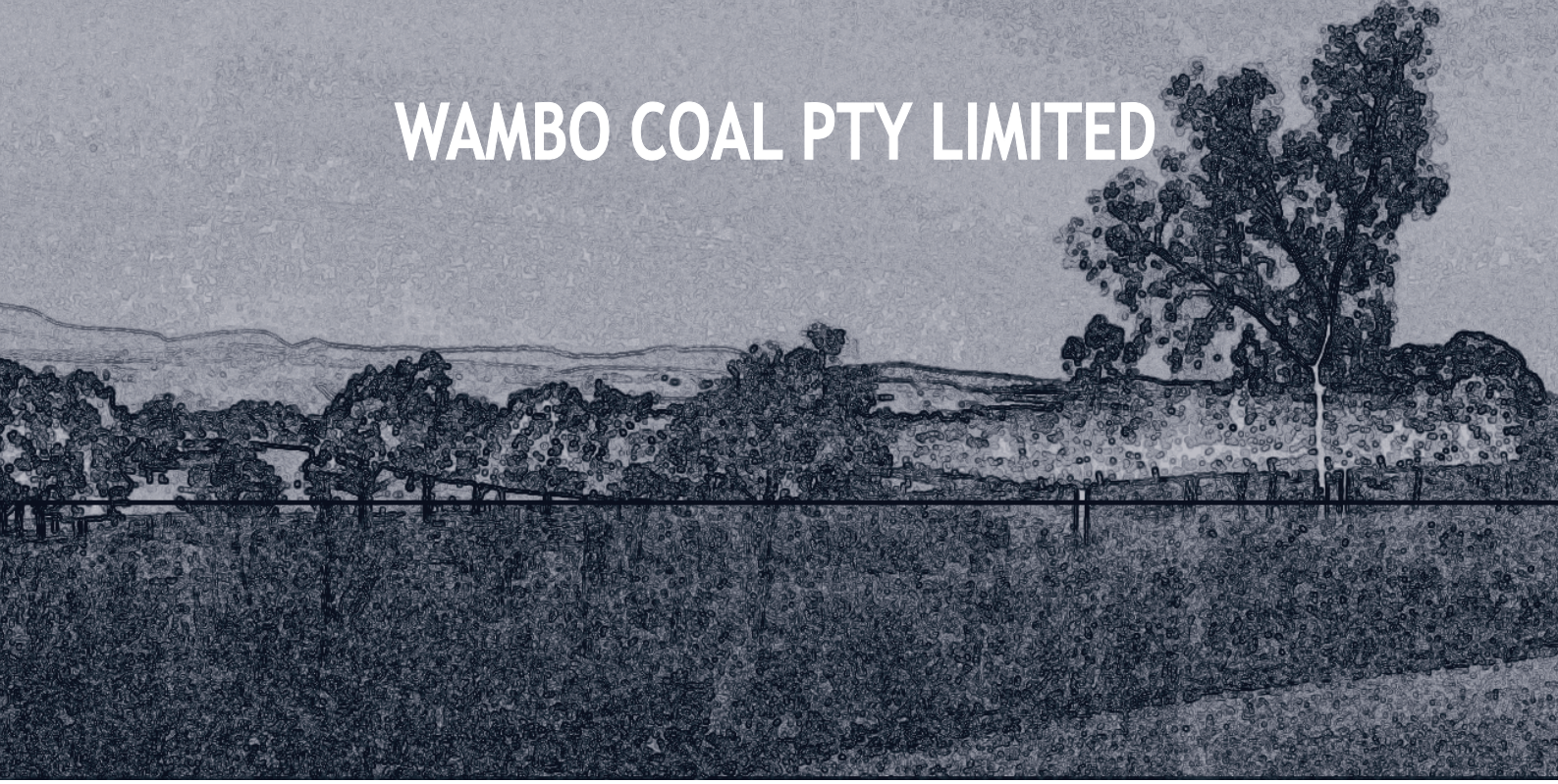

WAMBO COAL PTY LIMITED

SOUTH WAMBO UNDERGROUND MINE MODIFICATION

ENVIRONMENTAL ASSESSMENT

APPENDIX L

Environmental Risk Assessment

Peabody ENERGY

WAMBO COAL PTY LIMITED

SOUTH WAMBO UNDERGROUND MINE MODIFICATION

ENVIRONMENTAL RISK ASSESSMENT

PREPARED BY WAMBO COAL PTY LIMITED AND RESOURCE STRATEGIES PTY LTD

PROJECT NO. WAM-09-15

DOCUMENT NO. 00737584

DATE: MARCH 2016

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EXECUTIVE SUMMARY

This document is an Environmental Risk Assessment for a proposed modification to the Wambo Coal Mine (Wambo), an existing open cut and underground coal mining operation. This proposed modification involves a rearrangement of the South Wambo Underground Mine layout and is referred to as the South Wambo Underground Mine Modification (the Modification).

The Environmental Risk Assessment identifies environmental issues and ranks these issues in consideration of control measures. As part of the Environmental Risk Assessment, a risk review team identified the key environmental issues associated with the Modification, including those related to:

- impacts on ephemeral creeks associated with subsidence resulting from the modified underground mine;
- impacts of subsidence on the existing North Wambo Creek Diversion;
- incremental increases in subsidence induced ponding effects on areas of agricultural land;
- potential subsidence impacts on items of Aboriginal heritage; and
- potential cumulative air quality and noise amenity impacts associated with surface activities as part of the Modification.

These issues will be covered in detail in the specialist assessment reports to be appended to the Modification Environmental Assessment, including:

- Appendix A Subsidence Assessment.
- Appendix B Groundwater Assessment.
- Appendix C Surface Water Assessment.
- Appendix D Flora Assessment.
- Appendix E Fauna Assessment.
- Appendix F Cultural Heritage Impact Assessment.
- Appendix G Agricultural Impact Statement.
- Appendix H Noise Review.
- Appendix I Air Quality and Greenhouse Gas Review.
- Appendix J Road Transport Assessment.
- Appendix K Socio-Economic Assessment.

The review team risk ranked the key environmental issues and concluded that risks would be within the risk acceptance criteria and are broadly acceptable.

1 INTRODUCTION

This document is an Environmental Risk Assessment (ERA) for a proposed modification to the Wambo Coal Mine (Wambo), an open cut and underground coal mining operation which operates in accordance with Development Consent DA 305-7-2003. Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited (Peabody).

Mining of the South Wambo (Arrowfield and Bowfield Seams) Underground Mine was assessed as part of the Wambo Development Project Environmental Impact Statement (WCPL, 2003).

Following further mine planning for the approved South Wambo Underground Mine, which considered recent exploration results, WCPL has identified a modified mine arrangement which can be mined more economically and efficiently than the approved mine arrangement. This proposed rearrangement of South Wambo Underground Mine is referred to as the South Wambo Underground Mine Modification (the Modification).

The Modification would not involve changes to any aspects of the approved North Wambo Underground Mine or South Bates Underground Mine.

1.1 OBJECTIVE AND SCOPE

The objective of this ERA is to conduct a risk assessment consistent with the Modification Secretary's Environmental Assessment Requirements, which require:

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

The risk assessment included the following tasks:

- establishing the context including review of supporting information and objectives;
- identifying potential issues by review of the Modification description and similar issues from previous Wambo risk assessments;
- analysis of identified risks and nomination of key environmental issues; and
- ranking of the key issues and associated risks, including consideration of mitigation measures.

1.2 METHODOLOGY

The methodology used for this ERA was to conduct a risk assessment generally consistent with the guidance provided in Australian Standard/New Zealand Standard (AS/NZS) International Organisation for Standardisation (ISO) 31000: 2009 *Risk Management – Principles and Guidelines*.

This ERA draws on the findings of the previous risk assessments conducted at Wambo:

- *North Wambo Underground Mine – Longwalls 8 to 10A Subsidence Risk Assessment Report* (Operational Risk Mentoring, 2015a).
- *South Bates (Whybrow Seam) Underground Mine – Longwalls 11 to 13 Subsidence Risk Assessment Report* (Operational Risk Mentoring, 2015b).

1.3 TEAM REVIEW

Consistent with AS/NZS ISO 31000: 2009, a team review of the ERA outcomes was undertaken. Details of the team who contributed to the review are provided in Table 1.

Table 1
Team Members

Name	Role	Qualifications and Experience
Steven Peart	Peabody – Environment and Community Manager	B Sci, B Env Man; 11 years operational environmental management experience.
Jacques Abrahamse	Peabody – South Wambo Project Manager	B Mining Hons; Statutory Qualifications; 29 yrs coal mining operational experience and project experience.
Micheal Alexander	Peabody – Director Projects	30 years experience mining, energy and construction industry.
Josh Peters	Resource Strategies – Senior Environmental Manager	B Sci (Environment) Heritage and biodiversity related issues; 13 years consulting experience.
Joanna Hinks	Resource Strategies – Senior Environmental Manager	B Eng (Env); 8 years environmental management and project approvals experience in resource industry.

2 CONTEXT

2.1 MODIFICATION CONTEXT

Table 2 provides a comparative summary of the approved and proposed modified Wambo. The general arrangement of the approved and Modified Wambo is provided as Figure 1.

Table 2
Comparative Summary of the Approved and Modified Wambo

Component	Approved Wambo[1]	Modified Wambo
Life of Mine	• 21 years (i.e. until 1 March 2025).	• An extension of 7 years (i.e. until 1 March 2032).
Open Cut Mining	• Open cut mining at a rate of up to 8 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams. • An estimated total open cut ROM coal reserve of 98 million tonnes (Mt). • Open cut mining operations to March 2017.	• An extension of open cut mining operations by approximately 3 years (i.e. up to and including 2020). • Other open cut mining components unchanged.
Underground Mining	• Underground mining of up to 7.5 Mtpa of ROM coal from the Whybrow, Wambo, Arrowfield and Bowfield Seams. • Underground ROM coal reserves are estimated at 114.9 Mt.	• Changes to the alignment and extent of the approved South Wambo (Arrowfield Seam) Underground Mine longwall panels. • Mining of the proposed South Wambo (Woodlands Hill Seam) Underground Mine rather than the approved South Wambo (Bowfield Seam) Underground Mine and changes to the alignment and extent. • An increase in the underground mining rate up to 9.75 Mtpa of ROM coal. • Approximately 28.6 Mt of additional ROM coal from the South Wambo Underground Mine.

Table 2 (Continued)
Comparative Summary of the Approved and Modified Wambo

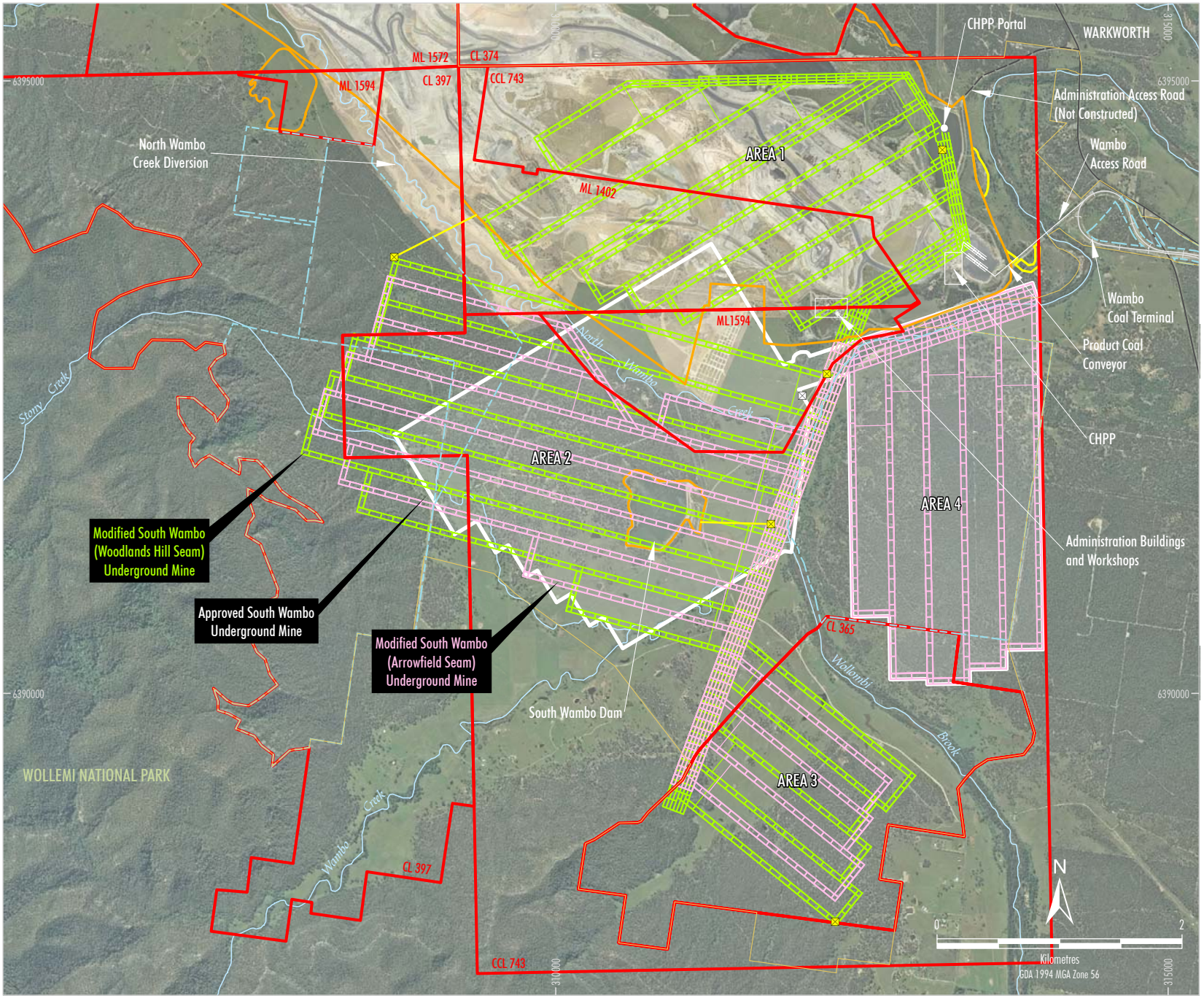
Component	Approved Wambo[1]	Modified Wambo
Subsidence Commitments and Management	• The subsidence impact performance measures listed in Conditions 22 and 22A, Schedule 4 of the Development Consent (DA 305-7-2003).	• Unchanged.
ROM Coal Production Rate	• Up to 14.7 Mtpa of ROM coal.	• Unchanged (i.e. the combined rate of the open cut and underground mining operations would remain within this limit).
Total ROM Coal Mined	• 212.9 Mt.	• 241.5 Mt.
Waste Rock Management	• Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations.	• Unchanged.
Total Waste Rock	• 640 million bank cubic metres.	• Unchanged.
Coal Washing	• Coal Handling and Preparation Plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph).	• Unchanged.
Product Coal	• Production of up to 11.3 Mtpa of thermal coal predominantly for export.	• Unchanged.
CHPP Reject Management	• Coarse rejects and tailings would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing Wambo management practices.	• Unchanged.
Total CHPP Rejects	• Approximately 29.3 Mt of coarse rejects and approximately 19.4 Mt of tailings.	• An additional 7.3 Mt of coarse rejects and 3 Mt of tailings.
Water Supply	• Make-up water demand to be met from runoff recovered from tailings storage areas, operational areas, dewatering, licensed extraction from Wollombi Brook and Hunter River.	• Unchanged.
Surface Facilities	• Construction of surface facilities within the approved surface development area.	• Minor extension to the surface development area.
Mining Tenements	• Coal Lease (CL) 365, CL 374, CL 397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML 1572, ML 1594, Authorisation (A) 444, Exploration Licence (EL) 7211.	• Unchanged.

[1] Development Consent DA 305-7-2003 (as modified).

2.2 RISK MANAGEMENT CONTEXT

It was confirmed that the ERA was to cover environmental issues only, and that issues associated with safety, business or operational issues were not intended to be covered.

The Wambo Development Consent (DA 305-7-2003) outlines a range of performance measures regarding the potential consequences of subsidence risks posed by mining. These subsidence impact performance measures are shown in Table 3.



LEGEND

- Mining and Coal Lease Boundary
- WCPL Owned Land
- Existing/Approved Surface Development Area
- Modified Surface Development Area
- Approved South Wambo Underground Mine Development
- Modified South Wambo (Woodlands Hill Seam) Underground Mine
- Modified South Wambo (Arrowfield Seam) Underground Mine
- Approved Ventilation Shaft
- Modified Ventilation Shaft
- Remnant Woodland Enhancement Program (RWEP) Area

Source: Department of Lands (July 2009); WCPL (2015); WCPL Orthophoto (Apr-Oct 2013)

Peabody ENERGY

WAMBO COAL MINE

Approved and Modified South Wambo Underground Mine General Arrangement

Figure 1

WAM-09-15_SWUMM_EA_ERA_201A

Table 3
Performance Measures

Feature	Subsidence Impact Performance Measure
Wollombi Brook	Negligible impact. Controlled release of excess site water only in accordance with Environment Protection Licence requirements.
Wollemi National Park	Negligible subsidence impacts. Negligible environmental consequences.
Warkworth Sands Woodland Community	Minor cracking and ponding of the land surface or other impact. Negligible environmental consequences.
White Box, Yellow Box, Blakely's Red Gum, Woodland/Grassy White Box Woodland Community	Minor cracking and ponding of the land surface or other impact. Negligible environmental consequences.
Other threatened species, populations or communities	Minor cracking and ponding of the land surface or other impact. Negligible environmental consequences.
Wambo Homestead Complex	Negligible impact on heritage values, unless approval has been granted by the Heritage Branch and/or the Minister.
All built features	Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.
Public Safety	No additional risk.

Source: DA 305-7-2003.

2.3 RISK CRITERIA

The 'tolerability' of a risk is the willingness to live with a risk to secure benefits, on the understanding that the risk is being properly controlled (Handbook [HB] 203:2006 – *Environmental Risk Management – Principles and Process*). Legislation and good practice is targeted to reduce risk to "*As Low as Reasonably Practicable"* (ALARP).

Consistent with recent Wambo risk assessments (Operational Risk Mentoring, 2015a and 2015b), the criteria adopted in this ERA is to treat risks to achieve an ALARP ranking, or lower.

3 RISK ASSESSMENT

3.1 RISK IDENTIFICATION

The process used for risk identification was to compile potential risks relevant to the Modification from recent risk assessments conducted at Wambo, tailoring these risks for the Modification and identifying new risks where previously identified risks did not cover the full breadth of the Modification. The identified risks were reviewed and confirmed by the team members (Table 1).

3.2 RISK ANALYSIS

Consistent with the objectives of the ERA (i.e. *a risk assessment of the potential environmental impacts of the project, identifying the key issues*) (Section 1.1), a selection of the risks identified through the process described in Section 3.1 were identified by the team members to be the key issues for the Modification ERA. The key issues are presented in Table 4 below.

Table 4
Key ERA Issues

Ref	Issue	Aspect
SW001	Subsidence impacts and incremental ponding of agricultural land.	Agricultural
SW002	Subsidence impacts on Stony Creek, including cracking of stream bed and loss of flow.	Surface Water
SW003	Cumulative noise impacts associated with the United Collieries and Warkworth Continuation Project.	Noise and Blasting
SW004	Cumulative air quality impacts associated with the United Collieries and Warkworth Continuation Project.	Air Quality
SW005	Subsidence impacts on the undiverted (lower) portion of North Wambo Creek.	Surface Water
SW006	Subsidence impacts on open cut mining operations resulting in increased wind erosion potential (e.g. changes in scheduled rehabilitation activities).	Air Quality
SB008	Failure of the monitoring program to detect and respond to an impact on the groundwater system.	Groundwater
SB010	North Wambo Creek Diversion damaged by subsidence.	Surface Water
SB046	Creation of subsidence monitoring tracks affects the conservation values of the Remnant Woodland Enhancement Program (RWEP) areas.	Flora/Fauna
SB020	Subsidence impacts and surface disturbance resulting in loss of habitat for threatened species.	Flora/Fauna
SB012	Unintended subsidence impacts resulting in rock instability of the Wollemi National Park escarpment and associated environmental consequences.	Land
SB045	Induced leakage from North Wambo Creek Diversion due to subsidence.	Surface Water
SB028	Mine subsidence impacts on items of Aboriginal heritage.	Archaeological
SB055	Mine subsidence impacts on riparian vegetation of Stony Creek resulting in environmental consequences.	Flora/Fauna
SB032	Subsidence effects on Stony Creek, including cracking of stream bed and loss of flow.	Surface Water
SB016	Subsidence impacts on RWEP areas reducing biodiversity values.	Flora/Fauna
SB019	Mine subsidence impacts resulting in impacts on vegetation along the North Wambo Creek Diversion.	Flora/Fauna
SB057	Subsidence impacts resulting in injury to livestock.	Agricultural
SB001	Environmental consequences associated with water flow and quality changes in Stony Creek (including changes to channel stability) resulting from subsidence impacts.	Surface Water
SB011	North Wambo Creek Diversion damaged by subsidence resulting in reduced flow affecting downstream water quality.	Surface Water
SB054	A change in flood regimes or extent of potential inundation due to subsidence.	Surface Water

Note: Issues with a 'Ref' prefix 'SB' sourced After Operational Risk Mentoring (2015b).

3.3 RISK EVALUATION

Risk ranking was undertaken by the team using qualitative measures of likelihood and consequence provided in Tables 5 and 6, respectively. These were combined to form a quantitative measure of risk outlined in Table 7.

Table 5
Qualitative Measures of Likelihood

Rank (L)	Likelihood	Description
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.

Source: Operational Risk Mentoring (2015b).

Table 6
Qualitative Measures of 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.

Source: Operational Risk Mentoring (2015b).

Table 7
Risk Ranking Table

Consequence (C)	Likelihood (L)				
	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)

Source: Operational Risk Mentoring (2015b).

Notes:
L = Low; M = Moderate; H = High

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

Legend:

	Broadly Acceptable
	ALARP – As low as reasonably practicable
	Intolerable

4 RISK TREATMENT

The Risk Treatment Plan was developed by the team (Table 8). The table is ordered by aspect type and priority.

Table 8
Risk Treatment Plan

Ref	Issue	Aspect	Planned Controls	L	C	R
SB028	Mine subsidence impacts on items of Aboriginal heritage.	Archaeological/ Heritage	Implementation of Aboriginal Heritage Impact Permit process and Heritage Management Plan. Due diligence process for surface disturbance (Surface Disturbance Permit process).	D	4	21
SW007	Mine subsidence impacts on the heritage value of the Wambo Homestead Complex.	Archaeological/ Heritage	Development and implementation of Wambo Homestead Complex Mine Management Plan. Separate approval process under the *Heritage Act, 1977*.	D	4	21
SB055	Mine subsidence impacts on riparian vegetation of Stony Creek resulting in environmental consequences.	Flora/Fauna	Implementation of the Extraction Plan, Biodiversity Management Plan, bed and bank stability management, monitoring and response capacity, Biodiversity Management Plan and visual inspections through subsidence monitoring.	D	5	24
SB016	Subsidence impacts on RWEP areas reducing biodiversity values.	Flora/Fauna	Implementation of the Extraction Plan, Biodiversity Management Plan, bed and bank stability monitoring, flora and fauna monitoring program, visual inspections and remediation.	D	5	24
SB019	Mine subsidence impacts resulting in impacts on vegetation along the North Wambo Creek Diversion.	Flora/Fauna	Implementation of the Extraction Plan, Biodiversity Management Plan, bed and bank stability monitoring, flora and fauna monitoring program, visual inspections and remediation.	C	5	22
SB020	Subsidence impacts and surface disturbance resulting in loss of habitat for threatened species.	Flora/Fauna	Implementation of the Extraction Plan, Biodiversity Management Plan, bed and bank stability monitoring, flora and fauna monitoring program, visual inspections and remediation.	E	5	25
SB059	Mine subsidence impacts resulting in damage to rehabilitated areas.	Flora/Fauna	Implementation of the Extraction Plan, Biodiversity Management Plan, bed and bank stability monitoring, flora and fauna monitoring program, visual inspections and remediation.	C	5	22
SB046	Creation of subsidence monitoring tracks affects the conservation values of the RWEP areas.	Flora/Fauna	Adherence to Surface Disturbance Permit as per Flora and Fauna Management Plan.	C	5	22
SB008	Failure of the monitoring program to detect and respond to an impact on the groundwater system.	Groundwater	Documentation and execution of the Water Management Plan (including the Surface Water Management Plan, Groundwater Management Plan, Surface and Groundwater Response Plan and North Wambo Creek Subsidence Response Strategy). Assessment of impacts during development of the Extraction Plan. Clear allocation of roles and responsibilities in the management plans.	D	4	21
SB010	North Wambo Creek Diversion damaged by subsidence.	Surface Water	Adequate design of North Wambo Creek Diversion. Implementation of the Extraction Plan. Implementation of a Trigger Action Response Plan (TARP) for crack remediation. Installation of adequate mine dewatering capacity.	D	4	18

Table 8 (Continued)
Risk Treatment Plan

Ref	Issue	Aspect	Planned Controls	L	C	R
SB057	Subsidence impacts resulting in injury to livestock.	Agricultural Impact Statement	Implementation of Public Safety Management Plan (particularly notification and fencing requirements).	E	5	25
SW001	Subsidence impacts and incremental ponding of agricultural land.	Agricultural Impact Statement	Implementation of Extraction Plan and Water Management Plan, including monitoring and mitigation of ponding impacts.	D	4	21
SB012	Unintended subsidence impacts resulting in rock instability of the Wollemi National Park escarpment and associated environmental consequences.	Land	Implementation of Extraction Plan, Land Management Plan and Public Safety Management Plan. Identification of cliff lines that are associated with the Wollemi National Park with appropriate mine design offsets applied.	E	3	20
SB045	Induced leakage from North Wambo Creek Diversion due to subsidence.	Surface Water	Implementation of Water Management Plan and subsidence remediation.	D	3	17
SB032	Subsidence impacts on Stony Creek, including cracking of stream bed and loss of flow.	Surface Water	Implementation of Extraction Plan and Water Management Plan, including bed and bank stability monitoring and remediation.	D	3	17
SB001	Environmental consequences associated with water flow and quality changes in Stony Creek (including changes to channel stability) resulting from subsidence impacts.	Surface Water	Implementation of Extraction Plan and Water Management Plan, including bed and bank stability monitoring and remediation.	D	4	21
SB011	North Wambo Creek Diversion damaged by subsidence resulting in reduced flow affecting downstream water quality.	Surface Water	Implementation of Extraction Plan and Water Management Plan, including bed and bank stability monitoring and remediation.	D	4	21
SB054	A change in flood regimes or extent of potential inundation due to subsidence.	Surface Water	Implementation of Extraction Plan and Water Management Plan, including monitoring and remediation.	D	5	24
SW002	Subsidence impacts on Wambo Creek, including cracking of stream bed and loss of flow.	Surface Water	Implementation of Extraction Plan and Water Management Plan, including bed and bank stability monitoring and remediation.	D	3	17
SW005	Subsidence impacts on the undiverted (lower) portion of North Wambo Creek.	Surface Water	Implementation of Extraction Plan and Water Management Plan, including bed and bank stability monitoring and remediation.	D	3	17

Table 8 (Continued)
Risk Treatment Plan

Ref	Issue	Aspect	Planned Controls	L	C	R
SW003	Cumulative noise impacts associated with the United Collieries and Warkworth Continuation Project.	Noise and Blasting	Underground mining method employed and implementation of Noise Monitoring Plan.	D	4	21
SW004	Cumulative air quality impacts associated with the United Collieries and Warkworth Continuation Project.	Air Quality	Underground mining method employed and implementation of Air Quality and Greenhouse Gas Management Plan.	D	4	21
SW006	Subsidence impacts on open cut mining operations resulting in increased wind erosion potential (e.g. changes in scheduled rehabilitation activities).	Air Quality	Scheduling of open cut rehabilitation activities in consideration of planned subsidence. Remediation of subsidence in accordance with the Mining Operations Plan.	E	5	25
SW008	Subsidence impacts on WCPL infrastructure resulting in environmental impact or risk to public safety.	Built Features	Implementation of Extraction Plan and Built Features Management Plan.	C	5	22
SW009	Subsidence impacts on Ausgrid powerline impacts safety or serviceability.	Built Features	Implementation of Extraction Plan and Built Features Management Plan, including consultation with Ausgrid.	D	5	24

5 MONITORING AND REVIEW

5.1 NOMINATED COORDINATOR

The nominated coordinator is the WCPL Environment and Community Manager. The coordinator should coordinate review of the ERA content and confirm its accuracy.

5.2 IMPLEMENTATION REVIEW PLAN

It is important to confirm the controls and actions identified are appropriately managed. The expectation of the team was that the WCPL Environment and Community Manager would coordinate and monitor all controls identified within the ERA.

5.3 COMMUNICATION AND CONSULTATION

Communication and consultation form an integral part of the risk management process. It is the WCPL Environment and Community Manager's responsibility to confirm that this report is shared with all relevant personnel and other stakeholders as appropriate.

5.4 CONCLUSIONS

A review team identified the key environmental issues associated with the Modification. These issues will be covered in detail in the specialist assessment reports to be appended to the Modification Environmental Assessment, including:

- Appendix A Subsidence Assessment.
- Appendix B Groundwater Assessment.
- Appendix C Surface Water Assessment.
- Appendix D Flora Assessment.
- Appendix E Fauna Assessment.
- Appendix F Cultural Heritage Impact Assessment.
- Appendix G Agricultural Impact Statement.
- Appendix H Noise Review.
- Appendix I Air Quality and Greenhouse Gas Review.
- Appendix J Road Transport Assessment.
- Appendix K Socio-Economic Assessment.

The review team risk ranked the identified key environmental issues and concluded that risks would be within the acceptable criteria and generally 'low' in nature.

6 REFERENCES

Operational Risk Mentoring (2015a) *North Wambo Underground Mine – Longwalls 8 to 10A Subsidence Risk Assessment Report.*

Operational Risk Mentoring (2015b) *South Bates (Whybrow Seam) Underground Mine – Longwalls 11 to 13 Subsidence Risk Assessment Report.*

Wambo Coal Pty Ltd (2003) *Wambo Development Project Environmental Impact Statement.*