, fauna and their habitats (including endangered ecological communities, up to 1,900 hollow trees and threatened species).	<p>Considered the loss of biodiversity associated with the Project.</p> <p>Mitigated by implementation of a vegetation clearance protocol, avoidance of endangered ecological communities in mine planning, rehabilitation of mining landforms and proposed offset areas.</p>	5	A	15(M)
Groundwater	Seepage from waste emplacements to alluvial materials adjacent to the Canyon Coal Mine final void leading to potential groundwater and surface water quality impacts.	<p>Considered the potential for seepage from waste rock placed within the Canyon Coal Mine void to report to the alluvial materials.</p> <p>Mitigated by the selective placement of potentially acid forming waste rock such that any seepage drains away from the alluvial materials.</p>	5	D	24(L)
	Long-term changes to groundwater levels, flow direction and quality in the vicinity of the final void.	<p>Considered the depressurisation of groundwater and creation of a local pit lake in the final void.</p> <p>Considered that the pit lake is likely to be saline in the longer term with potential to affect adjoining water resources (i.e. potential for reduction of water quality).</p> <p>Risk evaluated on the assumption that the final void is a groundwater sink. Noted that spills from the void are unlikely.</p>	5	A	15(M)
Noise and Blasting	Mine site noise emissions and potential effects on surrounding landholders.	<p>Considered the site noise emissions including employment of a large truck fleet to move ROM coal and waste rock.</p> <p>Mitigated through the use of noise attenuated haul trucks, excavators and dozers, bunding along key haul routes, noise attenuation of crusher, restriction of mining activities on the external face of the Western Emplacement during night-time and use of alternative dumping scenario during adverse meteorological conditions.</p>	4	B	14(M)
	Road noise impacts associated with 24 hours per day, seven days per week ROM coal haulage.	<p>Considered the potential for an increase in noise due to road haulage of coal, the number and location of sensitive receivers along the existing Whitehaven Haulage Route and the noise levels experienced with current ROM coal haulage from Whitehaven's existing operations was noted.</p> <p>Mitigated by driver education and behaviour monitoring, use of existing haulage fleet and compliance monitoring.</p>	4	B	14(M)
	Ground vibration and air blast effects on amenity of nearby receivers and buildings, (i.e. exceedance of structural damage criteria and human amenity criteria).	<p>Considered the blast emissions associated with the Project including the distance to sensitive receivers and proposed blast practices.</p> <p>Mitigated by adaptive management, monitoring and if necessary reducing blast size.</p>	4	D	21(L)
Road Transport	Duration of ROM coal haulage (i.e. 24 hours per day, seven days per week ROM coal haulage).	<p>Considered the increase in daily haul truck, employee and delivery movements. Considered the spread of the increased number of haul truck movements across a longer duration of haulage to that currently undertaken by Whitehaven's other mining operations.</p> <p>Mitigated by the construction of the private haul road and Kamilaroi Highway overpass between Blue Vale Road and the Whitehaven CHPP.</p>	5	B	19(L)

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Table 6 – Risk Ranking Results (Cont.)

Environmental Issue Subject Area	Issue	Description of Issue and Ranking Basis	C	P	R
Soil and Land Resource	Long-term geotechnical stability of final landforms.	<p>Considered the potential geotechnical issues associated with long-term geotechnical stability of the proposed post-mining landform.</p> <p>Mitigated through appropriate landform design according to the type of material, management and monitoring of rehabilitation and the development of a mine closure plan.</p>	5	C	22(L)
	Success/performance of rehabilitation post-mining.	<p>Considered potential failure of the rehabilitation. This could limit future land use options on the rehabilitated landforms and cause sediment release from the site.</p> <p>Mitigated through appropriate rehabilitation planning, implementation and monitoring against appropriate completion criteria prior to relinquishment</p>	5	C	22(L)
	Suitable topsoil management and storage for future use in rehabilitation.	<p>Considered the potential for reduced topsoil quality following stripping and stockpiling and considered that adequate space would be available for appropriate stockpiling.</p> <p>Mitigated through appropriate topsoil management (e.g. best practice stockpile management) and incorporation of stockpile areas into the mine plan.</p>	5	C	22(L)
	Impacts on agricultural resources disturbed as a result of mining activities.	<p>Considered the impacts on agricultural resources. Noted the existing agricultural suitability and land capability of the Project area and the impacts to the regions agricultural productivity as a result of the Project.</p> <p>Mitigated through the appropriate management of topsoil and the potential to re-establish agricultural areas within the post-mining landform, and the socio-economic benefits of the mine and post-mining land use (i.e. restoration of agricultural areas).</p>	5	A	15(M)
	Changes to the potential land uses directly disturbed or otherwise impacted as a result of mining activities	<p>Considered the impacts on agricultural resources. Noted the existing agricultural suitability and land capability of the Project area and the impacts to the regions agricultural productivity as a result of the Project.</p> <p>Mitigated through the identification of final land uses according to proposed land form and planning for those uses. Also considered appropriate material handling (e.g. management of sodic soils).</p>	4	A	10(M)
Surface Water	Insufficient site water flow/use monitoring data to enable model calibration which could cast doubt over predictions of water excess or shortfall.	<p>Considered the adequacy of the water balance calibration and the potential to cast doubt over predictions of water excess or shortfall.</p> <p>Mitigated by sufficient water licences held by Whitehaven (to offset impacts), ability to temporarily transfer water allocations between Whitehaven's operations, adequate sizing of storages (using the pit as a backup) and conservatism in modelling.</p>	4	E	23(L)

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Table 6 – Risk Ranking Results (Cont.)

Environmental Issue Subject Area	Issue	Description of Issue and Ranking Basis	C	P	R
Surface Water (Cont.)	Adverse impacts on downstream water quality parameters that could have consequential effects on ecology or beneficial use.	Considered impacts associated with surface water runoff from mine landforms to the downstream environment and users. Mitigated through appropriate erosion and sediment control structures, mine water management system and minimisation of catchment areas.	5	C	22(L)
	Changes to flooding characteristics due to construction of private haul road and Kamilaroi Highway overpass.	Considered changes to flood levels upstream of the Highway Overpass (i.e. increased flood heights) and changes to flood hydraulics (i.e. changes to flow regime). Mitigated through inclusion of culverts in the road design, constructing the structure close to natural ground level and appropriate road design (e.g. batters).	5	C	22(L)
	Licensed extraction from the Namoi River.	Considered the potential impact of water extraction to downstream users. Mitigated by operating in accordance with licence conditions.	5	C	22(L)
	Mine water discharge in the event of extreme weather events.	Considered the potential downstream impacts associated with potential mine water discharge to the environment and other users. Mitigated by appropriate design/maintenance of erosion controls and storages.	5	B	19(L)
	Increased leakage of, or reduced base flow to the Namoi River due to depressurisation of aquifers.	Considered impacts to the Namoi River as a result of groundwater depressurisation associated with mining operations. Mitigated through the location of the final voids away from the Namoi River and keeping the level of water in the Blue Vale void high to provide a hydraulic gradient towards the Namoi River.	5	B	19(L)
	Risk of seepage from storage within Blue Vale void towards the Namoi River.	Considered impacts of mine water stored within the Blue Vale void seeping to the Namoi River. Mitigated through regular water level and quality monitoring of the Namoi River and Blue Vale void.	5	A	15(M)
	Seepage/runoff from mine disturbance areas bypassing water management systems and migrating offsite with possible downstream contamination.	Considered the likely contaminants present in runoff from disturbed areas. Mitigated by an appropriately designed, suitably sized water management system and regular monitoring.	5	C	22 (L)
Visual	Visual impact of waste rock emplacements and mining infrastructure.	Considered the impact of the Project on visual amenity in rural areas (including impacts from night-lighting). Mitigated through progressive rehabilitation of waste rock emplacements, appropriate placement of lighting plants, restriction on night-time operations on the external face of the Western Emplacement and visual screening where required.	4	B	14(M)

R= 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.

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5 MONITOR AND REVIEW

5.1 NOMINATED CO-ORDINATOR

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

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

5.2 COMMUNICATION AND CONSULTATION

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

5.3 CONCLUDING REMARKS

The risk assessment process conducted by the team was aligned with AS/NZS ISO 31000:2009 and MDG1010 *Minerals Industry Safety and Health Risk Management Guideline* (Department of Trade and Investment, 2011), with the intention of identifying the key potential environmental issues for the Project.

An appropriately detailed assessment of the key potential environmental issues will be included in the EIS appendices/sections as presented in Table 7.

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

Ref	Environmental Issue Subject Area	Summary Description of Issue	EIS Appendix/ Section
V031, V038	Noise and Blasting	Mine site and road transport noise emissions.	Appendix C and Section 4
V123, V096, V091, V111, V099, V113, V118, V124	Surface Water	Impacts to Namoi River, changes to flooding characteristics, downstream water quality impacts and suitability of mine water management infrastructure.	Appendix B and Section 4
V205, V134	Groundwater	Groundwater drawdown, groundwater quality impacts.	Appendix A and Section 4
V089	Visual	Visual impact of waste rock emplacements and mining infrastructure.	Appendix H and Section 4
V007, V005, V022	Biodiversity	Loss of biodiversity in the Gunnedah Basin, vegetation and habitat clearance and offset requirements.	Appendix E and Section 4
V059, V067, V074, V121, V002	Soil and Land Resource	Long-term geotechnical stability of final landform, rehabilitation success, topsoil management, impacts on agricultural resources.	Appendix G and Section 4
V035	Air Quality	Potential effects of dust emissions on surrounding landowners.	Appendix D and Section 4
V069	Road Transport	Duration of ROM coal haulage (i.e. 24 hours per day, seven days per week ROM coal haulage).	Appendix F and Section 4

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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 Main Report of the EIS.

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



Peter Standish, July 2012

6 REFERENCES

Department of Trade and Investment (2011) *MDG1010 Minerals Industry Safety and Health Risk Management Guideline*.

Whitehaven Coal Limited (2011) *Vickery Coal Project - Project Description and Preliminary Environmental Assessment*.

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ATTACHMENT A – DEFINITIONS

Term	Explanation
ALARP	“As Low As Reasonably Practicable”. The level of risk between tolerable and intolerable levels that can be achieved without expenditure of a disproportionate cost in relation to the benefit gained.
AS/NSZ ISO 31000:2009	Australian Standard/New Zealand Standard on Risk Management (see references in Section 6).
Cause	A source of harm.
Control	An intervention by the proponent intended to either Prevent a Cause from becoming an incident or to reduce the outcome should an incident occur.
DGRs	Director-General’s Requirements.
ERA	Environmental Risk Assessment.
MDG1010	Department of Primary Industries guideline on risk management (see references in Section 6).
Outcome	The end result following the occurrence of an incident. Outcomes are analogous to impacts and have a risk ranking attached to them.
Personnel	Includes all people working in and around the site (e.g. all contractors, sub-contractors, visitors, consultants, project managers etc.).
Practicable	The extent to which actions are technically feasible, in view of cost, current knowledge and best practices in existence and under operating circumstances of the time.
Review	An examination of the effectiveness, suitability and efficiency of a system and its components.
Risk	The combination of the potential consequences arising from a specified hazard together with the likelihood of the hazard actually resulting in an unwanted event.

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ATTACHMENT B - ISSUE IDENTIFICATION RESULTS

The output from the team’s analyses are presented below. This list has been sorted according to the Incident Type – which were drawn, in part, from the DGRs received for the Project. Note that where issues were not ranked it indicated that they were not highlighted by the whole team - but are intended to be studied in more detail - and so be quantitatively ranked to confirm the impact the Project may have on them.

Ref	Environmental Issue Subject Area	Description of Issue
V001	Soil and Land Resource	Potential for loss of land capability.
V002	Soil and Land Resource	Impacts on agricultural resources disturbed as a result of mining activities.
V003	Soil and Land Resource	Potential impacts on forestry resources (i.e. Vickery State Forest).
V004	Air Quality	Air quality impacts associated with dust generation from land disturbance, blasting, excavation, hauling and handling of waste rock and run-of-mine (ROM) coal and greenhouse gas emissions.
V005	Biodiversity	Demonstrating the proposed offset is fit for purpose and in sufficient quantity.
V006	Biodiversity	Potential cumulative impacts from a number of mining projects on biodiversity values.
V007	Biodiversity	Cumulative impacts of multiple existing and proposed mine developments on regional biodiversity loss in the Gunnedah Basin.
V008	Biodiversity	<i>Environment Protection and Biodiversity Conservation Act, 1999</i> threatened vertebrate species or those species not located but with suitable habitat present in the Project area or the immediate surrounds.
V009	Biodiversity	Exceedance of gross ecosystem and geomorphic thresholds (in relation to water, Carbon, nutrient cycles and energy interception within the landscape [water movement and solar interception]).
V010	Biodiversity	Impacts on threatened fauna and ensuring offsets cater for threatened species.
V011	Biodiversity	Inability to communicate long term vision of the Project including benefits, costs and biodiversity-landform-rehabilitation-offset outcomes.
V012	Biodiversity	Loss of agricultural land, albeit degraded, with little understanding as to how to optimise production and nature conservation outcomes in remaining Whitehaven buffer lands as alternative and viable offset propositions.
V013	Biodiversity	Loss of Endangered Ecological Communities (EECs), vegetation and fauna habitat and potential impact on listed threatened species, in particular, clearing of Winged Peppergrass (<i>Lepidium monopllocoides</i>).
V014	Biodiversity	Loss of landscape connectivity restricting movement of fauna across the landscape.
V015	Biodiversity	New South Wales threatened vertebrate species present or those species not located but with suitable habitat present in the Project area or the immediate surrounds.
V016	Biodiversity	Potential cumulative loss of all native vegetation on Permian landscapes in the Gunnedah Basin.
V017	Biodiversity	Retention of habitat components from cleared area for future use to upgrade or complement on site restoration programmes (future or existing) without significant pre-clearing planning.
V018	Biodiversity	Success of transplantation of Winged Peppergrass and long-term management.
V019	Biodiversity	Impacts on groundwater dependent ecosystems as a result of groundwater drawdown.
V020	Biodiversity	Introduction of weeds and feral animals.
V021	Biodiversity	Potential impacts of vegetation disturbance associated with the Project.
V022	Biodiversity	Vegetation clearance related impacts on flora, fauna and their habitats (including EECs, threatened species and tree hollows).
V023	Groundwater	Potential drawdown of groundwater levels and alteration of groundwater flow directions due to depressurisation associated with the development of the open cut and mine de-watering activities.
V024	Groundwater	Impacts on groundwater quality.

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Ref	Environmental Issue Subject Area	Description of Issue
V025	Groundwater	Long-term changes to groundwater levels, flow direction and quality in the vicinity of the final void.
V026	Aboriginal Cultural Heritage	Potential impact of the Project on Aboriginal heritage items.
V027	Aboriginal Cultural Heritage	Potential impact of the Project on Aboriginal heritage.
V028	Non-Aboriginal Cultural Heritage.	Potential impact of the Project on non-Aboriginal heritage.
V029	Noise and Blasting	Fume, dust and wind direction impacts on neighbours.
V030	Air Quality	Cumulative dust impacts, particularly to the south as a consequence of cumulative operation of Rocglen Coal Mine.
V031	Noise and Blasting	Mine site noise emissions and potential effects on surrounding landholders.
V032	Air Quality	Ensuring adequate and ongoing water supply for dust suppression.
V033	Air Quality	Increased greenhouse gas emissions.
V034	Noise and Blasting	Real time monitoring and ability to operate the Project within the relevant requirements.
V035	Air Quality	Potential effects of dust emissions on surrounding landowners.
V036	Noise and Blasting	Potential effects of noise emissions on surrounding landowners.
V037	Noise and Blasting	Potential fly rock impacts.
V038	Noise and Blasting	Road noise impacts associated with 24 hour per day, seven days per week ROM coal haulage.
V039	Noise and Blasting	Ground vibration and airblast effects on amenity of nearby receivers and buildings.
V040	Noise and Blasting	Potential for increased noise from the highway overpass.
V041	Noise and Blasting	Potential for increases in road noise, particularly during the construction phase.
V042	Air Quality	Potential for odorous emissions associated with coal self-heating (spontaneous combustion).
V043	Noise and Blasting	Potential for vibration effects on nearby buildings.
V044	Noise and Blasting	Potential overpressure and ground vibration impacts due to blasting.
V045	Noise and Blasting	Noise impacts associated with the use of mining equipment.
V046	Non-Aboriginal Cultural Heritage.	Potential impact on non-Aboriginal heritage items.
V047	Soil and Land Resource	Combined risk from aggregation of mine sites in the area.
V048	Socio-Economic	Bushfire risk to plant, equipment and personnel.
V049	Land Contamination	Maintaining sufficient capacity for fine reject disposal in existing disposal areas (e.g. Brickworks Pit).
V050	Socio-Economic	Cumulative mining impacts in the overall area (Rocglen, Tarrawonga, Boggabri, Maules Creek).
V051	Soil and Land Resource	Acceptability of final voids and potential backfill requirements.
V052	Soil and Land Resource	Visual implications of rehabilitation success.
V053	Soil and Land Resource	Acceptability of a final void in the post-mining landform.
V054	Soil and Land Resource	Achieving appropriate integration of final landform so that it blends with the surrounding natural topography.
V055	Soil and Land Resource	Development of long-term rehabilitation and mine closure concepts that balance land use and conservation objectives (final void management/acceptability).
V056	Land Contamination	Risk of spill from final void.
V057	Biodiversity	Increase in weed species and feral vertebrate fauna.
V058	Soil and Land Resource	Integration of final landform with Vickery South Project.
V059	Soil and Land Resource	Long-term geotechnical stability of final landforms.
V060	Surface Water	Long-term success/performance of the North-West Drainage Line diversion.

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Ref	Environmental Issue Subject Area	Description of Issue
V061	Land Contamination	Management of Coal Handling and Preparation Plant (CHPP) rejects backfilled in-pit.
V062	Soil and Land Resource	Mine closure and long-term land use, including final void management.
V063	Soil and Land Resource	Rehabilitation failure due to deficient soil nutrients or seasonal impacts.
V064	Soil and Land Resource	Rehabilitation failures due to drought.
V065	Surface Water	Final void and associated water management to minimise adverse surface water and groundwater quality impacts, including seepage from final landform to final void increasing inflow to final void and reducing flow to receiving waters.
V066	Surface Water	Stability of final landform (erosion) and maintenance of stable drainage paths.
V067	Soil and Land Resource	Success/performance of rehabilitation post-mining.
V068	Visual	Waste rock management particularly in areas of rock with elevated elements.
V069	Road Transport	Duration of ROM coal haulage (i.e. 24 hours per day, seven days per week).
V070	Road Transport	Maintaining acceptable access to realigned public roads.
V071	Road Transport	Vickery integration with Vickery South.
V072	Socio-Economic	Perception that mine will devalue surrounding land.
V073	Socio-Economic	Socio-economic impact of the Project.
V074	Land Contamination	Changes to the potential uses of land directly disturbed or otherwise impacted as a result of mining activities.
V075	Surface Water	Is water sufficient for dust suppression or are surfactants required.
V076	Surface Water	Changes to catchment areas and flow characteristics due to the construction of water storage dams, waste rock emplacements and the final void.
V077	Surface Water	Increased potential for erosion and sedimentation due to the increased area of land disturbance.
V078	Surface Water	Potential extraction and/or discharge of water as part of the on-site water management system.
V079	Visual	Modification of the existing views from sensitive receptors of the Development Application area due to the development of the open cut and waste rock emplacements.
V080	Visual	Use of night-lighting for the Project.
V081	Socio-Economic	Developing a community contribution plan that is fair and reasonable and achieves agreement with Councils.
V082	Socio-Economic	Increased travel distance for residents using Blue Vale Road.
V083	Socio-Economic	Potential social impacts in nearby towns due to cumulative effects of mining.
V084	Socio-Economic	Perception of surrounding landholders being devalued as a consequence of ongoing mining operations.
V085	Visual	Potential for increased visual impacts, particularly for residential receivers.
V086	Road Transport	Potential impacts on public road network.
V087	Road Transport	Potential impacts to Kamilaroi Highway traffic during construction of the highway overpass.
V088	Socio-Economic	Socio-economic benefits to the region and State.
V089	Visual	Visual impact of waste rock emplacements and mining infrastructure.
V090	Visual	Visual impacts from lighting from the Project site, particularly from elevated dump heights, and safety impacts to road users on Kamilaroi Highway.
V091	Surface Water	Adverse impacts on downstream water quality parameters that could have consequent effects on ecology or beneficial use.
V092	Groundwater	Inundation of pit.
V093	Land Contamination	Segregation of top/sub soils and areas to stockpile them.
V094	Socio-Economic	Availability of adequate water licences to account for predicted water allocation requirements, particularly in the latter stages of the Project.
V095	Surface Water	Catastrophic failure of Blue Vale Pit embankment.

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Ref	Environmental Issue Subject Area	Description of Issue
V096	Surface Water	Changes to flooding characteristics due to construction of private haul road and Kamilaroi Highway overpass.
V097	Surface Water	Flooding risk of proposed infrastructure area from flood flows in Stratford and South Creeks.
V098	Surface Water	Inability to comply with Environment Protection Licence water quality limits in sediment dam discharge.
V099	Surface Water	Insufficient site water flow/use monitoring data to enable model calibration which could cast doubt over predictions of water excess or shortfall.
V100	Groundwater	Intersection of the alluvium at the southern end of pit and potential for failure of the highwall and consequential impacts of water flows in-pit and loss of water downstream.
V101	Surface Water	Potential changes to adjacent floodplain regime (i.e. during flood events) including the private haul road and Kamilaroi Highway overpass.
V102	Socio-Economic	Potential cumulative impacts on downstream surface water users.
V103	Surface Water	Potential for generation of erosion during construction and stripping activities.
V104	Socio-Economic	Potential for inadequate water supply on site for operational purposes - particularly if additional water application is necessary to reduce dust impacts.
V105	Surface Water	Potential impact of loss of water downstream from the Project site as a consequence of the north-west drainage line diversion (perception by landholders that creek flows underground and diversion may well risk the continued flow of water to their holdings).
V106	Groundwater	Potential impacts on aquifers and groundwater users - and the consequent effects of reduced groundwater flow to down gradient alluvium.
V107	Groundwater	Potential impacts on Upper Namoi Alluvium groundwater users.
V108	Surface Water	Redirection of surface flow due to the north-west drainage line diversion.
V109	Surface Water	Reduction in creek flows downstream of mine due to catchment excision during and post-mining.
V110	Surface Water	Risk of excess water (due to increased surface area of disturbance) and increased need to discharge via Licensed Discharge Points.
V111	Surface Water	Risk of seepage from storage within Blue Vale void towards the Namoi River.
V112	Surface Water	Risk of erosion along the north-west drainage line diversion.
V113	Surface Water	Seepage/runoff from mine disturbance areas bypassing water management system and migrating off-site with possible downstream contamination.
V114	Surface Water	Seepage from upslope areas seeping through waste emplacement and either contributing to mine water balance or causing further poor quality seepage off-site.
V115	Air Quality	Shortfall in water supply for dust suppression in dry times and consequent impacts on dust suppression/air quality.
V116	Surface Water	Site access for personnel, fuel and coal transport - local flooding (South Creek) and major floods (Namoi River).
V117	Surface Water	Stability of north-west drainage line diversion both in short term and long-term (post-mining).
V118	Surface Water	Mine water discharge in the event of extreme weather events.
V119	Surface Water	Pit water containment.
V120	Road Transport	Road diversion issues with cut and fill at south end of Vickery State Forest.
V121	Soil and Land Resource	Suitable topsoil management and storage for future use in rehabilitation.
V122	Air Quality	Greenhouse gases and associated impacts (positive use of larger fleet [lower diesel per tonne]).
V123	Surface Water	Increased leakage of, or reduced base flow to the Namoi River due to depressurisation of aquifers.
V124	Surface Water	Licensed extraction of water from the Namoi River.
V125	Road Transport	Road diversion issues with cut and fill at Southern end of Vickery State Forest.
V126	Road Transport	Impact of 24/7 trucking to CHPP.

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Ref	Environmental Issue Subject Area	Description of Issue
V127	Land Contamination	Hydro-carbon spills from site storages/activities.
V128	Soil and Land Resource	Cumulative impacts around Mining Lease 1464.
V129	Socio-Economic	Risks associated with explosives storage on site.
V130	Land Contamination	Bulk diesel (400 kL) storage at the Mine Infrastructure Area.
V131	Socio-Economic	Segregation of Travelling Stock Route with the construction of the road diversion.
V132	Land Contamination	Risks associated with sewage treatment works.
V133	Soil and Land Resource	Restoration of agricultural values - pasture.
V134	Groundwater	Seepage from waste emplacements on alluvial soils adjacent to the Canyon Coal Mine final void leading to potential groundwater and surface water quality impacts.
V135	Soil and Land Resource	Suitable controls for topsoil management and storage.
V136	Fauna (Terrestrial and Aquatic)	Stream line restoration of aquatic species.

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