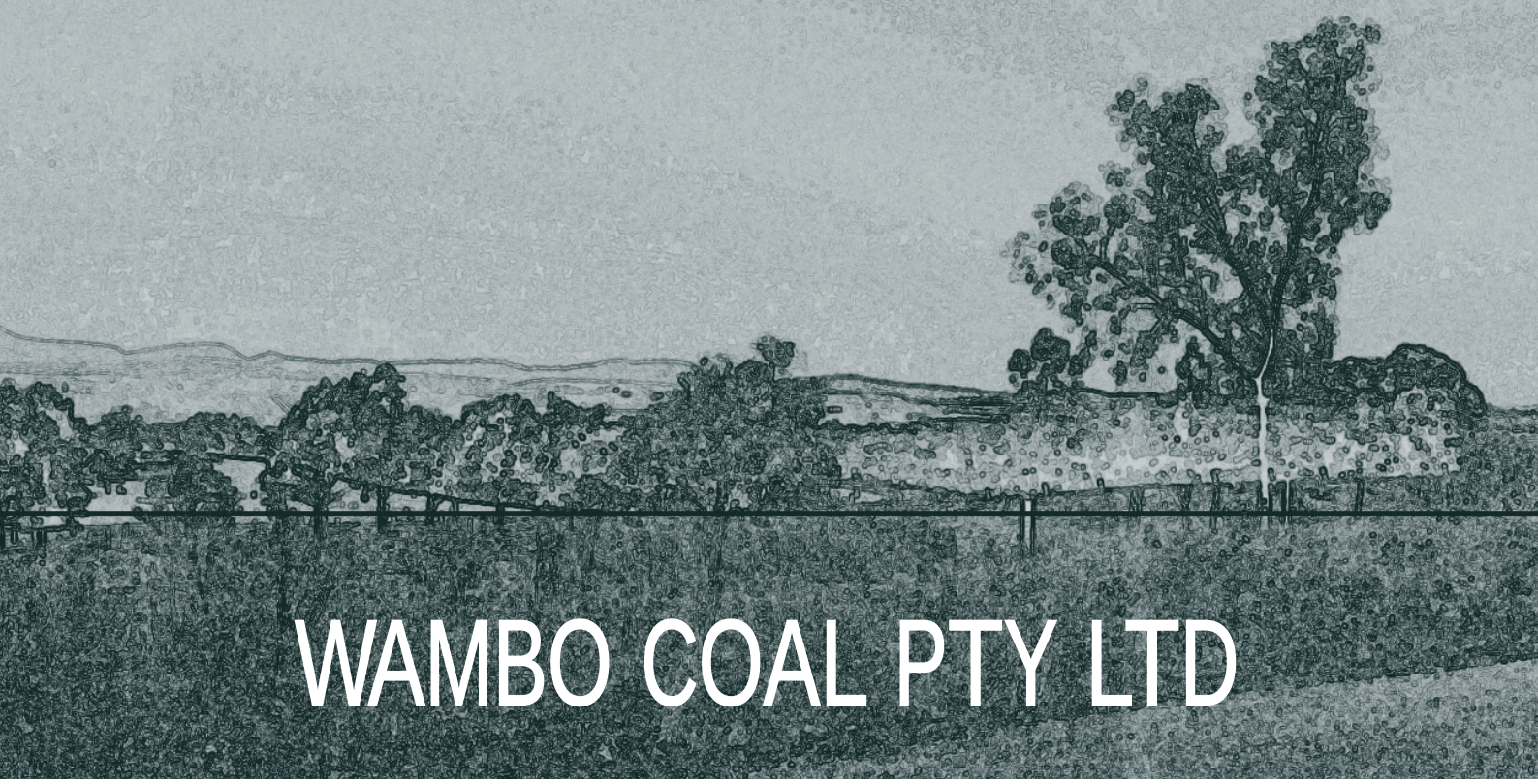


WAMBO COAL PTY LTD

NORTH WAMBO UNDERGROUND MINE
LONGWALL 10A MODIFICATION

ENVIRONMENTAL ASSESSMENT

FOR THE MODIFICATION OF DA 305-7-2003 (MOD 14)
THE ADDITION OF NORTH WAMBO UNDERGROUND MINE LONGWALL 10A

September 2014

Peabody ENERGY

WAMBO COAL PTY LTD

NORTH WAMBO UNDERGROUND MINE
LONGWALL 10A MODIFICATION
ENVIRONMENTAL ASSESSMENT

(Modification 14 to DA 305-7-2003)

PROJECT NO.	WAM-09-15
DOCUMENT NO.	00611725.doc
DATE:	SEPTEMBER 2014

EXECUTIVE SUMMARY

ES1.1 BACKGROUND

The Wambo Coal Mine (Wambo) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales. Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

A range of open cut and underground mine operations have been conducted at Wambo since mining operations commenced in 1969. Mining under the Development Consent (DA 305-7-2003) commenced in 2004 and currently both open cut and underground operations are conducted. The approved run-of-mine (ROM) coal production rate is 14.7 million tonnes per annum (Mtpa) and product coal is transported from Wambo by rail.

An aerial photograph of Wambo, illustrating the approved extent of the open cut and underground mine operations and key infrastructure is provided on Figure ES-1. A summary of the approved Wambo is provided in Table ES-1.

ES1.2 DESCRIPTION OF THE MODIFICATION

Following a review of mine planning and exploration results, WCPL has identified additional coal reserves adjoining the existing North Wambo Underground Mine that can be economically mined with an additional longwall panel and allow for ongoing operational continuity.

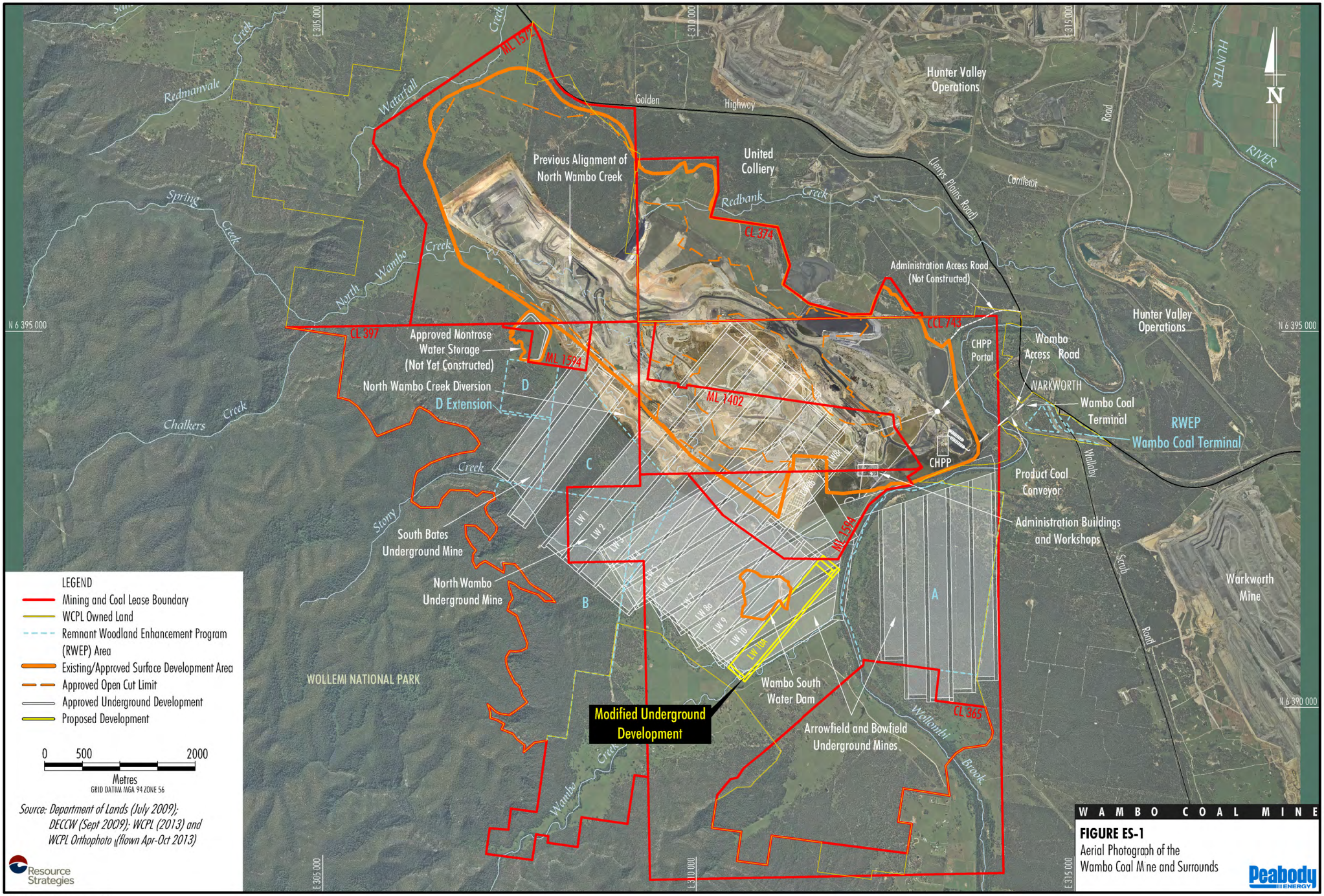
This Environmental Assessment has been prepared to support an application to modify the Wambo Development Consent (DA 305-7-2003) to allow for an extension to the approved North Wambo Underground Mine, referred to as the North Wambo Underground Mine Longwall 10A Modification (the Modification).

Table ES-1
Summary of the Approved Wambo Coal Mine

Component	Approved Wambo[1]
Life of Mine	• 21 years (from the date of the commencement of Development Consent [DA 305-7-2003]).
Open Cut Mining	• Open cut mining at a rate of up to 8 Mtpa of 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 until 2017.
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 107.7 Mt.*
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).
ROM Coal Production Rate	• Up to 14.7 Mtpa of ROM coal.
Total ROM Coal Mined	• *205.7 Mt.*
Waste Rock Management	• Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations.
Total Waste Rock	• 640 million bank cubic metres.
Coal Washing	• Coal handling and preparation plant (CHPP) capable of processing approximately 1,800 tonnes per hour.
Product Coal	• Production of up to 11.3 Mtpa of thermal coal predominantly for export.
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.
Total CHPP Rejects	• *Approximately 27.7 Mt of coarse rejects and approximately 18.4 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.
Mining Tenements	• Coal Lease (CL) 365, CL374, CL397, Consolidated Coal Lease 743, Mining Lease (ML) 1402, ML1572, ML1594, Authorisation 444, Exploration Licence 7211.

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

Note: Italicised components would be modified by the Modification.



WAMBO COAL MINE

FIGURE ES-1
Aerial Photograph of the Wambo Coal Mine and Surrounds

Peabody ENERGY

The Modification would include the development of an additional longwall panels (the proposed Longwalls 10A) in the Wambo Seam contiguous with the existing North Wambo Underground Mine. Access to the proposed Longwalls 10A would be via the existing North Wambo Underground Mine. The Modification would use the existing surface infrastructure of the North Wambo Underground Mine. The Modification area is wholly within land owned by WCPL.

The Modification would produce approximately 1.9 Mt of additional ROM coal and would be mined within the approved Wambo mine life.

The Modification would result in a marginal increase in total rejects from the CHPP (an additional 0.5 Mt coarse reject and 0.2 Mt tailings). No alteration of current coarse rejects or tailings management measures would be required.

The following approved components of Wambo would be unchanged by the Modification:

- overall life of the mine;
- ROM coal production rate;
- open cut operations;
- coal handling, CHPP and product coal transport operations; and
- major surface infrastructure.

ES1.3 ENVIRONMENTAL REVIEW

The key potential impacts of the Modification are related to the extraction of the proposed Longwall 10A at the North Wambo Underground Mine and the associated subsidence impacts and consequences.

The modified mine layout has been designed to be consistent with the subsidence impact performance measures in the existing Development Consent (DA 305-7-2003) (Table ES-2).

In order to assess the potential environmental impacts of the Modification, environmental reviews were completed for issues relating to potential subsidence impacts and environmental consequence. Table ES-3 summarises the key environmental assessment conclusions regarding the Modification.

WCPL would continue to implement existing environmental management and monitoring measures to minimise the potential impacts of Wambo incorporating the Modification on existing environmental values.

Additional mitigation measures, management and monitoring proposed for the Modification are summarised in Table ES-3.

An Extraction Plan would be prepared for the proposed Longwalls 10A prior to the commencement of second workings in accordance with Condition 22C, Schedule 4 of the Development Consent (DA-305-7-2003).

ES1.4 JUSTIFICATION OF THE MODIFICATION

The Modification would allow the recovery of approximately an additional 1.9 Mt of ROM coal.

The Modification would extend employment for the North Wambo Underground Mine workforce by approximately 6 months.

This coal would be mined within the approved Wambo mine life, would use the existing surface infrastructure of the North Wambo Underground Mine and would require minimal surface disturbance. Therefore, the Modification is a natural extension to the existing approved North Wambo Underground Mine.

The Modification is consistent with the subsidence impact performance measures in the existing Development Consent (DA 305-7-2003). In addition, this Environmental Assessment has demonstrated that the Modification can be conducted within minimal additional environmental impacts above those already approved for Wambo.

Table ES-2
Subsidence Impact Performance Measures

Feature	Subsidence Impact Performance Measure	Potential Environmental Consequences from the Modification
Wollombi Brook	Negligible impact. Controlled release of excess site water only in accordance with Environment Protection Licence requirements.	Wollombi Brook is located outside the extent of subsidence from the Modification. This performance measure can continue to be achieved.
Wollemi National Park	Negligible subsidence impacts. Negligible environmental consequences.	The Wollemi National Park is located outside the extent of subsidence from the Modification. This performance measure can continue to be achieved.
Warkworth Sands Woodland Community	Minor cracking and ponding of the land surface or other impact. Negligible environmental consequences.	The Warkworth Sands Woodland community is located outside the extent of subsidence from the Modification. This performance measure can continue to be achieved.
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.	The White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodland community is located outside the extent of subsidence from the Modification. This performance measure can continue to be achieved.
Wambo Homestead Complex	Negligible impact on heritage values, unless approval has been granted by the Heritage Branch and/or the Minister.	The Wambo Homestead Complex is located outside the extent of subsidence from the Modification. This performance measure can continue to be achieved.
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.	Consistent with the approved management measures for Longwalls 9 and 10 at the North Wambo Underground Mine, the water level in Wambo South Water Dam would be outside the angle of draw of active mining in order to maintain safety. Other infrastructure and improvements can be managed in a safe and serviceable condition, through the preparation and implementation of the appropriate management strategies as part of the Extraction Plan process. This performance measure can continue to be achieved.
Public safety	No additional risk.	There would be no additional risk to public safety, through the implementation of appropriate management strategies as part of the Extraction Plan process. This performance measure can continue to be achieved.

Source: Conditions 22 and 22A, Schedule 4, Wambo Development Consent DA 305-7-2003.

Table ES-3
Key Outcomes of the Environmental Review

Environmental Aspect	Summary of Environmental Assessment Conclusions	Additional Mitigation Measures, Management and Monitoring Proposed for the Modification[1]
Infrastructure and Improvements	• The potential subsidence impacts on Wambo South Water Dam would be managed in accordance with the requirements of the Dams Safety Committee to maintain safety. • Predicted levels of impact on other infrastructure and improvements can be managed through the preparation and implementation of appropriate management strategies, as part of the Extraction Plan process, to maintain items in a safe and serviceable condition.	• An Extraction Plan would be prepared prior to the commencement of second workings in the proposed Longwall 10A. • WCPL would continue to implement management strategies for the Wambo South Water Dam (developed for the approved Longwalls 9 and 10). These management strategies would be reviewed, and where necessary, revised to include the effects of the proposed Longwall 10A.
Land Resources	• There would be no significant change to the long-term agricultural productivity of the Modification area. • Mitigation measures and management would be required to minimise potential risk to agistment grazing of beef cattle within areas of active subsidence.	• The approved Land Management Plan would be reviewed and revised to include the proposed Longwall 10A during preparation of the Extraction Plan.
Groundwater	• The Modification would have no discernible impact on stream baseflow or natural river leakage, beyond the effects of approved mining, for Wollombi Brook, North Wambo Creek and Stony Creek. The Modification would result in a slight reduction in baseflow to Wambo Creek of up to 2.5 megalitres per annum. • The Modification would result in additional dewatering of the Permian coal measures, however the impact on water levels due to the Modification is negligible regionally. • The Modification is consistent with the *Aquifer Interference Policy* and adequate licences are available to account for the potential take of water associated with the approved Wambo operations and the Modification.	• WCPL would continue to implement the Surface and Groundwater Response Plan for Wambo including the Modification.
Surface Water	• Sections of Wambo and Stony Creeks in the Modification area may be vulnerable to scour and erosion as a result of subsidence from approved mining and the proposed Longwall 10A.	• Longitudinal geomorphological surveys would be conducted along the reaches of Wambo and Stony Creeks affected by subsidence and would be outlined in the Extraction Plan. • Trigger Action Response Plans would be developed for Wambo and Stony Creeks as part of the Extraction Plan with a process to determine appropriate triggers and remedial actions.
Aboriginal Cultural Heritage	• The incremental subsidence from the Modification would result in a negligible to low additional risk to Aboriginal cultural heritage sites.	• WCPL intends to leave Aboriginal cultural heritage sites *in situ*, subject to monitoring. • WCPL would apply for a variation to the existing Consent No. 2222 to cover the portion of the Modification area not contained within the existing Consent.
Flora and Fauna	• It is unlikely that vegetation or fauna habitat would be adversely affected by mine subsidence. • The Modification would have no significant impact on threatened species, populations, ecological communities or critical habitat.	• Monitoring and management measures for Wambo and Stony Creeks would be implemented for the Modification. • WCPL considers that no specific or additional mitigation measures, management or monitoring of terrestrial flora or fauna are required for the Modification.

[1] In addition to measures currently required under the Development Consent (DA 305-7-2003), mining leases, Environment Protection Licence or WCPL management plans and monitoring programmes.

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1 INTRODUCTION

This document is an Environmental Assessment (EA) 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 (Attachment 1). Wambo is owned and operated by Wambo Coal Pty Limited (WCPL), a subsidiary of Peabody Energy Australia Pty Limited (Peabody).

This Modification is sought under section 75W of the *Environmental Planning and Assessment Act, 1979* (EP&A Act).

1.1 WAMBO COAL MINE

Wambo is situated approximately 15 kilometres (km) west of Singleton, near the village of Warkworth, New South Wales (NSW) (Figure 1). Wambo adjoins grazing land to the south, other coal mining operations to the east and north, grazing land to the north-west and Wollemi National Park to the west and south-west (Figures 1 and 2).

A range of open cut and underground mine operations have been conducted at Wambo since mining operations commenced in 1969. Mining under the Development Consent (DA 305-7-2003) commenced in 2004 and currently both open cut and underground operations are conducted. The approved run-of-mine (ROM) coal production rate is 14.7 million tonnes per annum (Mtpa) and product coal is transported from Wambo by rail.

An aerial photograph of Wambo, illustrating the approved extent of the open cut and underground mine operations and locations of key infrastructure is provided on Figure 2.

1.2 NORTH WAMBO UNDERGROUND MINE LONGWALL 10A MODIFICATION

Following a review of mine planning and exploration results, WCPL has identified coal reserves adjoining the existing North Wambo Underground Mine that can be economically mined with an additional longwall panel and allow for operational continuity. This proposed extension to Wambo is referred to as the North Wambo Underground Mine Longwall 10A Modification (the Modification).

The Modification would include the development of an additional longwall panel in the Wambo Seam contiguous with the existing North Wambo Underground Mine (Figure 2). Access to the additional longwall panel would be via the existing North Wambo Underground Mine. The Modification would use the existing surface infrastructure of the North Wambo Underground Mine.

There would be no change to the approved ROM coal production rate of 14.7 Mtpa as a result of the modification.

Table 1 provides a comparative summary of the approved and proposed modified Wambo.

1.3 CONSULTATION FOR THE MODIFICATION

Consultation has been conducted with the local community, Aboriginal stakeholders, United Collieries, key state government agencies and Singleton Shire Council (SSC) during the preparation of this EA. A summary of this consultation is provided below.

It is anticipated that consultation between the local community, United Collieries and regulatory agencies will continue during the assessment of the Modification by the NSW Government.

Local Community

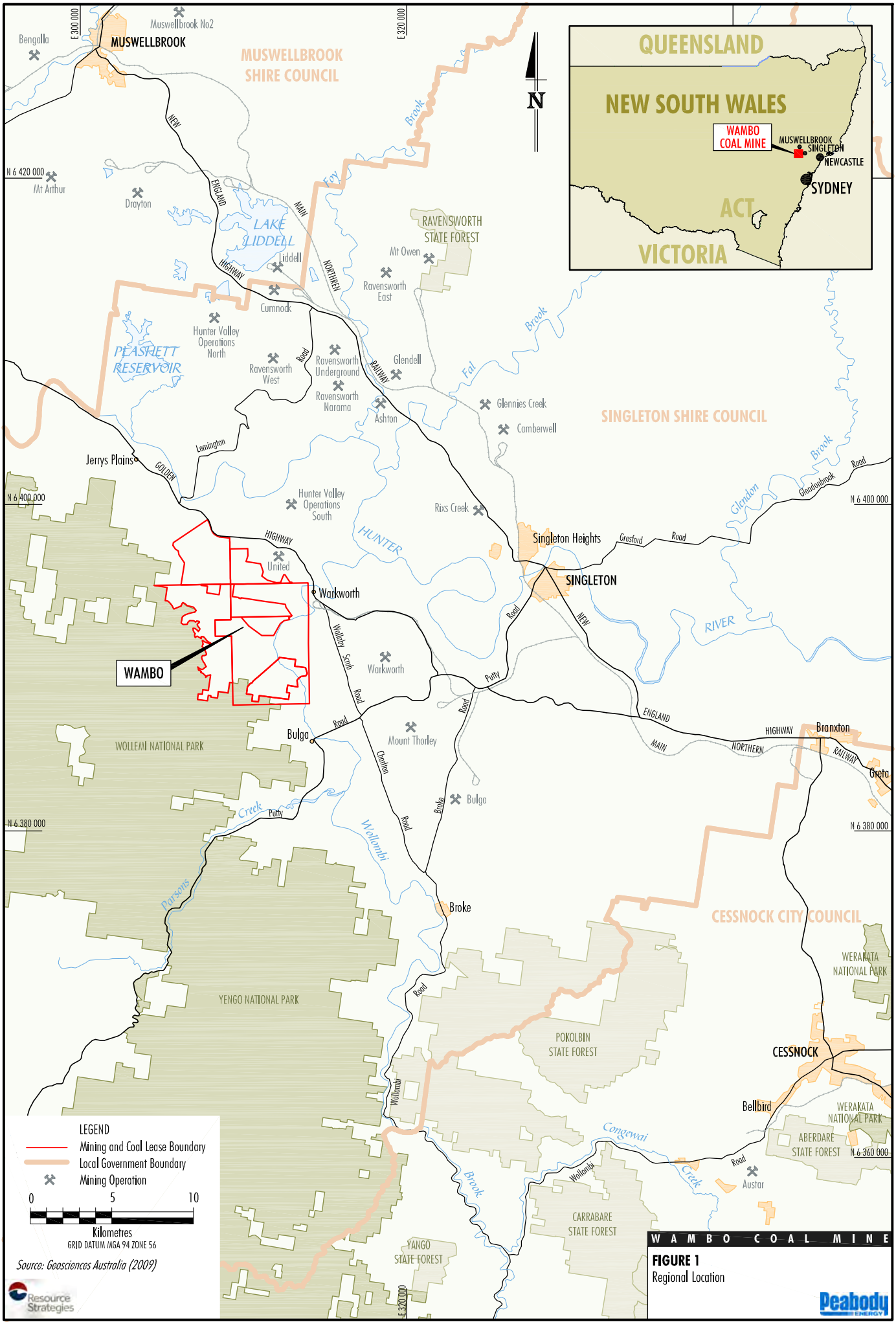
A Community Consultative Committee (CCC) for Wambo is in place and provides a mechanism for ongoing communication between WCPL and the local community. A letter providing information on the Modification was sent to the CCC members on 13 August 2014.

WCPL provided an overview of the proposed Modification at the CCC meeting on 26 August 2014.

Aboriginal Stakeholders

Aboriginal stakeholders were consulted throughout the preparation of the Cultural Heritage Impact Assessment for the Modification. Consultation was conducted in accordance with the NSW Office of Environment and Heritage (OEH) policy *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (NSW Department of Environment, Climate Change and Water [DECCW], 2010a).

Further detail on consultation with Aboriginal stakeholders for the Modification is provided in Appendix D.



WAMBO COAL MINE

FIGURE 1
Regional Location

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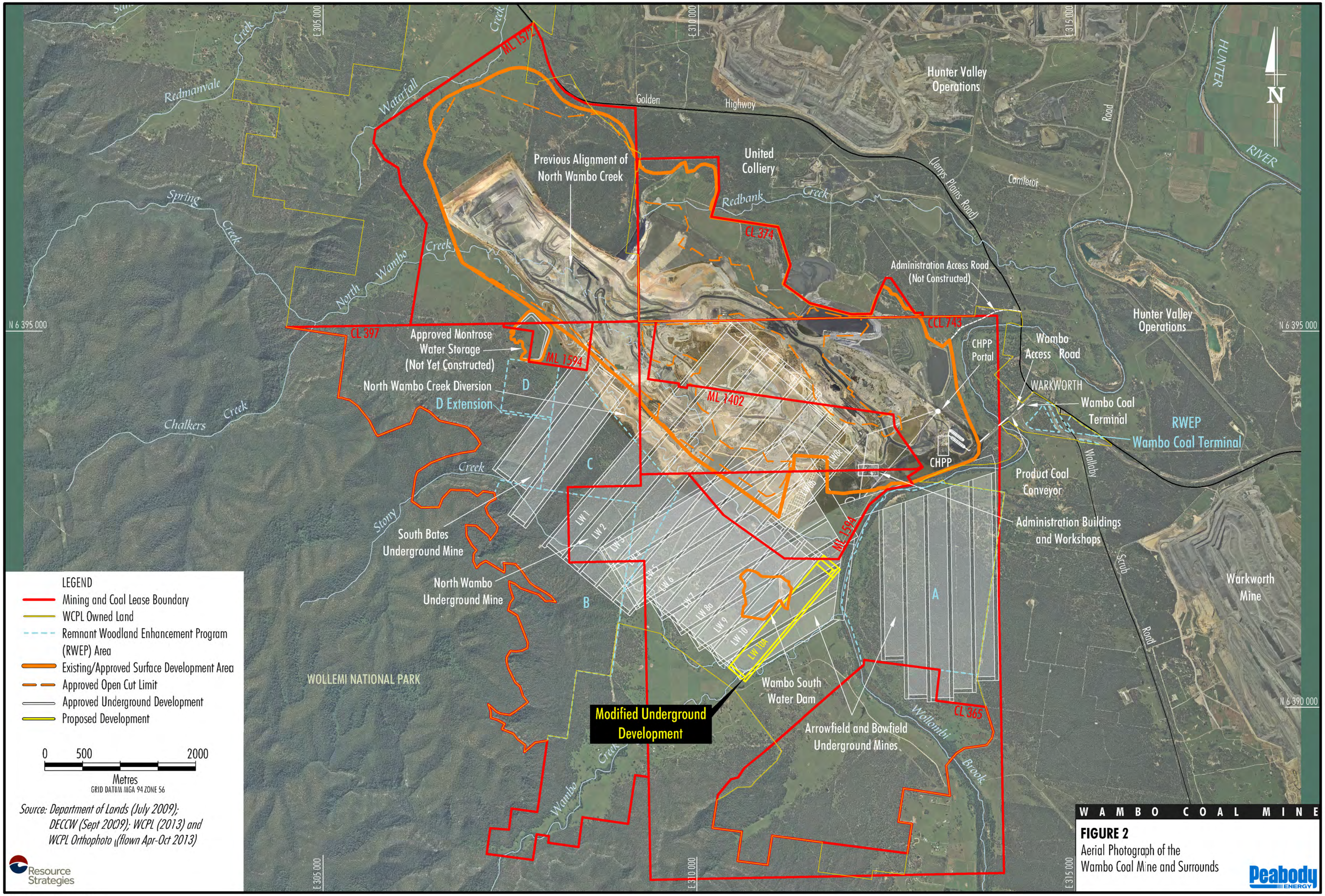


FIGURE 2
Aerial Photograph of the Wambo Coal Mine and Surrounds

WAM-09-15_EP LW 10a_103B

Table 1
Comparative Summary of the Approved and Modified Wambo Coal Mine

Component	Approved Wambo[1]	Modified Wambo
Life of Mine	• 21 years (from the date of the commencement of Development Consent [DA 305-7-2003]).	• Unchanged.
Open Cut Mining	• Open cut mining at a rate of up to 8 Mtpa of 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 until 2017.	• 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 107.7 Mt.	• Unchanged. • Approximately an additional 1.9 Mt of ROM coal from the modified North Wambo Underground Mine.
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.
Total ROM Coal Mined	• 205.7 Mt.	• 207.6 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 (Mbcm).	• 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 27.7 Mt of coarse rejects and approximately 18.4 Mt of tailings.	• Approximately an additional 0.5 Mt of coarse rejects and 0.2 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.
Mining Tenements	• Coal Lease (CL) 365, CL374, CL397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML1572, ML1594, Authorisation (A) 444, Exploration Licence (EL) 7211.	• Unchanged.

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

United Collieries

Consultation with United Collieries regarding the Modification was conducted during August 2014. During this consultation the interactions between the Modification and existing and future United Collieries infrastructure were discussed.

State Government Agencies

WCPL continues to consult with relevant State Government agencies on a regular basis in relation to the current mining operations at Wambo.

Department of Planning and Environment

WCPL initiated consultation regarding the Modification with the NSW Department of Planning and Environment (DP&E) in May 2014, providing an overview of the proposed first workings for Longwall 10A. On 12 May 2014, the DP&E advised WCPL that the development of the Longwall 10A first workings would be generally in accordance with Development Consent (DA 305-7-2003). As a consequence, this EA focuses on secondary extraction of the proposed Longwall 10A, rather than the associated first workings.

WCPL attended a briefing with the DP&E on 24 June 2014 to provide an overview of the proposed Modification. Key assessment requirements and the proposed timing for EA lodgement were discussed. WCPL sent a letter outlining the proposed scope of the Modification EA, including the proposed content of specialist studies, to the DP&E on 3 July 2014.

Division of Resources and Energy

The NSW Division of Resources and Energy within the Department of Trade, Investment, Regional Infrastructure and Services provided correspondence on 26 May 2014 that the Longwall 10A first workings met Condition 22E of Schedule 4 of the Development Consent (DA 305-7-2003).

NSW Office of Water

WCPL provided a briefing letter to the NSW Office of Water (NOW) in September 2014 providing information on the Modification and the results of the groundwater assessment.

Dams Safety Committee

WCPL lodged an application with the Dams Safety Committee for the first workings associated with the proposed Longwall 10A in May 2014. The Dams Safety Committee endorsed the application in June 2014.

Singleton Shire Council

Wambo is located within the Singleton local government area (LGA).

The SSC has been updated on the Modification through its involvement in the CCC (see above). WCPL also sent a letter to the General Manager of the SSC on 13 August 2014 to provide a briefing on the Modification and offering a meeting to provide further detail.

1.4 STRUCTURE OF THIS DOCUMENT

This EA comprises a main text component and supporting studies. An overview of the main text sections is presented below:

Section 1	Provides an overview of Wambo, the Modification and the consultation undertaken in relation to the Modification.
Section 2	Provides a description of existing and approved operations at Wambo.
Section 3	Provides a description of the Modification.
Section 4	Provides an environmental assessment of the Modification and describes the existing WCPL environmental management systems and measures available to manage and monitor any potential impacts.
Section 5	Describes the general statutory context of the Modification and identifies any Development Consent conditions or site management documents that would require revision in support of the Modification.
Section 6	References.

Attachments 1 and 2 and Appendices A to F provide supporting information as follows:

Attachment 1	Wambo Coal Mine Consolidated Development Consent.
Attachment 2	Relevant Environmental Planning Instruments and Government Policies.
Appendix A	Subsidence Assessment.
Appendix B	Groundwater Assessment.
Appendix C	Wambo Creek and Stony Creek Impact Assessment.

Appendix D	Cultural Heritage Impact Assessment.
Appendix E	Flora Assessment.
Appendix F	Fauna Assessment.

2 WAMBO COAL MINE – EXISTING OPERATIONS

2.1 APPROVALS HISTORY

The Wambo Development Project was approved under Part 4 of the NSW EP&A Act in February 2004. Eleven modifications to the Development Consent (DA 305-7-2003) have since been granted under the EP&A Act:

- 2004 under Section 96(1) – to facilitate the commencement of operations under Development Consent DA 305-7-2003 (MOD 1);
- May 2005 under Section 96(2) – to facilitate alterations to the North Wambo Underground Mine (MOD 2);
- January 2006 under Section 96(1A) – to facilitate the construction of an open cut workshop extension and surface infrastructure for the North Wambo Underground Mine (MOD 3);
- April 2006 under Section 96(1A) – to facilitate the extraction of remnant coal from the existing Wollemi Underground Mine (MOD 4);
- October 2006 under Section 96(1A) – to facilitate the construction and operation of a temporary North Wambo Creek bypass around the open cut operations (MOD 5);
- January 2007 under Section 96(2) – to facilitate the staged construction of the North Wambo Creek Diversion, a temporary North Wambo Creek pipeline and construction of gas drainage and dewatering infrastructure for the North Wambo Underground Mine (MOD 6);
- June 2009 under Section 96(1A) – to facilitate the construction and operation of the Chitter Dump Dam (MOD 7);
- August 2009 under Section 96(2) – to facilitate the construction and operation of the South Wambo Dam (MOD 8);
- February 2011 under Section 75W – to modify Development Consent DA 305-7-2003 to require WCPL to prepare an Extraction Plan for all underground operations at Wambo, rather than a Subsidence Management Plan (MOD 9);
- January 2013 under Section 75W – to modify Development Consent DA 305-7-2003 to facilitate the construction and operation of the Montrose Water Storage and associated supporting infrastructure (MOD 11); and
- July 2013 under Section 75W – to modify Development Consent DA 305-7-2003 to facilitate the development of two additional longwall panels contiguous with the existing North Wambo Underground Mine and recovery of an additional 3.7 Mtpa of ROM coal (MOD 13).

The consolidated Development Consent (DA 305-7-2003), incorporating these modifications, is provided in Attachment 1.

In addition, a modification application and request for Environmental Assessment Requirements were lodged in September 2012 for the realignment and extension/relocation of the Arrowfield and Bowfield Seam Underground Mines (the South Wambo Underground Mine Modification). The South Wambo Underground Mine Modification will be subject to separate environmental assessment and approval.

2.2 OPEN CUT MINING

Open cut mining operations at Wambo involve the extraction of coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams (Figure 3). The open cut is bounded by the United Colliery and the Golden Highway to the north, Wollombi Brook to the east (Figure 2) and by uneconomic strip ratios to the south and west.

The open cut mining fleet includes excavators, dozers, front end loaders, haul trucks, water trucks, service trucks, graders and drills.

During the 2013 reporting period, approximately 4.1 Mt of ROM coal was mined at the Wambo open cut operations (WCPL, 2014a).

2.3 UNDERGROUND MINING

The following underground mines at Wambo are approved (Figures 2 and 3):

- North Wambo Underground Mine (Wambo Seam);
- South Bates Underground Mine (also known as Whybrow Underground Mine) (Whybrow Seam);

SUPERGROUP	GROUP	SUBGROUP	FORMATION	SEAM
SINGLETON SUPERGROUP	NARRABEEN GROUP	WIDDEN BROOK CONGLOMERATE		
	NEWCASTLE COAL MEASURES [1]	GLEN GALLIC SUBGROUP	Greigs Creek Coal	
			Redmanvale Creek Formation	
			Dights Creek Coal	
		DOYLES CREEK SUBGROUP	Waterfall Gully Formation	
			Pinegrove Formation	
		HORSESHOE CREEK SUBGROUP	Lucernia Coal	
			Strathmore Formation	
			Alcheringa Coal	
			Clifford Formation	
		APPLETREE FLAT SUBGROUP	Charlton Formation	
			Abbey Green Coal	
		WATTS SANDSTONE		
	WITTINGHAM COAL MEASURES	DENMAN FORMATION		
		JERRYS PLAINS SUBGROUP	Mount Leonard Formation	***Whybrow Seam*** [2]
			Althorpe Formation	
			Malabar Formation	***Redbank Creek Seam*** [2]
				Wambo Seam [2]
				Whynot Seam [2]
				Blakefield Seam
			Mount Ogilvie Formation	*Glen Munro Seam*
				Woodlands Hill Seam
			Milbrodale Formation	
			Mount Thorley Formation	***Arrowfield Seam*** [2]
				Bowfield Seam [2]
				Warkworth Seam [3]
			Fairford Formation	
			Burnamwood Formation	*Mount Arthur Seam*
				Piercefield Seam
				Vaux Seam
				Broonie Seam
				Bayswater Seam
		ARCHERFIELD SANDSTONE		
		VANE SUBGROUP	Bulga Formation	
			Foybrook Formation	
			Saltwater Creek Formation	

[1] Previously known as the Wollombi Coal Measures.
[2] Coal reserves currently, previously and proposed to be mined at the Wambo Coal Mine.
[3] Coal reserves to be mined by the Wambo Coal Mine where the upper three plies of the Warkworth Seam combine with the two plies of the Bowfield Seam.

After: DMR (1993)

WAMBO COAL MINE

FIGURE 3
Stratigraphy of the
Wambo Coal Mine Area

Resource Strategies

Peabody ENERGY

WAM-09-15_EP LW10A_001A

- Arrowfield Underground Mine (Arrowfield Seam); and
- Bowfield Underground Mine (Bowfield Seam).

Development of the North Wambo Underground Mine commenced in 2005 and production (using longwall mining methods) commenced in 2007 (WCPL, 2008). During the 2013 reporting period approximately 5.5 Mt of ROM coal was mined at the North Wambo Underground Mine (WCPL, 2014a).

Access to the North Wambo Underground Mine is via the open cut highwall. ROM coal is conveyed to a 70,000 tonne (t) capacity stockpile adjacent to the open cut highwall where it is loaded into haul trucks and hauled to the ROM bin or the ROM coal stockpile.

Underground mining equipment includes continuous miners, longwall mining equipment, electric shuttle cars, load haul dump machines and personnel transporters.

Development of the main headings, maingate and tailgate (i.e. first workings) for the proposed Longwall 10A is being conducted generally in accordance with Development Consent (DA 305-7-2003).

Mining has not commenced at the approved Whybrow Underground Mine, Arrowfield Underground Mine, or the Bowfield Underground Mine to date.

2.4 COAL HANDLING AND PREPARATION

ROM coal from the mining operations is hauled to the CHPP for processing. The majority of ROM coal is placed directly into the 400 t ROM bin and the remainder is placed onto the 250,000 t capacity ROM coal stockpile (WCPL, 2014a). ROM coal is reclaimed from the ROM coal stockpile by front end loader as required.

ROM coal is crushed and washed in the CHPP which operates at a rate of up to approximately 1,800 tph of ROM coal feed. A product coal stockpile with an approximate capacity of 500,000 t is used to stockpile product coal, prior to reclaim and loading to trains for transport off-site.

The CHPP operates up to 24 hours per day, 7 days per week and during the 2013 reporting period approximately 9.7 Mt of ROM coal was processed at the CHPP producing approximately 6.2 Mt of product coal (WCPL, 2014a).

2.5 PRODUCT COAL TRANSPORT

The Wambo Coal Terminal is capable of loading product coal onto trains at a rate of 4,500 tph. Product coal is reclaimed from the product coal stockpile at three reclaim points and is transferred via conveyors to the train load-out bin.
The Wambo Coal Terminal operates up to 24 hours per day, 7 days per week. An average of four trains are loaded each day, with a maximum of six trains per day being loaded during peak coal transport periods.

2.6 WASTE ROCK MANAGEMENT

The open cut operations are expected to produce approximately 640 Mbcm of waste rock during the life of Wambo (WCPL, 2012). Only a limited amount of waste rock will be produced from the underground operations. The overburden and interburden waste rock materials comprise mudstones, siltstones, sandstone, shale and conglomerates (WCPL, 2012).

Overburden removal is carried out mostly by excavators and haul trucks with the waste rock material hauled to open cut voids or waste rock emplacements. Approximately 24.3 Mbcm of waste rock was excavated during the 2013 reporting period (WCPL, 2014a).

2.7 COAL REJECT MANAGEMENT

Approximately 27.7 Mt of coarse reject material is expected to be produced over the life of Wambo and will primarily comprise minor quantities of coal as well as sandstone, siltstones, shales, conglomerates and mudstone (WCPL, 2012). The coarse reject material is selectively handled and co-disposed of with waste rock in open cut voids or would be used as bulk fill in the covering and rehabilitation of tailings materials (WCPL, 2003).

Tailings produced at the CHPP primarily comprise carbonaceous shale, sands and clay materials (WCPL, 2003). The tailings are pumped as slurry to open cut voids. Once the tailings have filled a void they are progressively covered with coarse rejects and/or waste rock material using a combination of encapsulation and incorporation. Approximately 18.4 Mt of tailings (dry basis) are expected to be produced over the life of Wambo (WCPL, 2012).

2.8 INFRASTRUCTURE AND SERVICES

The main administration building, bathhouse and workshops are located at the south-east corner of the open cut operations (Figure 2). An administration block, bathhouse and workshops are also located at the CHPP.

Access to Wambo is currently via the sealed Wambo Access Road which intersects the Golden Highway near Warkworth (Figure 2).

2.9 SITE WATER MANAGEMENT

The site water management strategy for Wambo is based on the containment and re-use of mine water and on the control of sediment that may be potentially carried with runoff from disturbed areas such as the waste rock emplacements.

The Wambo water management system controls waters generated from development and operational areas while diverting upstream water around such areas. It includes both permanent structures that will continue to operate post-closure and temporary structures that will only be required until the completion of rehabilitation works. The water management system includes:

- up-catchment diversion structures;
- water storage dams;
- sediment dams;
- water transfer infrastructure (i.e. pumps and pipelines); and
- the North Wambo Creek Diversion.

The site water management system operates predominately as a closed self-contained system. The water balance of the system fluctuates with climatic conditions and as the extent of the mining operations evolves over time.

In accordance with Condition 25, Schedule 4 of the Development Consent (DA 305-7-2003), WCPL annually reviews the site water balance for Wambo and reports the results of this review in the Annual Environmental Management Report.

A section of North Wambo Creek has been diverted to avoid the Wambo open cut. The North Wambo Creek Diversion was constructed in accordance with the approved North Wambo Creek Diversion Plan (WCPL, 2007).

2.10 WORKFORCE

The Wambo workforce currently consists of approximately 750 employees and contractors.

2.11 REHABILITATION

Rehabilitation at Wambo occurs progressively as areas/landforms become available to minimise the area of disturbance at any one time. Approximately 354 hectares of final rehabilitation has been undertaken at Wambo (WCPL, 2014a).

A summary of the key elements of the rehabilitation programme at Wambo is provided below.

Rehabilitation Principles and Objectives

The following rehabilitation principles form the basis for rehabilitation planning and design at Wambo (WCPL, 2012):

- Existing remnant vegetation to be preserved wherever possible.
- Integration of open cut mining and rehabilitation planning to minimise the area of disturbance at any one time.
- Progressive rehabilitation of disturbed areas, including partial rehabilitation of temporarily inactive waste rock emplacements.
- Creation of post-mining landforms that enhance the amenity of the local landscape and contribute to local and regional habitat corridors as presented in the *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of New South Wales* (NSW Department of Mineral Resources, 1999).
- Consideration of issues of public safety in the design of final landforms.
- Consultation with the relevant state government authorities, SSC and the CCC during the final design and planning of rehabilitated landforms.
- Implementation of trials and design studies as necessary to maximise effectiveness of the rehabilitation programme.
- Routine monitoring in order to identify rehabilitated areas requiring maintenance works.

The rehabilitation objectives at Wambo include (WCPL, 2012):

- The creation of safe, stable, adequately drained post-mining landforms that are consistent with the local surrounding landscape.
- Establishment of woodland vegetation linking remnant vegetation to the north and east of Wambo with the eastern borders of Wollemi National Park.
- Preservation of existing beneficial use of water resources.
- Development of a sustainable post-mining land use plan towards the end of Wambo life.

Final Landform Concepts

The preferred final landform concepts for Wambo will be revised and refined throughout the life of Wambo, utilising the outcomes of ongoing consultation with relevant authorities, stakeholders and the results of rehabilitation trials.

Surface infrastructure with no ongoing beneficial use will be removed from the site at the completion of mining (WCPL, 2012). Some infrastructure (e.g. site access roads, water storages) may be retained for alternate post-mining uses (where agreed in consultation with the relevant landholders).

Revegetation Strategy

The Wambo revegetation programme will establish significant areas and a net increase in woodland vegetation over the long-term. The final distribution of woodland to be established on rehabilitated landforms will ultimately depend on the outcome of closure planning including the shape of final landforms and the agreed post-closure land use (WCPL, 2003).

In recognition of the importance of vegetation corridors to regional biodiversity, rehabilitation initiatives for Wambo will aim to increase the continuity of vegetation in the region through the establishment of woodland corridors. Accordingly, the rehabilitation programme has been designed to establish linkages between the rehabilitation areas, existing remnant vegetation and Wollemi National Park (WCPL, 2003).

The provisional revegetation strategy includes the revegetation of disturbance areas with areas of woodland (corridors), areas which contain a mixture of woodland and pasture, and riparian vegetation.

Remnant Woodland Enhancement Programme

Four Remnant Woodland Enhancement Programme (RWEP) areas have been established at Wambo (Figure 2). The objective of the RWEP areas is to help to conserve regional biodiversity, whilst enhancing the habitat available to flora and fauna (WCPL, 2014b). Conservation and enhancement of the RWEP areas will strengthen the linkages to be developed between Wollemi National Park, existing remnant woodland and woodland rehabilitation areas (WCPL, 2014b).

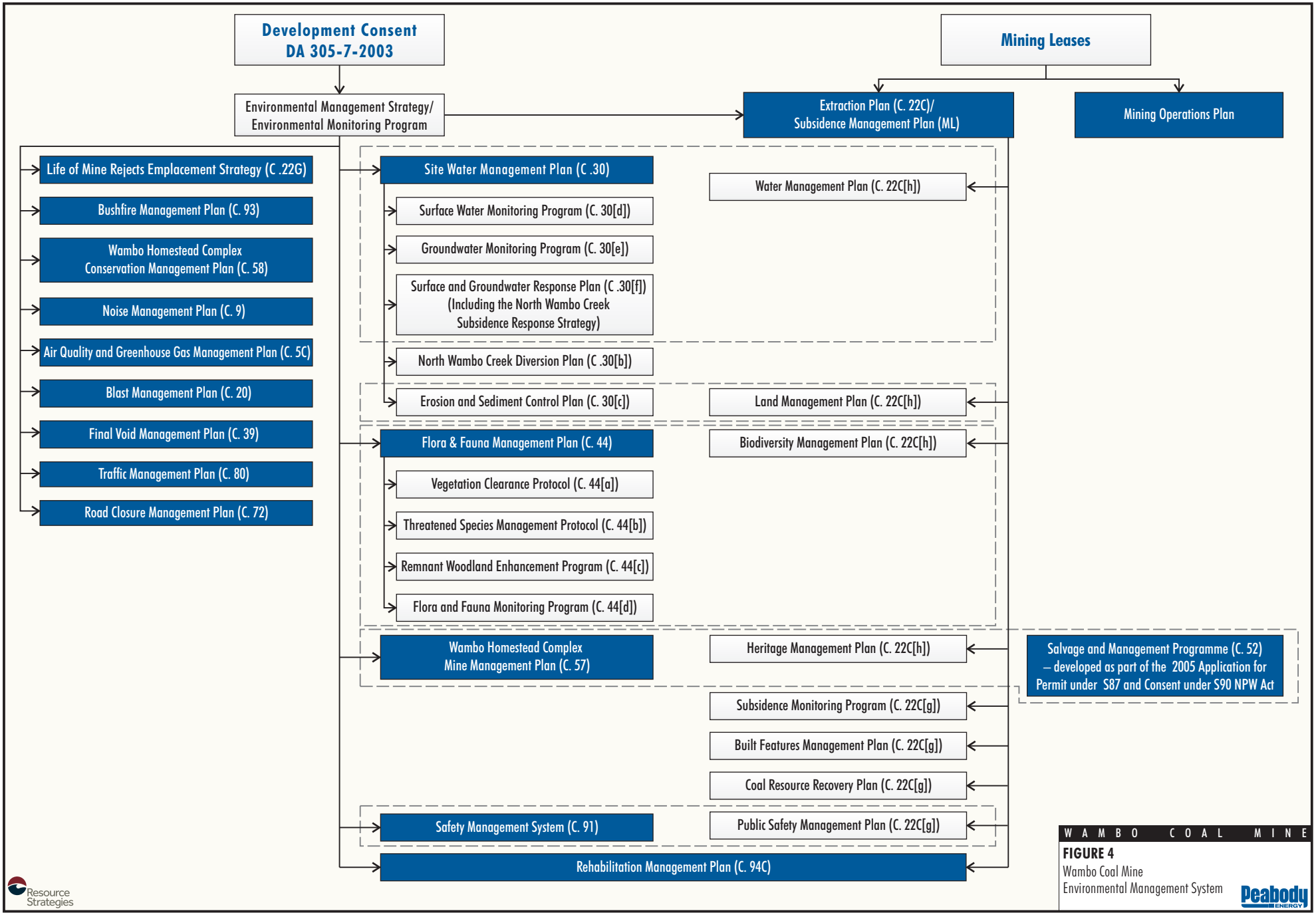
Details of the management of the RWEP areas are provided in the Flora and Fauna Management Plan (WCPL, 2014b).

WCPL is currently in the process of finalising agreements to conserve the RWEP areas as part of a Voluntary Conservation Agreement under Part 4, Division 12 of the NSW *National Parks and Wildlife Act, 1974* in accordance with Condition 41, Schedule 4 of Development Consent DA 305-7-2003.

2.12 ENVIRONMENTAL MONITORING AND MANAGEMENT

Environmental management at Wambo encompasses a range of management plans and monitoring programmes overseen by statutory planning provisions (Figure 4). Approved management plans/monitoring programmes include:

- Environmental Management Strategy (WCPL, 2010a).
- Environmental Monitoring Program (WCPL, 2010b).
- Flora and Fauna Management Plan (WCPL, 2014b).
- Blast Management Plan (WCPL, 2014c).
- Noise Management Plan (WCPL, 2014d).
- Air Quality and Greenhouse Gas Management Plan (WCPL, 2014e).
- Site Water Management Plan incorporating the following:
  - North Wambo Creek Diversion Plan (WCPL, 2007).
  - Groundwater Monitoring Program (WCPL, 2010c).
  - Surface Water Monitoring Program (WCPL, 2010d).



Resource Strategies

WAMBO COAL MINE

FIGURE 4
Wambo Coal Mine
Environmental Management System

Peabody ENERGY

WAM-09-15_EP LW10A_002A

  - Erosion and Sediment Control Plan (WCPL, 2010e).
  - Surface and Groundwater Response Plan (WCPL, 2010f).
- North Wambo Underground Mine Subsidence Management Plan for Longwalls 1 to 6 (WCPL, 2006).
- North Wambo Underground Mine Extraction Plan Longwalls 7 to 10 (WCPL, 2014f).
- Surface and Subsurface Investigation Programme (Strata Engineering, 2005).
- Life of Mine Rejects Emplacement Strategy (WCPL, 2011).
- Bushfire Management Plan (WCPL, 2013).
- Wambo Homestead Complex Mine Management Plan (Godden Mackay Logan, 2012).

WCPL maintains an extensive monitoring programme whereby data is collected, analysed and maintained for reporting, future examination and assessment. The locations of existing environmental monitoring sites at Wambo are shown on Figures 5 and 6.

2.13 COMPLAINTS

WCPL maintains a 24 hours a day, 7 days per week complaints line which is directed to the Environment and Community Manager (phone 02 6570 2245) and an email address (wambocommunity@peabody.com).

WCPL received a total of 30 complaints during the 2013 reporting period, with the majority related to noise (50 percent [%]) and blasting (40%) (WCPL, 2014a). This was a significant improvement from the 2012 reporting period where a total of 106 complaints were received. The complaints received were related to noise, blasting and lighting, and not generally related to the underground mining operations (WCPL, 2014a).

Mine-related complaints are managed in accordance with WCPL's Community Complaints Procedure.

3 NORTH WAMBO UNDERGROUND MINE LONGWALL 10A MODIFICATION

The Modification would not require any significant alteration to the approved Wambo operations and general supporting infrastructure. A description of the Modification is provided below.

3.1 NORTH WAMBO UNDERGROUND MINE

Layout of the Underground Mining Area

The proposed layout of the Modification is shown on Figure 7. Proposed Longwall 10A would be located to the south-east of the existing longwall panels and would be approximately 1.75 km long and approximately 253 metres (m) wide.

The extent of the proposed Longwall 10A is outside of the subsidence exclusion zone related to Wollombi Brook. The extent of the subsidence exclusion zone related to Wollombi Brook is defined by an angle of 26.5 degree (°) from the vertical to a 40 m buffer from the Wollombi Brook highbank.

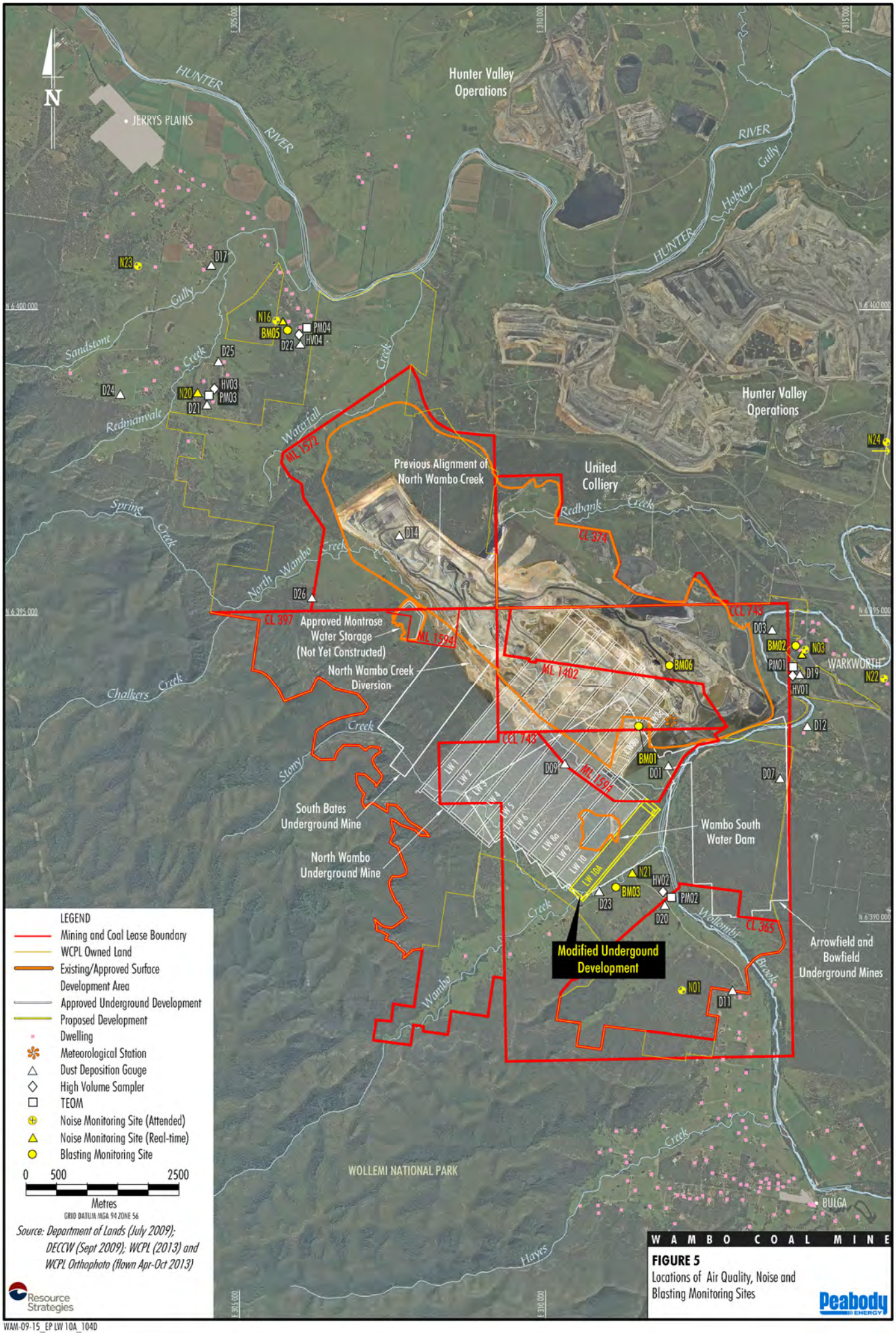
The proposed Longwall 10A would also be set back from North Wambo Creek by a distance equivalent to a 26.5° angle of draw from the Wambo Seam.

Mine Access and Development Works

Access to the proposed Longwall 10A would be via the existing North Wambo Underground Mine. Main headings are being extended from the South Mains to approved Longwalls 9 and 10 to provide access to the proposed Longwall 10A generally in accordance with Development Consent (DA 305-7-2003) (Figure 7). Gate roads are being driven from the main headings to the south-west to allow for the extraction of coal from the proposed Longwall 10A.

Longwall Mining Operations

Longwall mining would continue as per existing mining operations at the North Wambo Underground Mine. Longwall mining would commence at the south-western end of the proposed Longwall 10A and move towards the north-east.


N
HUNTER RIVER
JERRYS PLAINS
Hunter Valley Operations
Hunter Valley Operations
HUNTER RIVER
Hebden Gully
Sandstone Gully Creek
Redmanvale
Waterfall Creek
Spring Creek
North Wambo Creek
Chalkers Creek
Stony Creek
Redbank Creek
Wollombi Brooks
Wambo Creek
Hayes Creek
Previous Alignment of North Wambo Creek
United Colliery
Approved Montrose Water Storage (Not Yet Constructed)
North Wambo Creek Diversion
South Bates Underground Mine
North Wambo Underground Mine
Wambo South Water Dam
Modified Undergound Development
Arrowfield and Bowfield Underground Mines
WARKWORTH
WOLLEMI NATIONAL PARK
BULGA
ML 1572
CL 374
CL 748
ML 1594
ML 1402
CL 397
ML 1598H
CL 385
LW1
LW2
LW3
LW4
LW5
LW6
LW7
LW8c
LW9
LW10
LW10A
LW10B
N23
N16
N20
N24
N22
N03
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E 310 000
E 315 000
N 6 400 000
N 6 395 000
N 6 390 000
LEGEND
Mining and Coal Lease Boundary
WCPL Owned Land
Existing/Approved Surface Development Area
Approved Underground Development
Proposed Development
Dwelling
Meteorological Station
Dust Deposition Gauge
High Volume Sampler
TEOM
Noise Monitoring Site (Attended)
Noise Monitoring Site (Real-time)
Blasting Monitoring Site
0
500
2500
Metres
GRID DATUM MGA 94 ZONE 56
Source: Department of Lands (July 2009); DECCW (Sept 2009); WCPL (2013) and WCPL Orthophoto (flown Apr-Oct 2013)
Resource Strategies
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WAMBO COAL MINE
FIGURE 5
Locations of Air Quality, Noise and Blasting Monitoring Sites
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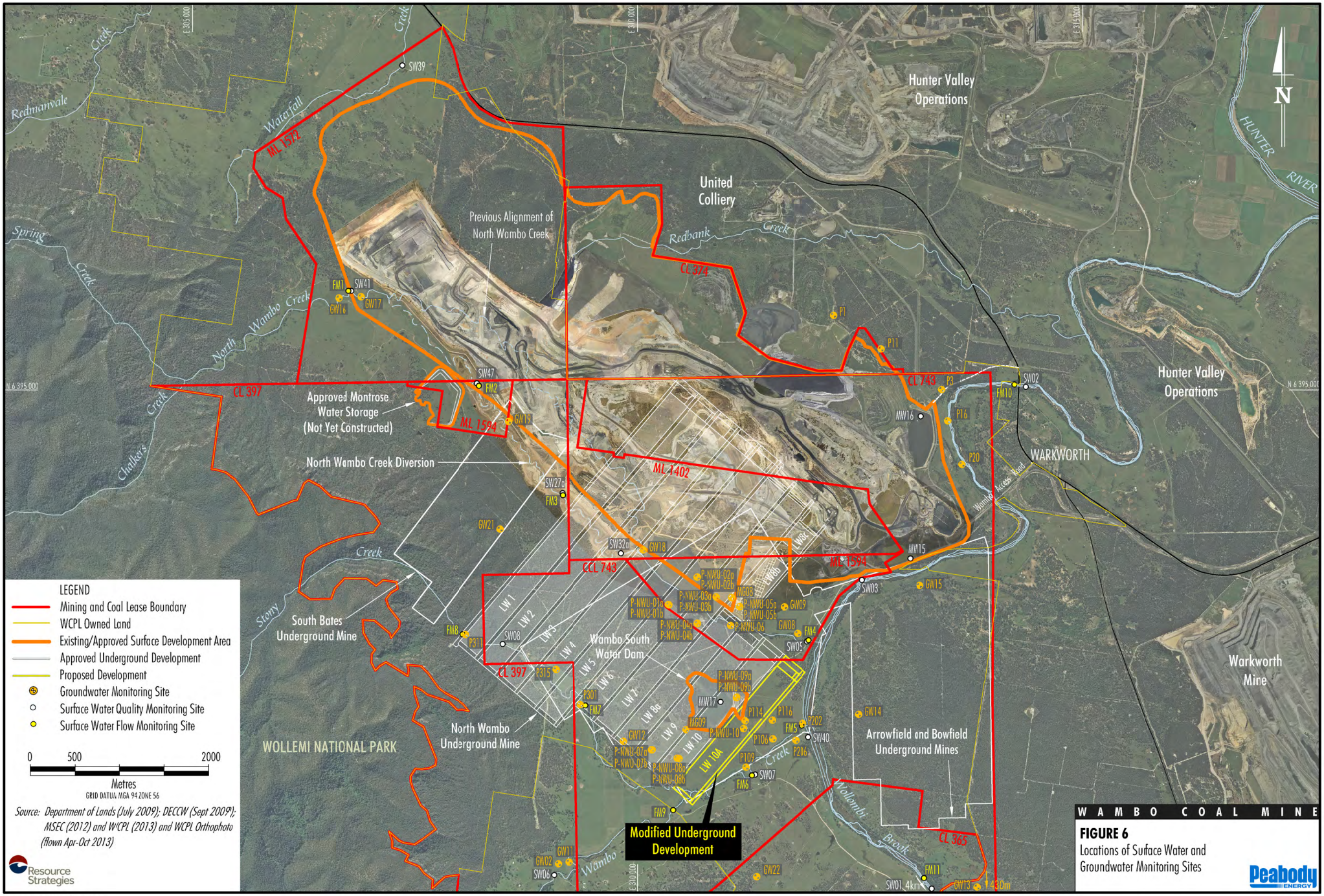
Hunter Valley Operations
United Colliery
Previous Alignment of North Wambo Creek
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North Wambo Creek Diversion
Wambo South Water Dam
South Bates Underground Mine
North Wambo Underground Mine
Arrowfield and Bowfield Underground Mines
Warkworth Mine
WARKWORTH
WOLLEMI NATIONAL PARK
Modified Underground Development
ML 1672
ML 1594
ML 1402
CL 374
CL 397
CCL 743
CL 365
LEGEND
Mining and Coal Lease Boundary
WCPL Owned Land
Existing/Approved Surface Development Area
Approved Underground Development
Proposed Development
Groundwater Monitoring Site
Surface Water Quality Monitoring Site
Surface Water Flow Monitoring Site
0 500 2000
Metres
GRID DATUM: MGA 94 ZONE 56
Source: Department of Lands (July 2009); DECCW (Sept 2009); MSEC (2012) and WCPL (2013) and WCPL Orthophoto (flown Apr-Oct 2013)
Resource Strategies
WAMBO COAL MINE
FIGURE 6
Locations of Surface Water and Groundwater Monitoring Sites
Peabody ENERGY
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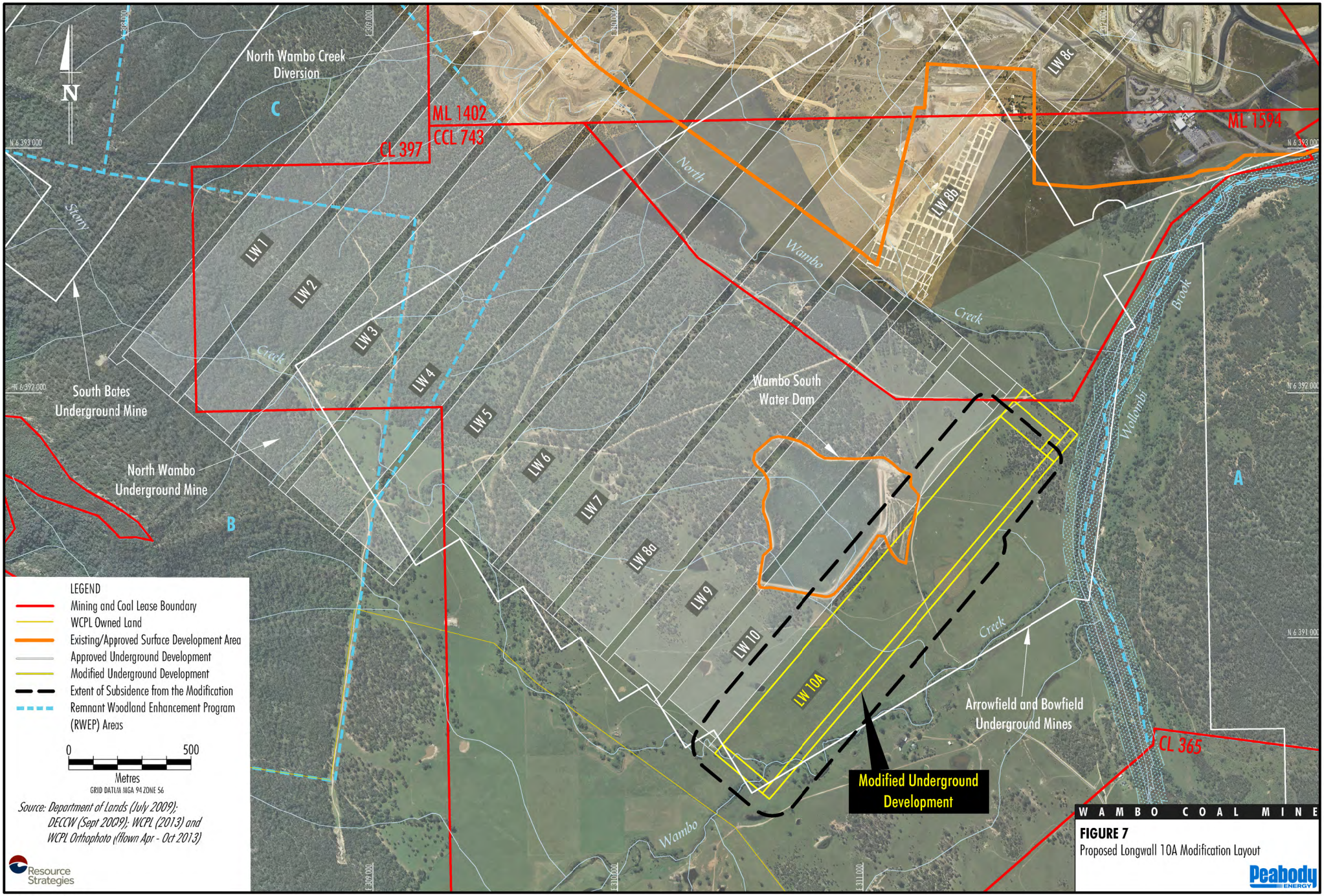

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Consistent with the approved operations, underground mining operations would be conducted 24 hours a day, seven days a week.

Approximately 1.9 Mt of additional ROM coal would be mined within the approved mine life, over a period of 4 to 5 months. Production from the North Wambo Underground Mine would be at a rate of up to 7.5 Mtpa. First workings development of the proposed Longwall 10A commenced in July 2014. Longwall extraction of the proposed Longwall 10A is scheduled to commence in June 2015.

Underground Equipment and Mobile Fleet

The existing North Wambo Underground Mine equipment and mobile fleet (Section 2.3) would be used for the Modification.

Ventilation System

The existing North Wambo Underground Mine ventilation system would be extended for the Modification. No additional surface disturbance for ventilation systems would be required.

Coal Seam Gas Management

The existing North Wambo Underground Mine gas management system would be extended to monitor and control the concentrations of mine gases for the Modification. No additional surface disturbance for gas management systems would be required for the Modification.

Dewatering

Groundwater that accumulates in underground workings would be pumped to the surface via the existing systems at the North Wambo Underground Mine.

No additional dewatering bores are required for the Modification.

3.2 APPROVED UNDERGROUND OPERATIONS

The Modification would include the development of an additional longwall panel in the Wambo Seam adjacent to the existing North Wambo Underground Mine (Longwall 10A) (Figure 7).

The proposed Modification does not include any alteration to the layout and/or operation of the approved South Bates Underground Mine (Whybrow Underground Mine), Arrowfield Underground Mine or Bowfield Underground Mine.

3.3 OPEN CUT OPERATIONS

The Modification would not alter the approved open cut mining methods, open cut maximum production rates, open cut mine fleet or waste rock management practices.

3.4 COAL HANDLING, PREPARATION AND PRODUCT COAL TRANSPORT

The Modification would not alter approved coal handling, CHPP or product coal transport operations (Sections 2.4 and 2.5).

3.5 COAL REJECT MANAGEMENT

The Modification would result in production of approximately 0.5 Mt of coarse rejects and 0.2 Mt of tailings. No alteration of current coarse rejects or tailings management measures would be required (Section 2.7).

3.6 INFRASTRUCTURE AND SERVICES

The existing North Wambo Underground Mine support facilities (including offices, control room, crib room, workshop, ablution building, laydown areas and a range of service facilities), access roads and utilities would continue to be utilised for the Modification.

Minor extensions and upgrades to existing utilities (e.g. electricity supply and communications) may be conducted for the Modification as required.

3.7 WATER MANAGEMENT AND SUPPLY

The Modification would not include any material changes to the approved water management system, water supply or water demand (Section 2.9).

3.8 WORKFORCE

The existing North Wambo Underground Mine workforce would continue to be employed for the Modification and therefore the Modification would not materially result in any additional demand for employees/contractors. The development of first workings for the proposed Longwall 10A and the Modification would extend employment for the North Wambo Underground Mine workforce by approximately 6 months.

3.9 REHABILITATION

The Modification would not require a material change to the rehabilitation programme presented in the EIS (WCPL, 2003) (Section 2.11).

The Modification area would be remediated if visual monitoring identifies any areas subject to excessive erosion and sedimentation as a result of subsidence. The following mitigation measures would be implemented if required:

- filling of cracks and minor erosion holes, where practicable;
- installation of sediment fences downslope of subsidence-induced erosion areas;
- stabilisation of erosion areas using rock or other appropriate materials;
- stabilisation of banks subject to soil slumping; and
- revegetation using brush matting, seeding or tubestock.

4 ENVIRONMENTAL ASSESSMENT

The Modification would include the development of an additional longwall panel at the North Wambo Underground Mine (the proposed Longwall 10A). The "Modification area" is the extent of predicted subsidence from the proposed Longwall 10A (Figure 7).

4.1 IDENTIFICATION OF KEY ISSUES

The following approved components of Wambo would be unchanged by the Modification (Section 3):

- overall life of the mine;
- ROM coal production rate;
- open cut operations;
- coal handling, CHPP and product coal transport operations; and
- major surface infrastructure.

In addition, the Modification would not materially result in any additional demand for employees/contractors.

Therefore, there would be no material alteration to the approved impacts of Wambo on the following aspects:

- air quality;
- noise;
- open cut blasting;
- visual amenity;
- road or rail transport network; and
- population and community infrastructure demand.

The key potential impacts of the Modification are related to the extraction of the proposed Longwall 10A at the North Wambo Underground Mine and the associated subsidence impacts and consequences.

A discussion of the predicted subsidence effects and impacts is provided in Section 4.2. An assessment of the potential consequences of the predicted subsidence impacts is provided in Sections 4.2 to 4.8 for:

- built features;
- land resources;
- groundwater;
- surface water;
- Aboriginal cultural heritage;
- flora; and
- fauna.

For completeness, Section 4.9 discusses potential impacts of the Modification on other issues, including greenhouse gas emissions, hazards and risk and non-Aboriginal heritage.

4.2 SUBSIDENCE

4.2.1 Background

Subsidence is the vertical and horizontal movement of the overburden and land surface as a result of the extraction of underlying coal. These movements are generically referred to as subsidence effects. The type and magnitude of the subsidence effects is dependent on a range of variables (e.g. mine geometry, topography and geology).

The different types of subsidence effects include systematic subsidence movements, non-systematic subsidence movements and sub-surface strata movements.

Extraction Plan

Condition 22C, Schedule 4 of the Development Consent (DA 305-7-2003) requires WCPL to prepare an Extraction Plan for second workings prior to extraction.

4.2.2 Environmental Review

A revised cumulative Subsidence Assessment, including the Modification, has been prepared by Mine Subsidence Engineering Consultants (MSEC) (2014) and is presented in Appendix A.

The subsidence assessment:

- provides subsidence predictions for the approved and proposed longwalls in the Wambo Seam and the future longwalls in the Arrowfield and Bowfield Seams;
- compares the subsidence predictions with those previously provided in the North Wambo Underground Mine Modification Environmental Assessment (WCPL, 2012);
- identifies the natural and built features located above and in the vicinity of the proposed Longwall 10A; and
- provides subsidence predictions and impact assessments, in conjunction with other specialist consultants, for these natural and built features.

A summary of the key findings of the Subsidence Assessment is provided below.

Prediction Methodology

Predictions of the systematic subsidence parameters for the Modification were made using the Incremental Profile Method, which consists of subsidence prediction curves based on monitoring data from mines extracting coal from the Southern, Newcastle, Hunter and Western Coalfields of NSW (Appendix A).

The Incremental Profile Method has a tendency to give slightly conservative predictions of the systematic subsidence parameters where the proposed mining geometry and geology are within the range of the empirical database (i.e. the method is based on upper bound curves and is generally conservative) (Appendix A).

The predicted subsidence effects for the approved and modified mining layout incorporating the proposed Longwall 10A have been calculated using a calibrated Incremental Profile Method, so that the change in subsidence effects can be directly compared.

Appendix A provides a more detailed description of the subsidence prediction methodologies, including a description of previous subsidence monitoring at Wambo and other collieries in the Hunter Coalfield and how the data has been used for the Modification subsidence predictions.

Predicted Subsidence Effects

Subsidence effects are the deformation of the ground mass due to underground mining, including all mining-induced ground movements.

Systematic Subsidence Effects

Systematic subsidence movements are described by the following parameters: subsidence, tilt, curvature, and associated strains (tensile and compressive strains).

Previous bord and pillar workings and extracted longwall panels associated with the Homestead Mine and the Wollemi Mine in the Whybrow Seam are located approximately 75 to 95 m above the proposed Longwall 10A (Appendix A).

Table 2 presents a comparison of the predicted cumulative subsidence effects from the approved and modified mining layout in the Wambo, Arrowfield and Bowfield Seams, including the associated reactivation of existing workings in the Whybrow Seam. Table 2 also presents the incremental subsidence associated with the proposed Longwall 10A.

The maximum predicted total vertical subsidence for the modified layout is similar to but slightly greater (i.e. 2 %) than the predictions based on the approved layout using the calibrated Incremental Profile Method (Appendix A). The maximum predicted total tilt, hogging curvature and sagging curvature for the modified mine layout are similar to those predicted based on the approved layout using the calibrated Incremental Profile Method (Appendix A).

Table 2
Comparison of Predicted Systematic Effects for the Approved and Modified Mining Layouts

Layout	Maximum Predicted Total Subsidence (mm)	Maximum Predicted Total Tilt (mm/m)	Maximum Predicted Hogging Curvature (km^{-1})	Maximum Predicted Sagging Curvature (km^{-1})
Approved Mining Layout (Wambo, Arrowfield and Bowfield Seams)	7,600	90	3.0	3.0
Proposed Longwall 10A (Wambo Seam Only)	2,550	50	2.0	2.0
Modified Mining Layout (Wambo, Arrowfield and Bowfield Seams)	7,700	90	3.0	3.0

Source: Appendix A.
mm = millimetre.
mm/m = millimetre per metre.
km^{-1} = per kilometre.

Tensile and Compressive Strains

There is no linear relationship between curvature and strain for multi-seam mining conditions, as localised strains develop in multi-seam mining conditions as the result of remobilising the existing goaf and chain pillars in the overlying seam, which are not directly related to curvature (Appendix A).

The magnitudes of the strains for the proposed Longwall 10A are expected to be similar to those observed for multi-seam conditions, during the previously extracted longwalls at the North Wambo Underground Mine. Further discussion on predicted strains is provided in Appendix A.

Subsurface Subsidence Effects

The caving and subsidence development process above a longwall panel usually results in subsurface fracturing and shearing of sedimentary strata in the overburden. The extent of fracturing and shearing depends on mining geometry and overburden geometry.

The overburden generally comprises a zone of continuous subsurface fracturing and a zone of discontinuous subsurface fracturing.

Within the continuous subsurface fracturing zone, cracking is likely to result in a direct hydraulic connection to the workings, if a subsurface (or shallow surface) aquifer is intersected. MSEC (Appendix A) does not expect that there would be a hydraulic connection between the surface and seam, as no direct connection has been observed above the previously extracted longwalls at the North Wambo Underground Mine at lower depths of cover.

Discontinuous subsurface fracturing does not usually provide a direct flow path or connection to the mine workings, but may interact with surface cracks, joints or faults. MSEC (Appendix A) predict that discontinuous subsurface fracturing resulting from the extraction of the proposed Longwall 10A would extend up to the existing workings in the Whybrow Seam, reactivate the existing goaf, with the fracturing extending up to the surface where the depths of cover are the shallowest.

Non-Systematic Subsidence Effects

Non-systematic subsidence movements include far-field horizontal movements, irregular subsidence movements and valley related movements (Appendix A). Appendix A provides a detailed description of potential non-systematic subsidence predictions.

The potential subsidence impacts to surface features which are sensitive to non-systematic movements have been identified and included in assessments made in the Subsidence Assessment (Appendix A).

Subsidence Impacts

Subsidence impacts are the physical changes to the ground and its surface caused by the subsidence effects described above. Potential subsidence impacts associated with the proposed Longwall 10A include:

- surface cracking;
- changes in stream bed gradients;
- ponding and changes in stream alignment;

- slope instability and erosion; and
- depressurisation of groundwater aquifers.

Given that the type and magnitude of predicted subsidence effects for the modified mine layout are similar to the approved mine layout, it is expected that the potential subsidence impacts above the proposed Longwall 10A would be similar to those observed above the previously extracted longwalls at the North Wambo Underground Mine.

Potential Environmental Consequences on Key Natural and Built Features

The modified mine layout has been designed to be consistent with the subsidence impact performance measures in the existing Development Consent (DA 305-7-2003) (Table 3).

A summary of the potential consequences of the potential subsidence impacts above the proposed Longwall 10A is provided below, including cross-references to sub-sections with further detail.

Streams

The Subsidence Assessment prepared by G.E. Holt & Associates (2003) concluded that approved longwall mining would have no subsidence impact on Wollombi Brook as:

- mining of longwall panels will be constrained by the subsidence exclusion zone limited to an angle of 26.5° from the vertical to a 40 m lateral buffer from the Wollombi Brook high bank; and
- the main development drivages beneath the Wollombi Brook for the future approved mining of the Arrowfield and Bowfield Seams will be designed to be permanently stable.

Wollombi Brook is located 125 m east of the finishing end of the proposed Longwall 10A. At this distance, the brook is predicted to experience less than 20 mm of vertical subsidence (Appendix A). While it is possible that Wollombi Brook could experience very low levels of subsidence, it would not be expected to experience any measurable tilts, curvatures or ground strains.

Table 3
Subsidence Impact Performance Measures

Feature	Subsidence Impact Performance Measure
Wollombi Brook	Negligible impact. Controlled release of excess site water only in accordance with EPL 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.
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: Conditions 22 and 22A, Schedule 4, Wambo Development Consent DA 305-7-2003.

The extent of the proposed Longwall 10A is outside of the subsidence exclusion zone related to Wollombi Brook (as defined above). It is expected, therefore, that the potential subsidence impacts on the Wollombi Brook due to the extraction of the proposed Longwall 10A would be negligible. Further discussion on the potential impacts to Wollombi Brook is provided in Appendix A.

North Wambo Creek is located outside the angle of draw, with the banks of the creek located at a distance of 270 m north of the finishing end of the proposed Longwall 10A. It is expected that any subsidence effects caused by the Modification would be negligible (Appendix A).

Sections of Wambo Creek (also known as South Wambo Creek) and Stony Creek are located directly above the Modification area. Wambo Creek is predicted to have increased ponding upstream of the maingate of the proposed Longwall 10A. Subsidence could also potentially result in cracking and an increased likelihood of scouring or erosion of the beds along Wambo and Stony Creeks. Potential subsidence impacts and environmental consequences for Wambo and Stony Creeks are described in Section 4.5 and Appendix C.

Alluvial Aquifers

The extent of alluvium for Wollombi Brook (Figure 8) is not located above the area of longwall extraction and is predicted to experience around 20 mm of subsidence. Therefore, it is unlikely that the Wollombi Brook alluvium would be adversely impacted as a result of the extraction of the proposed Longwall 10A (Appendix A).

Alluvium associated with Wambo Creek and Stony Creek is located above the Modification area (Figure 8). Potential consequences on this alluvium as a result of subsidence impacts are described in Section 4.4 and Appendix B.

Escarpments, Cliffs and Steep Slopes

The Wollemi National Park Escarpment is greater than 2 km west of the proposed Longwall 10A at its closest point, and is not expected to experience any measurable tilts, curvatures or strains (Appendix A). Therefore, the Modification is expected to be consistent with the subsidence impact performance measure of 'negligible subsidence impacts' for the Wollemi National Park.

MSEC (Appendix A) identified no natural steep slopes within the Modification area (i.e. natural grades were less than 1 in 3). In some locations surface grades are greater than 1 in 3, such as the banks of the creeks and the walls of the farm dams and water storage dam. However, these steep slope areas are small and localised.

MSEC identified some minor and isolated rock outcropping within the Modification area, primarily along the alignments of the creeks. Potential environmental consequences to streams are described in Section 4.5.

Land Use and Land Resources

Potential consequences on land resources and land use as a result of subsidence impacts are described in Section 4.3.

Aboriginal Cultural Heritage

A number of Aboriginal cultural heritage items, including artefact scatters and isolated finds have been identified in the Modification area. Potential consequences on Aboriginal cultural heritage items as a result of subsidence impacts are described in Section 4.6 and Appendix D.

Non-Aboriginal Cultural Heritage

There is predicted to be no measureable subsidence from the proposed Longwall 10A in the curtilage of the Wambo Homestead Complex. This is discussed further in Section 4.9.3.

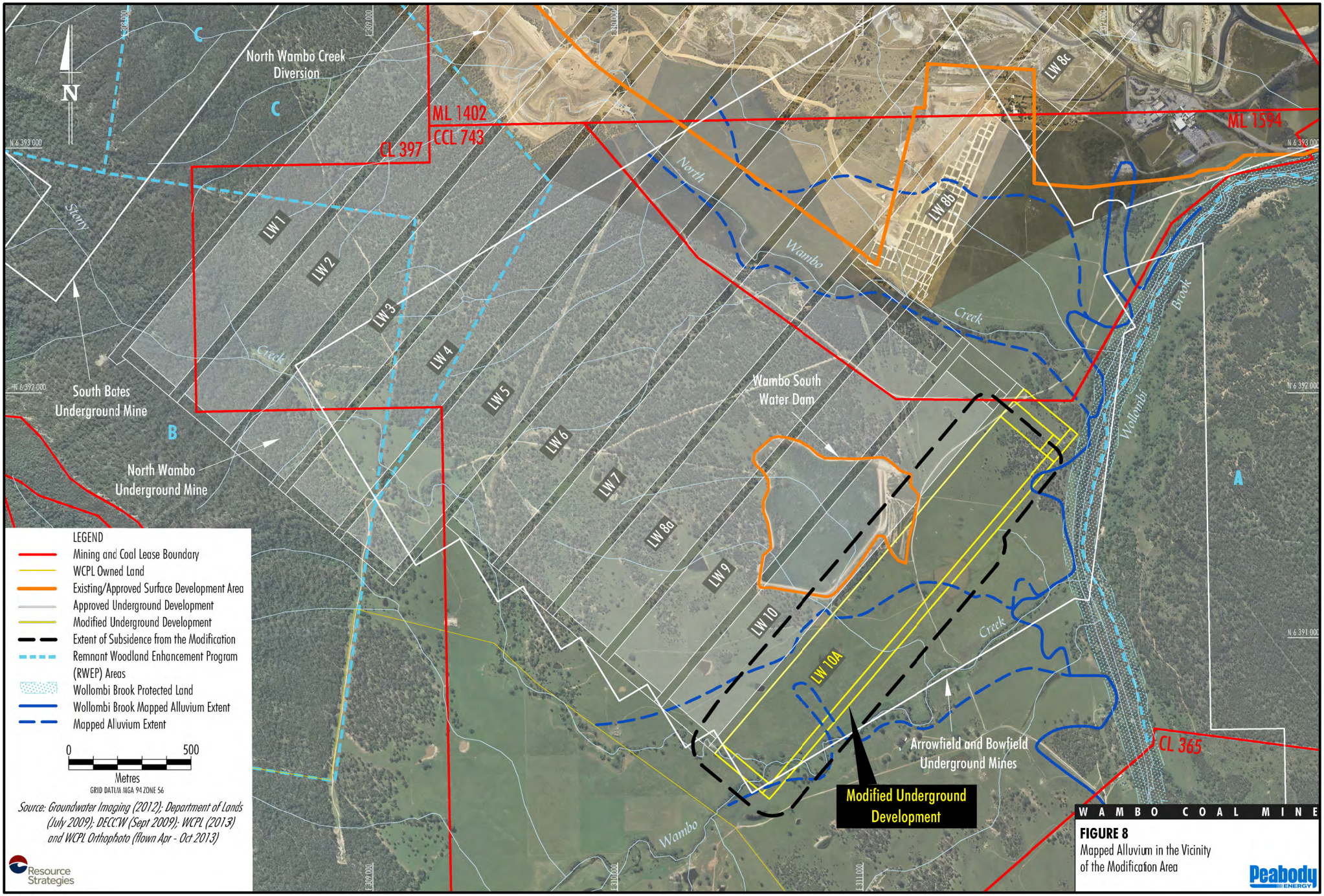
Threatened Ecological Communities

Potential consequences on threatened ecological communities as a result of subsidence impacts are discussed in Section 4.7 and Appendix E.

Infrastructure and Improvements

The potential impacts of subsidence effects on infrastructure and improvements are assessed in Appendix A. Infrastructure and improvements located within the Modification area and surrounds include:

- a WCPL 11 kilovolt powerline;
- unsealed roads and tracks, and a right of way in favour of several private properties (the route of which may be varied on reasonable notice);
- water pipelines for WCPL mining activities;
- fences and farm dams used for grazing activities on WCPL-owned land;



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- a WCPL-owned groundwater bore used for monitoring, and a number of WCPL-owned groundwater bores used for stock, irrigation, mining and monitoring;
- WCPL-owned exploration boreholes;
- Wambo South Water Dam, a prescribed dam owned and operated by WCPL; and
- survey control marks (at distances greater than 1.5 km from the proposed Longwall 10A).

WCPL would continue to implement management strategies for the Wambo South Water Dam (developed for the approved Longwalls 9 and 10). These management strategies would be reviewed, and where necessary, revised to include the effects of the proposed Longwall 10A.

The Subsidence Assessment indicates that the predicted levels of impact on other infrastructure and improvements can be managed through the preparation and implementation of appropriate management strategies, as part of the Extraction Plan process, to maintain items in a safe and serviceable condition.

Public Safety

Surface cracking, erosion and ponding have the potential to pose a safety hazard.

Potential safety issues resulting from extraction of the proposed Longwall 10A could include:

- potential safety hazards for users of existing unsealed roads and tracks in active subsidence areas; and
- potential safety hazards to agistees accessing active subsidence areas to manage stock.

WCPL would continue to implement the Public Safety Management Plan approved as part of the Extraction Plan so that there would be no additional risk to public safety.

Mitigation Measures, Management and Monitoring

An Extraction Plan would be prepared prior to the commencement of second workings in the proposed Longwall 10A to:

- demonstrate that the subsidence impact performance measures can be achieved; and
- develop detailed mitigation measures and monitoring to manage the potential impacts and/or environmental consequences on natural and built features.

Mitigation measures and management for potential consequences on land resources, groundwater, surface water, Aboriginal cultural heritage, flora and fauna are described in Sections 4.3 to 4.8.

Infrastructure and Improvements

As described above, WCPL owns the infrastructure and improvements potentially affected by the proposed Longwall 10A.

Measures to manage the impacts of subsidence on surface infrastructure would be developed as a component of the relevant Extraction Plan for consideration and approval by the relevant authorities, and would be consistent with the requirements of the Development Consent (DA 305-7-2003).

Public Safety

The Extraction Plan for the proposed Longwall 10A would include a Public Safety Management Plan as required under Condition 22C(g), Schedule 4 of the Development Consent (DA 305-7-2003). The approved Public Safety Management Plan includes measures to maintain public safety (e.g. regular monitoring and remediation of surface cracking).

4.3 LAND RESOURCES

4.3.1 Background

Landforms and Topography

The Wambo Coal Mine is located in the Upper Hunter Valley region where landforms are characterised by gently sloping floodplains associated with the Hunter River and the undulating foothills, ridges and escarpments of the Mount Royal Range and Great Dividing Range.

Elevations in the vicinity of Wambo range from approximately 60 m Australian Height Datum (AHD) at Wollombi Brook to approximately 650 m AHD at Mount Wambo within the Wollemi National Park to the West of Wambo (WCPL, 2003). Elevations in the vicinity of the Modification area range from approximately 60 m AHD at Wambo Creek to approximately 70 m AHD on along the western edge of the Project boundary.

Land Use

Land use in the vicinity of Wambo is characterised by a combination of coal mining operations, agricultural land use and WCPL-owned lands that are not subject to mining operations being utilised for the agistment of stock (WCPL, 2003).

The Modification area is wholly located on WCPL-owned land and land use comprises cleared grazing land (rain-fed unimproved pasture).

Soils

An Agricultural Resource Assessment was conducted for the adjacent Longwalls 9 and 10 by McKenzie Soil Management (2012) for the North Wambo Underground Mine Modification. Regional soil landscape (Kovac & Lawrie, 1991) mapped the Bulga soil landscape contiguously across Longwalls 9 and 10 and the proposed Longwall 10A.

McKenzie Soil Management (2012) mapped Brown Sodosol, Brown-Orthic Tenosol and Black-Orthic Tenosol soil types directly adjacent to the Modification area (McKenzie Soil Management, 2012).

Soil Condition

Physical and chemical analysis undertaken proximal to the proposed Longwall 10A area identified several constraints for agricultural land use including (McKenzie Soil Management, 2012):

- soil acidity and associated aluminium toxicity;
- a lack of water holding capacity;
- dispersive subsoil;
- subsoil salinity; and
- nutrient deficiencies.

Rural Land Capability and Agricultural Sustainability

Regional Rural Land Capability mapping has been completed by the Soil Conservation Service of NSW (1985). Regional Agricultural Suitability mapping has been completed by NSW Agriculture (1983).

The land in the Modification area was identified as Classes IV and V, which is suitable mainly for grazing.

Agricultural Activities and Productivity

Agriculture activities known to have been conducted in the Modification area comprise beef cattle production on rain-fed unimproved pasture. There is no evidence of crop production in the Modification area.

McKenzie Soil Management (2012) determined that the land above Longwall 9 and 10 is not considered to be highly productive agriculture land given the serious soil limitations for plant growth and the nature of agricultural activities conducted. Given the contiguous nature of the soil landscape, the same conclusion can be made for the land above the proposed Longwall 10A.

Strategic Agricultural Lands

The *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) includes mapping of lands identified as Biophysical Strategic Agricultural Land (BSAL).

The closest mapped BSAL in the Mining SEPP is associated with the Hunter River and is located approximately 8 km to the north-west of the proposed Longwall 10A (Figure 9).

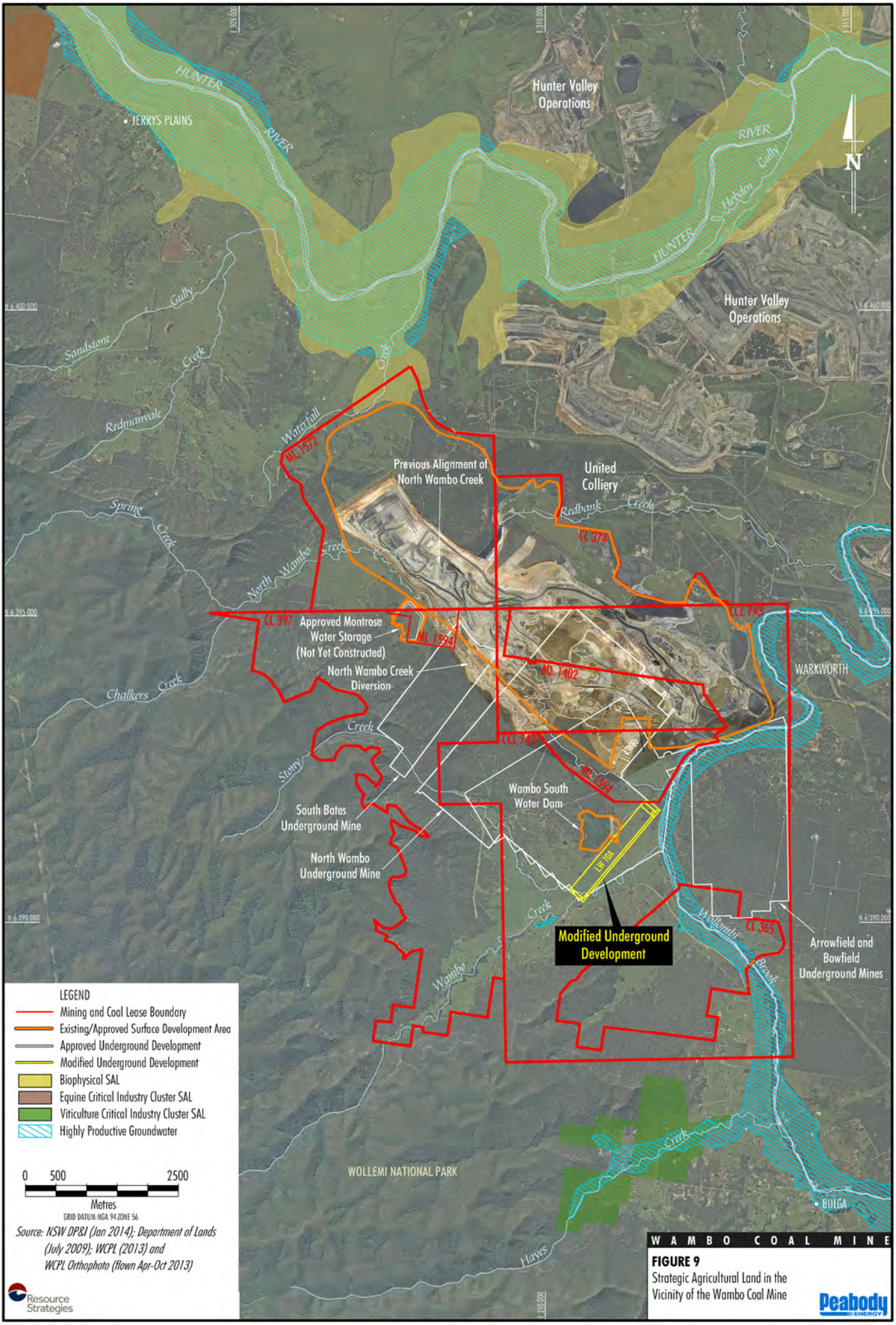
McKenzie Soil Management (2012) completed an assessment of the Longwalls 9 and 10 area adjacent to the proposed Longwall 10A, and determined that the area did not meet the BSAL criteria outlined in the Upper Hunter SRLUP. The same conclusion can be made for Longwall 10A due to the proximity and contiguous nature of soils with the Modification area.

The Modification area is not located within mapped Viticulture or Equine Critical Industry Clusters. The closest Viticulture Critical Industry Cluster is located approximately 3 km to the south of the Modification area. The closest Equine Critical Industry cluster us located approximately 14.5 km to the north-west of the Modification area (Figure 9).

4.3.2 Environmental Review

Potential Impacts

Potential land resource impacts as a result of the Modification would be limited to impacts associated with mine subsidence.


HUNTER RIVER
JERRYS PLAINS
Hunter Valley Operations
Hunter Valley Operations
RIVER
Gully
Hebden
HUNTER
Gully
Sandstone
Creek
Redmanvale
Waterfall
Creek
ML 1572
Previous Alignment of North Wambo Creek
United Colliery
Redbank
Creek
CCL 374
Spring
Creek
North Wambo
Creek
CL 397
Approved Montrose Water Storage (Not Yet Constructed)
ML 1594
North Wambo Creek Diversion
CCL 749
ML 1402
WARKWORTH
Chalkers
Creek
Creek
CCL 748
LW 10A
ML 1594
Stony
Wambo South Water Dam
South Bates Underground Mine
North Wambo Underground Mine
Modified Underground Development
Creek
Wollombi
CL 365
Brook
Arrowfield and Bowfield Underground Mines
Wambo
Creek
WOLLEMI NATIONAL PARK
BULGA
Hayes
Creek
E 305 000
E 310 000
E 315 000
N 6 400 000
N 6 395 000
N 6 390 000
N
LEGEND
Mining and Coal Lease Boundary
Existing/Approved Surface Development Area
Approved Underground Development
Modified Underground Development
Biophysical SAL
Equine Critical Industry Cluster SAL
Viticulture Critical Industry Cluster SAL
Highly Productive Groundwater
0
500
2500
Metres
GRID DATUM MGA 94 ZONE 56
Source: NSW DP&I (Jan 2014); Department of Lands (July 2009); WCPL (2013) and WCPL Orthophoto (flown Apr-Oct 2013)
Resource Strategies
WAM-09-15_EP LW 10A_106E
WAMBO COAL MINE
FIGURE 9
Strategic Agricultural Land in the Vicinity of the Wambo Coal Mine
Peabody ENERGY

Potential impacts on soils and agricultural productivity would be associated with the following subsidence impacts:

- surface cracking; and
- ponding and changes in stream alignment.

Frazier *et al*. (2010) found no significant effect of longwall mining subsidence on agricultural production, including cattle grazing, in the Hunter Valley region. Given the above, there is a low potential for impact to agricultural productivity in the Modification area.

The Modification area is wholly located on WCPL-owned land and is occasionally used for agistment grazing of beef cattle. Potential impacts on these agricultural activities would include:

- possible injury to persons undertaking agricultural activities;
- injury to livestock caused by surface cracking;
- loss of integrity of stock fences; and
- loss of water storage of small farm dams through tilting or surface cracking.

WCPL would implement mitigation measures and management to minimise potential risks to agricultural activities as described below.

It is considered that the Modification would not have any significant adverse impacts on the Viticulture and Equine Critical Industry Clusters as there are no equine or viticulture-related activities in the vicinity of the Modification area.

Mitigation Measures, Management and Monitoring

Erosion and sediment management at Wambo would continue to be conducted in accordance with the Erosion and Sediment Control Plan (WCPL, 2010g).

In the event that significant surface cracking is identified, the following remediation would be undertaken:

- infilling of surface cracks with soil or other suitable materials; or
- locally regrading, ripping and re-compacting the surface.

Erosion protection measures (e.g. vegetation planning) to stabilise any areas of surface cracking in the longer term would be implemented where required.

The management of potential subsidence impacts on agricultural activities is managed at the North Wambo Underground Mine in accordance with the approved Land Management Plan (WCPL, 2014h). The Land Management Plan includes measures such as:

- notification to agistees of areas of longwall mining and active subsidence;
- exclusion of agistment grazing from areas where surface cracking presents a reasonable risk to people and/or livestock;
- monitoring and repair of stock fences;
- monitoring of farm dams and implementation of mitigation measures where it presents a risk to people livestock and/or the environment; and
- management measures in accordance with the Erosion and Sediment Control Plan, including remediation of surface cracks where practicable.

The approved Land Management Plan would be reviewed and revised to include the proposed Longwall 10A during preparation of the Extraction Plan.

The Modification area would be rehabilitated as per the existing underground mining rehabilitation areas at Wambo as discussed in Section 2.11.

4.4 GROUNDWATER

4.4.1 Background

Hydrogeological Regime

The hydrogeological regime of the Wambo area and surrounds comprises two main systems (Appendix B):

- Quaternary alluvial aquifer system of channel fill deposits associated with Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek.

- Underlying Permian strata consisting of:
  - hydrogeologically "tight" and hence very low yielding to essentially dry sandstone and lesser siltstone; and
  - low to moderately permeable coal seams, which are the prime water-bearing strata within the Permian measures.

Alluvial Aquifers

Groundwater flow patterns within the shallow alluvial aquifers reflect topographic levels and the containment of alluvium within the principal drainage pathways (Appendix B).

Evidence indicates that the alluvial aquifer is responsive to rainfall recharge and it is likely that the alluvium plays an important role in supplying recharge to the underlying Permian strata as well as contributing to baseflow of surface water features (Appendix B). Deviations from this trend can be seen in a number of alluvium monitoring bores, which are attributed to impacts associated with approved open cut and underground mining operations.

Figure 8 shows alluvium in the vicinity of the Modification area based on mapping conducted by Groundwater Imaging Pty Ltd (2012).

Permian Aquifers

Prior to the commencement of mining operations in the region, the piezometric surface within the Permian aquifers of the Wambo area most probably reflected the topography, with elevated water levels/pressures in areas distant from the major drainages and reduced levels in areas adjacent to the alluvial lands (Appendix B).

Historical and ongoing open cut and underground mining within the Wambo area and adjoining mining operations has created a regional zone of depressurisation within the Permian coal measures (Appendix B).

Groundwater Monitoring Program

A Groundwater Monitoring Program (WCPL, 2010d) for Wambo was established in 2005 and details a monitoring program, groundwater impact assessment criteria, data review and investigation processes, and reporting requirements.

Groundwater levels and quality are generally monitored bi-monthly at each of the groundwater monitoring sites (Figure 6) and results are reported in the Annual Environmental Management Report.

Surface and Groundwater Response Plan

A Surface and Groundwater Response Plan (WCPL, 2010g) for Wambo was established in 2005 and details measures to mitigate potential surface and groundwater impacts. The Surface and Groundwater Response Plan includes the North Wambo Creek Subsidence Response Strategy (WCPL, 2014g).

4.4.2 Environmental Review

A cumulative Groundwater Assessment, including the Modification, has been prepared by HydroSimulations (2014) and is presented in Appendix B.

The Groundwater Assessment included predictive modelling of the cumulative groundwater impacts using a three-dimensional numerical model. Detail on the development and calibration of the numerical model is provided in Appendix B.

The numerical model used for the North Wambo Underground Mine Modification (Longwalls 9 and 10) was extended to include the life of approved mining at Wambo and to include dewatering of existing workings in the Whybrow Seam in advance of active mining at the North Wambo Underground Mine.

A summary of the key findings of the Groundwater Assessment is provided below.

Potential Impacts

The main potential impacts on the groundwater regime due to the Modification are as a result of:

- subsurface fracturing and shearing of sedimentary strata above the proposed Longwall 10A resulting in changes in bulk rock mass permeability and storage capacity;
- dewatering of groundwater that enters the underground mining area as a result of the above; and
- dewatering of the overlying workings in the Whybrow Seam to mitigate inrush risk to the underground mining area.

The potential impacts of the Modification on the groundwater system as a result of these mechanisms is summarised below.

Groundwater Inflows

The Modification would not increase peak inflow rates predicted for the approved North Wambo Underground Mine and would contribute approximately an additional 0.1 megalitres per day (ML/day) to inflow rates during mining of the proposed Longwall 10A.

Impacts to Permian Aquifers

The Permian coal measures within the approved North Wambo Underground Mine footprint are predicted to be essentially dewatered during mining of the target Wambo Seam (Appendix B).

The Groundwater Assessment (Appendix B) concluded that outside the mine footprint, the main impact from the approved North Wambo Underground Mine on potentiometric pressures within Permian strata would occur to the south and south-west of the mine. Impacts to the north, east and north-east would be minimal due to the influence of neighbouring mines to the east and the fact that the areas to the north and north-east are up-dip of Wambo and near to subcrop location (Appendix B).

The Modification would result in additional dewatering of the Permian coal measures, however the impact on water levels due to the Modification is negligible regionally (Appendix B).

Impacts to Alluvial Aquifers

The Modification would result in no discernible additional drawdown in alluvium associated with Wollombi Brook (Appendix B).

The Modification would also result in negligible additional drawdown (less than 1 m) in the alluvium associated with Wambo Creek and Stony Creek.

Stream Baseflows

The Groundwater Assessment (Appendix B) concluded that the Modification would have no discernible impact on stream baseflow or natural river leakage, beyond the effects of approved mining, for Wollombi Brook, North Wambo Creek and Stony Creek.

The Groundwater Assessment predicted the approved Wambo operations would result in a reduction in baseflow to Wambo Creek in the order of 0.01 ML/day (less than 4 megalitres per annum [ML/annum]) (Appendix B).

The Modification is predicted to cause additional slight reductions in the volume of baseflow discharged to Wambo Creek of up to 0.007 ML/day (2.5 ML/annum) reducing to approximately 0.004 ML/day (1.5 ML/annum) approximately 12 years after the completion of the proposed Longwall 10A. The Groundwater Assessment predicts that Wambo Creek would remain a gaining stream on average as a result of approved mining and the Modification (Appendix B).

Groundwater Users

HydroSimulations (Appendix B) predicted that no privately owned registered bores in alluvium or regolith would incur more than 0.5 m incremental drawdown due to the Modification and no bores would experience more than 2 m cumulative drawdown.

Limited information is available on three privately owned bores in the vicinity of Wambo. Depending on the extraction depth and nature of bores, these bores may experience more than 2 m cumulative drawdown as a result of the approved Wambo operations (Appendix B). The Modification would result in additional drawdown in these bores.

Aquifer Interference Policy

An assessment of the Modification against the minimal impact considerations in the NSW *Aquifer Interference Policy* (the AIP) (NSW Government, 2012a) was conducted as part of the Groundwater Assessment (Appendix B). The Groundwater Assessment concluded that the Modification is within the 'Level 1' minimal impact considerations outlined in the AIP for highly productive groundwater.

As discussed above, three privately owned registered bores in less productive groundwater may incur more than 2 m cumulative drawdown as a result of the approved Wambo operations (depending on the nature of the bores) (Appendix B). No additional privately owned registered bores are predicted to be impacted by the Modification.

Further discussion on the AIP is provided in Attachment 2 and Appendix B.

Mitigation Measures, Management and Monitoring

Alluvial Aquifers

Monitoring would continue to be conducted in accordance with the Groundwater Monitoring Program (WCPL, 2010c) and the Surface Water Monitoring Program (WCPL, 2010d).

Consistent with the Surface and Groundwater Response Plan (WCPL, 2010f), in the event that monitoring identifies a groundwater level or quality trigger level exceedance specified in the Groundwater Monitoring Program (WCPL, 2010c), an investigation would be conducted.

Permian Aquifers

WCPL would continue to implement the Surface and Groundwater Response Plan (WCPL, 2010f) in the event a complaint is received in relation to loss of groundwater supply.

Groundwater levels and quality would continue to be monitored at Wambo in accordance with the Groundwater Monitoring Program (WCPL, 2010c).

4.5 SURFACE WATER

4.5.1 Background

Hydrology

Wambo is situated adjacent to Wollombi Brook, south-west of its confluence with the Hunter River (Figures 1 and 2). Wollombi Brook drains an area of approximately 1,950 square kilometres and joins the Hunter River some 5 km north-east of Wambo. The Wollombi Brook sub-catchment is bound by the Myall Range to the south-east, Doyles Range to the west, the Hunter Range to the south-west and Broken Back Range to the north-east (Hunter Catchment Management Trust, 2002).

The majority of lands within Wambo mining tenements drain via Wambo (also known as 'South Wambo'), Stony, North Wambo and Redbank Creeks to Wollombi Brook, while Waterfall Creek drains directly to the Hunter River (Figure 2).

A section of North Wambo Creek has been diverted to avoid the Wambo open cut (Figure 2). The North Wambo Creek Diversion was constructed in accordance with the approved North Wambo Creek Diversion Plan (WCPL, 2007a).

Wambo and Stony Creeks in the Modification area have previously been undermined by the Homestead Mine workings in the Whybrow Seam.

Site Water Management and Monitoring

A summary of the existing site water management is provided in Section 2.9. WCPL annually reviews the site water balance for Wambo and reports the results of this review in the Annual Environmental Management Report.

A Surface and Groundwater Response Plan (WCPL, 2010f) for Wambo was established in 2005 and it details measures to mitigate potential surface and groundwater impacts.

The Erosion and Sediment Control Plan (WCPL, 2010g) for Wambo was established in 2005. The Erosion and Sediment Control Plan identifies potential erosion and sediment sources and details design criteria, inspection and monitoring programmes and reporting requirements.

A Surface Water Monitoring Program (WCPL, 2010d) for Wambo was established in 2005 and details surface water quality, stream flow and creek bed stability monitoring programs, water quality criteria, data review, and reporting requirements.

Surface water quality is generally monitored monthly at each of the surface water monitoring sites and stream flow is measured at the surface water flow monitoring sites during flow events (Figure 6).

4.5.2 Environmental Review

An assessment of potential subsidence impacts on Wambo and Stony Creeks has been prepared by Evans & Peck (2014) and is presented in Appendix C.

Potential Impacts

Wambo and Stony Creeks

The potential impacts of subsidence from the proposed Longwall 10A on Wambo and Stony Creeks include:

- increased erosion with the potential to result in head-cut erosion in creeks;
- increased ponding as a result of differential subsidence; and
- cracking of creek beds as a result of tensile strains.

Evans & Peck (Appendix C) has identified the following sections of stream in the Modification area that may be vulnerable to scour and erosion as a result of subsidence from the approved mining and the proposed Longwall 10A:

- Wambo Creek approximately 20 m downstream of the confluence with Stony Creek; and
- Stony Creek approximately 60 m upstream of the confluence with Wambo Creek.

Table 4 presents a summary of the predicted changes in grade along these sections of Wambo and Stony Creeks. An increase in velocity due to the predicted increases in stream grade would be likely to mobilise the finer material and possibly coarser gravel material (Appendix C). The degree of scouring and erosion that occurs would depend on actual subsidence and changes in grade and ground conditions, including vegetation and bed material.

Evans & Peck observed that the banks were generally well vegetated, with vegetation types including grass, reeds and River Oak (*Casuarina cunninghamiana*) (Appendix C). In some locations along Wambo Creek, larger vegetation (River Oak) was growing within the channel. In addition, the bed material of both streams ranged from grassed soil to gravel and small boulders.

Vegetation along the streams would provide a key stabilising influence, however additional mitigation measures may be required where the physical changes to channel slope leads to velocity increases beyond the capacity of the vegetation to stabilise the bed or banks (Appendix C).

Ponding along Wambo Creek is predicted to occur as a result of approved mining in the Arrowfield and Bowfield Seams. Mining in the Arrowfield and Bowfield Seams is predicted to result in a topographical depression on Wambo Creek that is 130 m long and 0.4 m deep in the Modification area (Appendix A).

The Modification would increase the size of this topographical depression on Wambo Creek to a length of 210 m and a maximum depth of 0.7 m following the completion of mining in the Wambo, Arrowfield and Bowfield Seams (Appendices A and C).

Additional ponding is not predicted to occur along Stony Creek as a result of the Modification (Appendix C).

Evans & Peck (Appendix C) notes that pools are a natural feature of creeks in the area, including Wambo Creek, and it is unlikely that remedial works would be required. Potential impacts on aquatic ecology is summarised in Section 4.8.2 and assessed in Appendix F.

Wambo and Stony Creeks may experience cracking of the bed material as a result of tensile strains similar to cracking that has been observed elsewhere at the North Wambo Underground Mine. The following remediation would be undertaken in the event that significant surface cracking is identified that cannot be managed through natural healing and regeneration:

- infilling of surface cracks with soil or other suitable materials; or
- locally regrading, ripping and re-compacting the surface.

Table 4
Predicted Changes in Grade along Wambo and Stony Creeks

Creek Section	Existing Grade[1]	Predicted Grade Following Approved Mining (Arrowfield and Bowfield Seams)	Predicted Grade Following Approved Mining and Longwall 10A
Wambo Creek (20 m downstream of confluence with Stony Creek)	0.9%	2.2%	3.8%
Stony Creek (60 m upstream of confluence with Wambo Creek)	1.0%	1.7%	2.2%

Source: After Appendix C.

[1] Includes subsidence from previous Homestead Mine workings in the Whybrow Seam.

Erosion protection measures (e.g. vegetation planning) to stabilise any areas of surface cracking in the longer term would be implemented where required.

Site Water Balance

The Modification would not include any material changes to the approved water management system, water supply or water demand (Section 3.7). The water demand for Wambo would not materially change as a result of the Modification, as maximum ROM coal production would remain unchanged.

The Groundwater Assessment predicted that the Modification would not increase peak inflow rates predicted for the approved North Wambo Underground Mine and would contribute approximately an additional 0.1 ML/day to inflow rates during mining of the proposed Longwall 10A (Section 4.4.2).

Stream Flows

The Groundwater Assessment (Appendix B) concluded that the Modification would have no discernible impact on stream baseflow or natural river leakage beyond the effects of approved mining for Wollombi Brook, North Wambo Creek and Stony Creek. The Modification would result in a slight reduction in baseflow to Wambo Creek of up to 2.5 ML/annum.

In addition, the Modification would not result in any material additional catchment excision. Therefore, the Modification would result in negligible impact on stream flows in the Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek.

Mitigation Measures, Management and Monitoring

Wambo and Stony Creeks

Evans & Peck (Appendix C) recommends an adaptive management approach to manage potential subsidence impacts on Wambo Creek, involving monitoring the development of subsidence and implementation of remediation measures where required.

Where there is no evidence of a head-cut developing as a result of subsidence, any observed instability of the banks would be addressed by battering back the bank and establishing a vegetated ground cover. WCPL has experience in the implementation of these types of works in other areas of Wambo and Stony Creeks.

If the development of a head cut is observed as a result of subsidence, WCPL would consider remediation works such as a constructed rock ramp in Wambo Creek downstream of the confluence with Stony Creek as described in Appendix C. These works would be implemented to avoid bed lowering and channel widening affecting Wambo and Stony Creeks over a longer stretch upstream (i.e. minimise the extent of disturbance) and maintain the existing hydraulic, hydrologic and geomorphic functions of the streams (Appendix C).

The rock ramp, or other structure, would be designed in consideration of NOW's *Guidelines for instream works on water front land* (NOW, 2012) and would be subject to a controlled activity approval under the NSW *Water Management Act, 2000.*

An Extraction Plan would be prepared for Longwall 10A prior to the commencement of second workings in accordance with Condition 22C, Schedule 4 of the Development Consent (DA-305-7-2003).

The following measures would be included in the Extraction Plan:

- Longitudinal geomorphological surveys would be conducted along the reaches of Wambo and Stony Creeks affected by subsidence, including prior to commencement of mining of the proposed Longwall 10A, immediately following subsidence; and following the completion of any restoration or remediation works;
- Trigger Action Response Plans (TARPs) would be developed with a process to determine appropriate triggers and remedial actions for:
  - changes in grade and erosion and scour risk, including a process to determine whether instream works, such as a rock ramp, are required;
  - pool development, including contingency remedial measures should subsidence create a pool that is significantly larger than predicted; and
  - surface cracking, consistent with erosion and sediment management in the approved Erosion and Sediment Control Plan.

Erosion and sediment management at Wambo would continue to be conducted in accordance with the Erosion and Sediment Control Plan. The approved Land Management Plan would be reviewed and revised to include the proposed Longwall 10A during preparation of the Extraction Plan.

Site Water Balance

Water pumped out of the North Wambo Underground Mine would continue to be monitored for the Modification.

The site water balance would be reviewed in consideration of the predicted groundwater inflows and measured water make. The results of the site water balance review would be reported in the Annual Environmental Management Report in accordance with Condition 25, Schedule 4 of the Development Consent (DA 305-7-2003).

Stream Flows

The Surface Water Monitoring Program for Wambo would continue to monitor surface water quality, stream flow and creek bed stability.

4.6 ABORIGINAL CULTURAL HERITAGE

4.6.1 Background

A number of Aboriginal cultural heritage surveys and assessments have previously been undertaken across the Modification area and surrounds.

A comprehensive survey and assessment was undertaken by White (2003) covering the area to the east of the Wambo and Jerrys Plains ridgelines (including the extent of land above the proposed Longwall 10A). White (2003) identified a number of artefact scatters and sites with varying significance within the area above the proposed Longwall 10A.

Occupation areas or open camp sites were generally located on the gently sloping areas in close proximity to water, in particular along major creek lines and at the confluence of major tributaries of North Wambo Creek, Wambo Creek Waterfall Creek and Stony Creek (White, 2003).

Aboriginal Cultural Heritage Management

Management of Aboriginal cultural heritage at Wambo is currently conducted in accordance with Consent No. 2222 under section 90 of the *National Parks and Wildlife Act, 1974*.

The existing Consent No. 2222 covers the vast majority of the Modification area (Figure 10).

4.6.2 Environmental Review

A Cultural Heritage Impact Assessment was prepared for the modification by RPS Australia East (RPS) (2014) and is presented in Appendix D.

The Cultural Heritage Impact Assessment has been undertaken in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a) and the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b) (Appendix D).

Assessment Programme

The Cultural Heritage Impact Assessment (Appendix D) used the results of:

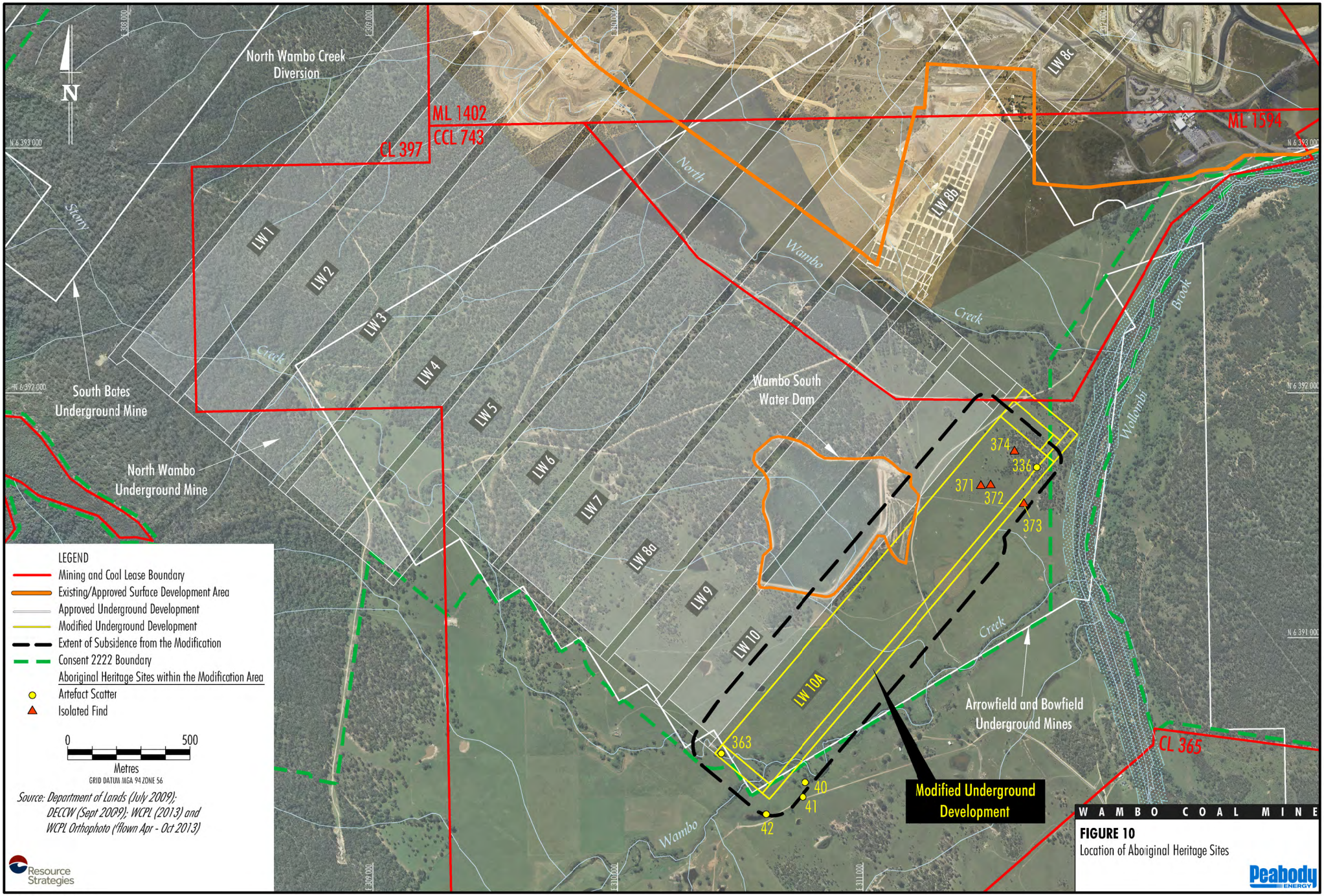
- prior field work and previous studies undertaken by archaeologists and representatives of the Aboriginal community;
- search results from the OEH Aboriginal Heritage Information Management System (AHIMS); and
- the results of an archaeological and cultural survey of the Modification area conducted by archaeologists and representatives of the Aboriginal community in June 2014 (Appendix D).

The Cultural Heritage Impact Assessment included consultation with 65 registered Aboriginal parties and one interested stakeholder (Appendix D). Participation of registered Aboriginal parties in the field surveys was in accordance with the established Wambo Coal Mine fieldwork roster system.

Survey Design

The archaeological and cultural surveys were undertaken to ground truth sites previously recorded within the Modification area, in addition to identifying new sites and determining the visible extent of existing and new artefact scatter sites.

The survey methodology focused on surveying landforms associated with previously identified sites, exposed ground surfaces as well as sampling all of the various landforms and vegetated areas within the Modification area (Appendix D).



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Archaeological Findings

Observed Aboriginal site occurrences were low within the Modification area when compared to other areas of North Wambo Underground Mine.

Four previously unrecorded Aboriginal cultural heritage sites were identified within the Modification area during the survey, all of which were isolated finds. Five previously recorded artefact scatters within the Modification area were relocated.

A detailed description of the nine recorded sites is provided in Appendix D and locations are shown on Figure 10.

Archaeological and Cultural Heritage Values

As part of the Cultural Heritage Impact Assessment, archaeological significance was assessed in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b).

RPS (Appendix D) concluded that all of the sites within the Modification area are of low archaeological significance, with the exception of Wambo Site 336 (artefact scatter) which was considered to have moderate local significance.

Separate to the archaeological significance assessment, registered Aboriginal stakeholders were requested to provide comment in regard to cultural significance of the Modification area and sites within it. Based on comments received (Appendix D):

- the floodplain area is not considered to have any specific cultural heritage significance as this area was not suitable to have been used for shelter and there was no evidence of any cultural heritage material in the area;
- the banks of the creeks have specific cultural significance as these areas would have been suitable for camping and procurement of food and water; and
- artefact sites within the Modification area were of cultural significance and related to other sites in the Wambo Coal Mine area, particularly to the other sites in the Wollombi Brook, North Wambo, Wambo and Stony Creek areas.

Potential Impacts

Potential impacts of the Modification on Aboriginal cultural heritage would be associated with (Appendix D):

- direct disturbance (e.g. due to vehicular movements or subsidence remediation activities); and
- subsidence impacts from the extraction Longwall 10A.

Direct Disturbance

The Modification would not result in any material additional land disturbance. Therefore, disturbance to the Aboriginal cultural heritage sites would be limited to impacts associated with vehicular movements, and minor subsidence remediation works (Section 3.1).

Vehicular movements in the Modification area would be limited to those required for monitoring and general site maintenance activities. If required, any minor subsidence remediation works would be located to minimise impacts on Aboriginal cultural heritage sites wherever possible.

Subsidence Impacts

Subsidence movements can potentially result in surface cracking resulting in impacts to Aboriginal cultural heritage sites where they coincide with any cracking.

Aboriginal cultural heritage sites are located across the Modification area and would be subject to the full range of predicted subsidence effects (Table 2). Individual predictions for each Aboriginal cultural heritage site are presented in Appendices A and D.

Based upon the subsidence predictions, RPS (Appendix D) concluded that the whole of surface movement and potential soil cracking has the propensity for potential impact on Aboriginal cultural heritage to occur in some parts of the Modification area. However, RPS (Appendix D) concluded that it would be unlikely that the stone artefacts at these sites would be destroyed by the surface cracking.

The overall risk from historic and approved subsidence was assessed as low to moderate (Appendix D). RPS concluded that the incremental subsidence from the Modification would result in negligible to low additional risk (Appendix D).

RPS (Appendix D) concluded that the Modification would not substantially increase the cumulative impacts to Aboriginal heritage in the region, in consideration of the nature and scale of historic and ongoing land disturbance processes in the region (predominantly agricultural activities), the nature and extent of identified and likely Aboriginal sites, and the nature and scale of potential impacts associated with the Modification.

Mitigation Measures, Management and Monitoring

Given the low risk of potential impact to Aboriginal cultural heritage sites, WCPL intends to leave the sites *in situ*, subject to subsidence monitoring. If monitoring identifies cracking or erosion in proximity to an artefact scatter or isolated find site, WCPL would salvage and transfer the artefacts to the temporary keeping place in consultation with the relevant Aboriginal parties (Appendix D).

Consistent with current site procedures, if any previously unrecorded Aboriginal sites are identified during the course of the Modification, works in that area would cease until the site has been recorded. Any new sites would be managed in accordance with management measures for similar sites previously identified, in consultation with the registered Aboriginal parties.

In the event that skeletal remains are discovered, work would cease in that area and the NSW Police Coroner and OEH would be contacted to determine if the material is of Aboriginal origin. If determined to be Aboriginal, an action plan for the management of the skeletal remains would be developed in consultation with OEH and the registered Aboriginal parties prior to any further surface works commencing in that area.

As described in Section 4.6.1, the existing Consent No. 2222 covers the vast majority of the Modification area (Figure 10). As recommended in Appendix D, WCPL would apply for a variation to the existing Consent to cover the portion of the Modification area not covered by Consent No. 2222.

4.7 FLORA

4.7.1 Background

A flora assessment was conducted by Orchid Research (2003) for the Wambo Development Project in 2003. Areas of remnant vegetation were systematically surveyed using quadrats and spot sampling sites to compile a comprehensive species list and to detect threatened species which may have been present.

Remnant vegetation was dominated by eucalypt forests and woodlands, however thin strips of River She-oak (*Casuarina cunninghamiana*) were reported to occur along North Wambo Creek, Wambo Creek, Stony Creek and Wollombi Brook. Sand dune heathy woodlands were also reported to be present.

A number of tree species including Narrow-leaved Ironbark (*Eucalyptus crebra*), Grey Box (*E. moluccana*) and Bulloak (*Allocasuarina luehmannii*) were widespread and common, and associated within many other species. Other dominant tree species included Spotted Gum (*Corymbia maculate*), Grey Gum (*E. punctata*), Blakely's Red Gum (*E. blakelyi*), Rough-barked Apple (*Angophora floribunda*) and Drooping She-oak (*Allocasuarina verticillata*).

No threatened flora species or populations listed under the NSW *Threatened Species Conservation Act, 1995* (TSC Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) were recorded at Wambo by Orchid Research (2003).

Orchid Research (2003) recorded two threatened ecological communities in the vicinity of Wambo, namely the Warkworth Sands Woodland Endangered Ecological Community (EEC) (listed in the TSC Act) and the White Box, Yellow Box, Blakely's Red Gum Woodland/Grassy White Box Woodlands EEC (listed in the TSC Act and EPBC Act).

Flora and Fauna Management Plan

A Flora and Fauna Management Plan (WCPL, 2014b) is implemented at Wambo and includes a vegetation clearance protocol, threatened species management protocol, RWEP management measures, rehabilitation programme and rehabilitation and RWEP monitoring programmes.

4.7.2 Environmental Review

A Flora Assessment was prepared for the Modification by FloraSearch (2014) and is presented in Appendix E. The impact of the Modification on threatened flora was assessed in consideration of the *Guidelines for Threatened Species Assessment* (Department of Environment and Conservation [DEC] and Department of Primary Industries [DPI], 2005) and the *Significant Impact Guideline 1.1 – Matters of National Environmental Significance* (Commonwealth Department of the Environment [DoE], 2013).

Baselines Flora Surveys

Baseline flora surveys were conducted in the Modification area and surrounds on 13 June 2014 and used in conjunction with earlier data collected in 2011 over a wider study area around the Modification area.

Vegetation was systematically surveyed using quadrats, spot sampling and random meanders. Target searches for threatened flora species were conducted in areas of suitable habitat as part of the field surveys. The locations of spot and quadrat sampling sites are shown in Appendix E.

As a component of the baseline flora surveys, a number of reference sources were reviewed, including previous relevant surveys, database records (e.g. BioNet website) and other scientific studies and literature. Where appropriate, these reference sources were included in the assessment of existing vegetation.

Vegetation Communities

A total of six vegetation communities have been mapped within the Modification area (Figure 11 and Table 5). A detailed description of these vegetation communities is provided in Appendix E.

Condition of Vegetation

The condition of vegetation in the Modification area was found to vary from poor to moderate (Appendix E). Historic land disturbance has included native vegetation clearing, grazing, logging, introduction of feral fauna and the construction of tracks and trails.

In general, the flat valley floor and gentle lower slopes in the valleys of North Wambo Creek and Stony Creek have been almost completely cleared of their original native tree and shrub cover and have low biodiversity value (Appendix E). The steeper areas are in moderate to good condition, because although these areas have generally been semi-cleared and logged historically they have retained most of their ecological resilience (Appendix E).

The vegetation within the incised watercourses of North Wambo Creek, Wambo Creek and Stony Creek comprises a mix of native and introduced species. Tree cover has been considerably thinned into disjunct patches and scattered individuals, especially along Stony Creek (Appendix E).

Threatened Flora Species

No flora species listed in the schedules of the TSC Act or EPBC Act were recorded during targeted searches or other sampling conducted within the Modification area and surrounds (Appendix E).

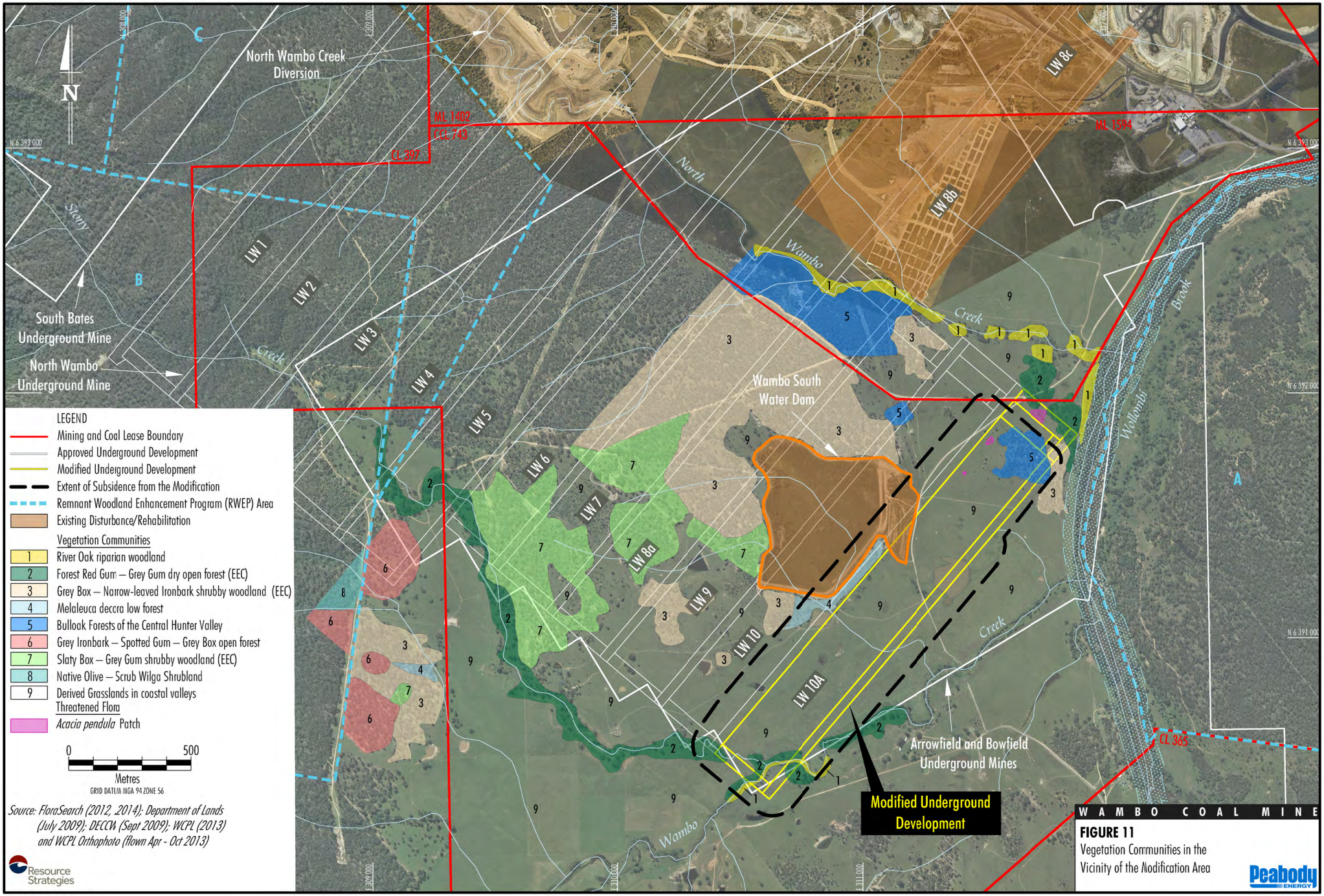
Threatened Populations

Three patches of Hunter Valley Weeping Myall (*Acacia pendula*) were identified by the 2014 surveys by FloraSearch, with two patches located within the Modification area (Figure 11). These patches constitute part of the *Acacia pendula population in the Hunter Catchment* endangered population (Appendix E).

Table 5
Vegetation Communities within the Modification Area

Community Number	Common Name	Scientific Names
1	River Oak riparian woodland	*Casuarina cunninghamiana* subsp. *cunninghamiana*
2	Forest Red Gum – Grey Gum dry open forest	*Eucalyptus tereticornis, E. punctata – E. crebra*
3	Grey Box – Narrow-leaved Ironbark shrubby woodland	*E. moluccana – E. crebra – Angophora floribunda – Allocasuarina luehmannii*
4	*Melaleuca decora* low forest	*Melaleuca decora – E. crebra*
5	Bulloak Forests of the Central Hunter Valley	*A. luehmannii – E. moluccana, E. crebra – A. floribunda*
9	Derived Grasslands in coastal valleys	*Aristida vagans – Microlaena stipoides* var. *Stipoides – Themeda australis – Cymbopogon refractus*

Source: Appendix E.



Source: FloraSearch (2012, 2014); Department of Lands (July 2009); DECCW (Sept 2009); WCPL (2013) and WCPL Orthophoto (flown Apr - Oct 2013)

Resource Strategies

WAMBO COAL MINE

FIGURE 11

Vegetation Communities in the Vicinity of the Modification Area

Peabody ENERGY

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Threatened Ecological Communities

Three threatened ecological communities listed in the TSC Act were recorded during the recent survey within the Modification area, namely the:

- *Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions* EEC (Community 2 on Figure 11);
- *Central Hunter Grey Box – Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions* EEC (Community 3 on Figure 11); and
- *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion* Vulnerable Ecological Community (Community 7 on Figure 11).

A detailed description of the threatened ecological communities is provided in Appendix E.

No threatened ecological communities listed under the EPBC Act occur within the Modification area (Appendix E).

Potential Impacts

Potential flora impacts of the Modification would primarily be associated with subsidence impacts from the extraction of the proposed Longwall 10A.

FloraSearch (Appendix E) concluded that it is unlikely that vegetation within the Modification area would be adversely affected by mine subsidence. This conclusion is supported by inspection of previously undermined areas to the west of the Modification area, which showed that despite evidence of surface cracking of the soil, the condition of the vegetation on the undermined area was not noticeably different from that on adjacent similar unmined areas and showed no signs of dieback (Appendix E).

The *Acacia pendula population in the Hunter Catchment* endangered population also occurs approximately 2 km to the north-west of the Modification area. The north-western occurrence has been undermined by Longwall 4 at the North Wambo Underground Mine with no obvious detrimental effects on *Acacia pendula* (RPS, 2011).

The proposed Longwall 10A is in the same coal seam at a similar depth below the surface as Longwall 4. Therefore Flora Search concluded that although there is potential for minor root damage caused by soil cracking, subsidence impacts are not expected to cause the deaths of any *Acacia pendula* plants (Appendix E).

FloraSearch (Appendix E) concluded that the Modification would have no significant impact on threatened flora species, populations, ecological communities or critical habitat.

Mitigation Measures, Management and Monitoring

Flora management and monitoring at the Wambo Coal Mine would continue to be conducted in accordance with the Flora and Fauna Management Plan (WCPL, 2014b) or its revisions.

WCPL considers that no specific or additional mitigation measures, management or monitoring of flora are required for the Modification.

4.8 FAUNA

4.8.1 Background

A number of ecological studies have been undertaken previously within the Wambo area and surrounds, including routine ecological monitoring surveys commissioned by WCPL.

A relatively high diversity of animals have been recorded by previous surveys within the Wambo area attributed to the proximity of the site to Wollemi National Park and a variety of habitat types present (Appendix F).

A total of 25 threatened fauna species have been previously recorded in the vicinity of the Wambo Coal Mine by previous surveys, including 17 birds and 8 mammals.

4.8.2 Environmental Review

A Fauna Assessment (terrestrial and aquatic fauna) was prepared for the Modification by Niche Environment and Heritage (Niche) (2014) and is presented in Appendix F. The impact of the Modification on threatened fauna was assessed in consideration of the *Guidelines for Threatened Species Assessment* (DEC and DPI, 2005) and the *Significant Impact Guideline 1.1 – Matters of National Environmental Significance* (DoE, 2013).

Terrestrial Fauna Surveys

The Fauna Assessment used the results of extensive field survey data collected at the Wambo Coal Mine over the past decade (Appendix F). Baseline habitat assessments and opportunistic surveys were conducted by Niche in June 2014 to supplement the previous comprehensive fauna surveys and monitoring programmes in the Modification area and surrounds.

Fauna Habitat

Habitats within the Modification area are generally in low to moderate condition, due to a lack of native species richness and the absence of older growth habitat components (Appendix F). Past land management practices have led to low densities of hollow-bearing trees and coarse woody debris and there is little rocky habitat throughout the Modification area (Appendix F).

Three broad habitat types were identified within the Modification area, namely: regenerating woodland; grassland (mixed native/exotic) with scattered trees; and creekline and riparian habitat (Appendix F). These habitat types are described further in Appendix F.

Fauna Species

A total of 30 fauna species were recorded during the supplementary fauna surveys comprising 27 species of birds, two species of mammals and one species of frog (Appendix F).

Threatened Fauna Species

No threatened species were recorded during the surveys. However, based on a conservative assessment, the Modification area is considered to contain potential habitat for 30 threatened fauna species (Table 6).

Aquatic Fauna along Wambo and Stony Creeks

Aquatic fauna monitoring of Wambo Creek was conducted in Autumn and Spring 2013. In addition, an aquatic assessment of Stony Creek was completed for the North Wambo Underground Mine Modification (Longwalls 9 and 10) (Niche, 2012).

Riparian habitats along Wambo Creek vary in habitat structure and quality including dense stands of River Oak (*Casuarina cunninghamiana*) and small pools of standing water (Appendix F).

Pools in Wambo Creek contain invertebrate communities in relatively good health compared to the other systems (Appendix F). Two native fish species (Flat Head Gudgeon [*Philypnodon grandiceps*] and Fire Tailed Gudgeon [H*ypseleotris galii*]) have been recorded in Wambo Creek downstream of the Modification area. No threatened species have been observed in Wambo Creek (Appendix F).

The bed and banks of Stony Creek have moderate to high levels of disturbance due to previous erosion and cattle access (Niche, 2012). There are few shallow pools along Stony Creek, with the pools having high turbidity and nutrient loads, offering poor habitat for most aquatic fauna (Niche, 2012).

Potential Impacts

Niche (Appendix F) concluded that the Modification is unlikely to substantially alter the ecological values of the Modification area and surrounding environment, such that any terrestrial or aquatic fauna species would be significantly impacted.

Niche (Appendix F) also concluded that no threatened fauna or their habitats are likely to be significantly impacted by the Modification.

Potential Impacts on Aquatic Habitat

Increased ponding is predicted to occur on Wambo Creek as described in Section 4.5.2. Ponding would likely increase the available habitat for fish and benthic macroinvertebrates (Appendix F). Given the ephemeral nature of Wambo Creek, the potential impact of ponding on flowing (lotic) habitat would be limited to periods of flow after rain (Appendix F).

Niche concluded that ponding would not be expected to change macroinvertebrate communities outside the natural variation expected in ephemeral stream pool habitats (Appendix F).

Changes in grade along Wambo Creek have the potential to increase the risk of scouring or erosion (Section 4.5.2). The management measures described in Appendix C and Section 4.5.2 would be implemented to protect aquatic habitat and fauna upstream and downstream of the Modification area.

Table 6
Threatened Fauna Species with Potential Habitat in the Modification Area

Common Name	Scientific Name	Conservation Status[1]	
		TSC Act	EPBC Act
Birds			
Spotted Harrier	*Circus assimilis*	V	-
Square-tailed Kite	*Lophoictinia isura*	V	-
Little Eagle	*Hieraaetus morphnoides*	V	-
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	-
Little Lorikeet	*Glossopsitta pusilla*	V	-
Turquoise Parrot	*Neophema pulchella*	V	-
Swift Parrot	*Lathamus discolor*	E	E
Masked Owl	*Tyto novaehollandiae*	V	-
Powerful Owl	*Ninox strenua*	V	-
Barking Owl	*Ninox connivens*	V	-
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	-
Specked Warbler	*Chthonicola sagittata*	V	-
Regent Honeyeater	*Anthochaera phrygia*	CE	E
Painted Honeyeater	*Grantiella picta*	V	-
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	-
Flame Robin	*Petroica phoenicea*	V	-
Scarlet Robin	*Petroica boodang*	V	-
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-
Varied Sittella	*Daphoenositta chrysoptera*	V	-
Diamond Firetail	*Stagonopleura guttata*	V	-
Mammals			
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-
Eastern Freetail-bat	*Mormopterus norfolkensis*	V	-
Little Bentwing-bat	*Miniopterus australis*	V	-
Eastern Bentwing-bat	*Miniopterus shcreibersii oceanensis*	V	-
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V
Southern Myotis	*Myotis macropus*	V	-
Greater Broad-nosed Bat	*Scoteanus rueppellii*	V	-

Source: Appendix F.

[1] Threatened species status under the TSC Act and EPBC Act (current as of August 2014).
E = Endangered V = Vulnerable

Mitigation Measures, Management and Monitoring

Fauna management and monitoring at the Wambo Coal Mine would continue to be conducted in accordance with the Flora and Fauna Management Plan (WCPL, 2014b) or its revisions.

Monitoring and management measures for Wambo and Stony Creeks described in Section 4.5.2 would be implemented for the Modification. WCPL considers that no specific or additional mitigation measures, management or monitoring of terrestrial fauna are required for the Modification.

4.9 OTHER ENVIRONMENTAL ASPECTS

4.9.1 Greenhouse Gas Emissions

In accordance with the National Greenhouse Accounts Factors (NGA Factors) (Commonwealth Department of Climate Change and Energy Efficiency [DCCEE], 2013), direct greenhouse gas emissions are referred to as Scope 1 emissions, and indirect emissions are referred to as Scopes 2 and 3 emissions.

The major sources of greenhouse gas emissions at Wambo include;

- combustion of diesel during mining operations (Scope 1);
- use of explosives (Scope 1);
- fugitive emissions of methane (Scope 1);
- off-site generation of electricity that is consumed at Wambo (Scope 2); and
- combustion of product coal produced at Wambo by third parties (Scope 3).

Holmes Air Sciences (2003) calculated the following predicted greenhouse gas emissions from Wambo over the 21 year life:

- combustion of diesel, use of explosives, fugitive emissions and generation of electricity consumed on-site (Scopes 1 and 2) – 45.4 Mt carbon dioxide-equivalent (CO_2-e); and
- combustion of product coal by third parties (Scope 3) – 157 Mt CO_2-e.

Incremental greenhouse gas emissions associated with the Modification would be related to underground mining (i.e. additional diesel and electricity consumption and fugitive emissions) and the processing, transportation and downstream use of the additional ROM coal.

An assessment of the incremental greenhouse gas emissions (Scopes 1, 2 and 3) for the Modification was conducted using empirical emission factors provided by the NGA Factors (DCCEE, 2013) and site-specific data for fugitive emissions.

Incremental greenhouse gas emissions associated with the Modification would be related to increased:

- combustion of diesel for underground mining operations (approximately 4.76 kilotonnes [kt] of CO_2-e of Scope 1 and 0.36 kt CO_2-e of Scope 3 emissions);
- consumption of electricity for underground activities, in ROM coal processing and at the Wambo Coal terminal (approximately 22.90 kt CO_2-e of Scope 2 and 5.0 kt CO_2-e of Scope 3 emissions);
- fugitive emissions from the extraction of coal (approximately 300 kt CO_2-e of Scope 1 emissions); and
- combustion of product coal produced at Wambo by third parties (approximately 2.92 Mt CO_2-e of Scope 3 emissions).

WCPL is currently implementing a number of measures to minimise, to the greatest extent practicable, greenhouse gas emissions from Wambo. Relevant measures are described below:

- maximising energy efficiency as a key consideration in the development of the mine plan. For example, significant savings of greenhouse gas emissions (through increased energy efficiency) are achieved by mine planning decisions for coal and waste rock transport and therefore fuel use;
- installation of Power Factor Correction equipment in the CHPP; and
- potential investigation into the beneficial reuse of methane gas at the Wambo Coal Mine.

4.9.2 Hazard and Risk

A preliminary hazard analysis (PHA) was conducted in 2003 to assess the potential hazards and risks associated with the Wambo Coal Mine. The PHA comprised a qualitative assessment of risks to the public, property and the environment associated with the development and operations of Wambo (Resource Strategies, 2003). The PHA was conducted in accordance with the general principles of risk evaluation and assessment provided in *Multi-Level Risk Assessment* (NSW Department of Urban Affairs and Planning, 1999).

The PHA identified no incremental risks posing significant off-site impacts (Resource Strategies, 2003).

It is considered that the Modification would not change the existing potential risk areas identified in the PHA conducted for the Wambo Coal Mine as the proposed activities associated with the Modification (e.g. underground mining operations) are consistent with the activities assessed in the PHA. However, environmental management plans and monitoring programmes would be reviewed, and if necessary, revised to include the Modification and manage any associated environmental risks.

4.9.3 Non-Aboriginal Heritage

A Cultural Heritage Impact Assessment was prepared for the Modification by RPS (2014) and is presented in Appendix D.

The existing Wambo Homestead Complex was assessed as the only item of non-Aboriginal heritage significance in the vicinity of the approved North Wambo Underground Mine (RPS, 2014).

RPS (2014) concluded that the Modification would not impact on the Wambo Homestead Complex or any associated structures as it is well removed from the Modification area and predicted to experience no additional subsidence impacts due to the development of the proposed Longwall 10A.

5 STATUTORY CONTEXT

5.1 APPLICABILITY OF SECTION 75W OF ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979

Wambo was approved under Part 4 of the EP&A Act in February 2004 (Development Consent DA 305-7-2003 – Attachment 1).

As outlined in Section 1.3, WCPL consulted with the DP&E in June 2014 with regards to seeking the necessary approvals for the Modification and based on this consultation, this EA has been prepared under section 75W of the EP&A Act.

Clause 12 of Schedule 6A of the EP&A Act provides that section 75W of Part 3A of the EP&A Act continues to apply to modifications of development consents referred to in clause 8J(8) of the *Environmental Planning and Assessment Regulation, 2000* (EP&A Regulation) following the repeal of Part 3A.

Wambo was approved under Part 4 of the EP&A Act in February 2004 by development consent under Division 4 of Part 4 of the Act (relating to State significant development). Therefore the Development Consent (DA 305-7-2003) is a development consent that falls within clause 8J(8)(c) of the EP&A Regulation. That is, section 75W of the EP&A Act continues to apply to modifications to the Wambo Development Consent (DA 305-7-2003), notwithstanding its repeal.[1]

Approval for the Modification will be sought as a modification to the Development Consent (DA 305-7-2003) under section 75W of the EP&A Act. Section 75W of the EP&A Act relevantly provides:

> **75W Modification of Minister's approval**
>
> *(1) In this section:*
>
> ***Minister's approval** means an approval to carry out a project under this Part, and includes an approval of a concept plan.*
>
> ***modification of approval** means changing the terms of a Minister's approval, including:*
>
> *(a) revoking or varying a condition of the approval or imposing an additional condition of the approval, and*

[1] Part 3A of the EP&A Act (as in force immediately before its repeal) continues to apply for Wambo. The description and quotations of relevant references to clauses of Part 3A in this document are as if Part 3A of the EP&A Act is still in force.

(b) changing the terms of any determination made by the Minister under Division 3 in connection with the approval.

(2) The proponent may request the Minister to modify the Minister's approval for a project. The Minister's approval for a modification is not required if the project as modified will be consistent with the existing approval under this Part.

(3) The request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.

(4) The Minister may modify the approval (with or without conditions) or disapprove of the modification.

…

5.2 GENERAL STATUTORY REQUIREMENTS

Environmental Planning Instruments

The following environmental planning instruments may be potentially relevant to Wambo:

- *Singleton Local Environmental Plan 2013* (Singleton LEP);
- Mining SEPP;
- *State Environmental Planning Policy No 33 – Hazardous and Offensive Development* (SEPP 33);
- *State Environmental Planning Policy No 44 – Koala Habitat Protection* (SEPP 44); and
- *State Environmental Planning Policy No. 55 (Remediation of Land)* (SEPP 55).

These environmental planning instruments are discussed further in Attachment 2. The Modification is not inconsistent with these environmental planning instruments.

NSW Government Policy

In September 2012, the NSW Government released the following policy documents potentially relevant to the Modification:

- *Strategic Regional Land Use Policy* (NSW Government, 2012b).
- AIP (NSW Government, 2012a).

The relevance of these policy documents to the Modification are discussed further in Attachment 2.

Commonwealth Environment Protection and Biodiversity Conservation Act, 1999

The objective of the EPBC Act is to provide for the protection of those aspects of the environment that are of *national* environmental significance. Proposals that are likely to have a significant impact on a matter of environmental significance are defined as a controlled action under the EPBC Act.

Proposals that are, or may be, a controlled action are required to be referred to the DoE to determine whether or not the action is a controlled action.

Wambo was referred to the Commonwealth Department of Environment and Heritage (now DoE) due to the potential for impacts to occur to the following matters of national environmental significance under the EPBC Act:

- Listed threatened species and ecological communities.
- Listed migratory species.

Wambo was determined to be a *controlled action* under the EPBC Act (EPBC 2003/1138) and was subsequently approved on 23 November 2004.

The potential impacts of the Modification on flora and fauna have been assessed in Appendices E and F and summarised in Sections 4.7 and 4.8. These assessments indicate that there would be no significant impact on threatened species, populations and communities and migratory species listed under the EPBC Act as a result of the Modification.

The potential impacts of the Modification on water resources have been assessed in Appendices B, C and F and summarised in Sections 4.4, 4.5 and 4.6. These assessments indicate:

- The Modification would result in no discernible additional drawdown in alluvium associated with Wollombi Brook.
- The Modification would also result in negligible additional drawdown in the alluvium associated with Wambo Creek and Stony Creek.
- The Modification would have no discernible impact on stream baseflow or natural river leakage, beyond the effects of approved mining, for Wollombi Brook, North Wambo Creek and Stony Creek. The Modification would result in a slight reduction in baseflow to Wambo Creek of up to 2.5 ML/annum.
- The Modification would result in additional dewatering of the Permian coal measures, however the impact on water levels due to the Modification is negligible regionally.
- Additional ponding on Wambo Creek would not be expected to change macroinvertebrate communities outside the natural variation expected in ephemeral stream pool habitats.
- Sections of Wambo and Stony Creeks in the Modification area may be vulnerable to scour and erosion as a result of subsidence from approved mining and the proposed Longwall 10A. WCPL would implement management measures described in Appendix C and Section 4.5.2 to protect aquatic habitat and fauna upstream and downstream of the Modification area.

In addition, WCPL and Peabody Energy hold adequate licence entitlement under a state water resource plan to account for the potential take of water associated with the Modification.

It is therefore considered that there is no need to refer the Modification to the Commonwealth Minister for the Environment.

5.3 MANAGEMENT PLANS THAT REQUIRE REVISION

An Extraction Plan would be prepared for Longwall 10A prior to the commencement of second workings in accordance with Condition 22C, Schedule 4 of the Development Consent (DA-305-7-2003).

WCPL considers that no other management plans require revision to include the Modification.

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