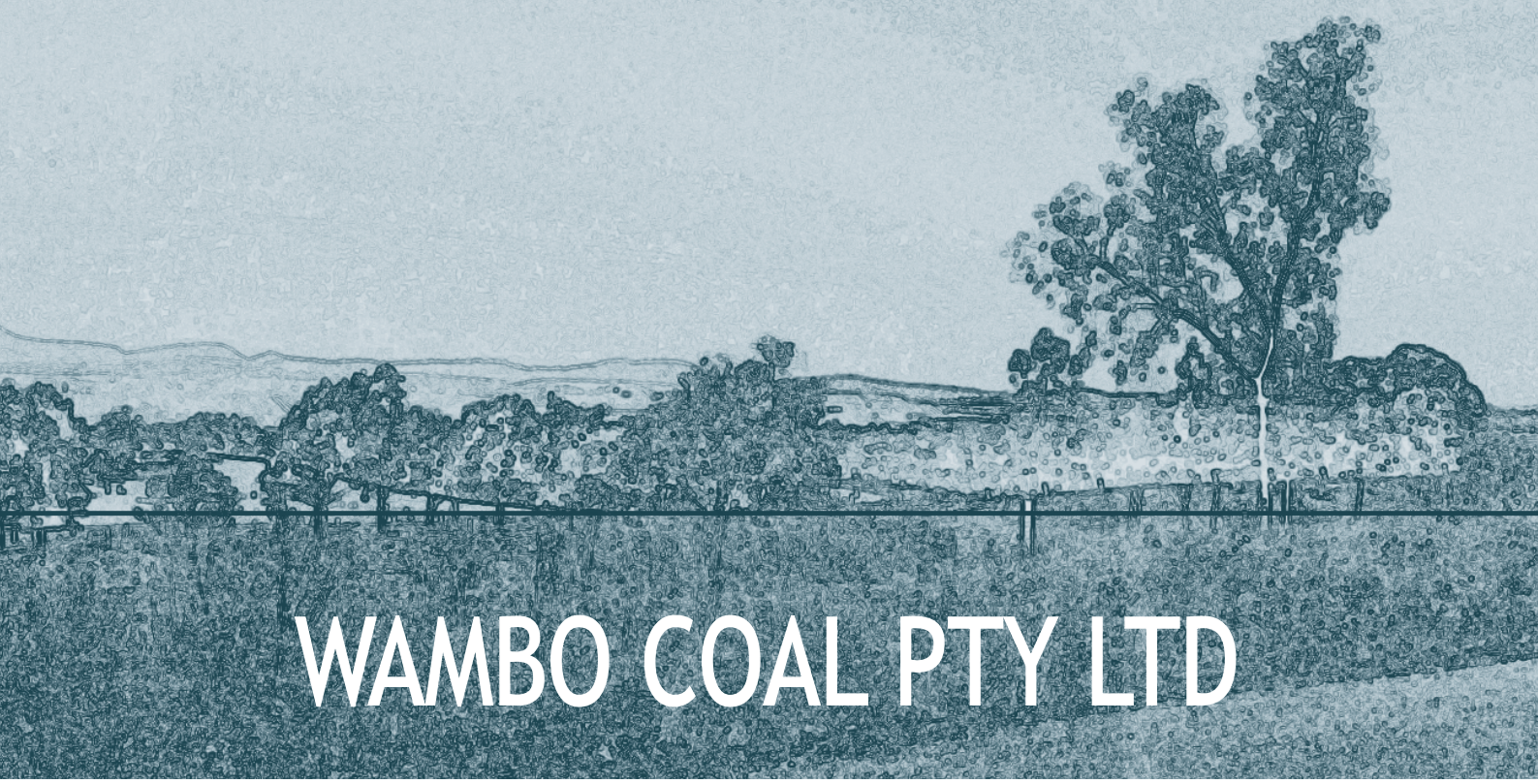


WAMBO COAL PTY LTD

NORTH WAMBO UNDERGROUND MINE MODIFICATION

ENVIRONMENTAL ASSESSMENT

FOR THE MODIFICATION OF DA 305-7-2003 (MOD 13)
THE ADDITION OF NORTH WAMBO UNDERGROUND MINE
LONGWALLS 9 AND 10

December 2012

Peabody ENERGY

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 coal production rate is 14.7 million tonnes per annum 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 recent exploration results, WCPL has identified additional coal reserves adjoining the existing North Wambo Underground Mine that can be economically mined with underground mining methods.

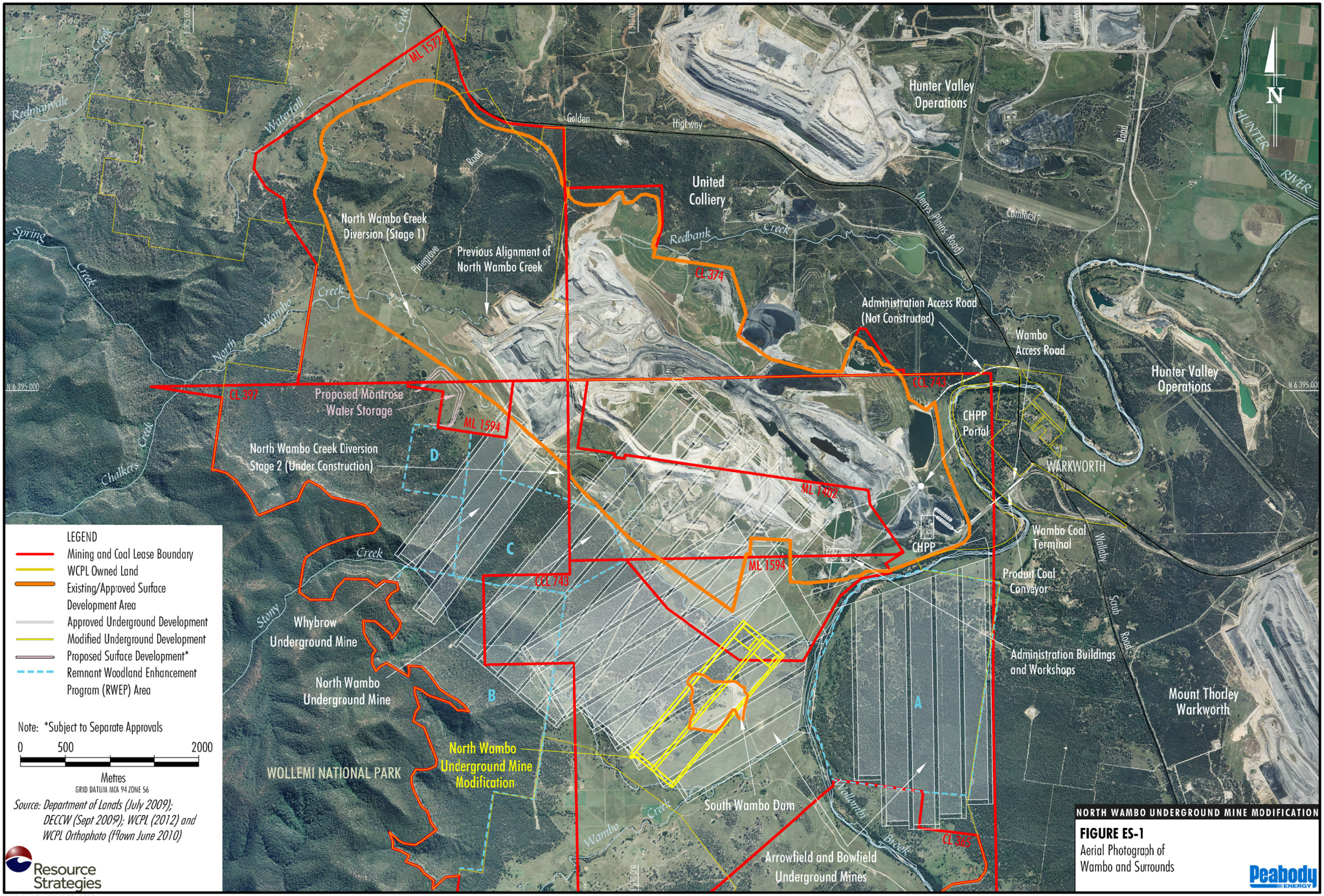
This Environmental Assessment has been prepared to support an application to modify the Wambo Development Consent (DA 305-7-2003) to allow for an extension to the approved North Wambo Underground Mine, referred to as the North Wambo Underground Mine Modification (the Modification).

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 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal from the Whybrow, Redbank Creek, Wambo and Whynot Seams. • An estimated total open cut ROM coal reserve of 98 million tonnes (Mt). • Open cut mining operations 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 104 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	• *202 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 capable of processing approximately 1,800 tonnes per hour.
Product Coal	• Production of up to 11.3 Mtpa of thermal coal predominantly for export.
Coal Handling and Preparation Plant 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 Mt of coarse rejects and approximately 18 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.

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

Note: Italicised components would be modified by the Modification.



WAM-09-15_NWUM ES_101B

The Modification would include the development of two additional longwall panels (Longwalls 9 and 10) in the Wambo Seam contiguous with the existing North Wambo Underground Mine. Access to the modified longwall panels 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 3.7 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 coal handling and preparation plant (an additional 0.7 Mt coarse reject and 0.4 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;
- run-of-mine coal production rate;
- open cut operations;
- coal handling, coal handling and preparation plant 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 Modification longwall panels 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-2 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.

The following management plans would be reviewed, and if necessary, revised to include the Modification (subject to approval of the Modification):

- Rehabilitation Management Plan;
- Life of Mine Rejects Emplacement Strategy; and
- North Wambo Creek Subsidence Response Strategy.

In addition, the site water balance would be reviewed to incorporate the Modification. The results of the site water balance review would be reported in the Annual Review in accordance with Condition 25, Schedule 4 of the Development Consent (DA-305-7-2003).

An Extraction Plan would be prepared for Longwalls 9 and 10 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 3.7 Mt of ROM coal.

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 impact.[1]	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.	No measureable subsidence from the Modification longwall panels in the curtilage of the Wambo Homestead Complex is predicted, and therefore no impact on heritage values would occur as a result of 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.	In order to maintain safety, serviceability of South Wambo Dam may not be maintained during the extraction of the Modification longwall panels. This would be reviewed in consultation with the Dams Safety Committee as part of the Extraction Plan process. 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 preparation and implementation of the 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.

[1] The Subsidence Impact Performance Measure is proposed to be modified from "nil impact" to "negligible impact" for consistency with recent determinations by the Planning Assessment Commission.

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 serviceability of South Wambo Dam during the extraction of the Modification longwall panels would be reviewed in consultation with the Dams Safety Committee as part of the Extraction Plan process. • Predicted levels of impact on 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.	• An Extraction Plan would be prepared for Longwalls 9 and 10 prior to the commencement of second workings. • WCPL would develop management strategies for the South Wambo Dam as part of the Extraction Plan process, which could include lowering the water level or completely draining the dam prior to directly mining beneath it. These management strategies would be developed in consultation with the Dams Safety Committee.
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 relevant Extraction Plan would include management of potential subsidence impacts on agricultural activities from the extraction of the Modification longwall panels. • The Rehabilitation Management Plan and Life of Mine Rejects Emplacement Strategy would be reviewed, and if necessary, revised to include the Modification (subject to Development Consent conditions).
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, Wambo Creek and Stony Creek. • 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 operations and the Modification.	• The North Wambo Creek Subsidence Response Strategy would be reviewed, and if necessary, revised to include the Modification (subject to Development Consent conditions). • The site water balance would be reviewed to incorporate the Modification.
Surface Water	• The Modification would result in negligible additional impact on stream flows in the Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek. • The Wambo water demand would not materially change as a result of the Modification, as maximum ROM coal production would remain unchanged. • The Modification would add approximately 0.2 megalitres per day to peak inflow rates predicted for the currently approved mine plan, resulting in a total peak inflow rate for the North Wambo Underground Mine of approximately 1.7 megalitres per day.	• To minimise the potential for subsidence impacts on North Wambo Creek, the Modification longwall panels would be set back from this features by a distance equivalent to a 26.5 degree angle of draw from the Wambo Seam. • The site water balance would be reviewed to incorporate the Modification.

Table ES-3 (Continued)
Key Outcomes of the Environmental Review

Environmental Aspect	Summary of Environmental Assessment Conclusions	Additional Mitigation Measures, Management and Monitoring Proposed for the Modification[1]
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 the existing Consent No. 2222 to be slightly expanded or would apply for a new Aboriginal Heritage Impact Permit to cover the additional areas. • Regular monitoring of a possible scar tree Wambo Site 360 (ST3) would be undertaken to monitor health of the tree, and would be outlined in the Extraction Plan for the Modification longwall panels. • Dewatering bores would be located such that they would not disturb any known Aboriginal heritage sites.
Non-Aboriginal Cultural Heritage	• The Modification longwall panels would not involve secondary extraction within the curtilage of the Wambo Homestead Complex. • There is predicted to be no measureable subsidence from the Modification longwall panels in the curtilage of the Wambo Homestead Complex, and therefore no impact on heritage values as a result of the Modification.	• WCPL would lodge an application under section 60 of the *Heritage Act, 1977* to develop the main headings for the Modification longwall panels (in accordance with Condition 57, Schedule 4 of the Development Consent [DA 305-7-2003]).
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.	• Dewatering bores would be located within already cleared farmland and would not impact any remnant native vegetation. • WCPL considers that no specific or additional mitigation measures, management or monitoring of flora and fauna is required for the Modification. • Based on the assessments, there is considered no need to refer the Modification to the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities.

[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).

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 (Figure 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 MODIFICATION

Following a review of mine planning and recent exploration results, WCPL has identified additional coal reserves adjoining the existing North Wambo Underground Mine that can be economically mined with underground mining methods. This proposed extension to Wambo is referred to as the North Wambo Underground Mine Modification (the Modification).

The Modification would include the development of two additional longwall panels in the Wambo Seam contiguous with the existing North Wambo Underground Mine (Figure 2). Access to the modified longwall panels 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 would produce approximately 3.7 million tonnes (Mt) of additional ROM coal and would be mined within the approved Wambo mine life.

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 public exhibition of this EA and the assessment of the proposal 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.

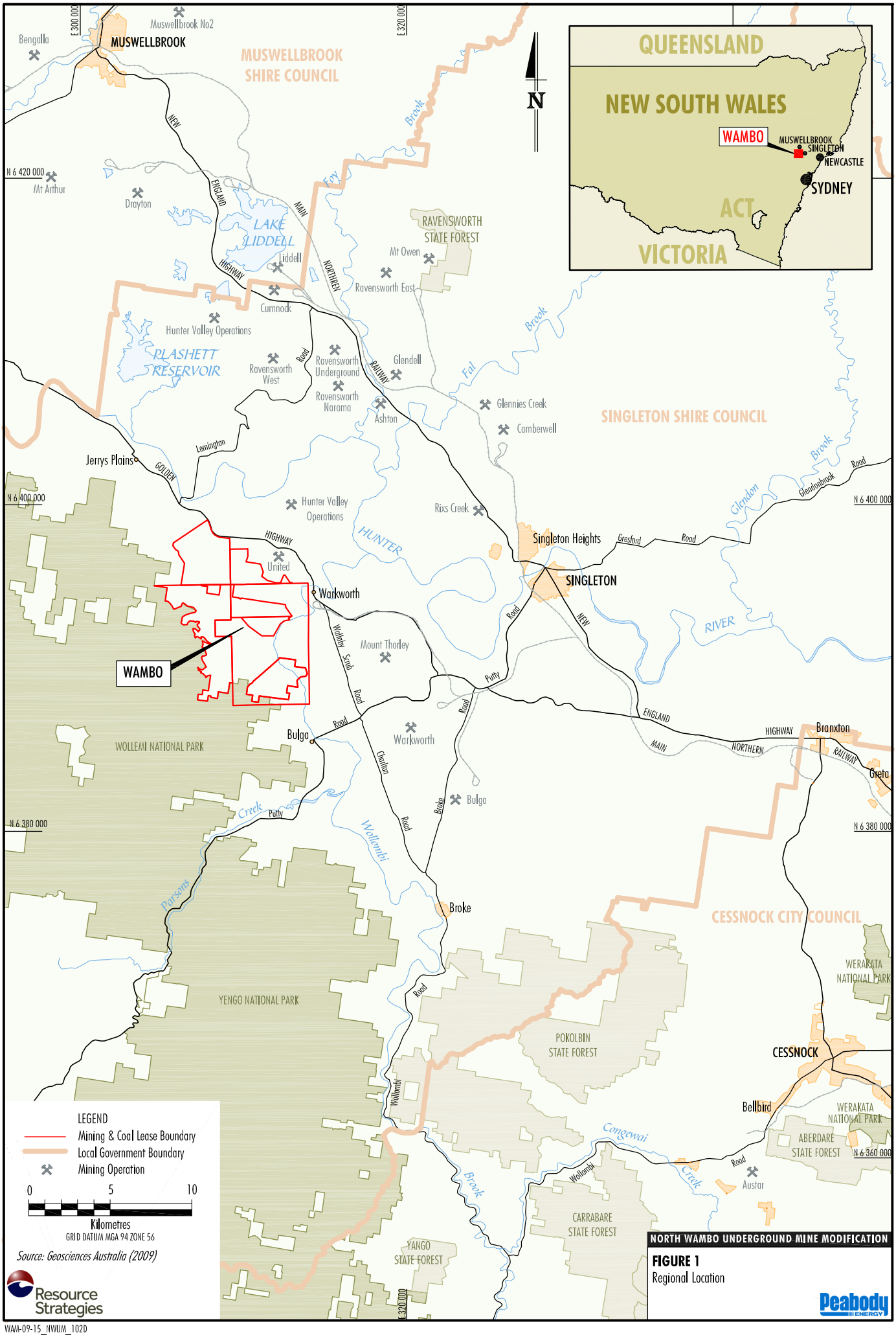
WCPL provided an overview of the proposed Modification at the CCC meeting in March 2011. At the time of the meeting a fact sheet was provided and issues concerning subsidence on surrounding land were discussed. The length of the Modification longwalls (Longwalls 9 and 10) were subsequently reduced following further mine planning and design.

A letter providing a further update on the Modification was distributed to members of the CCC in October 2012.

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 *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 C.



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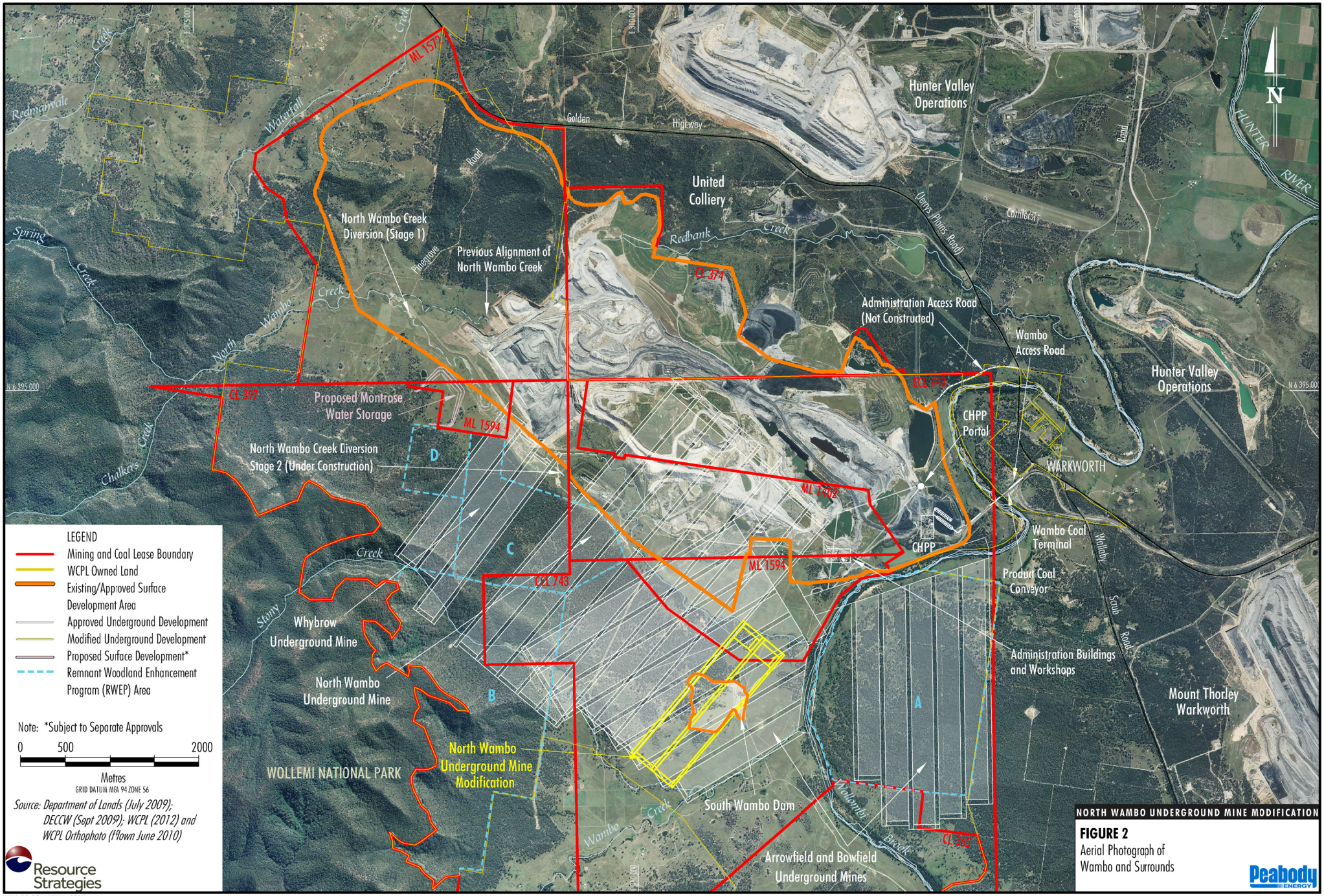


NORTH WAMBO UNDERGROUND MINE MODIFICATION

FIGURE 2
Aerial Photograph of Wambo and Surrounds

Peabody ENERGY

WAM-09-15_NWUM_101K

Table 1
Comparative Summary of the Approved and Modified Wambo

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 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 104 Mt.	• Unchanged. • Approximately an additional 3.7 Mt of ROM coal from the extended 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	• 202 Mt.	• 205.7 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 Mt of coarse rejects and approximately 18 Mt of tailings.	• Approximately an additional 0.7 Mt of coarse rejects and 0.4 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.	• Unchanged.

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

United Collieries

Consultation with United Collieries regarding the Modification was conducted during 2011 and early 2012. During this consultation the Modification and the location and potential impacts on 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 Infrastructure

WCPL initiated consultation regarding the Modification with the Department of Planning and Infrastructure (DP&I) in March 2011 when an overview of the proposed Modification was provided to the DP&I and key assessment requirements and the proposed timing for EA lodgement were discussed.

Division of Resources and Energy

A briefing on the Modification was provided to representatives of the NSW Division of Resources and Energy (DRE) within the Department of Trade, Investment, Regional Infrastructure and Services (NSW Trade & Investment) on 9 October 2012 to provide background on the Modification and the proposed resource recovery.

NSW Office of Water

WCPL provided a briefing to the NSW Office of Water (NOW) on 17 October 2012 providing information on the Modification and the results of the groundwater assessment.

Office of Environment and Heritage

WCPL provided a briefing package to the NSW Office of Environment and Heritage (OEH) in October 2012 providing information on the Modification and offering a further briefing if requested.

Dams Safety Committee

WCPL provided a briefing package to the Dams Safety Committee in November 2012 providing information on the Modification and the interaction with South Wambo Dam.

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 held a meeting with the Mayor and General Manager of the SSC on 7 November 2012 to provide a briefing on Wambo and the Modification.

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 proposed 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	Consolidated Development Consent DA 305-7-2003
Attachment 2	Relevant Environmental Planning Instruments and Government Policies
Appendix A	Subsidence Assessment
Appendix B	Groundwater Assessment
Appendix C	Cultural Heritage Impact Assessment
Appendix D	Flora Assessment
Appendix E	Fauna Assessment
Appendix F	Agricultural Resource Assessment

2 WAMBO – EXISTING OPERATIONS

2.1 APPROVALS HISTORY

Wambo was approved under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) in February 2004. Nine modifications to the Development Consent (DA 305-7-2003) have 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;
- May 2005 under Section 96(2) – to facilitate alterations to the North Wambo Underground Mine;
- 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;
- April 2006 under Section 96(1A) – to facilitate the extraction of remnant coal from the existing Wollemi Underground Mine;
- October 2006 under Section 96(1A) – to facilitate the construction and operation of a temporary North Wambo Creek bypass around the open cut operations;
- 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;
- June 2009 under Section 96(1A) – to facilitate the construction and operation of the Chitter Dump Dam;
- August 2009 under Section 96(2) – to facilitate the construction and operation of the South Wambo Dam; and
- 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.

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

WCPL submitted a modification application in June 2012 for the construction and operation of the Montrose Water Storage and associated supporting infrastructure under section 75W of the EP&A Act. The modification application has not yet been determined by the NSW Planning Assessment Commission.

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 (WCPL, 2011a).

During the 2010/2011 financial year approximately 4 Mt of ROM coal was mined at the Wambo open cut operations (WCPL, 2011a).

2.3 UNDERGROUND MINING

The following underground mines at Wambo are approved (Figure 2):

- North Wambo Underground Mine (Wambo Seam);
- Whybrow Underground Mine (Whybrow Seam);
- Arrowfield Underground Mine (Arrowfield Seam); and
- Bowfield Underground Mine (Bowfield 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)

NORTH WAMBO UNDERGROUND MINE MODIFICATION

FIGURE 3
Stratigraphy of the
Wambo Coal Mine Area

Resource Strategies

Peabody ENERGY

WAM-09-15_NWUM_002B

Development of the North Wambo Underground Mine commenced in 2005 and production (using longwall mining methods) commenced in 2007 (WCPL, 2008a). During the 2010/2011 financial year approximately 4.7 Mt of ROM coal was mined at the North Wambo Underground Mine (WCPL, 2011a).

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 (WCPL, 2011a).

Underground mining equipment includes continuous miners, longwall mining equipment, electric shuttle cars, load haul dump machines and personnel transporters (WCPL, 2011a).

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, 2011a). 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 (WCPL, 2011a).

The CHPP operates up to 24 hours per day, 7 days per week and during the 2010/2011 financial year approximately 8.7 Mt of ROM coal was processed at the CHPP producing approximately 5.7 Mt of product coal (WCPL, 2011a).

2.5 PRODUCT COAL TRANSPORT

The Wambo Coal Terminal is capable of loading product coal onto trains at a rate of 4,500 tph (WCPL, 2011a). 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, 2003). 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, 2003).

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 27.6 Mbcm of waste rock was excavated during the 2010/2011 financial year (WCPL, 2011a).

2.7 COAL REJECT MANAGEMENT

Approximately 27 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, 2003). 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 Mt of tailings (dry basis) are expected to be produced over the life of Wambo (WCPL, 2003).

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 Review (previously reported 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, 2007b).

2.10 WORKFORCE

The Wambo workforce currently consists of approximately 842 employees and contractors (WCPL, 2011a).

2.11 REHABILITATION

Rehabilitation at Wambo occurs progressively as areas/landforms become available to minimise the area of disturbance at any one time. Approximately 264 hectares (ha) of final rehabilitation has been undertaken at Wambo (WCPL, 2011a).

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, 2003):

- 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, 2003):

- 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, 2003). 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, 2010a). 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, 2010a).

Details of the management of the RWEP areas are provided in the Flora and Fauna Management Plan (WCPL, 2010a).

Rehabilitation Trials and Audit

A number of capping studies have been undertaken on the North East Tailings Dam. The outcomes of these studies have been incorporated into the rehabilitation strategy currently being implemented at the North East Tailings Dam (WCPL, 2011a).

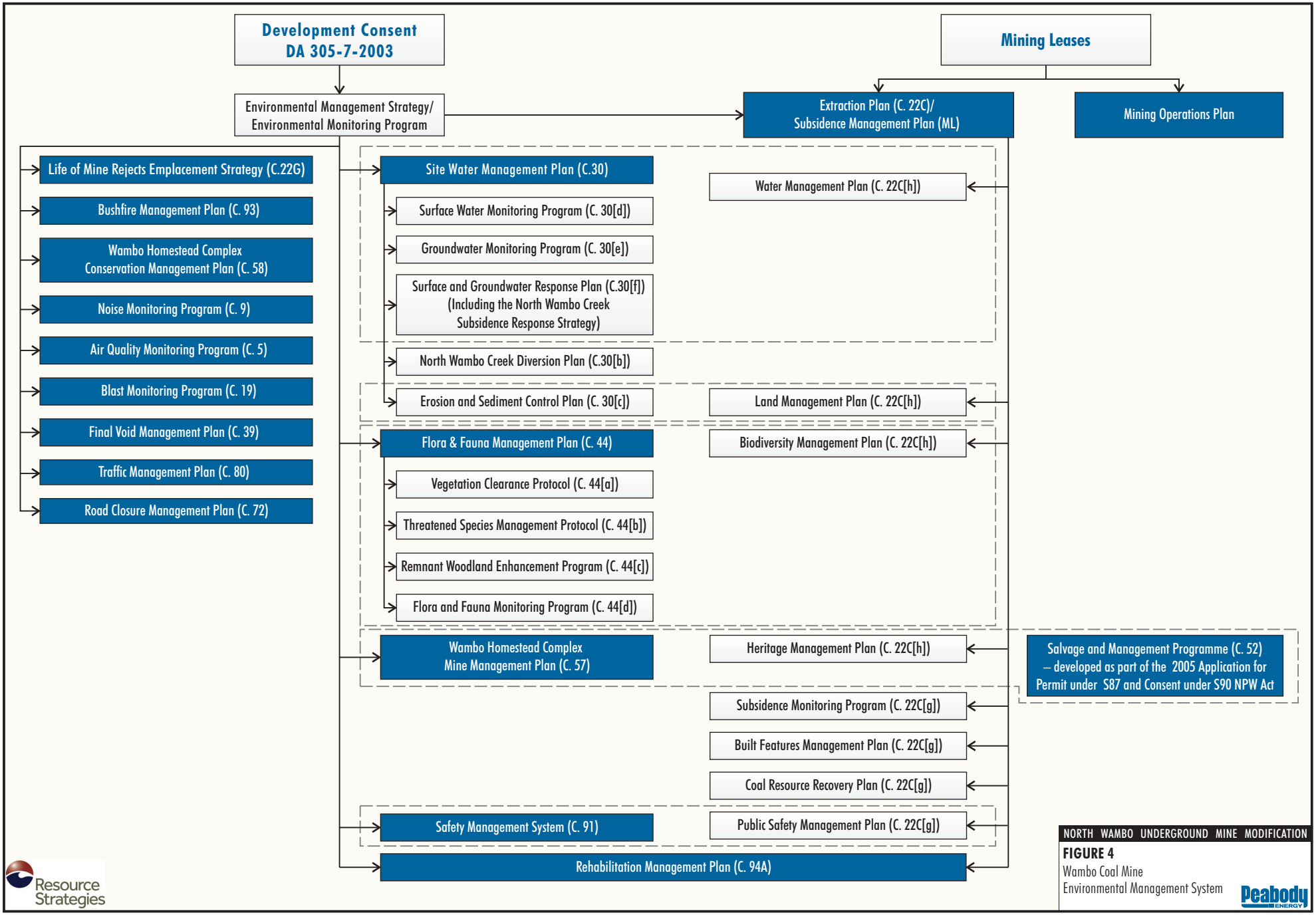
WCPL proposes to conduct the following rehabilitation trails during 2012 (WCPL, 2011a):

- Biosolids application on rehabilitated waste rock emplacements.
- Supplementary planting of native grass species seed mix, in areas of patchy tree establishment.
- Use of mobile tree mulchers during vegetation clearance so that mulch material can be placed on soil to be stripped. Potential benefits include dust suppression, erosion control and provision of organic matter in stripped topsoil.

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, 2010b).
- Environmental Monitoring Program (WCPL, 2010c).
- Flora and Fauna Management Plan (WCPL, 2010a).
- Air Quality Monitoring Program (WCPL, 2008b).
- Noise Monitoring Program (WCPL, 2007a).
- Blast Monitoring Program (WCPL, 2009).
- Site Water Management Plan incorporating the following:
  - North Wambo Creek Diversion Plan (WCPL, 2007b).
  - Groundwater Monitoring Program (WCPL, 2010d).
  - Surface Water Monitoring Program (WCPL, 2010e).



NORTH WAMBO UNDERGROUND MINE MODIFICATION

FIGURE 4

Wambo Coal Mine
Environmental Management System

Resource Strategies

Peabody ENERGY

WAM-09-15_NWUM_001A

  - Erosion and Sediment Control Plan (WCPL, 2010f).
  - Surface and Groundwater Response Plan (WCPL, 2010g).
- North Wambo Underground Mine Subsidence Management Plan for Longwalls 1 to 6 (WCPL, 2006).
- Surface and Subsurface Investigation Programme (Strata Engineering, 2005).
- Life of Mine Rejects Emplacement Strategy (WCPL, 2011b).
- Bushfire Management Plan (WCPL, 2008c).
- Wambo Homestead Complex Mine Management Plan (Godden Mackay Logan, 2012).

WCPL is currently developing an Extraction Plan/Subsidence Management Plan for Longwalls 7 and 8 at the North Wambo Underground Mine.

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).

WCPL received a total of 82 complaints during the 2011/2012 financial year, with the majority related to noise (over 80 percent [%]). Approximately 70% of the noise complaints were received from two complainants. The complaints received were related to noise, dust, blasting, water and lighting, and not generally related to the underground mining operations.

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

3 NORTH WAMBO UNDERGROUND MINE 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 Longwalls 9 and 10 would be located to the south-east of the existing longwall panels and would be approximately 2.0 km long and approximately 250 metres (m) wide.

To minimise the potential for subsidence impacts on North Wambo Creek, the Modification longwall panels would be set back from this feature by a distance equivalent to a 26.5 degree (°) angle of draw from the Wambo Seam.

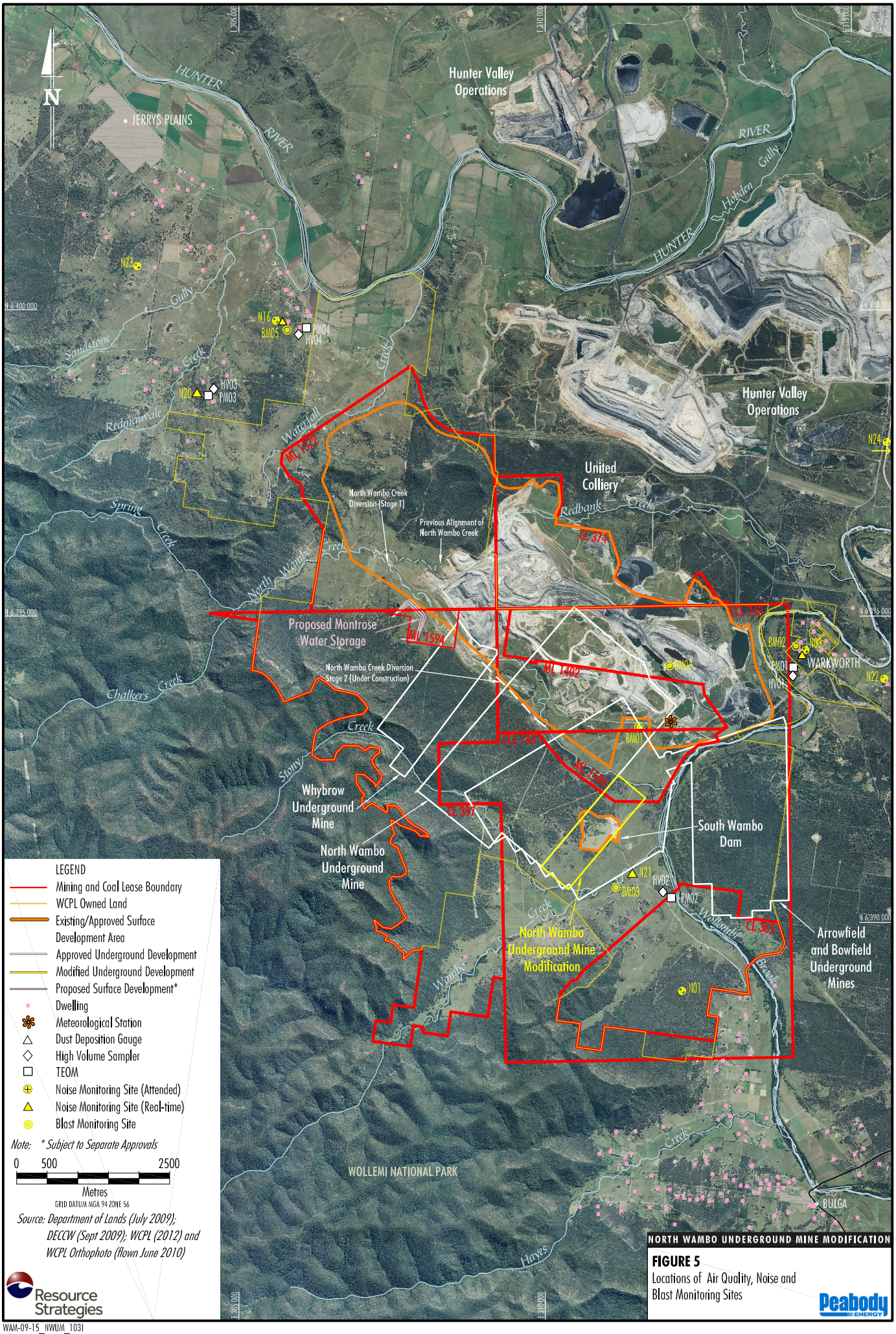
The detailed documentation of the interaction of the Modification longwall panels with North Wambo Creek would be presented in the relevant Extraction Plan for consideration and approval by the relevant authorities, and would be consistent with the requirements of the Development Consent (DA 305-7-2003).

Mine Access and Development Works

Access to the Modification longwall panels would be via the existing North Wambo Underground Mine. Main headings would be driven off the gate roads of approved Longwall 8 to provide access to proposed Longwalls 9 and 10 (Figure 7). Gate roads would be driven from the main heading to the south-east to allow for the extraction of coal from the Wambo Seam.

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 Modification longwall panels and move towards the north-east. In order to start each new longwall panel, the longwall machine is separated into components and re-assembled in the roadway of the next panel.



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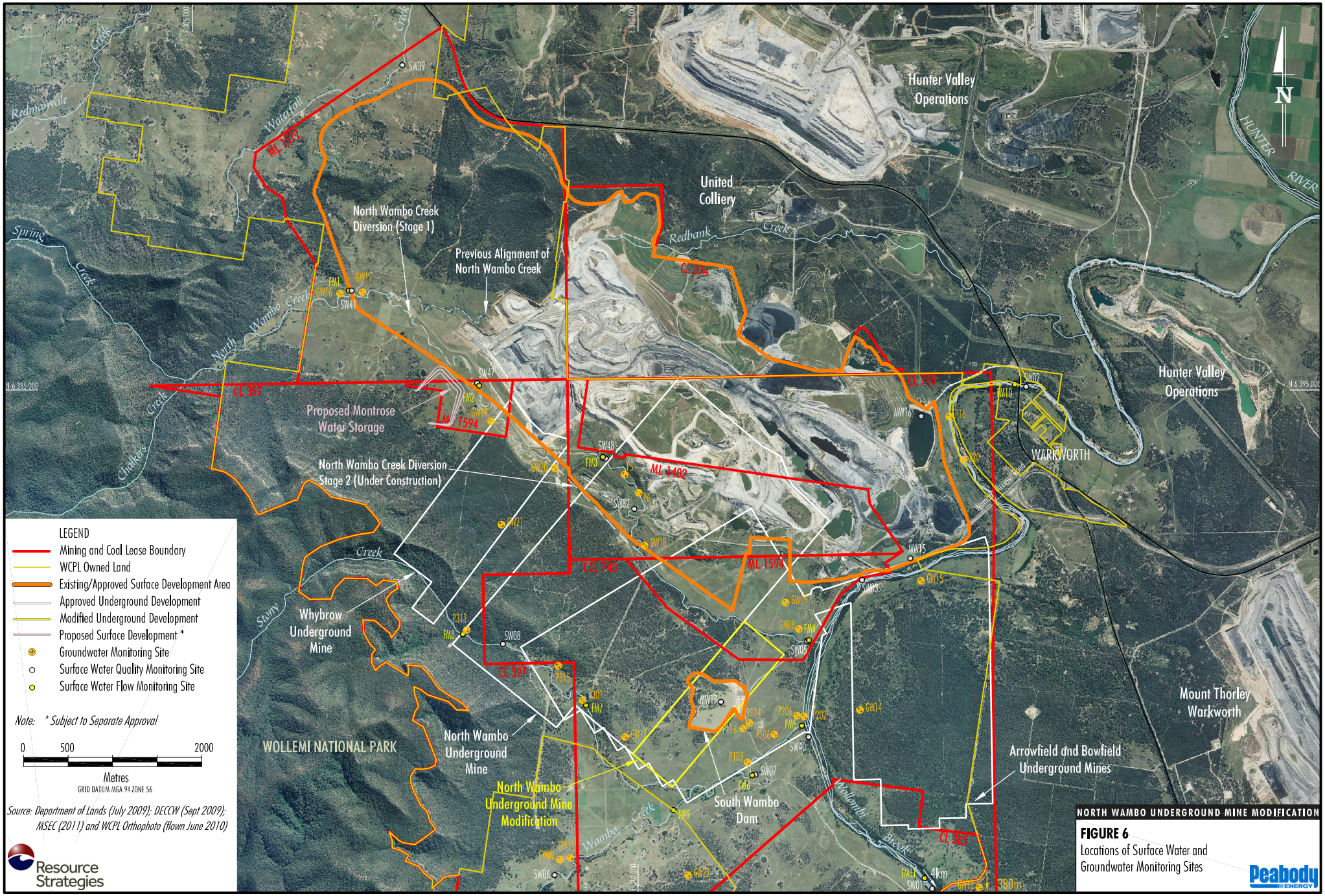

NORTH WAMBO UNDERGROUND MINE MODIFICATION

FIGURE 6
Locations of Surface Water and Groundwater Monitoring Sites

Peabody ENERGY

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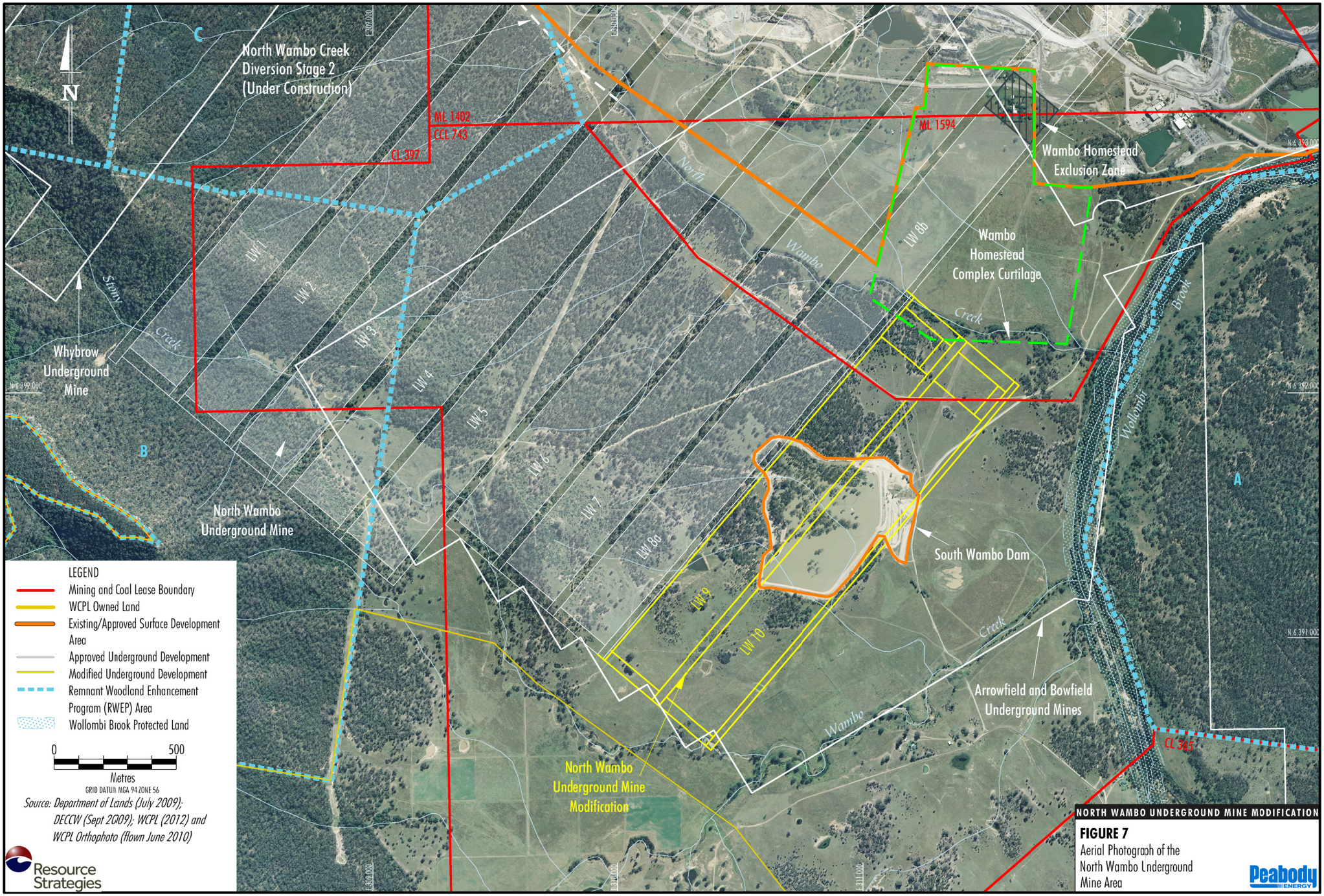

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Consistent with the approved operations, underground mining operations would be conducted 24 hours a day, seven days a week.

Approximately an additional 3.7 Mt of ROM coal would be mined within the approved mine life, over approximately 2 years. Production from the North Wambo Underground Mine would be at a rate of up to 7.5 Mtpa. Development of the Modification longwall panels is planned to commence in 2013.

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.

Dewatering bores may be required to drain the voids of previous underground workings above the Modification longwall panels. These bores would be located such that they are within already cleared farmland, would not impact any remnant native vegetation and would not disturb any known Aboriginal heritage sites. These bores would be located on WCPL-owned land.

3.2 APPROVED UNDERGROUND OPERATIONS

The Modification would include the development of two additional longwall panels in the Wambo Seam adjacent to the existing North Wambo Underground Mine (Longwalls 9 and 10) (Figure 7).

The proposed Modification does not include any alteration to the layout and/or operation of the approved 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 0.7 Mt of coarse rejects and 0.4 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.

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 longwall 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:

- 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

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 Modification longwall panels (Longwalls 9 and 10) 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 4.9 for:

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

For completeness, Section 4.10 discusses potential impacts of the Modification on greenhouse gas emissions plus hazards and risk.

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.

North Wambo Creek Subsidence Response Strategy

A North Wambo Creek Subsidence Response Strategy (WCPL, 2010h) for Wambo has been developed as a component of the Surface and Groundwater Response Plan (WCPL, 2010g). The North Wambo Creek Subsidence Response Strategy (WCPL, 2010h) describes subsidence management and monitoring for North Wambo Creek associated with the North Wambo Underground Mine.

The North Wambo Creek Subsidence Response Strategy is currently being revised to incorporate management and monitoring associated with Longwalls 7 and 8 at the approved North Wambo Underground Mine.

4.2.2 Environmental Review

A revised cumulative Subsidence Assessment, including the Modification, has been prepared by Mine Subsidence Engineering Consultants (MSEC) (2012) and is presented in Appendix A.

The Subsidence Assessment:

- identifies the natural and built features located above and in the vicinity of the Modification longwall panels (Longwalls 9 and 10);
- provides subsidence predictions for the approved and proposed longwalls in the Wambo Seam (the North Wambo Underground Mine) and the future longwalls in the Arrowfield and Bowfield Seams;
- compares the subsidence predictions with the approved mining layout in the Wambo, Arrowfield and Bowfield Seams; and
- assesses the likely subsidence impacts on natural and built features, in consideration of the cumulative subsidence effects.

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 is 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 over-predict 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 are generally conservative) (Appendix A).

Since the potential subsidence effects for the North Wambo Underground Mine were predicted in the *Wambo Development Project – Wambo Seam Underground Mine Modification Statement of Environmental Effects* (WCPL, 2005), more detailed multi-seam monitoring data has been gathered from the NSW Coalfields, including at the North Wambo Underground Mine (Appendix A).

Therefore, the predicted subsidence effects for the approved and modified mining layout 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 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 55 to 95 m above the Modification longwall panels. The extraction of the Modification longwall panels would result in some reactivation of these workings.

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 Modification longwall panels (Longwalls 9 and 10).

Table 2
Comparison of Predicted Systematic Subsidence 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
Modification Longwall Panels (Wambo Seam Only)	*2,600*	*50*	*2.0*	*2.0*
Modified Mining Layout (Wambo, Arrowfield and Bowfield Seams)	7,900	90	3.0	3.0

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

The maximum predicted total vertical subsidence for the modified layout is similar to but slightly greater (i.e. 4 %) than that predicted 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 layout are similar to those predicted based on the approved layout using the calibrated Incremental Profile Method (Appendix A).

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 Modification longwall panels 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) do not expect that there would be an 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.

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 Modification longwall panels 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 assessed 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 Modification longwall panels could 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 Modification longwall panels 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 Modification longwall panels 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.

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 Environment Protection Licence requirements.
Wollemi National Park	Negligible impact.[1]
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.

[1] The Subsidence Impact Performance Measure is proposed to be modified from "nil impact" to "negligible impact" for consistency with recent determinations by the Planning Assessment Commission.

Wollombi Brook is located 450 m east of Longwall 10, at its closest point to the Modification longwall panel. At this distance, Wollombi Brook is not expected to experience any measurable tilts, curvatures or strains.

The extent of the Modification longwall panels (i.e. 450 m east of Wollombi Brook at the closest point) is outside of the subsidence exclusion zone related to Wollombi Brook by more than 300 m. As noted above, the extent of the subsidence exclusion zone related to Wollombi Brook is defined by an angle of 26.5^{o} from the vertical to a 40 m buffer from the Wollombi Brook highbank.

North Wambo Creek and Wambo Creek (also known as South Wambo Creek) are located outside the extent of the Modification longwall panels. These creeks are not expected to experience any measurable tilts, curvatures or strains resulting from the extraction of the Modification longwall panels (Appendix A).

Stony Creek is also located outside the extents of the Modification longwall panels, but it is situated immediately adjacent to the southern corner of the proposed Longwall 10. Stony Creek could experience small additional subsidence in the vicinity of the proposed longwalls, however, this is negligible when compared with the total subsidence where the creek is located directly above the longwalls in the Wambo, Arrowfield and Bowfield Seams further upstream (Appendix A).

Alluvial Aquifers

The predicted incremental 20 mm subsidence contour due to the extraction of the Modification longwall panels is located well outside the estimated limit of alluvium for Wollombi Brook (Figure 8). Therefore, it is unlikely that the Wollombi Brook alluvium would be adversely impacted as a result of the extraction of the Modification longwall panels.

Alluvium associated with North Wambo Creek and Stony Creek is located in the vicinity of the Modification longwall panels (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 1 km west of the Modification longwall panels 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 'nil impact' for the Wollemi National Park.

MSEC (Appendix A) identified no natural steep slopes within the extent of systematic subsidence from the Modification longwall panels (i.e. natural grades were less than 1 in 3). Surface grades are locally greater than 1 in 3 in some locations, such as the walls of the farm dams and water storage dam and the banks of the creeks (Appendix A), however these areas are small and localised.

MSEC identified some minor and isolated rock outcropping in the vicinity of the Modification longwall panels, primarily along the alignments of the drainage lines. 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

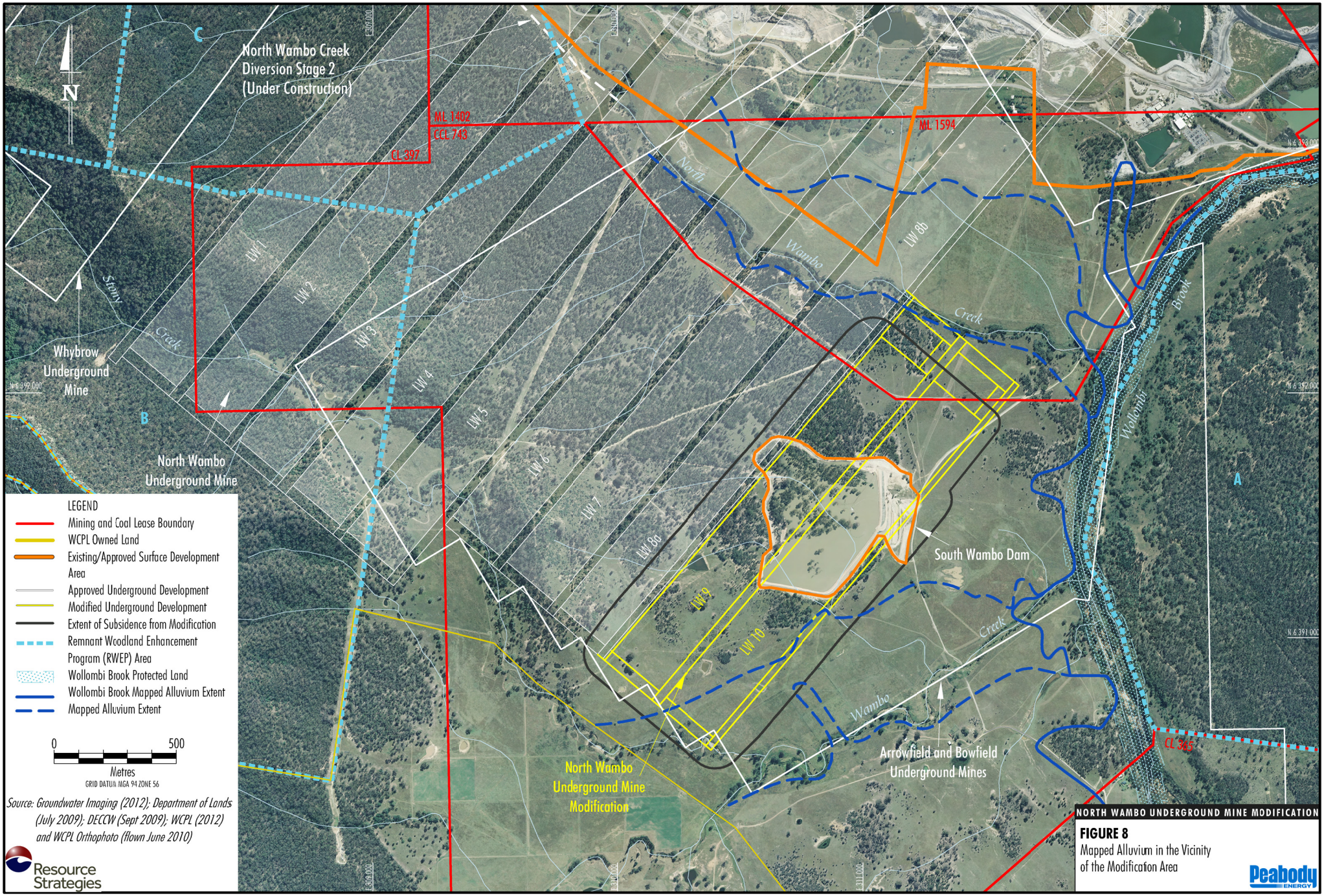
A number of Aboriginal cultural heritage items, including artefact scatters, isolated finds and a possible scar tree have been identified in the vicinity of the Modification longwall panels. Potential consequences on Aboriginal cultural heritage items as a result of subsidence impacts are described in Section 4.6 and Appendix C.

Non-Aboriginal Heritage

There is predicted to be no measureable subsidence from the Modification longwall panels in the curtilage of the Wambo Homestead Complex (WHC), however the main headings for the Modification longwall panel are within the curtilage area. This is discussed further in Section 4.7.

Threatened Ecological Communities

Potential consequences on threatened ecological communities as a result of subsidence impacts are discussed in Section 4.8 and Appendix D.



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Infrastructure and Improvements

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

- South Wambo Dam, a prescribed dam owned and operated by WCPL;
- electricity transmission lines, including WCPL and Ausgrid 11 kilovolt powerlines;
- unsealed roads and tracks, and a right of way in favour of two 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 of WCPL-owned land;
- exploration boreholes; and
- survey control marks.

WCPL would develop management strategies for the South Wambo Dam as part of the Extraction Plan process, which could include lowering the water level or completely draining the dam prior to directly mining beneath it. These management strategies would be developed in consultation with the Dams Safety Committee.

The Subsidence Assessment indicates that the predicted levels of impact on the other infrastructure and improvements can be managed through the preparation and implementation of the 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 Modification longwall panels 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 develop management strategies to mitigate any such safety risks so that there would be no additional risk to public safety as part of the Extraction Plan process.

Mitigation Measures, Management and Monitoring

An Extraction Plan would be prepared prior to the commencement of second workings in the Modification longwall panels 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, non-Aboriginal cultural heritage, flora and fauna are described in Sections 4.3 to 4.9.

The North Wambo Creek Subsidence Response Strategy would be reviewed, and if necessary, revised to include the Modification as part of the Extraction Plan process.

Infrastructure and Improvements

As described above, WCPL owns the majority of infrastructure and improvements potentially affected by the Modification longwall panels.

Measures to manage the impacts of subsidence on surface infrastructure would be developed in consultation with other infrastructure owners 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 Modification longwall panels would include a Public Safety Management Plan as required under Condition 22C(g), Schedule 4 of the Development Consent (DA 305-7-2003). The Public Safety Management Plan would include 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

Wambo is located in the Upper Hunter Valley region where landforms are characterised by gently sloping flood plains 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 Modification longwall panel area range from approximately 65 m AHD at North Wambo Creek to approximately 85 m AHD on low hills along the south-western boundary.

Land Use

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

The Modification longwall panel area is wholly located on WCPL-owned land and land use includes cleared grazing land (rain-fed unimproved pasture) (Appendix F) and patches of remnant native woodland.

Soils

An Agricultural Resource Assessment was undertaken for the Modification by McKenzie Soil Management (2012) and is included as Appendix F.

The soil types mapped in the Modification longwall panel area comprise Stratic Rudosol, Grey Kandosol, Brown Kandosol, Red Kandosol, Brown Sodosol and Brown-Orthic Tenosol (Appendix F).

Soil Condition

A broad range of physical and chemical soil constraints for agricultural land use were identified in the Modification longwall panel area including (Appendix F):

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

Rural Land Capability and Agricultural Suitability

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 regional Rural Land Capability and Agricultural Suitability mapping is documented in Appendix F.

Agricultural Activities and Productivity

Agricultural activities known to have been conducted in the Modification longwall panel area include beef cattle production on rain-fed unimproved pasture. There was no evidence of crop production or vineyards in the Modification longwall panel area (Appendix F).

The Modification longwall panel area is not considered to be highly productive agriculture land given the serious soil limitations for plant growth and the nature of agricultural activities conducted (Appendix F).

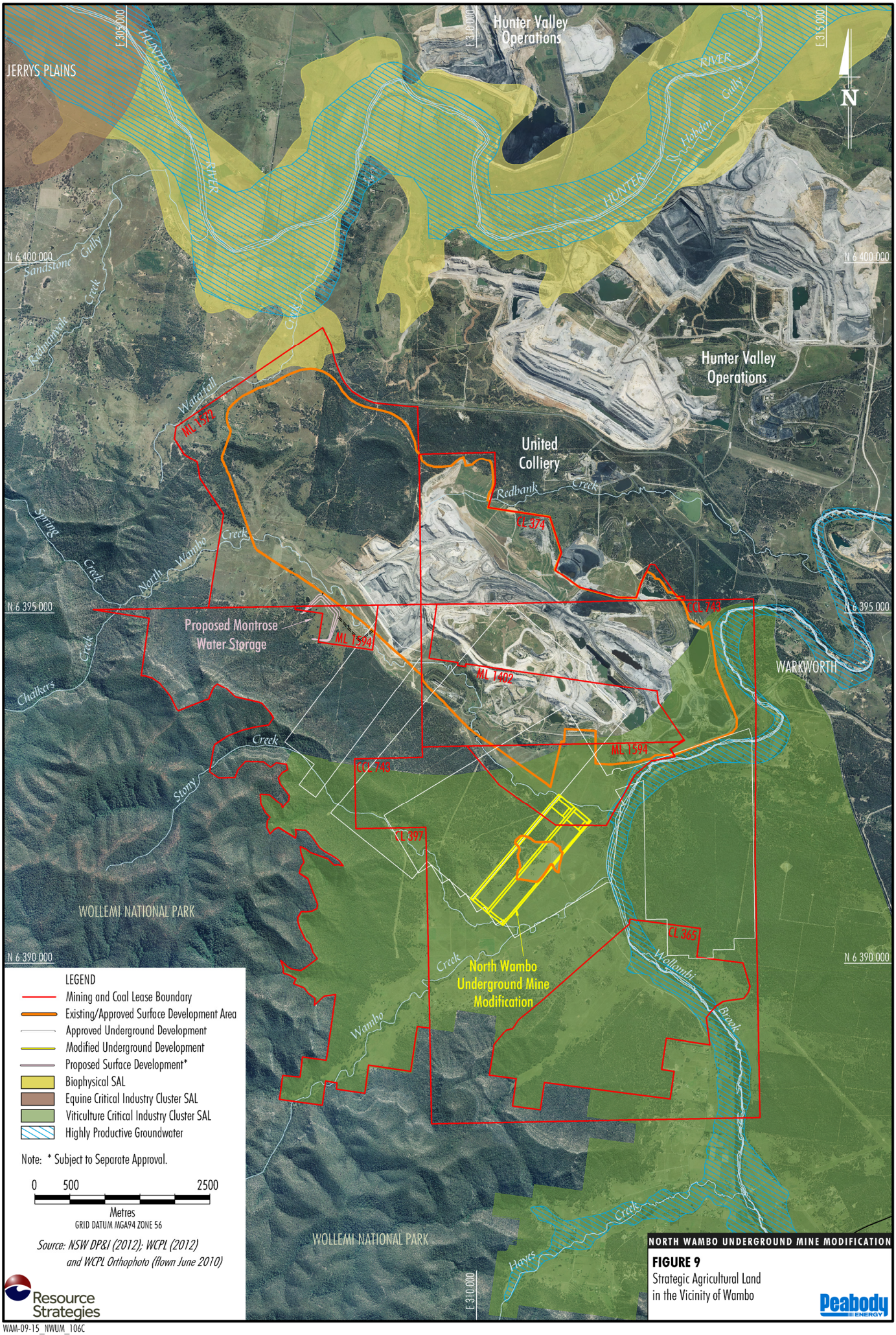
Strategic Agricultural Lands

The *Upper Hunter Strategic Regional Land Use Plan* (Upper Hunter SRLUP) (NSW Government, 2012a) includes mapping of lands identified as Biophysical Strategic Agricultural Land (BSAL). Figure 9 shows BSAL mapped in the vicinity of Wambo.

BSAL is classified as land with reliable water of suitable quality, and:

- a soil fertility of ‘high’ or ‘moderately high’ (Draft Inherent General Fertility of NSW) and Land and Soil Capability Classes I, II or III; or
- a soil fertility of ‘moderate’ (Draft Inherent General Fertility of NSW) and Land and Soil Capability Classes I or II.

The closest mapped BSAL in the Upper Hunter SRLUP is associated with the Hunter River and is located approximately 7 km to the north-west of the Modification longwall panels (Figure 9) (Appendix F).



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McKenzie Soil Management completed an assessment of the Modification longwall panel area and determined that the area did not meet the BSAL criteria outlined in the Upper Hunter SRLUP (Appendix F).

The Upper Hunter SRLUP also includes mapping of lands identified as Viticulture and Equine Critical Industry Clusters (Figure 9).

The Modification longwall panel area is located within a mapped Viticulture Critical Industry Cluster (Figure 9), however there was no evidence of viticulture in the Modification longwall panel area (Appendix F). The closest Equine Critical Industry Cluster is located approximately 12 km to the north-west of the Modification longwall panels (Figure 9) (Appendix F).

4.3.2 Environmental Review

Potential Impacts

Potential land resource impacts as a result of the Modification would be limited to potential impacts associated with mine subsidence (Section 4.2) and minor and temporary disturbance associated with dewatering bores.

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, and with the implementation of management measures described below, McKenzie Soil Management considers that there would be no significant change to the long-term agricultural productivity of the Modification area (Appendix F).

As described in Section 4.3.1, the Modification longwall panel 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, 2010f).

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 planting) 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 from the extraction of the Modification longwall panels would be detailed in 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).

The Extraction Plan may include 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; and
- monitoring of farm dams and implementation of mitigation measures where it presents a risk to people, livestock and/or the environment.

The Modification longwall area would be rehabilitated as per the approved underground mining areas at Wambo (Section 3.9). The rehabilitation principles for land disturbance areas are described 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 aquifer 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 mining operations. Monitoring bores screened within alluvium associated with North Wambo Creek show a punctuated decline in water levels associated with longwall extraction, followed by recovery of water levels within 12 months (Appendix B).

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 Review.

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 and includes the North Wambo Creek Subsidence Response Strategy (WCPL, 2010h).

The North Wambo Creek Subsidence Response Strategy is currently being revised to incorporate management and monitoring associated with Longwalls 7 and 8 at the approved North Wambo Underground Mine.

4.4.2 Environmental Review

A cumulative Groundwater Assessment, including the Modification, has been prepared by Heritage Computing (2012) 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.

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 Modification longwall panels resulting in changes in bulk rock mass permeability and storage capacity; and
- dewatering of groundwater that enters the underground mining area as a result of the above.

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

Groundwater Inflows

The Modification would add about 0.2 megalitres per day to peak inflow rates predicted for the currently approved mine plan, resulting in a peak inflow rate of approximately 1.7 megalitres per day at the completion of the North Wambo Underground Mine (Appendix B).

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 impacts of the Modification on the North Wambo Creek alluvium are predicted to be limited to the area where alluvium is present overlying the Modification longwall panels (Appendix B). Heritage Computing (Appendix B) predicts a maximum additional localised drawdown of less than 0.5 m in the alluvium.

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, Wambo Creek and Stony Creek.

Groundwater Users

Heritage Computing (Appendix B) predicted that no privately owned registered bores in alluvium or regolith would incur more than 0.1 m incremental drawdown due to the Modification.

In addition, no privately owned registered bores in Triassic Sandstone and Permian overburden would incur more than 1 m incremental drawdown due to the Modification (Appendix B).

Aquifer Interference Policy

An assessment of the Modification against the *Aquifer Interference Policy* (NSW Government, 2012b) is provided in Attachment 2. 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 operations and the Modification.

Mitigation Measures, Management and Monitoring

Alluvial Aquifers

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

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

In addition, the North Wambo Creek Subsidence Response Strategy (WCPL, 2010h) would be reviewed, and if necessary, revised to include the Modification (subject to Development Consent conditions).

Permian Aquifers

Given the lack of licensed water supply bores within the Permian coal measures and the generally poor water quality, no specific groundwater impact management measures are proposed for the Permian aquifer system.

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

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 WCPL 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, 2007b).

Site Water Management and Monitoring

A summary of the existing site water management is provided in Sections 2.9. As described in Section 2.9, WCPL annually reviews the site water balance for Wambo and reports the results of this review in the Annual Review.

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

The Erosion and Sediment Control Plan (WCPL, 2010f) 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, 2010f) 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 (Figure 6) and stream flow is measured at the surface water flow monitoring sites (Figure 6) during flow events.

4.5.2 Environmental Review

Potential Impacts

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 remained unchanged.

The Groundwater Assessment predicted that the Modification would add approximately 0.2 megalitres per day to peak inflow rates predicted for the currently approved mine plan (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, Wambo Creek and Stony Creek.

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.

Erosion and Sedimentation

The Modification is not expected to materially alter erosion and sediment control requirements.

Potential erosion and sedimentation impacts related to subsidence are described in Section 4.3.2.

Mitigation Measures, Management and Monitoring

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 Review 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.

Erosion and Sedimentation

Erosion and sediment management at Wambo would continue to be conducted in accordance with the Erosion and Sediment Control Plan.

Mitigation measures and monitoring relevant to subsidence-related erosion and sediment control impacts are described in Section 4.3.2.

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 longwall panel 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 subsidence from the Modification). White (2003) identified a large number of artefact scatters and isolated finds in the area, together with evidence of raw materials for making stone tools, ochre and an abundant supply of fauna and flora, all of which would have been useful resources.

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 (Appendix C).

The results of other archaeological studies undertaken in the area show that the north-eastern bank of North Wambo Creek has a higher density of artefact scatters and isolated finds than the south-western bank (Appendix C). As such, the north-eastern area appears to have been more densely occupied or used in the past than the south-western area (Appendix C). The Modification longwall panel area is located on the south-western side of North Wambo Creek.

Aboriginal Cultural Heritage Management

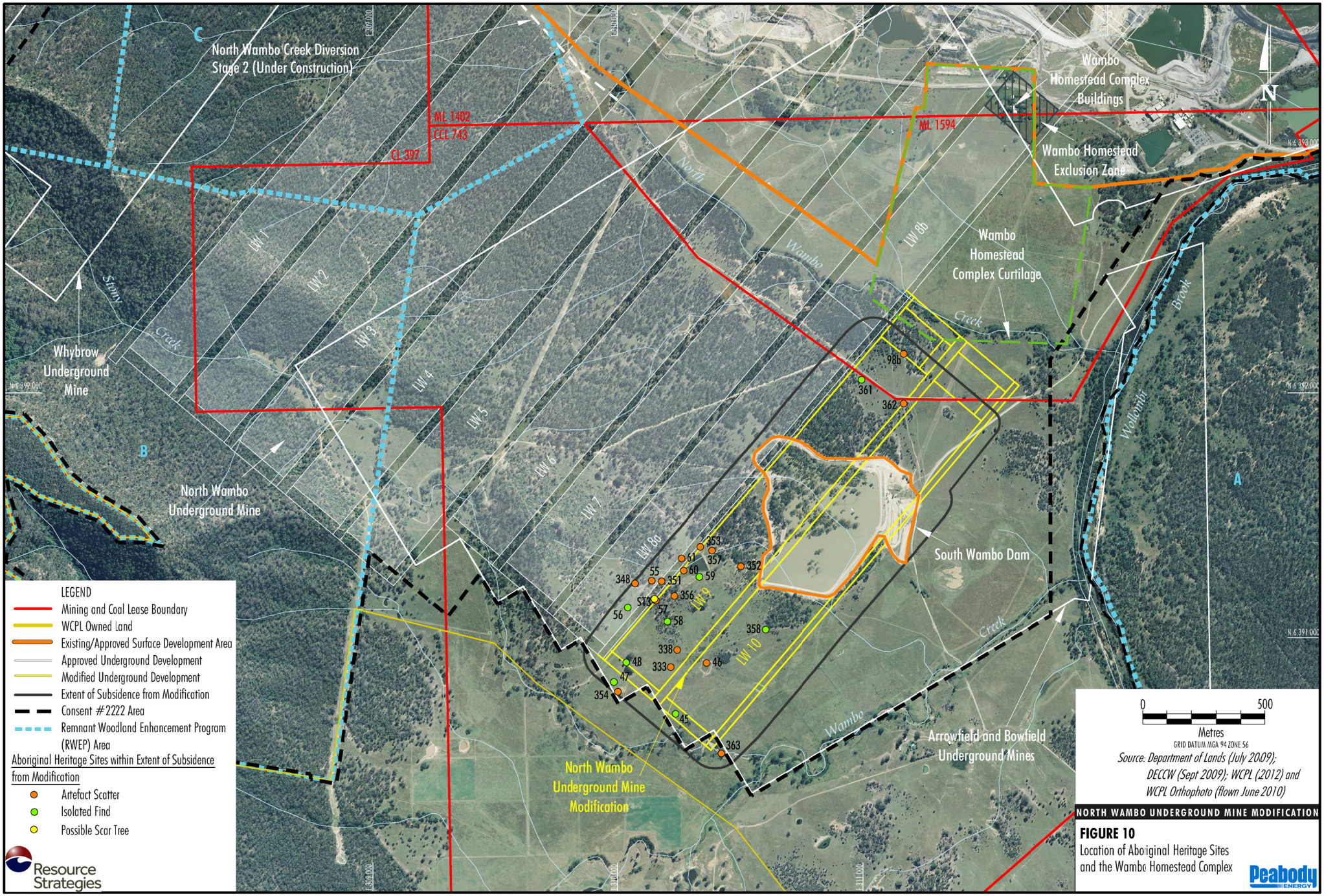
Management of Aboriginal cultural heritage at Wambo is currently conducted in accordance with Consent No. 2222 under section 90 of the *National Parks and Wildlife Act, 1974*.

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

4.6.2 Environmental Review

A Cultural Heritage Impact Assessment was prepared for the Modification by RPS Australia Asia Pacific (RPS) (2012) and is presented in Appendix C.

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 C).



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Assessment Programme

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

- prior fieldwork and previous studies;
- search results from the OEH Aboriginal Heritage Information Management System (AHIMS);
- the results of a preliminary archaeological survey of the extent of subsidence from the Modification conducted in May 2011; and
- the results of an archaeological and cultural survey of the extent of subsidence from the Modification conducted by archaeologists and representatives of the Aboriginal community in July 2011, August 2011 and April 2012 (Appendix C).

The Cultural Heritage Impact Assessment included consultation with 31 registered Aboriginal stakeholder groups (Appendix C). Participation in the field surveys was in accordance with the established Wambo field roster system (Appendix C).

Survey Design

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

The survey methodology focused on landforms associated with previously identified sites, exposed ground surfaces and targeted the various landforms and vegetated areas within the Modification longwall panel area (Appendix C).

Archaeological Findings

Sixteen previously unrecorded Aboriginal cultural heritage sites were identified by the surveys conducted for the Modification, including 13 sites within the extent of subsidence from the Modification (Appendix C).

When considered with previously recorded sites, there have been 26 sites recorded within the extent of subsidence from the Modification, including (Figure 10):

- one artefact scatter that has been previously relocated for the construction of South Wambo Dam;
- 16 other artefact scatters;
- eight isolated finds; and
- one possible scar tree.

A detailed description of these sites is provided in Appendix C.

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 C) concluded that all of the sites within the extent of subsidence from the Modification have low archaeological significance, with the exception of the following two sites in close proximity that are considered to have moderate local significance:

- Wambo Site 57 (37-5-0300), which is an artefact scatter with a number of formal tools; and
- Wambo Site 360 (ST3), which is a possible scar tree.

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

- the isolated finds and artefact scatters are considered of cultural significance in relation to the other sites in the Stony Creek area;
- 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, other than three isolated finds; and
- the possible scar tree Wambo Site 360 (ST3) is considered to be culturally significant and a good example of the method used for extracting bark from such trees.

Potential Impacts

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

- direct disturbance (e.g. due to vehicular movements or subsidence remediation activities); and
- subsidence impacts from the extraction of the Modification longwall panels.

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, minor subsidence remediation works and the construction of dewatering bores (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. Dewatering bores would be located such that they would not disturb any known Aboriginal heritage sites (Section 3.1).

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 extent of subsidence from the Modification 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 C.

Based upon the subsidence predictions, RPS (Appendix C) concluded that the whole of surface movement and potential soil cracking has the propensity for minor to moderate impacts to Aboriginal cultural heritage to occur in some parts of the Modification area.

The overall risk from all historic and approved subsidence is therefore assessed as low to moderate (Appendix C). However, when the historic and approved subsidence impacts are considered, RPS concluded that the incremental subsidence from the Modification would result in a negligible to low additional risk (Appendix C).

The registered Aboriginal parties who participated in the field surveys inspected a number of trees with a similar girth and of similar type to the possible scar tree (Wambo Site 360 [ST3]) in an adjacent area which had been previously undermined by longwall mining and found that the previously undermined trees had not been adversely affected. The Aboriginal stakeholders present concluded that if the predicted subsidence is similar to that experienced in the other underground mining area then the tree should be left *in situ* and that regular monitoring of the site should be undertaken to monitor health of the tree (Appendix C).

RPS (Appendix C) 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 C).

As described above, regular monitoring of the possible scar tree Wambo Site 360 (ST3) would be undertaken to monitor health of the tree (Appendix C). This monitoring would be outlined in the Extraction Plan for the Modification longwall panels.

Consistent with current site procedures, if any previously unrecorded Aboriginal sites are identified during the course of the Modification, surface 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 surface works recommencing in that area.

The current induction program is regularly reviewed and updated to ensure that staff are aware of statutory obligations for heritage protection.

As described in Section 4.6.1, the existing Consent No. 2222 covers the vast majority of the Modification longwall panel area (Figure 10). WCPL would apply for the existing Consent to be slightly expanded or would apply for a new Aboriginal Heritage Impact Permit to cover the additional areas.

4.7 NON-ABORIGINAL CULTURAL HERITAGE

4.7.1 Background

EJE Town Planning assessed the potential non-Aboriginal impacts of Wambo in 2003 (EJE Town Planning, 2003). The assessment included surveys of lands in the vicinity of Wambo and an assessment of the heritage significance of sites identified during these surveys.

The assessment identified the Wambo Homestead Complex (WHC) as the only item of non-Aboriginal heritage significance within the vicinity of the approved North Wambo Underground Mine (EJE Town Planning, 2003).

The heritage value of the WHC was assessed in 1994 and the WHC was subsequently listed on the State Heritage Register of NSW accompanied by the following Statement of Significance:

> *Wambo Homestead is highly significant in the context of Australian pastoral activities and horse breeding in New South Wales. The use of Wambo relates directly to the economic climate and resource based needs of the Colony and State. It is an important group of homestead buildings which remain substantially intact and display the progressive architectural development of a typical Australian homestead.*

The heritage status of the WHC has diminished since it was listed on the State Heritage Register of NSW due to changes in the physical surrounds and setting of the WHC (WCPL, 2003).

WCPL have developed a Wambo Homestead Complex Mine Management Plan (Godden Mackay Logan, 2012) which demonstrates that the underground mining at the approved North Wambo Underground Mine (Longwalls 1 to 8) would not have adverse heritage impacts on the WHC due to land subsidence, with appropriate mine designs in place. The Mine Management Plan also includes mitigation measures, management and monitoring for the WHC.

4.7.2 Environmental Review

A Cultural Heritage Impact Assessment was prepared for the Modification by RPS (2012) and is presented in Appendix C.

Research of the various heritage databases identified no other items of heritage significance in the vicinity of the Modification area in addition to the WHC (Appendix C).

Potential Impacts

The main headings for the Modification longwall panels are located within the curtilage of the WHC (Figure 10). These main headings would be designed to be stable and non-subsiding and are far removed from the WHC buildings.

The Modification would not include secondary extraction within the curtilage of the WHC.

There is predicted to be no measureable subsidence from the Modification longwall panels in the curtilage of the WHC and there is expected to be no impact on heritage values as a result of the Modification.

Mitigation Measures, Management and Monitoring

In accordance with Condition 57, Schedule 4 of the Development Consent (DA 305-7-2003), WCPL would lodge an application under section 60 of the *Heritage Act, 1977* to develop the main headings for the Modification longwall panels.

Given that there would be no measureable subsidence within the WHC curtilage, WCPL considers that no specific mitigation measures, management or monitoring of the WHC buildings is required for the Modification.

Consistent with current site procedures, if any new significant European cultural heritage material is uncovered during the course of the Modification, surface work would cease in that area until an appropriate management strategy has been developed.

4.8 FLORA

4.8.1 Background

A flora survey and assessment was conducted by Orchid Research (2003) for Wambo 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, South Wambo Creek, Stony Creek and Wollombi Brook and 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 associate within many other species. Other dominant tree species include Spotted Gum (*Corymbia maculata*), 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, 2010b) for Wambo was established in 2005 and includes a vegetation clearance protocol, threatened species management protocol, RWEP management measures, rehabilitation programme and rehabilitation and RWEP monitoring programmes.

4.8.2 Environmental Review

A Flora Assessment was prepared for the Modification by FloraSearch (2012) and is presented in Appendix D. The impact of the Modification on threatened flora was assessed in consideration of the *Threatened Species Assessment Guidelines: The Assessment of Significance* (NSW Department of Environment and Climate Change [DECC], 2007).

Baseline Flora Surveys

Baseline flora surveys were conducted in the Modification longwall panel area and surrounds over 4 days in the periods 8 to 10 June and 26 September 2011.

The vegetation was systematically surveyed using quadrats, spot sampling and random meanders. Targeted searches for threatened flora species and other plant species of conservation significance were conducted in areas of suitable habitat as part of the field surveys. The location of spot and quadrat sampling sites are shown in Appendix D.

As a component of the baseline flora surveys, a number of reference sources including previous relevant flora surveys, database records (e.g. Atlas of NSW Wildlife and Royal Botanic Gardens, Domain Trust, Forests NSW and the Australian Museum database records) and other scientific studies and literature were reviewed, and where appropriate, included in the assessment of existing vegetation.

Vegetation Communities

A total of six vegetation communities have been mapped within the extent of subsidence from the Modification (Figure 11 and Table 4). A detailed description of these vegetation communities is provided in Appendix D. Appendix D also provides a description of the other vegetation communities recorded outside of the extent of subsidence from the Modification during the baseline flora surveys.

Condition of Vegetation

The condition of the native vegetation across the Modification longwall panel area varies considerably.

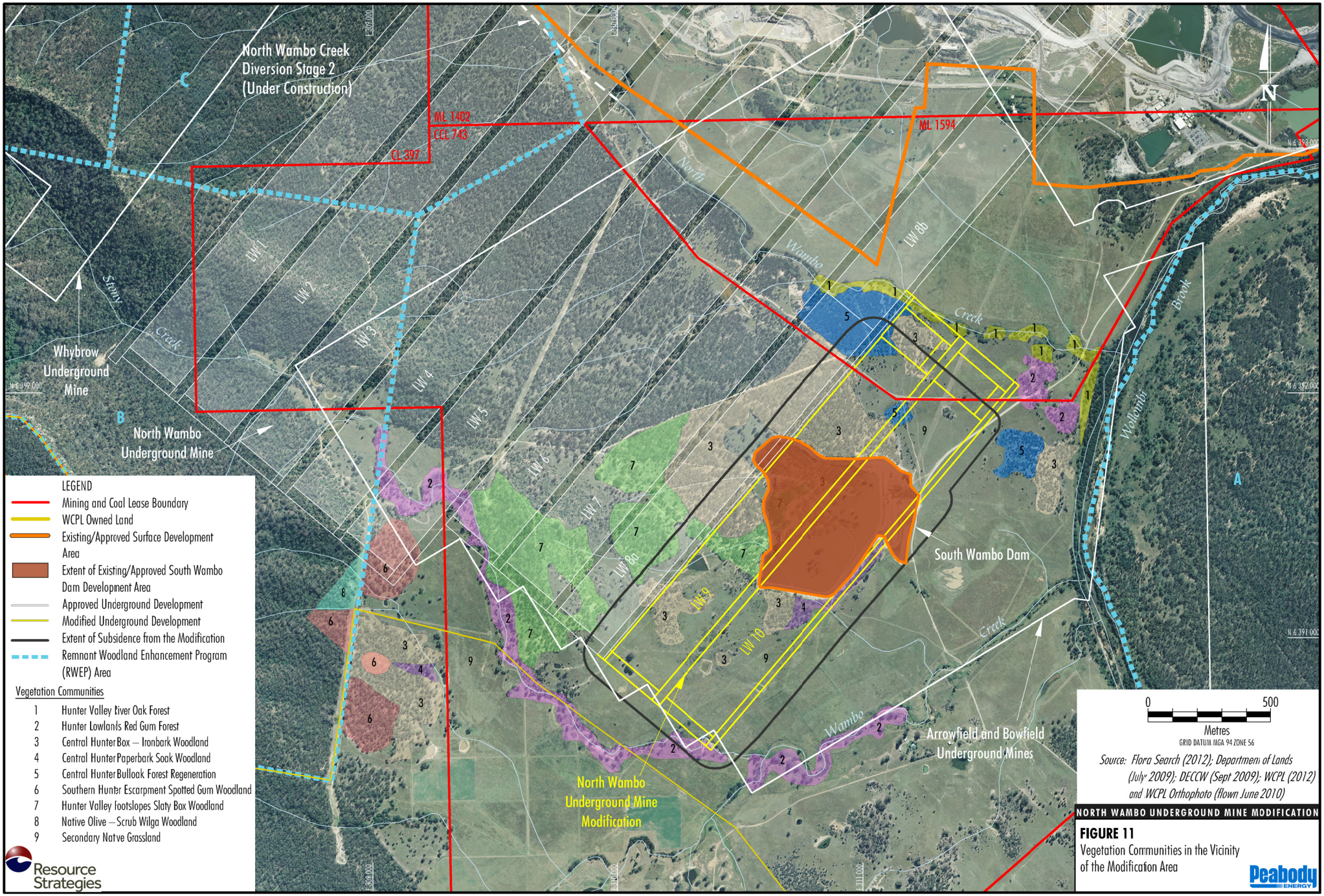
North Wambo Creek Diversion Stage 2 (Under Construction)
ML 1402
CCL 748
CL 397
ML 1594
Whybrow Underground Mine
North Wambo Underground Mine
South Wambo Dam
North Wambo Underground Mine Modification
Arrowfield and Bowfield Underground Mines
LW1
LW2
LW3
LW4
LW5
LW6
LW7
LW8a
LW8
LW8b
LW10
LW11
Stony Creek
North Wambo Creek
Wollombi Brook
A
B
C
LEGEND
Mining and Coal Lease Boundary
WCPL Owned Land
Existing/Approved Surface Development Area
Extent of Existing/Approved South Wambo Dam Development Area
Approved Underground Development
Modified Underground Development
Extent of Subsidence from the Modification
Remnant Woodland Enhancement Program (RWEP) Area
Vegetation Communities
1 Hunter Valley River Oak Forest
2 Hunter Lowlands Red Gum Forest
3 Central Hunter Box – Ironbark Woodland
4 Central Hunter Paperbark Soak Woodland
5 Central Hunter Bullock Forest Regeneration
6 Southern Hunter Escarpment Spotted Gum Woodland
7 Hunter Valley footslopes Slaty Box Woodland
8 Native Olive – Scrub Wilga Woodland
9 Secondary Native Grassland
Resource Strategies
N
0
500
Metres
GRID DATUM MGA 94 ZONE 56
Source: Flora Search (2012); Department of Lands (July 2009); DECCW (Sept 2009); WCPL (2012) and WCPL Orthophoto (flown June 2010)
NORTH WAMBO UNDERGROUND MINE MODIFICATION
FIGURE 11
Vegetation Communities in the Vicinity of the Modification Area
Peabody ENERGY
WAM-09-15_NWUM_108C

Table 4
Vegetation Communities within the Extent of Subsidence from the Modification

Community Number	Common Name	Scientific Names
2	Hunter Lowland Red Gum Forest	*Eucalyptus tereticornis – Angophora floribunda ± E. melliodora*
3	Central Hunter Box – Ironbark Woodland	*E. crebra – E. moluccana – Allocasuarina luehmannii*
4	Central Hunter Paperbark Soak Woodland	*Melaleuca decora*
5	Central Hunter Bulloak Forest Regeneration	*A. luehmannii*
7	Hunter Valley Footslopes Slaty Box Woodland	*E. dawsonii – E. moluccana – Acacia salicina*
9	Secondary Native Grassland	-

Source: After Appendix D.

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 D). 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 D).

The vegetation within the incised watercourses of North Wambo Creek and Stony Creek comprises a mix of native and introduced species. Overall, the riparian vegetation on the study area is considered to be in poor condition (Appendix D).

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 D).

Threatened Flora Populations

No threatened flora populations were recorded during the targeted searches or other sampling conducted within the Modification area and surrounds (Appendix D).

Threatened Ecological Communities

Three threatened ecological communities listed as under the TSC Act were recorded during the recent survey within the extent of subsidence from the Modification, 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 these threatened ecological communities is provided in Appendix D.

No threatened ecological communities listed under the EPBC Act occur within the extent of subsidence from the Modification (Appendix D).

Potential Impacts

Dewatering bores would be located within already cleared farmland and would not impact remnant native vegetation (Section 3.1).

Therefore, potential flora impacts of the Modification would primarily be associated with subsidence impacts from the extraction of the Modification longwall panels.

FloraSearch (Appendix D) concluded that it is unlikely vegetation within the extent of subsidence from the Modification 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 D).

In addition, FloraSearch (Appendix D) 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 at Wambo would continue to be conducted in accordance with the Flora and Fauna Management Plan (WCPL, 2010a).

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

4.9 FAUNA

4.9.1 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 E).

A total of 24 threatened fauna species have been previously recorded in the vicinity of Wambo, including 16 birds and 8 mammals (Table 5) (Mount King Ecological Surveys, 2003; Greg Richards and Associates, 2003; HLA-Envirosciences Pty Limited, 2007; RPS Harpers Somers O'Sullivan, 2007, 2008, 2009; Biosphere Environmental Consultants, 2011).

4.9.2 Environmental Review

A Fauna Assessment was prepared for the Modification by Niche Environment and Heritage (Niche) (2012) and is presented in Appendix E.

Baseline Fauna Surveys

Baseline fauna surveys were conducted in the Modification longwall panel area and surrounds over 7 days in the periods 23 to 28 May 2011and 26 September 2011.

Four systematic sampling sites and additional targeted sampling sites were surveyed using a variety of methods including Elliot traps, cage traps, infrared camera traps, bat echolocation recorders, bird surveys, spotlighting, call playback and herpetological surveys, identification of faunal traces and/or opportunistic observations (Appendix E). The locations of the systematic sampling sites are shown in Appendix E.

Fauna Habitat

Habitats within the extent of subsidence from the Modification are generally in low to moderate condition, due to a lack of native species richness and the absence of older growth habitat components (Appendix E). Past land management practices have led to low densities of hollows and logs (with the exception of one or two log dumps) and there is little rocky habitat throughout the site (Appendix E).

Three broad habitat types were identified within the extent of subsidence from the Modification, namely: Regenerating Woodland; Mixed Native/Exotic Derived Grassland; and Dams and Creeklines (Appendix E). These habitat types are described further in Appendix E.

Niche (Appendix E) observed that Stony Creek was significantly degraded with significant alteration of the hydrological regime over time as a result of previous disturbance.

Native Fauna Species

A total of 98 vertebrate animal species were recorded during the field surveys comprising 68 birds, 20 mammals, six reptiles and four frogs (Appendix E).

The following threatened species were recorded by the field surveys (Appendix E):

- Brown Treecreeper (eastern subspecies);
- Speckled Warbler;

Table 5
Threatened Fauna Species Previously Recorded in the Vicinity of Wambo

Common Name	Scientific Name	Conservation Status[1]	
		TSC Act	EPBC Act
Birds			
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	-
Masked Owl	*Tyto novaehollandiae*	V	-
Powerful Owl	*Ninox strenua*	V	-
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	-
Speckled Warbler	*Pyrrholaemus saggitatus*	V	-
Painted Honeyeater	*Grantiella picta*	V	-
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	-
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-
Varied Sittella	*Daphoenositta chrysoptera*	V	-
Scarlet Robin	*Petroica boodang*	V	-
Diamond Firetail	*Stagonopleura guttata*	V	-
Mammals			
Squirrel Glider	*Petaurus norfolcensis*	V	-
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V
Yellow-bellied Sheathtailed-bat	*Saccolaimus flaviventris*	V	-
Eastern Freetail-bat	*Mormopterus norfolkensis*	V	-
Eastern Bentwing-bat	*Miniopterus australis*	V	-
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-

Source: Mount King Ecological Surveys (2003), Greg Richards and Associates (2003) and HLA-Envirosciences Pty Limited (2007), RPS Harpers Somers O'Sullivan (2007, 2008, 2009).

[1] Threatened species status under the TSC Act and EPBC Act (current as of October 2012).
E = Endangered V = Vulnerable

- Scarlet Robin;
- Grey-crowned Babbler (eastern subspecies);
- Eastern Freetail-bat; and
- Large-eared Pied Bat.

The Scarlet Robin (*Petroica boodang*) is listed as vulnerable under the TSC Act and was the only threatened species that had not been recorded by previous surveys in the Wambo area.

Introduced Fauna Species

One introduced bird and five introduced mammal species were located during the survey (Appendix E). The species included the Common Starling (*Sturnus vulgaris*), House Mouse (*Mus musculus*), Black Rat (*Rattus rattus*), Red Fox (*Vulpes vulpes*), Brown Hare (*Lepus capensis*) and Cattle (*Bos taurus*) (Appendix E).

Potential Impacts

Dewatering bores would be located within already cleared farmland and would not impact remnant native vegetation (Section 3.1). Therefore, there is expected to be little impact on fauna species or their habitats.

Niche (Appendix E) concluded that subsidence impacts from the Modification are not expected to have adverse impacts on available fauna habitats. Further, the Modification would not have any adverse impact on movement of vertebrate fauna species throughout the landscape or cause fragmentation of vegetation within the study area.

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

Mitigation Measures, Management and Monitoring

Fauna management at Wambo would continue to be conducted in accordance with the Flora and Fauna Management Plan (WCPL, 2010a).

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

4.10 OTHER ENVIRONMENTAL ASPECTS

4.10.1 Greenhouse Gas Emissions

In accordance with the *National Greenhouse Accounts Factors* (NGA Factors) (Commonwealth Department of Climate Change and Energy Efficiency [DCCEE], 2012), direct greenhouse 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, 2012) and site-specific data for fugitive emissions.

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

- combustion of diesel for underground mining operations (approximately 9.4 kilo tonnes [kt] CO_2-e) of Scope 1 and 0.7 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 45.9 kt CO_2-e of Scope 2 and 9.4kt CO_2-e of Scope 3 emissions);
- fugitive emissions from the extraction of coal (approximately 750 kt CO_2-e of Scope 1 emissions); and
- combustion of product coal produced at Wambo by third parties (approximately 5.8 Mt CO_2-e of Scope 3 emissions).

This represents approximately 1.6% of the Scope 1 and Scope 2 emissions and approximately 3.7% of the Scope 3 emissions estimated by Holmes Air Sciences (2003).

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 which minimise haul distances 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 re-use of methane gas at Wambo.

4.10.2 Hazard and Risk

A preliminary hazard analysis (PHA) was conducted in 2003 to assess the potential hazards and risks associated with Wambo. 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 Wambo 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.

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&I in March 2011 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]

[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.

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*
>
> *(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 1996* (Singleton LEP);
- *Hunter Regional Environmental Plan (Heritage) 1989* (Hunter REP [Heritage]);
- *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (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, 2012c).
- *Aquifer Interference Policy* (NSW Government, 2012b).

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 Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) to determine whether or not the action is a controlled action.

Wambo was referred to the Commonwealth Department of Environment and Heritage (now SEWPaC) 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 D and E and summarised in Sections 4.8 and 4.9. These assessments indicate that there would be no significant impact on matters of national environmental significance as a result of the Modification.

It is therefore considered that there is no need to refer the Modification to the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities.

5.3 MANAGEMENT PLANS THAT REQUIRE REVISION

The following management plans would be reviewed, and if necessary, revised to include the Modification (subject to approval of the Modification):

- Rehabilitation Management Plan;
- Life of Mine Rejects Emplacement Strategy; and
- North Wambo Creek Subsidence Response Strategy.

In addition, the site water balance would be reviewed to incorporate the Modification. The results of the site water balance review would be reported in the Annual Review in accordance with Condition 5, Schedule 6 of the Development Consent (DA-305-7-2003).

An Extraction Plan would be prepared for Longwalls 9 and 10 prior to the commencement of second workings in accordance with Condition 22C, Schedule 4 of the Development Consent (DA-305-7-2003).

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