Peabody ENERGY

SECTION 4

ENVIRONMENTAL ASSESSMENT

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4 ENVIRONMENTAL ASSESSMENT

4.1 ENVIRONMENTAL RISK ASSESSMENT

As a component of the environmental assessment of the Project, an Environmental Risk Assessment was undertaken to identify key potential environmental issues for further assessment in the EIS. The Environmental Risk Assessment workshop was conducted in January 2013, and was facilitated by a risk assessment specialist (Safe Production Solutions, 2015).

The workshop attendees included representatives from:

- WCPL;
- HydroSimulations;
- Gilbert & Associates Pty Ltd; and
- Resource Strategies.

Subsequent to the workshop, a further team review of the Environmental Risk Assessment was undertaken in 2015, including representatives from:

- WRM Water & Environment;
- Todoroski Air Sciences Pty Ltd;
- SLR Consulting; and
- Hunter Eco.

The key potential environmental issues identified during the Environmental Risk Assessment workshop are summarised in Table 4-1 and addressed in Sections 4.2 to 4.19, and the relevant appendices to this EIS.

The risks associated with the potential environmental issues identified were ranked in accordance with the frameworks detailed in Australian Standard/New Zealand Standard International Organisation for Standardisation 31000:2009 *Risk Management – Principles and Guidelines*.

Table 4-1
Summary of Key Potential Environmental Issues

Environmental Issue Subject Area	Description of Potential Issues	EIS Section/Appendix
Noise	Potential effects of operational noise emissions on surrounding private landowners (Project-specific and cumulative).	Section 4.3 and Appendix A
Air Quality	Potential effects of dust emissions on surrounding private landowners (Project-specific and cumulative), greenhouse gas emissions and potential spontaneous combustion events.	Sections 4.4, 4.6 and 4.18 and Appendix B
Blasting	Potential effects of blasting on surrounding private landowners (Project-specific and cumulative) and heritage sites.	Section 4.5 and Appendices A, G and H
Groundwater	Potential incremental impacts on aquifers and groundwater users, groundwater depressurisation effects, direct and indirect impacts on springs and alluvium.	Section 4.7 and Appendix C
Surface Water	Potential for failure or reduced effectiveness of diversions and/or water treatment facilities, reverse osmosis plant concentrate management and seepage/runoff bypassing the water management system.	Sections 4.7 and 4.8 and Appendices C and D
Rehabilitation/Closure	Incremental changes to final voids and associated post-mining water management.	Sections 4.7, 4.8 and 5 and Appendices C and D
Biodiversity	Incremental and cumulative loss of vegetation and fauna habitat, potential impact on listed threatened species and impacts of the realigned TransGrid Wollar to Wellington 330 kV ETL on ECAs.	Section 4.9 and Appendices E and F
Aboriginal Cultural Heritage	Potential incremental direct impacts on Aboriginal heritage items or areas of significance.	Section 4.10 and Appendix G
Road Transport	Increased traffic on the public road network.	Sections 4.13 and 4.14 and Appendix J
Social and Community Infrastructure	Cumulative impacts with other mining projects on community infrastructure (roads, accommodation, services).	Section 4.17 and Appendix N

Source: After Appendix P.

All of the potential issues identified were ranked within the 'Medium – As Low as Reasonably Practicable' or 'Low' range by the risk assessment team. The Environmental Risk Assessment is provided in full as Appendix P.

4.2 CLIMATE AND TOPOGRAPHY

4.2.1 Climate

Long-term meteorological data for the region is available from a range of Commonwealth Bureau of Meteorology (BoM) weather stations (Figure 4-1 and Tables 4-2 and 4-3).

Local meteorological data (from January 2006 onwards) is also available from the on-site Wilpinjong Coal Mine weather station (Figure 4-1), which is operated in accordance with Project Approval 05-0021 and EPL 12425.

The on-site weather station monitors a number of meteorological parameters, including temperature, humidity, rainfall, wind speed and wind direction.

WCPL also maintains a 60 m high temperature inversion monitoring tower for the direct measurement of temperature lapse rates at the Wilpinjong Coal Mine.

A summary of meteorological data in the vicinity of the Project relevant to the environmental studies in this EIS is provided below.

Rainfall Data and Statistics

Table 4-2 provides a summary of long-term rainfall data from regional BoM weather stations. The long-term mean annual rainfall in the vicinity of the Wilpinjong Coal Mine ranges from 587.7 to 651.5 mm, with the driest month generally being April and the wettest month being January.

Table 4-2 also provides a summary of rainfall data available from the Wilpinjong Coal Mine weather station. The mean annual rainfall recorded by the Wilpinjong Coal Mine weather station over the period of record is 649.7 mm.

Evaporation Data and Statistics

Table 4-2 shows long-term pan evaporation data from the Scone SCS weather station and Data Drill extract. The data indicates the rate of evaporation significantly exceeds rainfall on a monthly and annual-average basis.

Temperature Data and Statistics

Table 4-3 shows long-term mean temperature data from several BoM weather stations. The long-term mean temperature ranges from 8.0 to 23.1 degrees Celsius (°C).

Table 4-3 also shows the temperature range recorded at the Wilpinjong Coal Mine weather station between 2011 and 2015. The minimum temperature recorded was -2.8°C while the maximum was 41.7°C.

Temperature inversions occur in the Wilpinjong Coal Mine area, particularly during the night-time in winter months. The frequency of temperature inversions is described in the Noise and Blasting Assessment (Appendix A).

Humidity Data and Statistics

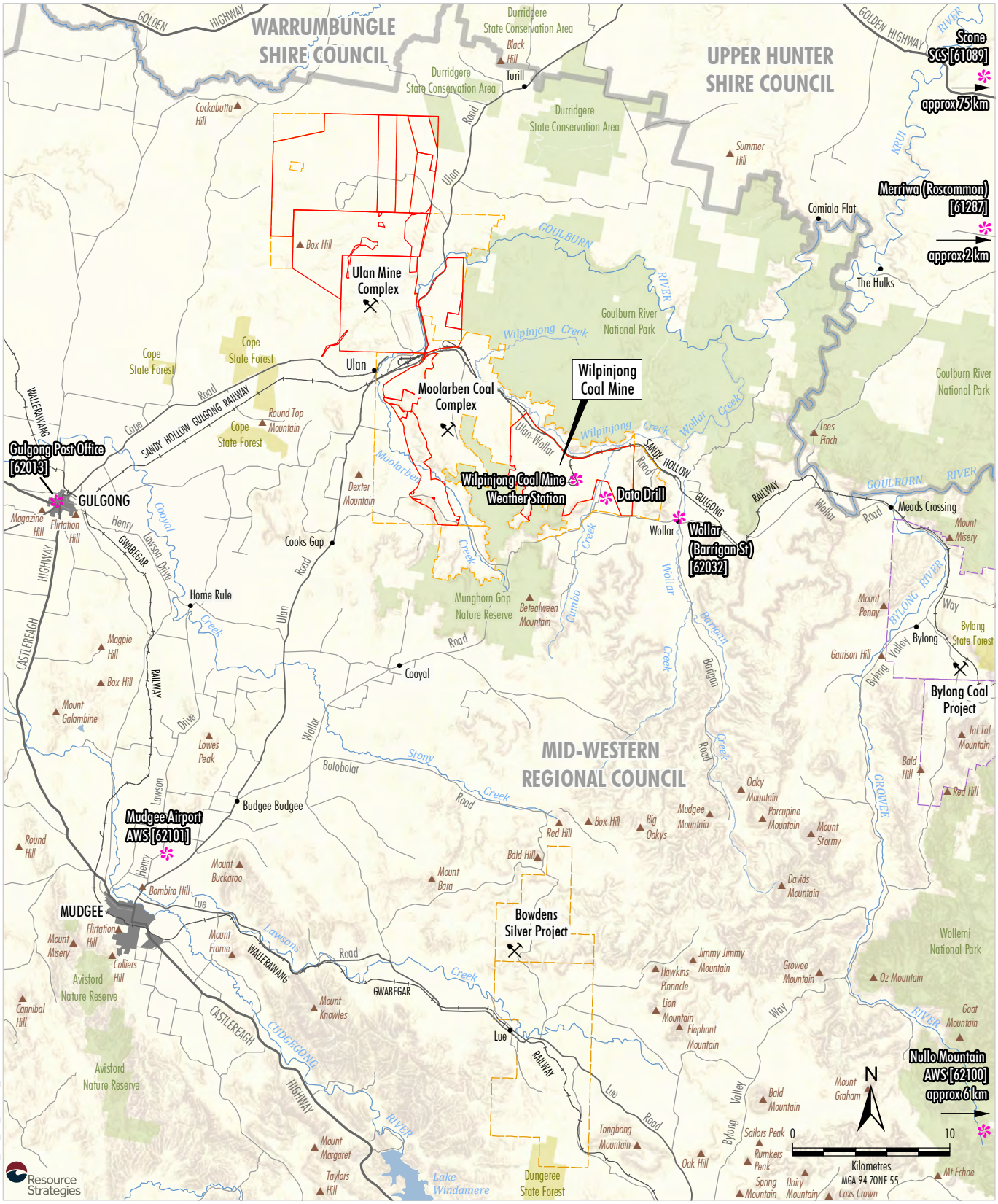
Table 4-3 shows long-term humidity data from the BoM Gulgong Post Office weather station, Mudgee Airport Automatic Weather Station (AWS) and Nullo Mountain AWS. The long-term annual mean humidity ranges from 71 to 78% at 9 am and 44 to 62% at 3 pm.

Wind Direction and Speed

As part of the Air Quality and Greenhouse Gas assessment (Appendix B), windroses were developed using wind direction and wind speed data from several weather stations in the region. The annual and seasonal windroses for the Wilpinjong Coal Mine weather station indicate that the prevailing wind directions are from the east-southeast and east, with a lesser portion of winds from the north-west quadrant with annual mean wind speeds generally between 1.5 and 4.5 metres per second (m/s) (Figure 4-2) (Appendix B).

Meteorological Monitoring

The Wilpinjong Coal Mine weather station would continue to operate for the Project. The data recorded would continue to be used as part of the noise (Section 4.3) and air quality (Section 4.4) management regimes, and to assist in the interpretation of groundwater (Section 4.7) and surface water (Section 4.8) monitoring results.



LEGEND

- Mining Lease Boundary
- Exploration Licence Boundary
- Authorisation Boundary
- Local Government Boundary
- NSW State Forest
- National Park, Nature Reserve or State Conservation Area
- Mining Operation
- Meteorological Station

Source: Bureau of Meteorology (2015); NSW Land & Property Information (2015); NSW Dept of Industry (2015); Geoscience Australia (2011)

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WILPINJONG EXTENSION PROJECT

Regional Meteorological Monitoring Sites

Figure 4-1

Table 4-2
Meteorological Data Summary – Rainfall and Pan Evaporation

Period of Record	Long-term Mean Monthly Rainfall (mm)						Short-term Mean Monthly Rainfall (mm)	Mean Monthly Pan Evaporation (mm)	
	Gulgong Post Office (62013)	Wollar (Barrigan St) (62032)	Mudgee Airport AWS (62101)	Merriwa (Roscommon) (61287)	Data Drill[1,2]	Nullo Mountain AWS (62100)	Wilpinjong Coal Mine Weather Station	Data Drill[1,2]	Scone SCS (61089)
	1881 – 2015	1901 – 2015	1994 - 2015	1969 - 2015	1889 - 2015	1994 – 2015	2006 - 2015	1969 - 2015	1965 - 2015
January	70.3	66.7	66.5	77.9	69.6	96.3	53.3	230.8	220.1
February	61.9	63.1	70.5	59.0	63.7	104.9	79.0	181.5	173.6
March	54.8	52.2	54.0	51.0	54.1	85.8	61.3	159.8	155.0
April	44.3	39.5	36.0	34.6	40.2	61.6	31.6	107.7	105.0
May	45.1	37.7	37.7	38.5	40.3	58.0	29.2	68.6	68.2
June	50.8	44.0	43.5	39.5	47.2	76.3	62.8	47.5	48.0
July	49.1	42.5	44.0	35.5	44.9	61.8	39.6	53.2	55.8
August	46.0	41.2	35.8	33.1	45.9	56.4	32.3	77.6	83.7
September	46.3	40.6	51.1	37.8	43.6	63.7	39.7	110.2	117.0
October	55.6	51.2	51.0	50.9	52.9	71.0	34.0	155.9	158.1
November	59.6	55.7	75.5	59.4	57.2	104.2	72.9	187.5	183.0
December	67.5	59.0	82.8	71.3	61.7	90.6	114.0	230.2	220.1
Annual Mean	**651.1 [651.3]**	**587.7 [593.4]**	**644.7 [647.4]**	**600.1 [588.5]**	**618 [621.3]**	**928 [930.6]**	**649.7**	**1,638 [1,638]**	**1,606 [1,587.6]**

Source: BoM (2015a) (2 October 2015); WCPL (2015e).

[ ] Sum of mean monthly records. Discrepancy with annual means is based on BoM historical records.

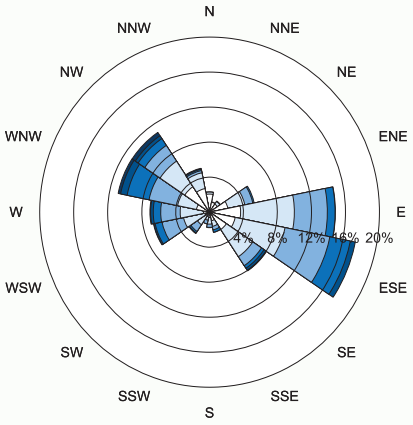
1 Data Drill located at 32.35°S, 149.9°E – located approximately 750 m west of Pit 7, in ECA-A. The Data Drill sequence is a continuous, synthetic record based on interpolation of data from nearby sites.

2 After WRM Water & Environment (2015).

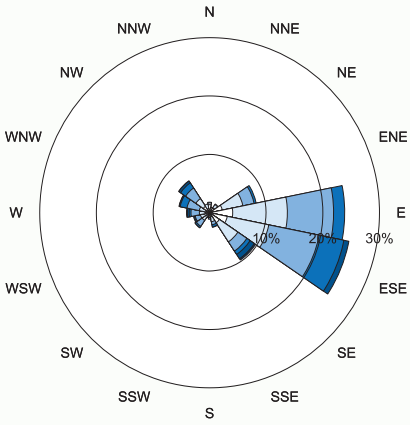
Table 4-3
Meteorological Data Summary – Temperature and Humidity

Period of Record	Long-term Mean Temperature (°C) [Min-Max]			Short-term Temperature Range (°C) [Min-Max]		Long-term Mean Humidity (%) [9.00 am, 3.00 pm]		
	Gulgong Post Office (62013)	Mudgee Airport AWS (62101)	Nullo Mountain AWS (62100)	Wilpinjong Coal Mine Weather Station	Merriwa (Roscommon) (61287)	Gulgong Post Office (62013)	Mudgee Airport AWS (62101)	Nullo Mountain AWS (62100)
	1970 – 2015	1991 – 2015	1991 - 2015	2011 - 2015	2007 – 2015	1985 - 2015	1991 - 2015	1991 - 2015
January	16.7 - 31.0	15.8 - 30.6	13.5 - 24.0	10.0 - 41.7	15.1 - 33.4	64, 37	63, 37	75, 56
February	16.3 - 29.8	15.6 - 29.1	13.2 - 22.6	10.2 - 37.7	14.5 - 31.9	71, 42	70, 42	82, 64
March	13.7 - 27.3	12.4 - 26.6	11.3 - 20. 0	6.6 - 35.8	11.4 - 29.8	71, 41	72, 42	83, 64
April	9.8 - 23.4	7.7 - 22.8	8.4 - 16.7	3.2 - 29.4	7.0 - 24.6	70, 42	71, 41	78, 62
May	6.3 - 19.1	4.0 - 18.5	5.7 - 12.8	-0.8 - 26.6	2.8 - 20.7	79, 49	80, 49	81, 68
June	3.6 - 15.5	2.3 - 14.9	3.4 - 9.7	-1.5 - 20.3	2.6 - 17.3	84, 57	87, 57	85, 74
July	2.6 -14.7	1.2 - 14.3	2.4 - 9.1	-2.8 - 20.7	1.7 - 16.8	84, 54	87, 55	84, 71
August	3.4 - 16.5	1.6 -16.3	3.0 - 10.9	-2.2 - 24.4	1.4 - 20.9	76, 46	78, 47	76, 60
September	6.1 - 19.8	4.3 - 19.6	5.6 - 14.3	-1.8 - 29.8	3.8 - 24.9	70, 44	70, 44	72, 56
October	9.2 - 23.6	7.4 - 22.9	7.8 - 17.3	2.2 - 34.8	6.5 - 28.1	61, 40	61, 41	70, 54
November	12.3 - 26.8	11.3 - 26.3	10.1 - 19.9	6.6 - 40.3	11.1 - 32.4	63, 39	63, 40	73, 58
December	14.9 - 29.7	13.5 - 28.4	11.6 - 22.1	5.9 - 38.5	11.8 - 31.8	62, 36	62, 37	73, 56
Annual Mean	**9.6 - 23.1**	**8.1 - 22.5**	**8.0 - 16.6**	**3.0 - 31.7**	**8.3 - 24.8**	**71, 44**	**72, 44**	**78, 62**

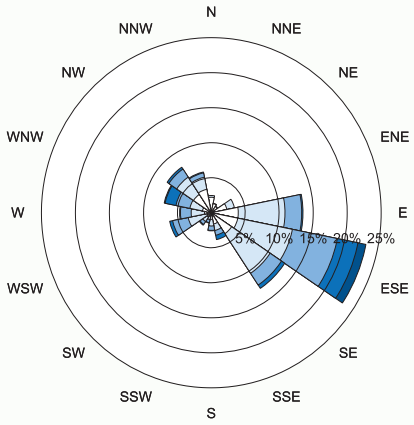
Source: BoM (2015a) (2 October 2015); WCPL (2015e).



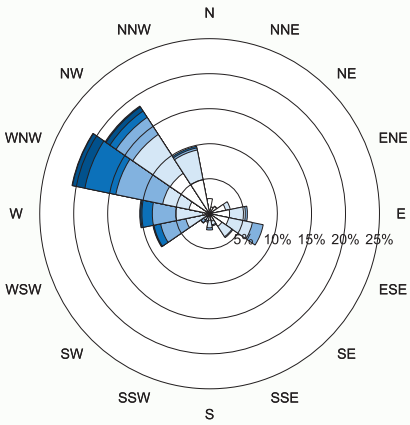
ANNUAL



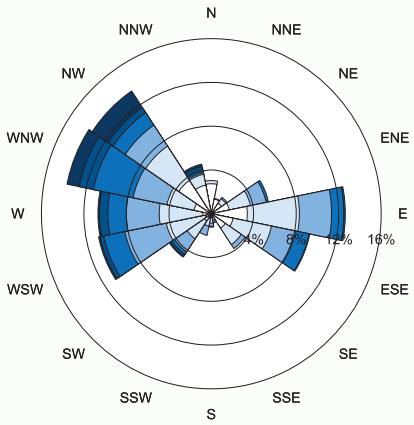
SUMMER



AUTUMN



WINTER



SPRING

WIL-12-12 WEP EIS Section 4 001B

Resource Strategies

LEGEND

Wind Speed (m/s)

- > 0 - 1.5
- > 1.5 - 3
- > 3 - 4.5
- > 4.5 - 6
- > 6 - 7.5
- > 7.5

Source: Todoroski Air Sciences (2015)

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WILPINJONG EXTENSION PROJECT

Wilpinjong Annual and Seasonal Windroses 2013

Figure 4-2

4.2.2 Landforms and Topography

Existing Environment

Landforms in the vicinity of the Project are characterised by the narrow floodplains associated with tributaries of the Goulburn River, undulating foothills, ridges and escarpments of the Great Dividing Range and the dissected landforms of the Goulburn River National Park (Plate 4-1).

Wilpinjong Creek (part of the Goulburn River Catchment) is located to the north of ML 1573, with steep timbered ridges located to the north, west and east. The Goulburn River National Park lies to the north and the Munghorn Gap Nature Reserve is located to the south (Figure 4-1).

Elevations in the vicinity of Wilpinjong Coal Mine range from approximately 350 m AHD at Wilpinjong Creek and Wollar Creek to approximately 610 m AHD on ridges to the immediate south of the Wilpinjong Coal Mine.

The development of the approved Wilpinjong Coal Mine and associated open cut mining and waste rock emplacements has resulted in alteration to the site's pre-mining topography. Modified landforms include open cut pits, an approved elevated waste rock emplacement in Pit 2, ROM pads/coal stockpiles, water management infrastructure and other infrastructure areas.

The existing/approved mine landforms of the Moolarben Coal Complex to the west of the Project will also modify the topography in the vicinity of the Project.

Potential Impacts

The Project would alter the landforms and topography within the Project open cut extension and infrastructure areas. Some topographic changes would be temporary (e.g. temporary bund/drains) and some would be permanent (e.g. final mine landforms).

The Project would increase the extent of the existing approved open cut mining areas by approximately 800 ha (Figure 1-4).

The construction of a connecting haul road to Pit 8 would also involve the development of a cutting on the northern point of the ridgeline separating Pits 3 and 8 (Figure 1-4).

Waste rock mined during the development of the Project would continue to be used to backfill the mine voids behind the advancing open cut operations, as well as being disposed of in the approved elevated waste rock emplacement in Pit 2.

At the cessation of mining three final voids would remain (Section 5.3.8).

Plate 4-1: Modified and Natural Landforms – Wilpinjong Coal Mine

These changes, while altering the layout and extent of the approved/existing Wilpinjong Coal Mine, would generally be consistent with the nature and form of the approved mine landforms.

A range of lesser topographic changes would be associated with the construction of roads, hardstands, water management and erosion and sediment control features over the life of the Project.

Further description of the proposed post-mining final landform for the Project is provided in Section 5.

An assessment of the likely visual impacts of the changes to landforms and topography associated with the Project is provided in Section 4.15 and Appendix O.

4.3 OPERATIONAL NOISE

A Noise and Blasting Assessment for the Project was undertaken by SLR Consulting (2015) and is presented in Appendix A.

The operational noise assessment was conducted in accordance with the:

- NSW *Industrial Noise Policy* (INP) (EPA, 2000); and
- *Interim Construction Noise Guideline* (DECC, 2009a).

Consideration was also given to the NSW Government (2014) *Voluntary Land Acquisition and Mitigation Policy For State Significant Mining, Petroleum and Extractive Industry Developments* (Voluntary Land Acquisition and Mitigation Policy).

The Noise and Blasting Assessment was peer reviewed by Mr Richard Heggie (Director, SLR Consulting), who concluded that the report is comprehensive, conforms to the relevant guidelines and has been undertaken in a professional manner. The peer review report is presented in Attachment 4.

Section 4.3.1 provides a description of the existing noise environment, including a description of the existing Wilpinjong Coal Mine noise management and monitoring regime. Section 4.3.2 describes the potential operational noise impacts of the Project, including cumulative impacts. Section 4.3.3 outlines mitigation measures, management and monitoring for the Project.

4.3.1 Existing Environment

Noise Management and Monitoring Regime

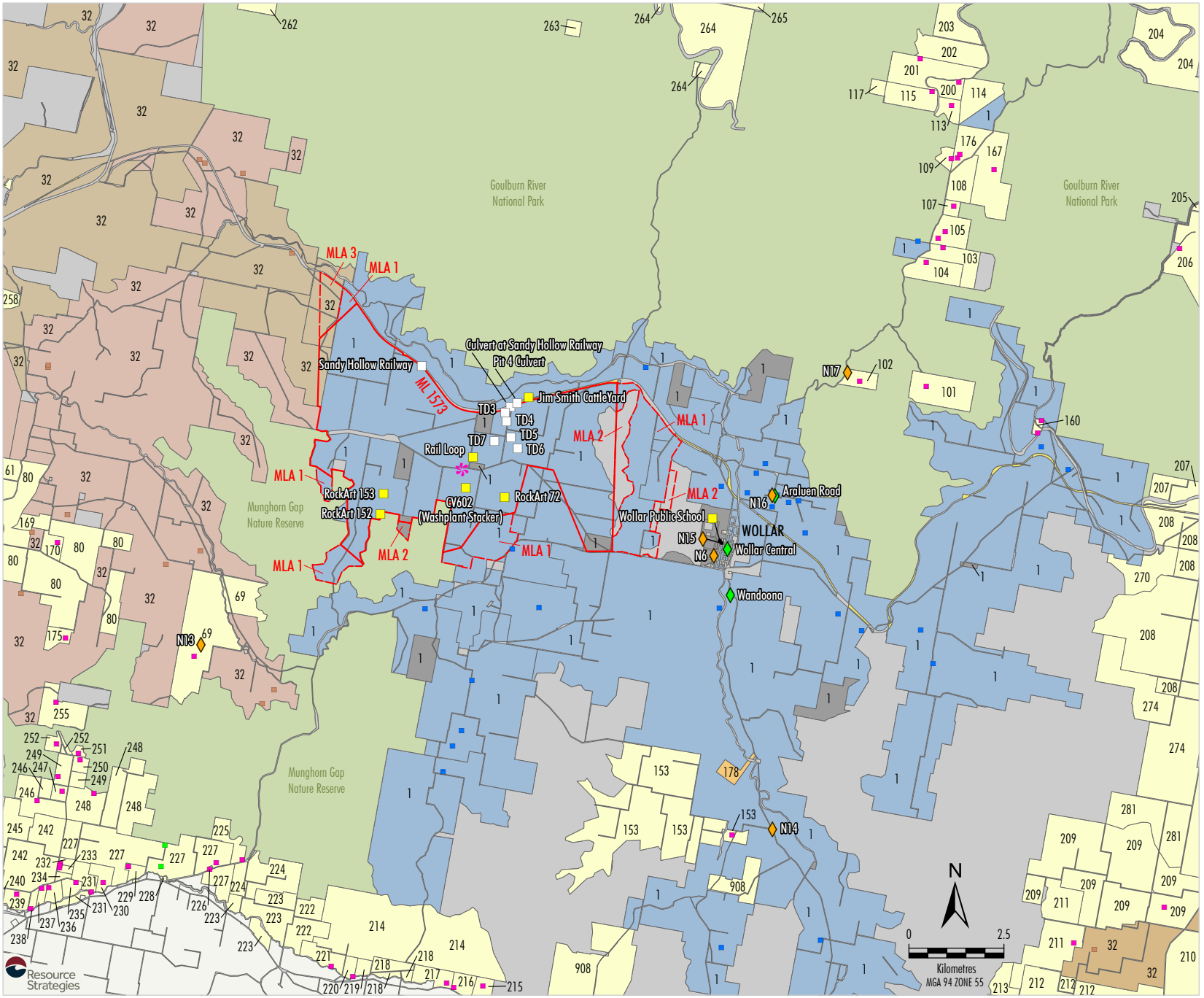
Noise management at the Wilpinjong Coal Mine is currently undertaken in accordance with the Noise Management Plan which outlines:

- noise mitigation measures and controls;
- the noise monitoring and reporting regimes; and
- procedures for the management of exceedances and complaints.

The Noise Management Plan describes general noise management and mitigation measures including:

- the training of contractors and staff on environmental noise control and awareness;
- the communication of noise levels for the previous 24 hours to key WCPL personnel at operational and management meetings;
- periodic noise emission test work on mobile equipment;
- consideration of sound power levels in equipment selection and maintaining equipment in good order;
- management of complaints received;
- real-time monitoring and an associated protocol for real-time management of noise emissions (Plate 4-2);
- monitoring for adverse meteorological conditions and adjusting mining operations where necessary;
- predictive meteorological forecasting to guide day-to-day planning of mining operations; and
- attended monitoring to verify ongoing compliance with noise criteria.

The Noise Management Plan describes the combination of off-site operator-attended monitoring sites and continuous real-time monitors utilised in the noise monitoring program. Current attended and real-time noise monitoring locations in the vicinity of the Wilpinjong Coal Mine are shown on Figure 4-3.



LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Peabody Energy
- Bylong Coal Project
- Moolarben Coal Mine
- Ulan Coal Mine
- Crown Land (Special Lease)
- Crown Land
- TransGrid
- Railway Land
- Relevant Private Landholder
- Other Land (Ownership not identified)
- National Parks and Wildlife Service
- 1 Landholder Number*
- Peabody Energy Dwelling
- Ulan/Moolarben Dwelling
- Private Dwelling
- Community Building

Noise Monitoring Sites

- Attended Noise
- Real-time Noise

Blasting Monitoring Sites

- Indicative Blast
- Fixed Blast
- Meteorological Station

* Refer Figure 1-5c for List of Landholders.

Source: WCPL (2015); NSW Dept of Industry (2015); NSW Land & Property Information (2015)

Peabody ENERGY

WILPINJONG EXTENSION PROJECT

Noise and Blasting Monitoring Locations

Figure 4-3

Plate 4-2: Wilpinjong Coal Mine Real-time Noise Monitor

Current real-time noise monitoring is focused to the east of Wilpinjong Coal Mine in the vicinity of the nearest privately-owned receivers, however, attended monitoring is also undertaken at the nearest privately-owned receivers to the north-east, south and west (Figure 4-3).

As described in the Noise Management Plan, the noise monitoring system provides real-time access to noise data and provides the capacity to set a real-time target noise level (e.g. 2 decibels [dB] below the compliance level).

Upon noise emissions reaching the identified target level, an automated SMS and email message is sent to the Control Room Operator and relevant WCPL management, who then implement the response protocol described in the Noise Management Plan.

The response protocol includes the identification of the noise source. Upon determination that the noise source is Wilpinjong Coal Mine related, active measures can be put in place to modify operations or stand down equipment to ensure compliance with noise criteria continues to be maintained.

A priority list is created based on the proximity of mobile equipment to the monitor. Mobile equipment is shutdown or relocated in the order of the priority list until noise levels drop.

The start-up of mobile equipment (once noise levels have dropped sufficiently) is staggered and occurs in the reverse order of the priority list.

Details of the investigation into the cause of the alarm and response are recorded and subsequently reviewed by the Environment and Community Manager or delegate.

In the Wilpinjong Coal Mine Modification 6 assessment report the DP&E noted that the real-time noise management system is consistent with best practice in the mining industry (DP&E, 2014).

Compliance and Complaints

To date, the obligation to meet the noise criteria specified in Project Approval 05-0021 for privately-owned receivers has been achieved by WCPL through a combination of the following:

- Property acquisition, which has reduced the number of privately-owned receivers that could potentially be affected by noise impacts from the mine.
- For the remaining privately-owned receivers, the implementation of the Wilpinjong Coal Mine noise management strategy as per the Noise Management Plan, which includes the use of real-time noise monitoring to manage noise levels.

Attended noise monitoring has been undertaken at the Wilpinjong Coal Mine since 2006. Monitoring is currently undertaken at the locations shown on Figures 4-3, 2-3a and 2-3c.

WCPL reported compliance with relevant noise limits at the nearest privately-owned receivers during the most recent Independent Audit period between 2012 and 2014 (AECOM Australia, 2015) and the January to August 2015 period (WCPL's EPL 12425 compliance summary reports) (Appendix A).

WCPL manages complaints in accordance with the Noise Management Plan. A summary of noise-related complaints is provided in Appendix A.

In 2014, 73 complaints were received in relation to on-site noise from 13 households (35 complaints from two households now owned by Peabody Energy), while 63 complaints were received in January to August 2015 from 13 households (11 complaints from one household now owned by Peabody Energy).

All complaints were investigated and in some cases site operations were modified to address the complaint. In some cases additional monitoring was carried out by WCPL to verify real-time noise levels at the location of the complaint.

Between November 2014 and October 2015 (inclusive), approximately 600 shutdown hours were accumulated for individual mobile equipment in direct response to the implementation of the noise management strategy, including responses to noise investigation triggers. The majority of excavator shutdown hours for noise are accumulated during the cooler months, coinciding with the higher likelihood of temperature inversions.

Noise Measurement and Description

The assessed noise levels presented in Appendix A and summarised in this section are expressed in A-weighted decibels (dBA). The logarithmic dBA scale simulates the response of the human ear, which is more sensitive to mid to high frequency sounds and relatively less sensitive to lower frequency sounds. Table 4-4 provides information on common noise sources in dBA for comparative reference.

Hearing 'nuisance', for most people, begins at noise levels of about 70 dBA, while sustained (i.e. eight hours) noise levels of 85 dBA can cause hearing damage.

Measured or predicted noise levels are expressed as statistical noise exceedance levels (L_{AN}) which are the levels exceeded for a specific percentage (N) of the interval period. For example, L_{A10} is the noise level that is exceeded for 10% of the sampling period and is also considered to be the average maximum noise level.

The equivalent continuous noise level (L_{Aeq}) refers to the steady sound level, which is equal in energy to the fluctuating levels recorded over the sampling period.

Background Noise Levels

The Rating Background Level is the background noise level determined without the subject premises in operation, in accordance with the INP.

Given that the Wilpinjong Coal Mine operations commenced in 2006 and are ongoing, SLR Consulting referred to background noise surveys conducted in 2004, prior to the establishment of the mine (Appendix A).

Review of these background noise levels indicated that the Rating Background Levels in the Village of Wollar are 31 dBA during the daytime, 30 dBA during the evening and 30 dBA during night-time periods. Rating Background Levels in all other areas are 30 dBA during all periods. These Rating Background Levels continue to be adopted for the Project (Appendix A).

Table 4-4
Relative Scale of Various Noise Sources

Noise Level (dBA)	Relative Loudness	Common Indoor Noise Levels	Common Outdoor Noise Levels
110 to 130	Extremely noisy	Rock band	Jet flyover at 1,000 m
100	Very noisy	Internal demolition work (jackhammer)	Petrol engine lawn mower at 1 m
90	Very noisy	Food blender at 1 m	Diesel truck at 15 m
80	Loud	Garbage disposal at 1 m, shouting at 1 m	Urban daytime noise
70	Loud	Vacuum cleaner at 3 m, normal speech at 1 m	Commercial area heavy traffic at 100 m
60	Moderate to quiet	Large business office	-
50	Moderate to quiet	Dishwasher next room, wind in trees	Quiet urban daytime
40	Quiet to very quiet	Small theatre, large conference room (background), library	Quiet urban night-time
30	Quiet to very quiet	Bedroom at night, concert hall (background)	Quiet rural night-time
20	Almost silent	Broadcast and recording studio	-
0 to 10	Silent	Threshold of hearing	-

Source: After United States Department of the Interior (1994) and Richard Heggie Associates (1995).

4.3.2 Potential Impacts

The operational noise component of the Noise and Blasting Assessment (Appendix A) included assessment of the following potential impacts:

- on-site operational noise (including the potential for sleep disturbance); and
- construction noise.

These aspects are described further below and in Appendix A. Blasting is addressed in Section 4.5 and transport noise is addressed in Section 4.14.

Operational Noise Criteria

The INP assessment procedure for industrial noise sources has two components (EPA, 2000):

- controlling potential intrusive noise levels in the short-term for residences; and
- maintaining noise level amenity for particular land uses, for residences and other land uses.

The INP prescribes detailed calculation routines for establishing Project-specific $L_{Aeq(15\ minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity criteria. The INP Project-specific intrusive and amenity assessment criteria for the Project (i.e. Project-specific noise levels) are presented in Table 4-5. Intrusive criteria are applied on a Project-only basis whilst amenity criteria are applied cumulatively with other industrial noise sources.

Potential noise impacts on land uses other than residences are also assessable under the INP. Appendix A assesses potential Project noise levels at the Wollar Public School, two churches and the Community Hall in the Village of Wollar, as well as passive recreational areas (i.e. in the Goulburn River National Park and Munghorn Gap Nature Reserve). The relevant INP amenity criteria for these land uses are also provided in Table 4-5.

In those cases where the INP Project-specific assessment criteria are exceeded, it does not automatically follow that all people exposed to the noise would find the noise noticeable or unacceptable.

The Voluntary Land Acquisition and Mitigation Policy provides some useful context in regard to characterising the practical implications of exceedances of the INP criteria (Table 4-6).

For the purposes of assessing potential noise impacts consistent with the Voluntary Land Acquisition and Mitigation Policy, exceedances can be separated into a Noise Management Zone (i.e. negligible, marginal or moderate impacts of 1 to 5 dBA above the criteria) and a Noise Affectation Zone (i.e. greater than 5 dBA above the criteria, with impacts considered to be significant) (Table 4-6).

Table 4-6 presents the methodology used for assessing operational noise against the INP Project-specific noise assessment criteria.

Table 4-5
INP Project-specific Intrusive and Amenity Assessment Criteria (dBA)

Locality	Land Use	Intrusive $L_{Aeq(15\ minute)}$[1]			Amenity $L_{Aeq(period)}$[1]		
		Day	Evening	Night	Day	Evening	Night
Village of Wollar	Rural Residential[2]	36	35	35	50	45	40
	Rural Vacant Land[3]						
Other Privately-owned Land	Rural Residential[2]	35	35	35	50	45	40
	Rural Vacant Land[3]						
Any	School[4]	Intrusive noise criteria not applicable			External 45 when in use		
Any	Church, Hall[4]	Intrusive noise criteria not applicable			External 50 when in use		
Any	Passive Recreation	Intrusive noise criteria not applicable			External 50 when in use		

Source: Appendix A.

1 Daytime 7.00 am to 6.00 pm, Evening 6.00 pm to 10.00 pm, Night-time 10.00 pm to 7.00 am.

2 At the most affected point within 30 m of the residential area.

3 Where exceedances are predicted over 25% of the vacant land area.

4 Internal criteria equivalent to external criteria minus 10 dBA.

Table 4-6
Characterisation of the Significance of Noise Impacts and Potential Treatments

Residual Noise Exceeds INP Criteria By	Characterisation of Significance of Residual Impacts	Potential Treatments
0 to 2 dBA above the Project-specific noise level	Impacts are considered to be **negligible**	The exceedances would not be discernible by the average listener and therefore would not warrant receiver based treatments or controls.
3 to 5 dBA above the Project-specific noise level in the INP but the development would contribute less than 1dB to the total industrial noise level	Impacts are considered to be **marginal**	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
3 to 5 dBA above the Project-specific noise level in the INP and the development would contribute more than 1dB to the total industrial noise level	Impacts are considered to be **moderate**	As for marginal impacts but also upgraded façade elements like windows, doors, roof insulation etc. to further increase the ability of the building façade to reduce noise levels.
>5 dBA above the Project-specific noise level in the INP	Impacts are considered to be **significant**	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions.

Source: After NSW Government (2014).

Operational Noise Modelling

An acoustic model was developed by SLR Consulting that simulates the Project components using noise source information (i.e. sound power levels and locations) and predicts noise levels at relevant receiver locations. In accordance with the INP, the model has been calibrated based on noise monitoring measurements undertaken both on-site and off-site at the Wilpinjong Coal Mine.

The model considers meteorological effects, surrounding terrain, the distance from source to receiver and noise attenuation.

The locations of modelled receivers (i.e. dwellings) are shown on Figures 1-5a, 1-5b and 4-3.

Assessment of Meteorological Conditions

In accordance with the INP, SLR Consulting (2015) assessed meteorological data collected at the Wilpinjong Coal Mine to determine the prevailing meteorological conditions for noise modelling. These prevailing conditions generally have the effect of increasing (or decreasing) noise levels at receivers relative to calm conditions.

Details of the analysis and prevailing meteorological conditions modelled are provided in Appendix A. Section 4.2 provides a summary description of meteorology and topography in the vicinity of the Project.

Noise Modelling Scenarios

Five operational scenarios based on the indicative progressive development of the Project were assessed (Appendix A):

- Year 2 – Representative of initial mining of Pit 8 (single fleet operations in the far north of Pit 8), in combination with single fleet operations in Pits 1, 3, 4, 6 and 7. Includes maximum Project ROM coal extraction rate.
- Year 4 – Representative of single fleet operations in the north of Pit 8, in combination with single fleet operations in Pits 2, 3, 5, 6 and 7.
- Year 8 – Representative of two fleets operating in central Pit 8, in combination with single fleet operations in Pit 3 and Pit 5 (far south) and two fleets operating in Pit 6. Includes construction of Ulan-Wollar Road realignment, Stage 2.
- Year 12 – Representative of single fleet operations in southern Pit 8, in combination with single fleet operations in Pit 4 and two fleets operating in Pit 6.
- Year 15 – Representative of single fleet operations in the far south of Pit 8, in combination with two fleets operating in Pit 6.

The operational scenarios were selected to evaluate the potential impacts at the nearest privately-owned receivers over the life of the Project. A particular focus for the selection of scenarios was to evaluate potential operational noise impacts from different stages of development of Pit 8.

Assessment of Feasible and Reasonable Noise Mitigation Measures

WCPL has previously committed to maintaining operational noise levels in the Village of Wollar to the Project-specific noise level, through the implementation of the Noise Management Plan.

The development of Pit 8 would reduce the distance from the mine to remaining private landholders located east of the Wilpinjong Coal Mine. In addition, one of the two significant topographic ridgelines that are located between Pits 3 and 7 and privately-owned receivers to the east, would no longer provide a barrier to operations located in Pit 8 (Figure 2-8).

SLR Consulting (2015) and WCPL conducted an investigation of potential reasonable and feasible noise mitigation measures for the Project, particularly in relation to evening and night-time operations in the context of mining operations progressing from north to south in Pit 8 (Figures 2-8 to 2-12).

A number of iterative steps were undertaken to develop reasonable noise mitigation measures for the Project, including (Appendix A):

1. Preliminary noise modelling of scenarios representative of the maximum noise emissions from the Project to identify the potential for noise exceedances.
2. Evaluation of primary noise sources and various combinations of noise management and mitigation measures to reduce receptor noise levels.
3. Review of the effectiveness of these measures and assessment of their feasibility by WCPL.
4. Adoption by WCPL of management and mitigation measures to appreciably reduce noise emissions associated with the Project.

The preliminary noise modelling indicated that in the absence of additional noise mitigation measures, Project intrusive noise levels at privately-owned dwellings could, with adverse meteorological conditions coincident with peak operations in Pit 8[1], range up to 7 dBA above the Project-specific noise levels (i.e. 42 dBA) (Appendix A).

Potential noise management and mitigation measures that would achieve a reduction in Project noise levels under adverse meteorological conditions of up to 7 dBA (e.g. from 42 dBA to 35 dBA) were evaluated with respect to the feasibility of implementing the measures for the Project. These measures included shutting down both mining fleets located in Pit 8, or attenuating noise emissions from all major mobile equipment (with additional mobile equipment shutdowns as required).

While technically feasible, measures to achieve up to a 7 dBA reduction at the nearest privately-owned receivers to Project operations in Pit 8 were then evaluated in light of the relative cost and benefits that would arise, including potential environmental benefits and corresponding capital and operating costs.

Modelling and evaluation of a range of potential noise mitigation benefits, capital and operating costs of mitigation (based on consultation with machinery suppliers and other mining operations) and impacts on related Project metrics was undertaken. From this it was identified by WCPL that an appreciable Project noise reduction of up to 5 dBA (e.g. from 42 dBA to 37 dBA) could be reasonably achieved *albeit* at significant capital and operating cost to WCPL. This substantial noise reduction could be achieved at approximately 25% of the estimated capital and operational costs to WCPL that would be incurred to achieve a noise reduction target of up to 7 dBA (Section 6.7.7).

For all but one of the proximal privately-owned receivers, the resulting achievable maximum intrusive noise level of 36 dBA or 37 dBA would be only 1 dBA to 2 dBA above the evening and night-time Project-specific noise level of 35 dBA.

The impact of a potential exceedance of the Project-specific noise level of this magnitude is negligible and not discernible by the average listener based on the characterisation of noise impacts described in Table 4-6.

[1] Associated with two mining fleets operating in Pit 8, from approximately Year 6 to Year 10.

This would represent a negligible increase on the current approved operational evening and night-time noise limit of 35 dBA for the nearest privately-owned receivers and would remain well within the range of consented noise limits above 35 dBA that have previously been approved (i.e. 36 dBA to >40 dBA) at the nearest privately-owned residences to the Wilpinjong Coal Mine.

WCPL therefore concluded that an approximate fourfold increase in the cost of noise mitigation for a very marginal gain in environmental outcome at a small number of the nearest privately-owned receivers (i.e. the difference between 35 dBA and 36 dBA or 37 dBA would not be discernible to the average listener) would not be reasonable.

When two mining fleets are operating in Pit 8 between approximately Year 6 and Year 10, the most cost-effective combination of operational controls (i.e. mobile equipment shutdowns) and noise attenuation of key Pit 8 mobile equipment would be used as required to maintain noise levels at or below 37 dBA at nearby privately-owned dwellings.

For the remainder of the Project life it is anticipated that the most cost-effective operational controls (e.g. mobile equipment shutdowns as currently employed at the Wilpinjong Coal Mine) would be used to maintain noise levels at or below 37 dBA for all but one of the nearby privately-owned dwellings. One isolated rural receiver is predicted to experience a maximum intrusive noise level of 38 dBA in Year 12, due to its topographic location.

A wide range of reasonable noise mitigation measures would be available to WCPL to achieve the outcome of compliance with these predicted noise levels at nearby privately-owned dwellings.

Plate 4-3 illustrates the control room where real-time noise monitoring and associated operational shutdowns/relocations are managed.

Plate 4-3: Wilpinjong Coal Mine Operational Control Room

WCPL would continue to validate the noise model predictions with attended and unattended noise monitoring as mining progresses south in Pit 8 before selecting the most cost-effective mitigation strategy to achieve the outcome of compliance with consent conditions relevant to operational requirements and priorities at the time. This would include evaluation of the relative costs of potential acquisition of nearby private landholdings.

As shown in Figure 4-4, the number of privately-owned receivers with predicted exceedances (and the quantum of these noise exceedances) of the Project-specific noise levels has progressively reduced over time, since the approval of the Wilpinjong Coal Project in 2006. This has largely been due to Peabody Energy's proactive property strategy.

DP&E's support for Peabody Energy's proactive property strategy was articulated in the Wilpinjong Coal Mine Modification 6 assessment report (DP&E, 2014).

Peabody Energy would continue to pursue opportunities to advance the proactive property strategy over the life of the Project (e.g. through further property acquisitions or compensatory outcomes for the nearest privately-owned receivers where noise levels above the Project-specific noise levels are predicted).

Predicted Noise Emissions

In summary, with the implementation of reasonable and feasible mitigation measures, the operational noise assessment indicates the following (Appendix A):

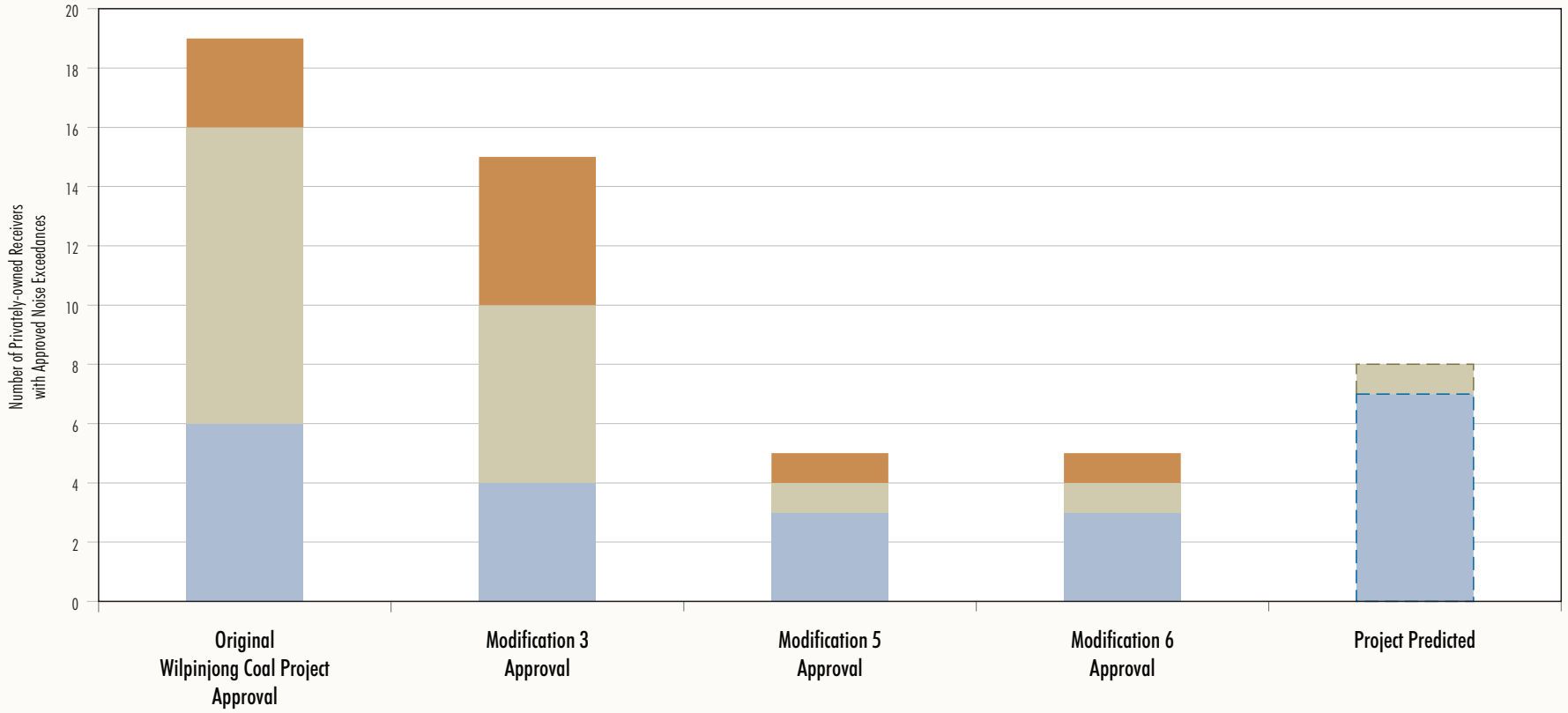
- During the daytime, operational noise would not exceed the Project-specific noise levels at any privately-owned receivers.
- During evening and night-time periods, operational noise would not exceed the Project-specific noise levels at any privately-owned receivers during periods of calm meteorological conditions.
- During evening and night-time periods with adverse meteorological conditions, operational noise would exceed Project-specific noise levels at eight privately-owned receivers. Of these, seven would be negligible exceedances and one would be a marginal to moderate exceedance.

Table 4-7 presents a summary of potential exceedances of criteria under adverse meteorological conditions for the evening and night-time periods.

Table 4-7
Summary of Potential Operational Noise Exceedances at Privately-owned Receivers under Adverse Meteorological Conditions

Period	Noise Management Zone					Noise Affectation Zone
	Negligible 1 to 2 dBA above Project-specific noise level		Marginal to Moderate 3 to 5 dBA above Project-specific noise level			Significant >5 dBA above Project-specific noise level
	1 dBA	2 dBA	3 dBA	4 dBA	5 dBA	>5 dBA
Daytime	-		-			-
Evening	903 Hardiman & Hogan, 952 O'Hara, 102 Filipczyk	908 Lynch, 914 Nicod, 921 Toombs, 933 Faulkner, 942 Schneider	-			-
Night-time	942 Schneider	-	102 Filipczyk	-	-	-

Source: After SLR Consulting (2015).



WIL-12-12 WEP EIS Section 4 006C

Resource Strategies

LEGEND

- Noise Affectation Zone (> 5 dBA above 35 dBA, significant)
- Noise Management Zone (3-5 dBA above 35 dBA, moderate/marginal)
- Noise Management Zone (1-2 dBA above 35 dBA, negligible)

Source: WCPL (2015); SLR (2015); Project Approval 05-0021 (2006; 2010; Feb 2014; Nov 2014)

Peabody ENERGY

WILPINJONG EXTENSION PROJECT

Wilpinjong Coal Mine
Approved Noise Exceedances

Figure 4-4

Indicative noise contours for evening operations under adverse conditions in Year 4 and for night-time operations under adverse conditions in Years 8 and 12 are presented as Figures 4-5, 4-6 and 4-7, respectively.

WCPL considers the proposed noise management strategy to be the optimal outcome for Project noise management, as it provides a balance between the competing factors of capital and operating noise management costs incurred by WCPL and environmental benefits to nearby privately-owned receivers (i.e. noise reductions). Achievable measures have been identified and would be adopted to reduce the significance of potential noise exceedances to a level considered negligible at all privately-owned receivers, except one isolated rural receiver with a predicted marginal to moderate exceedance (Table 4-7).

In addition, no privately-owned receivers are predicted to be noise affected (i.e. >40 dBA) by the Project, while previous approvals have included between one to five noise affected privately-owned receivers in the vicinity of the Wilpinjong Coal Mine (Figure 4-4). Predicted Project noise levels of 36 dBA (two privately-owned residences), 37 dBA (five privately-owned residences) and 38 dBA (one privately-owned residence) are also consistent with previously consented noise levels at the nearest privately-owned receivers at the Wilpinjong Coal Mine (Figure 4-4).

Vacant Land Assessment

The Voluntary Land Acquisition and Mitigation Policy states:

> *The noise generated by the development would contribute to exceedances of the recommended maximum noise levels in Table 2.1 of the INP* ***on more than 25% of any privately owned land*** *where there is an existing dwelling or where a dwelling could be built under existing planning controls.*

SLR Consulting (2015) determined no privately-owned properties would experience exceedances of the recommended maximum noise levels (night – 45 dBA $L_{Aeq(period)}$) on more than 25% of the property (Appendix A).

Other Land Uses

Other (non-residential) land uses were assessed by SLR Consulting in accordance with the INP.

No exceedances of the Project-specific noise levels are predicted at the school, churches or Community Hall in the Village of Wollar (Appendix A).

Consistent with previous assessments, the passive recreational area Project-specific noise level of $L_{Aeq(period)}$ 50 dBA would be exceeded at both the Goulburn River National Park and the Munghorn Gap Nature Reserve in the vicinity of the Project.

Project noise emission levels in these areas would be generally comparable to those assessed for the approved Wilpinjong Coal Mine. Public facilities in these areas (i.e. camping grounds) are not proximal to the Project and public access is very limited to the reserved lands in the vicinity of the Project.

Should the Project be approved, WCPL will seek to have the passive recreational area criteria applied only at designated locations with publicly available facilities and tracks in the Munghorn Gap Nature Reserve and Goulburn River National Park.

Project-only Noise Amenity Assessment (incremental)

Assessment of Project-only noise emissions against applicable INP amenity criteria is provided in Appendix A.

No exceedances of the amenity criteria due to the Project only are predicted.

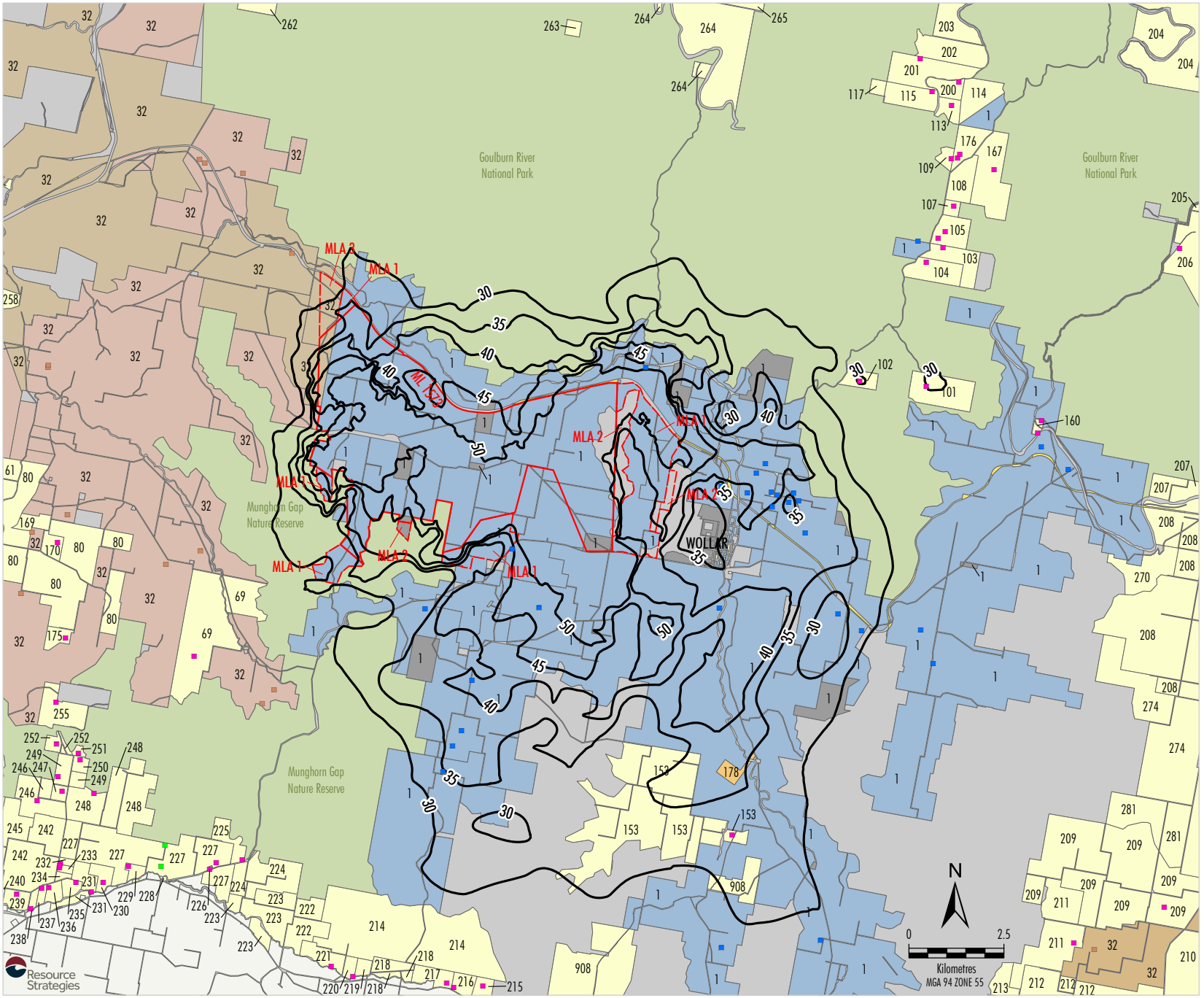
Cumulative Noise Emissions

Major existing, approved and proposed coal mining operations in the vicinity of the Wilpinjong Coal Mine that may potentially be sources of cumulative noise emissions include:

- the Moolarben Coal Complex; and
- the Ulan Mine Complex.

Cumulative noise impacts resulting from the concurrent operation of the Project and the developments listed above were assessed against the INP amenity criteria.

The proposed Bylong Coal Project (KEPCO, 2015) is approximately 15 km east-southeast of the Wilpinjong Coal Mine and is too distant to materially contribute to cumulative noise levels at privately-owned receivers in the vicinity of the Wilpinjong Coal Mine (Appendix A).



LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Peabody Energy
- Bylong Coal Project
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- Ulan Coal Mine
- Crown Land (Special Lease)
- Crown Land
- TransGrid
- Railway Land
- Relevant Private Landholder
- Other Land (Ownership not identified)
- National Parks and Wildlife Service
- 1 Landholder Number*
- Peabody Energy Dwelling
- Ulan/Moolarben Dwelling
- Private Dwelling
- Community Building
- Evening North West Wind Intrusive $L_{Aeq\ (15\ minute)}$ Noise Contour

* Refer Figure 1-5c for List of Landholders.

Source: WCPL (2015); SLR Consulting (2015); NSW Dept of Industry (2015); NSW Land & Property Information (2015)

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WILPINJONG EXTENSION PROJECT

Project Evening North West Wind Intrusive $L_{Aeq\ (15\ minute)}$ Noise Contours - Year 4

Figure 4-5

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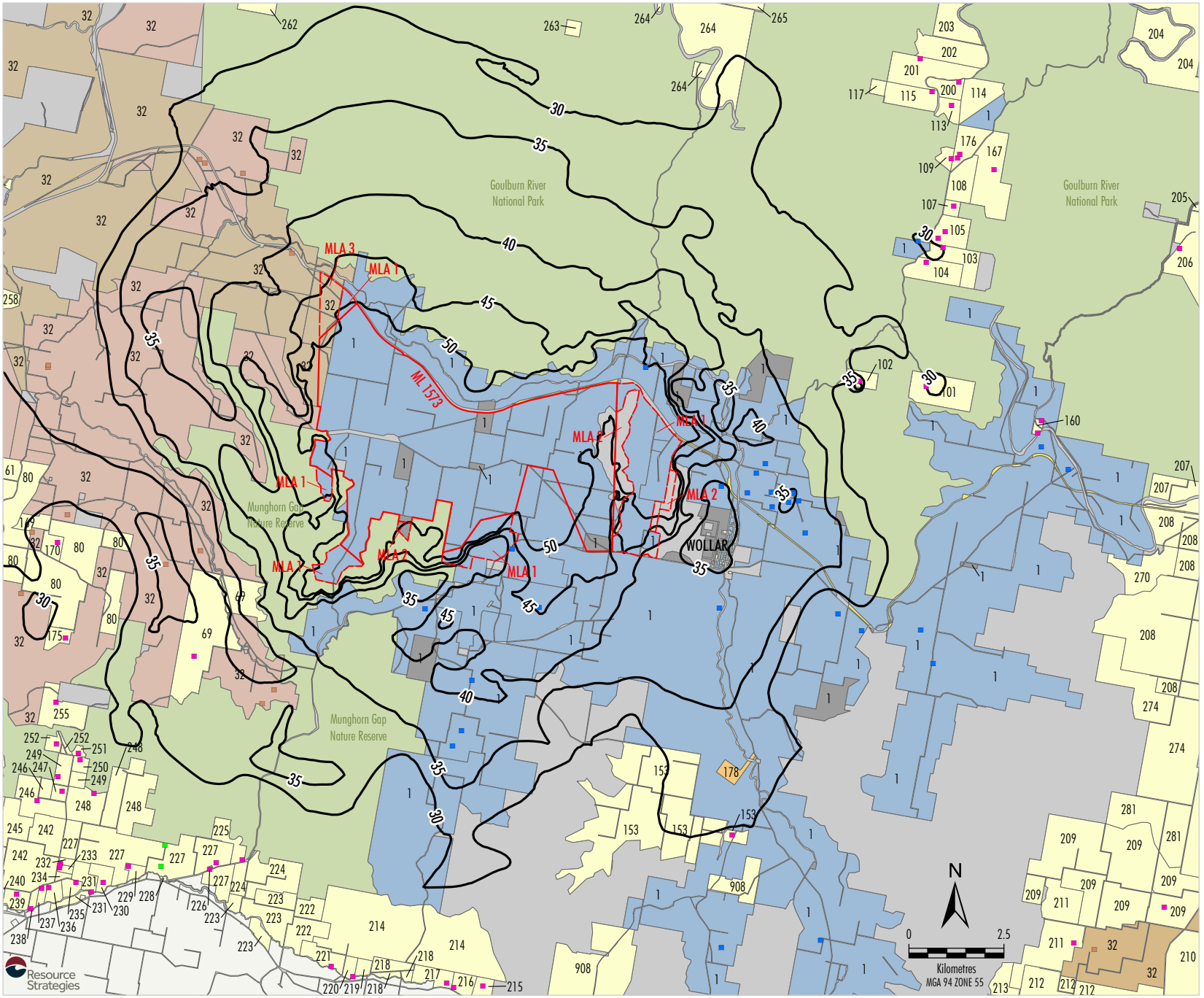

LEGEND

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- Peabody Energy
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- National Parks and Wildlife Service
- 1 Landholder Number*
- Peabody Energy Dwelling
- Ulan/Moolarben Dwelling
- Private Dwelling
- Community Building
- Night-time Inversion Intrusive $L_{Aeq\ (15\ minute)}$ Noise Contour

* Refer Figure 1-5c for List of Landholders.

Source: WCPL (2015); SLR Consulting (2015); NSW Dept of Industry (2015); NSW Land & Property Information (2015)

Peabody ENERGY

WILPINJONG EXTENSION PROJECT

Project Night-time Inversion Intrusive $L_{Aeq\ (15\ minute)}$ Noise Contours - Year 8

Figure 4-6

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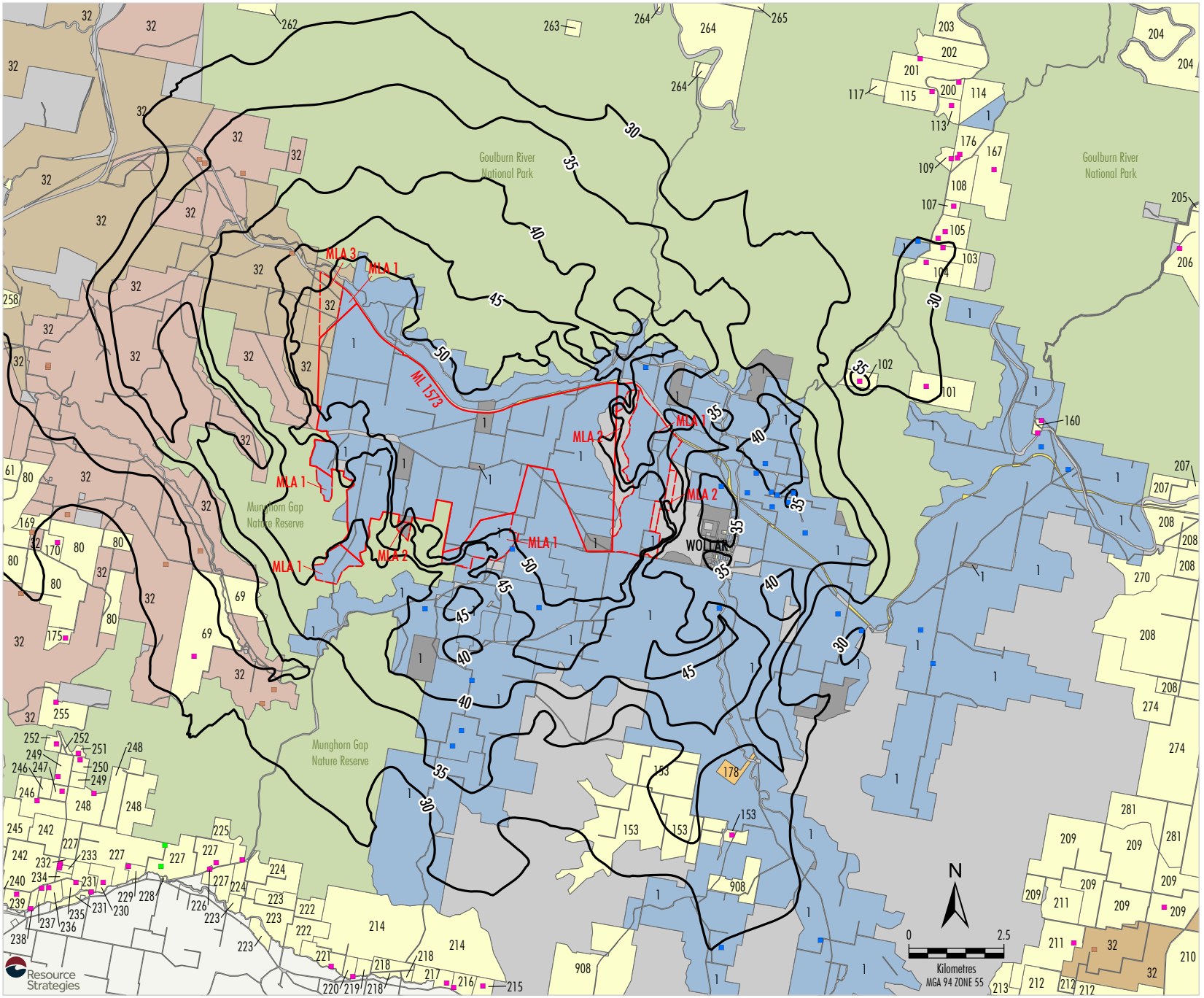
LEGEND
Mining Lease Boundary
Mining Lease Application Boundary
Peabody Energy
Bylong Coal Project
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Crown Land
TransGrid
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Landholder Number*
Peabody Energy Dwelling
Ulan/Moolarben Dwelling
Private Dwelling
Community Building
Night-time Inversion Intrusive
$L_{Aeq\ (15\ minute)}$ Noise Contour
* Refer Figure 1-5c for List of Landholders.
Source: WCPL (2015); SLR Consulting (2015); NSW Dept of Industry (2015); NSW Land & Property Information (2015)
Goulburn River National Park
Munghorn Gap Nature Reserve
WOLLAR
MLA 1
MLA 2
MLA 3
ML 1573
N
0
2.5
Kilometres
MGA 94 ZONE 55
Resource Strategies
Peabody ENERGY
WILPINJONG EXTENSION PROJECT
Project Night-time Inversion Intrusive $L_{Aeq\ (15\ minute)}$ Noise Contours - Year 12
Figure 4-7
WIL-12-12_WEP_EIS_Section 4_2031

The methodology used for cumulative assessment was to logarithmically sum the respective noise predictions for the Project, the Moolarben Coal Complex and the Ulan Mine Complex, and compare the results for each receiver against the INP amenity criteria.

For this assessment, SLR Consulting used noise level predictions from the Moolarben Coal Complex UG1 Optimisation Modification Environmental Assessment (Moolarben Coal, 2015) and the Ulan Coal Continued Operations Environmental Assessment (UCML, 2009).

This assessment focused on evening and night-time noise levels because Project noise levels are predicted to be most pronounced in these periods (Appendix A).

No exceedances of the recommended acceptable amenity criteria were predicted at privately-owned receivers or community facilities during the evening and night-time periods (Appendix A).

A further assessment of the Project noise emissions against the non-discretionary development standard for mining is provided in Attachment 5.

Sleep disturbance

Appendix A also presents an assessment of potential sleep disturbance impacts. A sleep disturbance criterion ($L_{A1(1\ minute)}$) of 15 dBA above the Rating Background Level has been adopted by the EPA. The sleep disturbance criterion for the Project is therefore a $L_{A1(1\ minute)}$ of 45 dBA.

No exceedances of the sleep disturbance criterion were predicted at any privately-owned receivers during the night-time.

Construction Noise

In accordance with the *Interim Construction Noise Guideline* (DECC, 2009a), construction noise associated with the Project was assessed using the INP. Construction activities were included in the daytime modelling scenarios for Year 2 and Year 8 and no exceedances of relevant criteria were identified for daytime noise as described above (Appendix A).

4.3.3 Mitigation Measures, Management and Monitoring

Noise mitigation and management measures for the existing Wilpinjong Coal Mine are described in the Noise Management Plan (Section 4.3.1) and would continue to be implemented for the Project. This plan would be reviewed and updated to address the Project, subject to the conditions of any Development Consent for the Project.

Operational Noise Mitigation Measures

As described in Section 4.3.2, the privately-owned receivers where noise emissions are predicted to exceed the Project-specific criteria would be within the Project Noise Management Zone. No privately-owned receivers are predicted to experience exceedances greater than 5 dBA above the Project-specific noise levels and, therefore, no privately-owned receivers would be considered noise affected (i.e. significantly impacted) (Table 4-6).

Proposed management procedures for privately-owned receivers in the Noise Management Zone are described below.

Noise Management Zone

Potential noise impacts in the Noise Management Zone would be negligible for seven privately-owned receivers and marginal to moderate for one isolated rural receiver (Table 4-7). In addition to the noise mitigation measures included in the predictive modelling, noise management procedures would include:

- noise monitoring on-site and in the vicinity of the Wilpinjong Coal Mine, including real-time monitoring;
- prompt response to any community complaints or concerns;
- refinement of on-site noise mitigation measures and operating procedures where practicable;
- implementation of reasonable and feasible acoustical mitigation at receivers (which may include measures such as enhanced glazing, insulation and/or air conditioning), in consultation with the relevant landowner (one predicted), where noise monitoring shows noise levels which are 3 to 5 dBA above Project-specific noise criteria; and

- continued investigation of the potential to reach negotiated agreements between WCPL and relevant private landholders in accordance with the Voluntary Land Acquisition and Mitigation Policy.

The above procedures would continue to be documented in the Noise Management Plan and would form part of the adaptive management approach to Project noise management that would include real-time noise monitoring and meteorological forecasting.

Noise Management Plan

The Noise Management Plan would, as relevant, be revised for the Project to include the following (subject to the conditions of any Development Consent for the Project):

- The Project reasonable and feasible noise mitigation and operational management measures (Section 4.3.3).
- Revised locations for continuous operational noise monitoring to assist with noise management and operator attended compliance monitoring as mining progresses.
- Details of triggers for the Project real-time monitoring and management system. As described in Section 4.3.1 and the Noise Management Plan, this would include trigger-based protocols incorporating review of prevailing meteorological conditions, identification of on-site noise levels and shutdown of relevant noise sources, where necessary, to achieve the relevant Development Consent noise criteria.
- Details of any required revisions to the predictive meteorological forecasting system used as part of proactive management in conjunction with the real-time monitoring and management system.

4.4 AIR QUALITY

An Air Quality and Greenhouse Gas Assessment for the Project was undertaken by Todoroski Air Sciences (2015) and is presented as Appendix B. The assessment was conducted in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (Approved Methods) (DEC, 2005c).

Consideration was also given to the Voluntary Land Acquisition and Mitigation Policy.

The Air Quality and Greenhouse Gas Assessment was peer reviewed by Dr Nigel Holmes, who concluded that the report followed the relevant assessment procedures and was a realistic assessment of the effects of the Project on air quality. The review report is presented in Attachment 4.

A description of the existing environment relating to air quality and Wilpinjong Coal Mine air quality management and monitoring is provided in Section 4.4.1. Section 4.4.2 describes the potential air quality impacts of the Project, including cumulative impacts, and Section 4.4.3 outlines Project air quality mitigation measures, management and monitoring.

The assessment focuses on potential impacts associated with particulate matter generated by mining activities. Emissions of other pollutants, such as carbon monoxide, nitrogen dioxide and sulfur dioxide also arise due to fuel combustion in mobile equipment. However, emissions of pollutants associated with fuel combustion are considered too low to generate any significant off-site concentrations (Appendix B).

Potential emissions associated with blasting fumes have been considered in Section 4.4.2 and Project greenhouse gas emissions are described in Section 4.18.

4.4.1 Existing Environment

Air Quality Management Regime

Air Quality management at the Wilpinjong Coal Mine is currently undertaken in accordance with the Air Quality Management Plan which outlines:

- air quality mitigation measures and controls;
- air quality monitoring (Plate 4-4) and reporting regimes; and
- procedures for the management of exceedances and complaints.

Plate 4-4: Wilpinjong Coal Mine Air Quality Monitor

Existing key air quality management and mitigation measures are provided in Table 4-8.

Air Quality Criteria

Concentrations of Suspended Particulate Matter

The Project mining activities described in Section 2 have the potential to generate particulate matter (i.e. dust) emissions in the form of:

- TSP;
- PM_{10} (a subset of TSP); and
- particulate matter with an equivalent aerodynamic diameter of 2.5 µm or less ($PM_{2.5}$) (a subset of TSP and PM_{10}).

Exposure to suspended particulate matter can result in adverse health impacts. The likely risk of these impacts to a person depends on a range of factors including the size, chemical composition and concentration of the particulate matter, and the existing health of the person (NSW Health and NSW Minerals Council, 2011).

The EPA assessment criteria are generally based on thresholds relating to human health effects. These criteria have been developed to a large extent in urban areas, where the primary pollutants are the products of combustion, which are more harmful to human health than particulates of crustal origin, such as particulate matter from mining operations (Appendix B).

Relevant health based air quality criteria (i.e. criteria set at levels to reduce the risk of adverse health effects) for PM_{10} and TSP concentrations, as specified by the EPA in the Approved Methods (DEC, 2005c), are provided in Table 4-9.

The EPA does not have specific criteria for $PM_{2.5}$. In the absence of EPA criteria, Table 4-9 also contains the Ambient Air National Environmental Protection Measure (Ambient Air – NEPM) $PM_{2.5}$ advisory reporting standards (National Environment Protection Council, 2003).

Table 4-8
Existing Approved Wilpinjong Coal Mine Air Quality Mitigation and Management Measures

Emission Type	Area/Activity	Management Measure
Wind Blown Particulate Matter Sources	Areas disturbed by mining	• Only the minimum area necessary for mining is disturbed. • Exposed areas are reshaped, topsoiled and revegetated as soon as practicable.
	Waste rock emplacements	• Progressive rehabilitation (i.e. reshaping, topsoil placement and revegetation) of waste rock emplacements continues throughout the life of the Wilpinjong Coal Mine.
	Coal handling areas	• Coal handling areas are kept in a moist state using water carts or alternative means to minimise wind-blown and traffic generated dust. • Water sprays on CHPP feed. • Water sprays used when tipping raw coal.
	Coal stockpiles	• Water sprays on clean coal stockpile discharges.
Mining Generated Particulate Matter Sources	Haul road dust	• All roads and trafficked areas are watered using water carts to minimise the generation of dust as required. • Obsolete roads are ripped and revegetated.
	Light vehicle roads	• Development of light vehicle roads is limited and the locations of these are clearly defined. • Regularly used light vehicle roads are watered. • Obsolete roads are ripped and revegetated.
	Topsoil stripping	• Access tracks used for topsoil stripping during the loading and unloading cycle are watered. • Stripping occurs during favourable wind conditions.
	Topsoil stockpiling	• Long-term topsoil stockpiles are revegetated with a cover crop.
	Drilling	• Air pollution control equipment are operated and maintained on all drilling rigs.
	Blasting	• Wind conditions are assessed prior to blasting and blasts are postponed if wind speed and direction are above trigger limits in the Blast Management Plan. • Adequate stemming is used at all times. • Holes are dipped for water to determine controls to minimise blast fumes. • Where water is identified, explosive product is 'bottom loaded' to displace water or a gas bag used for water less than 500 mm. • Where significant water is identified a wet-hole product is used. • Water is decanted from blast holes.
All	All	• Real-time air quality monitoring is undertaken and used as a guide to the implementation of the above management measures to maintain compliance with air quality criteria.

Source: WCPL (2014c).

Table 4-9
Criteria for Particulate Matter Concentrations

Pollutant	Averaging Period	Impact Assessment Criteria (µg/m³)	Acquisition Criteria (µg/m³)
TSP	Annual mean	90[1]	90[1]
PM_{10}	24-hour maximum[1]	50[1]	50[2]
	Annual mean	30[1]	30[1]
$PM_{2.5}$	24-hour maximum	25[3]	-
	Annual mean	8[3]	-

Source: Appendix B.

µg/m³ = micrograms per cubic metre.

1 Criterion is cumulative (i.e. includes background concentrations but excludes regional dust events such as bushfires).

2 Criterion is Project-only.

3 Advisory reporting standard.

Dust Deposition

Particulate matter has the potential to cause nuisance (amenity) effects when it is deposited on surfaces.

The amenity criteria for the maximum increase in dust deposition and maximum total dust deposition, as specified by the EPA in the Approved Methods (DEC, 2005c), are provided in Table 4-10.

Table 4-10
Criteria for Dust Deposition (Insoluble Solids)

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level (g/m²/month)	Maximum Total Deposited Dust Level (g/m²/month)
Deposited dust	Annual	2	4

Source: Appendix B.

g/m²/month = grams per square metre per month.

Existing Air Quality

PM_{10}, TSP and dust deposition data are collected at the Wilpinjong Coal Mine. In addition, data collected for the Moolarben Coal Complex were also reviewed by Todoroski Air Sciences for comparative reference. A summary of monitoring results is provided below.

The monitoring captures particulate matter from sources including current mining operations, other localised particulate matter sources (e.g. vehicles using unsealed roads, stock movements, and other exposed areas) and regional particulate matter sources (e.g. bushfires and dust storms).

PM_{10}

PM_{10} monitoring data have been collected by WCPL at eight locations using HVASs and tapered element oscillating microbalances (TEOMs). Some monitoring locations have changed over the life of the Wilpinjong Coal Mine to reflect operational and land ownership changes. The locations of the current Wilpinjong Coal Mine PM_{10} air quality monitors are shown on Figure 4-8.

Recorded annual average PM_{10} concentrations in the period 2012 to 2014 (i.e. the most recent Independent Audit period) are provided in Table 4-11.

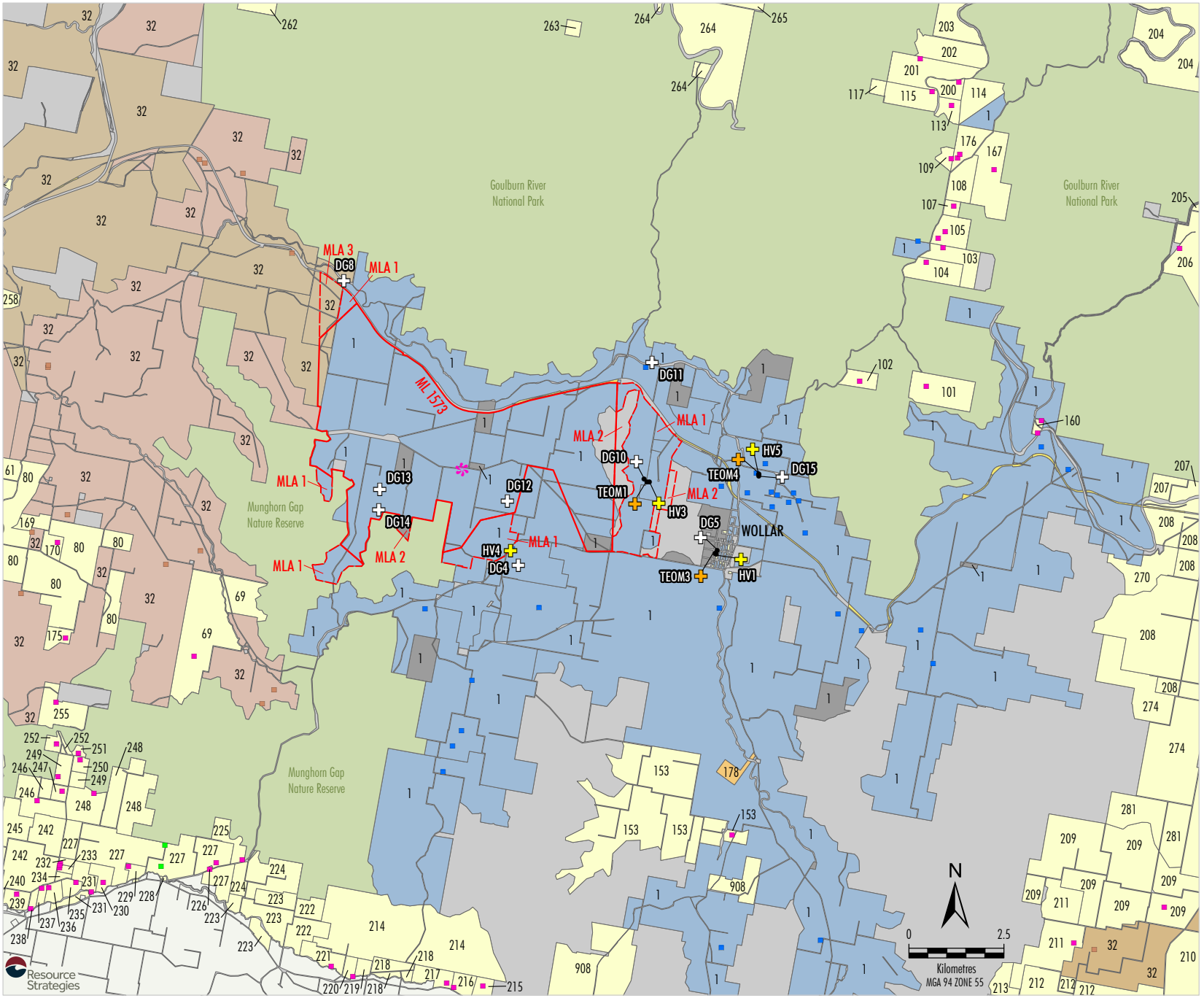
Table 4-11
Annual Average PM_{10} Concentrations (µg/m³)

Monitor	2012	2013	2014
TEOM 1	13.3	17.9	17.4
TEOM 2	11.5	ND	ND
TEOM 3	ND	13.6	13.4
TEOM 4	ND	17.2	13.5
HV1	9.0	10.8	10.9
HV2	13.6	ND	ND
HV4	9.8	12.8	11.7
HV5	ND	15.7	14.6

Source: Appendix B.

ND = No data record (prior to installation/decommissioned).

PM_{10} monitoring results show that since monitoring commenced in 2006, there have been no exceedances of the EPA annual average criterion of 30 µg/m³. The average PM_{10} across all sites for the 2012 to 2014 monitoring period is 13.4 µg/m³ (Appendix B).



LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Peabody Energy
- Bylong Coal Project
- Moolarben Coal Mine
- Ulan Coal Mine
- Crown Land (Special Lease)
- Crown Land
- TransGrid
- Railway Land
- Relevant Private Landholder
- Other Land (Ownership not identified)
- National Parks and Wildlife Service
- 1 Landholder Number*
- Peabody Energy Dwelling
- Ulan/Moolarben Dwelling
- Private Dwelling
- Community Building

Air Quality Monitoring Sites

- Static Dust Gauge
- High Volume Air Sampler
- Real-time PM_{10}
- Meteorological Station

* Refer Figure 1-5c for List of Landholders.

Source: WCPL (2015); NSW Land & Property Information (2015); NSW Dept of Industry (2015)

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Air Quality Monitoring Locations

Figure 4-8

WIL-12-12_WEP_EIS_Section 4_215B

In addition, PM_{10} monitoring data recorded at the Moolarben Coal Complex were also reviewed by Todoroski Air Sciences. Data from two HVAS sites were reviewed for the period 2012 to 2014, with the average over both sites being 11.5 µg/m³ (Appendix B).

Monitoring data collected at the Wilpinjong Coal Mine for the period 2012 to 2014 indicate that there have been 11 elevated recordings above the EPA 24-hour PM_{10} average criterion of 50 µg/m³ across all sites (one day in 2012, six days in 2013 and four days in 2014). A more detailed review of the elevated recordings shows that the 24-hour PM_{10} concentrations are strongly influenced by regional-scale phenomena, such as bushfires and dust storms (Appendix B).

$PM_{2.5}$

No $PM_{2.5}$ concentration data are available in the vicinity of the Project. A conservative estimate of background levels was calculated based on the assumption that an annual average $PM_{2.5}$ concentration of 8 µg/m³ is equivalent to an annual average PM_{10} concentration of 30 µg/m³. Based on the mean annual average PM_{10} concentration across all sites for the 2012 to 2014 monitoring (13.4 µg/m³), the $PM_{2.5}$ level would be approximately 3.6 µg/m³ (Appendix B).

TSP

TSP monitoring data have been collected by WCPL at one location using a HVAS. The location of the Wilpinjong Coal Mine TSP air quality monitor (HV3) is shown on Figure 4-8.

Recorded annual average TSP concentrations in the period 2012 to 2014 are provided in Table 4-12.

Table 4-12
Annual Average TSP Concentrations (µg/m³)

Monitor	2012	2013	2014
HV3	18.9	27.5	22.7

Source: Appendix B.

TSP monitoring results show that since monitoring commenced in 2006, there have been no exceedances of the EPA annual average criterion of 90 µg/m³. The average for the 2012 to 2014 monitoring period is 23.0 µg/m³ (Appendix B).

Dust Deposition

Dust deposition monitoring data have been collected by WCPL at 10 locations. Some monitoring locations have changed over the life of the Wilpinjong Coal Mine to reflect operational and land ownership changes. The locations of the current Wilpinjong Coal Mine dust deposition monitors are shown on Figure 4-8.

Recorded annual average dust deposition levels in the period 2012 to 2014 are provided in Table 4-13.

Table 4-13
Annual Average Dust Deposition (Insoluble Solids) Levels (g/m²/month)

Monitor	2012	2013	2014
DG4[1]	1.1	0.9	1.7
DG5[2]	0.7	0.6	0.8
DG7[3]	1.5	ND	ND
DG8[4]	1.0	1.4	1.5
DG10[4]	1.2	2.0	3.3
DG11[1]	1.4	2.0	1.3
DG12[4]	6.5	3.3	3.3
DG13[4]	2.4	1.9	2.8
DG14[4]	2.2	1.0	1.4
DG15[1]	ND	0.9	0.9

Source: Appendix B.

1 Monitoring location currently representative of a mine-owned dwelling.

2 Monitoring location currently representative of privately-owned dwellings.

3 Monitor no longer in operation.

4 Monitoring location currently for diagnostic data only.

ND = No data record (prior to installation/decommissioning).

Dust deposition monitoring results show that annual average dust deposition levels recorded near privately-owned dwellings were below the EPA criterion of 4 g/m²/month.

The average across all sites for the 2012 to 2014 monitoring period is 1.8 g/m²/month (Appendix B).

Background Air Quality for Assessment Purposes

The assessment of Project and cumulative annual average air quality impacts requires background particulate matter concentrations and dust deposition levels to be defined and added to dispersion modelling results for Project emissions. The proximity of local air quality monitors to the existing mining operations means that the recorded air quality data includes particulate matter and dust deposition contributions from the existing Wilpinjong Coal Mine (Appendix B).

Use of these data therefore has the potential to result in double-counting of mine-related emissions. Therefore, background particulate matter concentrations excluding Wilpinjong Coal Mine, and other modelled local mining operation sources, have been estimated by analysing:

- modelling results for a cumulative dispersion model incorporating past (known) operations of the Wilpinjong Coal Mine, the Moolarben Coal Complex and Ulan Mine Complex for 2013; and
- measured data from the air quality monitors for the same period.

Other local mining operations have been included in the modelling rather than as a background level to better reflect changes in those mining operations over time, including those associated with approved modifications.

The average difference between the predicted and measured particulate matter concentrations and dust deposition levels was considered to be the contribution from other non-modelled sources (i.e. background dust levels excluding local mining operations).

The estimated background dust levels excluding local mining operations calculated by Todoroski Air Sciences (2015) based on this analysis are presented in Table 4-14.

Table 4-14
Estimated Background Dust Levels Excluding Local Mining Operations

Pollutant	Averaging Period	Estimated Background Dust Level	Unit
PM_{10}	Annual	11.9	µg/m³
$PM_{2.5}$	Annual	3.2	µg/m³
TSP	Annual	20.2	µg/m³
Dust deposition	Annual	1.1	g/m²/month

Source: Appendix B.

Complaints

WCPL manages complaints in accordance with the Air Quality Management Plan. A summary of air quality-related complaints is provided in Appendix B.

In 2014, 11 complaints were received in relation to dust associated with the Wilpinjong Coal Mine from six households (seven complaints from two households now owned by Peabody Energy), while three complaints were received in January to August 2015 from one household, now owned by Peabody Energy.

The number of dust related complaints recorded at the Wilpinjong Coal Mine has decreased since 2013 (Appendix B).

All complaints were investigated and in some cases site operations were modified to address the complaint.

4.4.2 Potential Impacts

Assessment Methodology

Modelling Scenarios

The same five operational scenarios based on the indicative progressive development of the Project assessed for noise were also assessed for air quality (Appendix B):

- Year 2 – Representative of initial mining of Pit 8 (single fleet operations in the far north of Pit 8), in combination with single fleet operations in Pits 1, 3, 4, 6 and 7. Includes maximum Project ROM coal extraction rate.

- Year 4 – Representative of single fleet operations in the north of Pit 8, in combination with single fleet operations in Pits 2, 3, 5, 6 and 7.
- Year 8 – Representative of two fleets operating in central Pit 8, in combination with single fleet operations in Pit 3 and Pit 5 (far south) and two fleets operating in Pit 6. Includes construction of Ulan-Wollar Road realignment, Stage 2.
- Year 12 – Representative of single fleet operations in southern Pit 8, in combination with single fleet operations in Pit 4 and two fleets operating in Pit 6.
- Year 15 – Representative of single fleet operations in the far south of Pit 8, in combination with two fleets operating in Pit 6.

The operational scenarios were selected to evaluate the potential impacts at the nearest privately-owned receivers over the life of the Project. A particular focus of the selection of the scenarios was to evaluate potential air quality impacts from operations at different stages of development of Pit 8.

Table 2-4 provides the indicative coal processing and production schedule for the Project.

Emission Inventories

Air quality emission inventories were prepared for Years 2, 4, 8, 12 and 15 in consideration of the indicative mining activities for each year, including ROM coal extraction, waste rock removal rates, haul road distances and routes, active stockpile and pit areas and mobile equipment operating hours. The major emission sources were associated with the following activities (Appendix B):

- hauling of waste rock and ROM coal in trucks on unpaved roads;
- dozer operations;
- wind erosion of exposed areas; and
- handling and loading/unloading of ROM and product coal.

A full description of the dispersion model methodology and emission inventories is provided in Appendix B.

Comparison with Best Practice Mitigation Measures

In 2011, the EPA commissioned a review of methods to minimise coal mining particulate matter emissions called the *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Katestone Environmental Pty Ltd, 2011) (the Best Practice Report).

As an outcome of the Best Practice Report, the EPA developed a pollution reduction program that requires each mining company to prepare a report on the practicality of implementing best practice measures to reduce particulate matter emissions.

The best practice dust mitigation measures within the Wilpinjong Coal Mine pollution reduction program report were considered and where appropriate, applied in the emission inventories (such as watering haul roads, stockpile profiling, etc.) (Appendix B).

In addition to the best practice dust mitigation measures incorporated into the modelling, the Wilpinjong Coal Mine's reactive dust management system includes temporarily ceasing select on-site operations when high dust concentrations are measured by the real-time dust monitors (Appendix B).

Dispersion Modelling

A combination of The Air Pollution Model (TAPM) and the CALPUFF Modelling System was used by Todoroski Air Sciences to assess potential air quality impacts associated with the Project.

The CALPUFF Modelling System includes three main components: CALMET, CALPUFF and CALPOST.

TAPM is a prognostic air model used to simulate the upper air data for input into CALMET. The model predicts meteorology important to local scale air pollution against a background of larger scale meteorology provided by synoptic analysis.

CALPUFF is a multi-layer, non-steady state puff dispersion model that is approved by the EPA (DEC, 2005c) and endorsed by the United States Environmental Protection Agency (Appendix B).

CALMET is a meteorological pre-processor that produces the three-dimensional meteorological fields that are used in the CALPUFF dispersion model. Observed hourly meteorological data including data from the Wilpinjong Coal Mine, the Merriwa (Roscommon) BoM site (61287), the Mudgee Airport AWS BoM site (62101) and the Nullo Mountain AWS BoM site (62100) were used as input for CALMET.

CALPOST is a program used to process the output of the CALPUFF dispersion model to produce tabulations that summarise the results of the simulation.

Cumulative Impacts

Cumulative impacts associated with the Moolarben Coal Complex and Ulan Mine Complex were included in the air quality assessment (Appendix B). Emissions from both mining operations were estimated using the latest publically-available air quality assessments for each operation at the time of modelling.

Emissions were estimated based on the *Moolarben Coal Project Stage 1 Optimisation Modification Air Quality and Greenhouse Gas Assessment* (Todoroski Air Sciences, 2013) and the *Air Quality Impact Assessment Ulan Coal – Continued Operations* (PAEHolmes, 2009) (Appendix B).

One application for a modification to the Ulan Mine Complex has been lodged since the time of modelling. The proposed modification would not change the emission estimates that have been used for the cumulative assessment (Appendix B).

Two applications for modifications to the Moolarben Coal Complex have been lodged since the time of modelling. The air quality assessments associated with the proposed modifications have, conservatively, not been considered for this assessment as they reduce the total dust emissions from the Moolarben Coal Complex (Appendix B).

The cumulative assessment for the Project is therefore considered conservative (Appendix B).

Potential Project Only Impacts

All privately-owned receivers were predicted to comply with the EPA's criteria for 24-hour average PM_{10}, annual average PM_{10} and annual average TSP concentrations as well as annual average dust deposition and the Ambient Air – NEPM advisory reporting standards for 24-hour and annual average $PM_{2.5}$ concentrations for the Project Years 2, 4, 8, 12 and 15 (Appendix B).

Figures 4-9, 4-10 and 4-11 show the predicted maximum Project only 24-hour PM_{10} contours for Years 2, 8 and 15 respectively. Additional air quality contour plots are provided in Appendix B.

Vacant Land

Vacant land is considered to be affected if greater than 25% of the property is predicted to exceed the impact assessment criteria.

Todoroski Air Sciences (2015) reviewed the relevant air quality contours and land tenure information for the Project. From this review, it was concluded that there was no predicted air quality affected vacant land (Appendix B).

Potential Cumulative Impacts

Annual Average PM_{10}

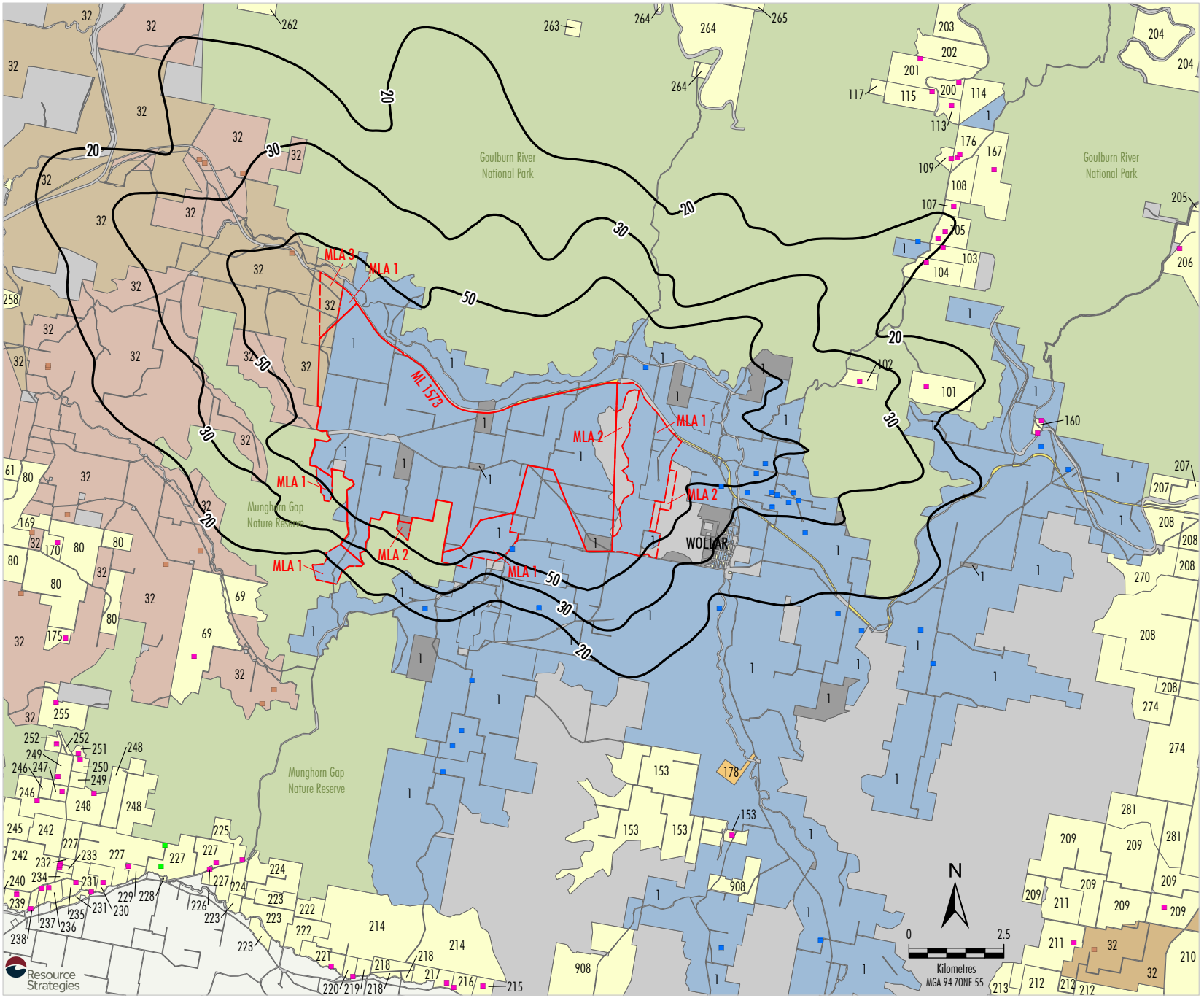
The annual average PM_{10} concentrations were not predicted to exceed the EPA annual average criterion (30 µg/m³) due to the cumulative contributions from the Project, the Moolarben Coal Complex, the Ulan Mine Complex and other background sources (Appendix B).

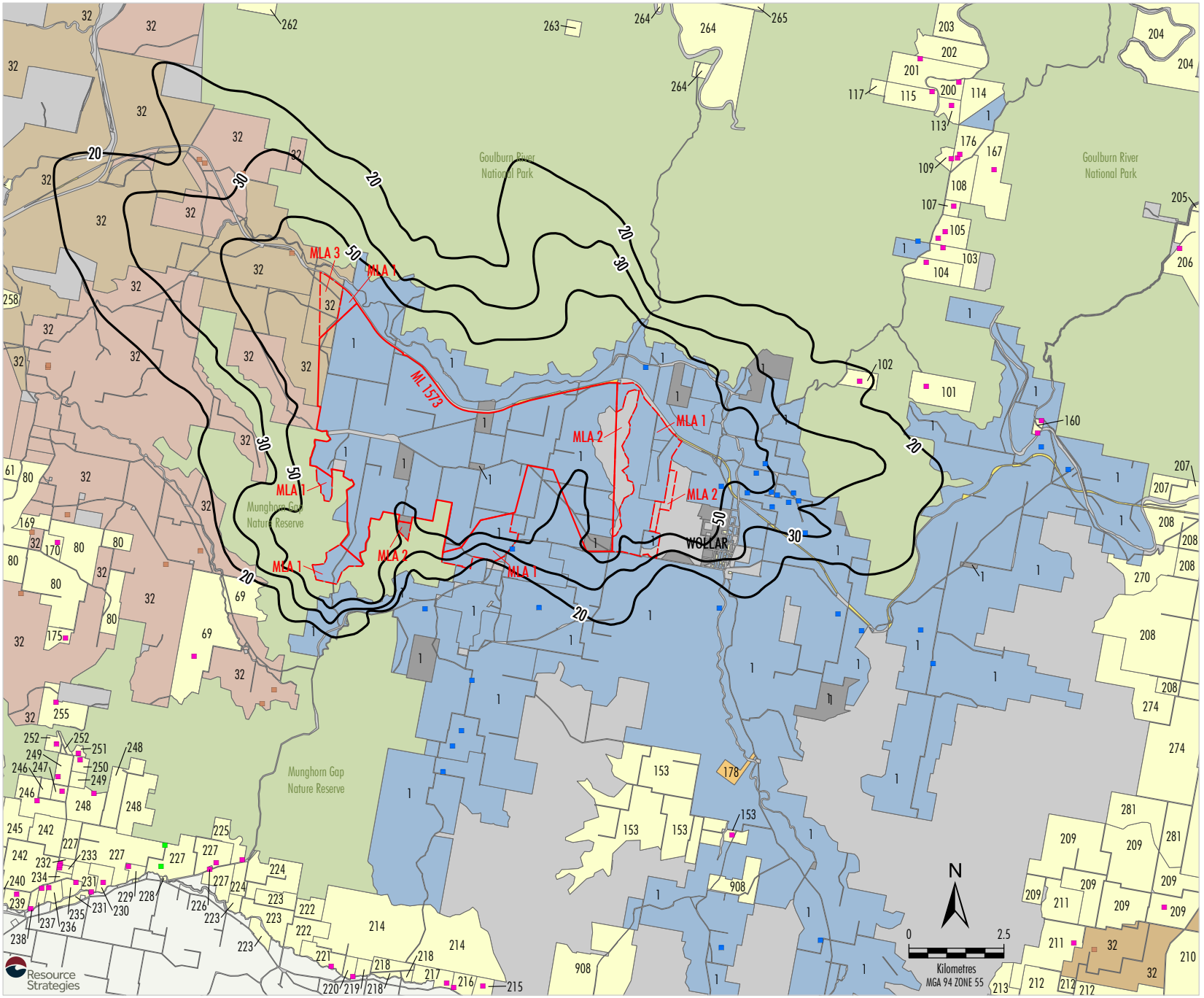
24-hour Average PM_{10}

Potential cumulative 24-hour PM_{10} impacts were considered by Todoroski Air Sciences (2015).

The EPA contemporaneous assessment method was applied to analyse the potential maximum cumulative 24-hour average PM_{10} concentrations arising from the Wilpinjong Coal Mine incorporating the Project (Appendix B).

The contemporaneous assessment adds model-predicted Project 24-hour average PM_{10} concentrations to measured 24-hour average PM_{10} concentrations for each day of the modelled scenario (Appendix B).


LEGEND
Mining Lease Boundary
Mining Lease Application Boundary
Peabody Energy
Bylong Coal Project
Moolarben Coal Mine
Ulan Coal Mine
Crown Land (Special Lease)
Crown Land
TransGrid
Railway Land
Relevant Private Landholder
Other Land (Ownership not identified)
National Parks and Wildlife Service
1 Landholder Number*
Peabody Energy Dwelling
Ulan/Moolarben Dwelling
Private Dwelling
Community Building
Project-only 24 hour PM10 Air Quality Contour (µg/m3)
* Refer Figure 1-5c for List of Landholders.
Source: WCPL (2015); After Todoroski Air Sciences (2015); NSW Dept of Industry (2015); NSW Land & Property Information (2015)
Goulburn River National Park
Munghorn Gap Nature Reserve
WOLLAR
MLA 1
MLA 2
MLA 3
ML 1573
20
30
50
N
0
2.5
Kilometres
MGA 94 ZONE 55
Resource Strategies
WIL-12-12_WEP_EIS_Section 4_204G
Peabody ENERGY
WILPINJONG EXTENSION PROJECT
Project 24-hour PM10 Air Quality Contours - Year 2
Figure 4-9


LEGEND
Mining Lease Boundary
Mining Lease Application Boundary
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Bylong Coal Project
Moolarben Coal Mine
Ulan Coal Mine
Crown Land (Special Lease)
Crown Land
TransGrid
Railway Land
Relevant Private Landholder
Other Land (Ownership not identified)
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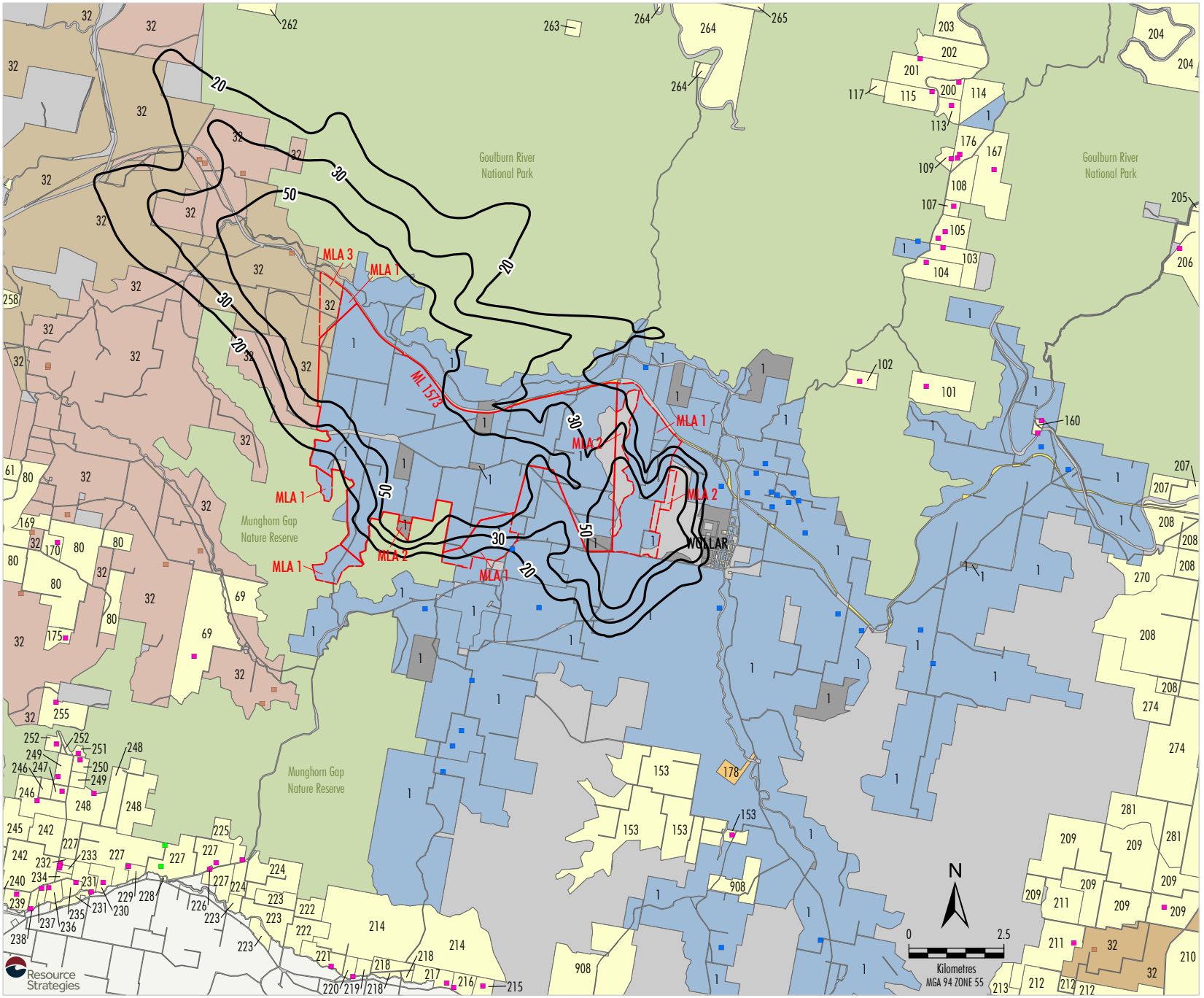
1 Landholder Number*
Peabody Energy Dwelling
Ulan/Moolarben Dwelling
Private Dwelling
Community Building
Project-only 24 hour PM10 Air Quality Contour (µg/m3)
* Refer Figure 1-5c for List of Landholders.
Source: WCPL (2015); After Todoroski Air Sciences (2015); NSW Dept of Industry (2015); NSW Land & Property Information (2015)
MLA 1
MLA 2
MLA 3
ML 1573
WOLLAR
Goulburn River National Park
Munghorn Gap Nature Reserve
20
30
50
N
0
2.5
Kilometres
MGA 94 ZONE 55
Resource Strategies
WIL-12-12_WEP_EIS_Section 4_205G
Peabody ENERGY
WILPINJONG EXTENSION PROJECT
Project 24-hour PM10 Air Quality Contours - Year 8
Figure 4-10



LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Peabody Energy
- Bylong Coal Project
- Moolarben Coal Mine
- Ulan Coal Mine
- Crown Land (Special Lease)
- Crown Land
- TransGrid
- Railway Land
- Relevant Private Landholder
- Other Land (Ownership not identified)
- National Parks and Wildlife Service
- 1 Landholder Number*
- Peabody Energy Dwelling
- Ulan/Moolarben Dwelling
- Private Dwelling
- Community Building
- Project-only 24 hour PM_{10} Air Quality Contour ($\mu g/m^3$)

* Refer Figure 1-5c for List of Landholders.

Source: WCPL (2015); After Todoroski Air Sciences (2015); NSW Dept of Industry (2015); NSW Land & Property Information (2015)

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WILPINJONG EXTENSION PROJECT

Project 24-hour PM_{10} Air Quality Contours - Year 15

Figure 4-11

The assessment indicated only low potential for any cumulative 24-hour average PM_{10} impacts to occur (i.e. up to two additional days per annum above the 24-hour average criterion at a small number of the nearest privately-owned receivers) (Appendix B).

Additional analysis indicated that continued use of the Wilpinjong Coal Mine reactive dust management system (i.e. temporary pausing of activities in Pit 8 during adverse weather conditions) would avert the predicted potential incremental exceedances (Appendix B).

Annual Average TSP

No exceedances of the EPA annual average TSP criterion (90 µg/m³) were predicted at any privately-owned receivers due to the cumulative contributions from the Project, the Moolarben Coal Complex, the Ulan Mine Complex and other non-modelled sources (Appendix B).

Annual Average $PM_{2.5}$

The annual average $PM_{2.5}$ concentrations were not predicted to exceed the Ambient Air – NEPM advisory reporting standard annual average criterion (8 µg/m³) due to the cumulative contributions from the Project, the Moolarben Coal Complex, the Ulan Mine Complex and other non-modelled sources (Appendix B).

Dust Deposition

No exceedances of the EPA maximum total deposited dust level criterion (4 g/m²/month [annual average]) were predicted at any privately-owned receivers due to the cumulative contributions from the Project, the Moolarben Coal Complex, the Ulan Mine Complex and other non-modelled sources (Appendix B).

A further assessment of the Project air quality emissions against the non-discretionary development standard for mining is provided in Attachment 5.

Potential Blasting Fume Emissions

Blasting activities have the potential to result in fugitive fume and particulate matter emissions. Particulate matter emissions from blasting are included in the dispersion modelling results and are controlled by adequate stemming of the blast and assessing meteorological conditions prior to blasting (Appendix B).

Measures to minimise or avoid imperfect blasts, which may result in oxides of nitrogen (NO_X) fumes being emitted, would be implemented in accordance with *Code of Practice: Prevention and Management of Blast Generated NO_x Gases in Surface Blasting* (Australian Explosives Industry and Safety Group Inc., 2011), and the Blast Fume Management Strategy within the Blast Management Plan (Sections 4.4.3, 4.5.1 and 4.5.3).

The existing Blast Management Plan includes a Blast Fume Management Strategy to minimise the occurrence of blast fumes associated with blasting at the Wilpinjong Coal Mine. These measures include:

- consideration of geology and moisture levels (e.g. reduce powder factor in weak strata, use of wet hole products in clay holes and use of gas bags for wet holes);
- consideration of meteorological conditions (e.g. rain and strong winds);
- blast design (e.g. blast layout, priming, explosives desensitisation and blast delays);
- product selection and quality (e.g. stemming materials and techniques, loading sequence, product delivery);
- blast crew education (e.g. permitting, product development and updates, product selection and training); and
- on bench practices (e.g. bench drainage techniques, managing sleep times and checking for shallow blocked or slumped holes).

With the implementation of these blast practices and management measures, potential impacts from blast fume emissions would be readily managed for the Project and adverse impacts in the surrounding environment would be minimised (Appendix B).

Potential Construction Impacts

Construction activities would potentially be sources of short-term particulate matter emissions.

Particulate matter emissions from construction activities (e.g. road diversions) would typically be contained to specific areas and would be of limited duration (Appendix B). Construction dust emissions would be effectively managed through best practice mitigation measures, as described in Section 4.4.3 and Appendix B.

Coal Transport

Product coal is transported via the Sandy Hollow Gulgong Railway to domestic power generation customers and the Port of Newcastle for export.

As described in Section 2.9, product coal would be transported off-site within the existing maximum and annual average daily rail limits. Given that the train loading/coal treatment methods, trains used to transport product coal and the characteristics of the coal transported would not change for the Project (i.e. coal from the same coal seams and the same CHPP), it is likely that there would be no change to particulate matter concentrations along the railway associated with the Project in comparison to approved operations (Appendix B).

The extension of the mine life by approximately seven years would mean that particulate matter emissions along the railway associated with the Wilpinjong Coal Mine would continue accordingly during the extended mine life (Appendix B).

Analysis of the potential impacts associated with rail transport suggests that the potential for adverse air quality impacts associated with coal dust generated during rail transport would likely be low and would not make any appreciable difference to existing air quality levels (Appendix B).

4.4.3 Mitigation Measures, Management and Monitoring

Air quality management measures are currently implemented at the Wilpinjong Coal Mine in accordance with the Air Quality Management Plan (Section 4.4.1) and would continue to be implemented for the Project. This plan would be reviewed and updated to address the Project, subject to the conditions of any Development Consent for the Project.

Current ambient air quality monitoring at the Wilpinjong Coal Mine shows that existing operations have a minimal impact on local air quality (Appendix B).

Air Quality Management Plan

The management measures in the Air Quality Management Plan would be revised and implemented during construction and operation of the Project.

The Air Quality Management Plan would be updated to include specific dust suppression measures to be implemented during Project construction activities (e.g. public road relocations), such as minimisation of disturbance areas and watering trafficked areas.

An additional aspect of the best practice management at the site is the real-time monitoring and management system. An outline of the real-time monitoring and management system is provided in the Air Quality Management Plan.

The existing real-time monitoring and management system would continue to enable WCPL to proactively and reactively manage the potential short-term particulate matter emissions from the Project, to prevent or minimise potential impacts at privately-owned residences.

Blasting Fume Emissions

Potential blasting fume emissions would continue to be managed in accordance with the Blast Fume Management Strategy within the Blast Management Plan which would be updated for the Project, subject to the conditions of any Development Consent for the Project.

4.5 BLASTING

A Noise and Blasting Assessment for the Project was undertaken by SLR Consulting (2015) and is presented in Appendix A.

The blasting assessment was conducted in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZEC, 1990).

The Noise and Blasting Assessment was peer reviewed by Mr Richard Heggie (Director, SLR Consulting) who concluded that the report is comprehensive, conforms to the relevant guidelines and has been undertaken in a professional manner. The peer review report is presented in Attachment 4.

4.5.1 Existing Environment

Blast Management and Monitoring Regime

Blast management at the Wilpinjong Coal Mine is undertaken in accordance with the Blast Management Plan. The Blast Management Plan describes the blast monitoring regime and general blast management measures. It also describes the process for notifying landowners of upcoming blast events, flyrock distribution monitoring, reporting and complaint management procedures.

Blast management measures used at the Wilpinjong Coal Mine include:

- public notification of upcoming blasts;
- coordinating the time of blasts with the timing of blasts at the Moolarben Coal Complex and Ulan Mine Complex to minimise the potential for cumulative blasting impacts;
- enforcing a minimum exclusion zone of 500 m;
- conducting pre-blast inspections;
- training relevant personnel in environmental obligations and safe handling of explosives;
- designing blasts to ensure that vibration and airblast limits are compliant, including consideration of meteorological conditions and management of blast maximum instantaneous charge (MIC);
- flyrock management;
- use of adequate stemming, a delay detonation system and careful drilling and hole loading;
- monitoring of blasts at a location representative of the closest privately-owned receivers;
- ongoing review of site based prediction equations; and
- visual monitoring of all blasts.

In addition, Ulan-Wollar Road and the Sandy Hollow Gulgong Railway are temporarily closed when blasting is carried out within a certain distance (e.g. 500 m), in accordance with the Blast Management Plan. Temporary road closures are typically for a period of less than 20 minutes and no more than one closure per day. Notification of temporary road closures is provided at least three days prior to planned road closures.

The Blast Management Plan also includes a Blast Fume Management Strategy to minimise the occurrence of blast fumes associated with blasting at the Wilpinjong Coal Mine. These measures are described in Section 4.4.

Compliance and Complaints

Blast overpressure and vibration monitoring has been undertaken at the Wilpinjong Coal Mine since 2006. The nearest privately-owned receivers are currently located in the Village of Wollar and WCPL maintains a blast monitor within the village (Figure 4-3).

From the review of blast monitoring data between 2012 and 2014 (i.e. the most recent Independent Audit period), no airblast or vibration results exceeding the blast criteria described in Condition 6 of Project Approval 05-0021 were recorded at any privately-owned properties (AECOM Australia, 2015).

Review of WCPL's EPL 12425 compliance summary reports from January to August 2015 also indicate no exceedances of the relevant blasting limits at privately-owned receivers for that period (Appendix A).

WCPL manages complaints in accordance with the Blast Management Plan. A summary of blast-related complaints is provided in Appendix A.

In 2014, 23 complaints were received in relation to blast overpressure and vibration from 11 households (six complaints from two households now owned by Peabody Energy), while 13 complaints were received in January to August 2015 from five households. Subsequent review of the monitored overpressure and vibration levels associated with each complaint indicated that blast emissions were below the limits specified in EPL 12425.

Blast Measurement and Description

Overpressure (or airblast) is reported in linear decibels (dBL) and is the measurable effect of a blast on air pressure, including generated energy that is below the limit of human hearing. Ground vibration is the measurable movement of the ground surface caused by a blast and is measured in mm/s as Peak Vector Sum (PVS) vibration velocity.

Discernible blast emission effects can be divided into the three categories listed below:

1. Occupants of a building can be inconvenienced or disturbed (i.e. temporary amenity effects).
2. Contents of a building can be affected.
3. Integrity of a building structure can be affected.

An individual's response to blasting vibration and overpressure is highly dependent on previous experience and expectations.

Blasting Criteria

Ground vibration and airblast levels which cause human discomfort are generally lower than the recommended structural damage limits. Therefore, compliance with the lowest applicable human comfort criteria generally means that the potential to cause structural damage to buildings is minimal.

The EPA adopts the ANZEC (1990) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* for assessing potential annoyance from blast emissions during daytime hours, as listed below (Appendix A):

- The recommended maximum level for airblast is 115 dBL.
- The level of 115 dBL may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 120 dBL at any time.
- The recommended maximum for ground vibration is 5 mm/s, PVS vibration velocity.
- The PVS level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10 mm/s at any time.

AS 2187: 2006 *Explosives - Storage and Use – Part 2: Use of Explosives* provides guidance in assessing blast-induced ground (and structural) vibration and airblast effects on buildings and their occupants. In relation to building damage airblast criteria, AS 2187.1 recommends a maximum airblast of 133 dB (peak linear). In accordance with AS 2187.1, SLR Consulting also adopted 12.5 mm/s as the building damage vibration criterion (Appendix A).

There are no regulatory criteria nominated in Australia for the assessment of damage to infrastructure or archaeological/geological structures (including Aboriginal rock shelter sites of significance) from vibration. Based on literature, SLR Consulting adopted the following vibration criteria for the assessment (Appendix A):

- Railway infrastructure – 100 mm/s.
- Roadway infrastructure – 80 mm/s.
- TransGrid Wollar to Wellington 330 kV ETL – 50 mm/s.
- Archaeological/geological structures (i.e. Aboriginal rock shelter sites with art) – 250 mm/s.

4.5.2 Potential Impacts

The Noise and Blasting Assessment (Appendix A) included an assessment of the potential impacts of on-site blasting. The potential impacts are described further below and in Appendix A.

Predicted Blasting Emissions

The blasting assessment in Appendix A indicates that no exceedances of relevant airblast or vibration criteria (described above) would occur at any privately-owned receivers, community facilities or historical heritage sites in the Village of Wollar for the typical maximum blast MIC proposed for the Project (up to approximately 3,900 kilograms [kg]).

Safe working distances for varying blast MICs for proximal general infrastructure (i.e. railway, roadway or ETL) are provided in Appendix A.

Most of the Aboriginal rock shelter sites that have been identified in close proximity to current or proposed open cut boundaries do not warrant any management of blast vibration levels (Section 4.10.2 and Appendix G).

Through the continued management of blast MICs, there would be no exceedances of vibration damage criteria at any Aboriginal rock shelter sites with art in the vicinity of the Wilpinjong Coal Mine (Appendix A).

Flyrock

Flyrock is any material ejected from the blast site by the force of the blast. Flyrock is managed by appropriate blast design and execution in accordance with the Blast Management Plan.

A further assessment of the blast emissions of the Project against the non-discretionary development standard for mining is provided in Attachment 5.

4.5.3 Mitigation Measures, Management and Monitoring

Blast management measures for the Wilpinjong Coal Mine, including the Blast Fume Management Strategy, are described in the Blast Management Plan (Section 4.5.1) and would continue to be implemented for the Project. This plan would be reviewed and updated to address the Project (e.g. updates with respect to any proximal infrastructure to the open cut extension areas), subject to the conditions of any Development Consent for the Project.

WCPL would continue to vary the MIC (or other relevant blasting parameters) of blasts over the life of the Project according to the location of the blast and the proximity of nearby sensitive receivers, to minimise blasting effects at nearby privately-owned receivers, proximal infrastructure features and Aboriginal rock shelter sites with art. Blast MICs would typically be up to approximately 3,900 kg (i.e. for overburden) and, consistent with existing management measures, would be adjusted as required for blasts located in close proximity to sensitive features (e.g. infrastructure) to maintain compliance with relevant vibration or airblast criteria.

In some cases, the Blast Management Plan includes additional performance criteria for blast vibration that are more stringent than the damage criteria adopted by SLR Consulting (Appendix A), such as the current WCPL performance criteria for Aboriginal rock shelter sites with art (80 mm/s).

Temporary closures of Ulan-Wollar Road and the Sandy Hollow Gulgong Railway would continue to be conducted when blasting is carried out in proximity to them (e.g. within 500 m), in accordance with the Blast Management Plan.

4.6 SPONTANEOUS COMBUSTION

4.6.1 Existing Environment

Spontaneous Combustion Management Regime

The focus of spontaneous combustion management at the Wilpinjong Coal Mine is on preventing outbreaks rather than management of outbreaks in accordance with the Spontaneous Combustion Management Plan.

Current measures for preventing outbreaks include mine planning, spontaneous combustion propensity testing, risk identification and assessment, and identification of potential hot spots. Further detail on these measures is provided in Section 2.10.5.

The key source of historical combustion events at the Wilpinjong Coal Mine was the temporary Keylah waste rock emplacement. These events have at times resulted in perceptible odour and/or associated environmental complaints from nearby privately-owned receivers and/or users of Ulan-Wollar Road.

A management plan specific to the Keylah waste rock emplacement was developed and is appended to the Spontaneous Combustion Management Plan. This plan was developed to facilitate the removal and disposal of carbonaceous material within the Keylah waste rock emplacement in a manner that minimises off-site odour and/or dust emissions.

Staged removal of the Keylah waste rock emplacement commenced in October 2014 and is scheduled for completion in mid 2016. This work has been undertaken in consultation with relevant government agencies and the local community.

The Spontaneous Combustion Management Plan also includes specific monitoring of potential combustion related pollutants at the Village of Wollar. Monitoring results indicate that all pollutants, including those relating to odour, have been below the relevant air quality criteria to date (Ecotech Pty Ltd, 2013; Pacific Environment Limited, 2014). This monitoring will continue until completion of the Keylah waste rock emplacement removal program.

A targeted program of spontaneous combustion propensity testing has also been undertaken across the Wilpinjong Coal Mine in accordance with the Spontaneous Combustion Management Plan.

Results to date indicate that parting material ranges from low propensity (Pit 4) to low/medium propensity (Pit 7) and that target coal ranges from low propensity (Pit 4) to medium propensity (Pit 5). Propensity testing results are used to inform management of these materials to reduce the risk of future spontaneous combustion events.

Complaints

WCPL manages complaints in accordance with the Spontaneous Combustion Management Plan.

In 2014, some 30 complaints were received in relation to odour associated with the Wilpinjong Coal Mine from seven households (16 complaints from two households now owned by Peabody Energy), while 25 complaints were received in January to August 2015 from seven households (12 complaints from one household now owned by Peabody Energy). This is a reduction from the 35 complaints received in 2013. There has been some reduction in odour-related complaints since the commencement of the staged removal of the Keylah waste rock emplacement.

In 2014, WCPL commissioned (in consultation with the EPA) Pacific Environment Limited to compare the results of air pollutant monitoring (from Village of Wollar and Cooks Gap) against the timing of complaints and the dominant wind direction.

The study concluded (Pacific Environment Limited, 2014) that it was *unlikely that spontaneous combustion at the mine was the primary source of the odour nuisance*. This conclusion was supported by very low pollutant concentrations recorded during monitoring and the wind direction during the period of most odour complaints being from the Village of Wollar towards the Wilpinjong Coal Mine.

4.6.2 Potential Impacts

Since the implementation of a revised Spontaneous Combustion Management Plan in 2014, as at October 2015 there has only been one heating event that did not relate to a legacy temporary waste rock emplacement. This involved heating on a monitored ROM coal stockpile and, in accordance with the Spontaneous Combustion Management Plan, was quickly identified and resolved by collecting and then preferentially processing the relevant coal through the CHPP.

There were no spontaneous combustion events recorded over this period that were related to the general mining, transport and placement of overburden, coal rejects or parting material.

The material to be excavated in ROM operations at the Project is expected to have similar propensity for spontaneous combustion as the material currently being handled and managed on-site. There would, therefore, continue to be some potential for spontaneous combustion events to occur in coal or other carbonaceous materials over the life of the Project.

4.6.3 Mitigation Measures, Management and Monitoring

Sections 2.10.5 and 4.6.1 describe the mitigation measures, management and monitoring currently implemented at the Wilpinjong Coal Mine to minimise the risk of spontaneous combustion events, which includes:

- mine planning;
- spontaneous combustion propensity testing;
- risk identification and assessment; and
- identification of potential hot spots.

These would continue to be implemented for the Project, in accordance with the Spontaneous Combustion Management Plan.

As an extension to WCPL's current spontaneous combustion propensity testing program, spontaneous combustion propensity testing would also be undertaken in Pit 8 to inform the management of materials and reduce the risk of future spontaneous combustion events.

The existing Spontaneous Combustion Management Plan would be reviewed and updated to address the Project, subject to the conditions of any Development Consent for the Project.

4.7 GROUNDWATER

A Groundwater Assessment for the Project was undertaken by HydroSimulations (2015) and is presented in Appendix C. The Groundwater Assessment was peer reviewed by Kalf and Associates (Dr Frans Kalf) who concluded that the hydrogeological description, conceptualisation, model design, simulations and reporting had been conducted in a professional manner. The peer review report is presented in Attachment 4.

A description of the existing groundwater resources environment in the vicinity of Project, including baseline data and the existing monitoring regime and effects of the Wilpinjong Coal Mine is provided in Section 4.7.1.

Section 4.7.2 describes the potential impacts of the Project on groundwater resources including cumulative impacts, while Section 4.7.3 outlines mitigation measures, management (including licensing considerations) and monitoring.

The Project groundwater and surface water studies have been undertaken in an integrated manner. For example, the assessment of potential groundwater impacts includes the predicted post-mining water levels of the final voids determined by the Surface Water Assessment (Appendix D).

The groundwater and surface water studies have considered the potential impact of the action under the EPBC Act and the SEARs with respect to water resources (Attachment 2).

The Groundwater Assessment has considered the requirements of the relevant water sharing plan under the NSW *Water Management Act, 2000*, which is the *Water Sharing Plan for the Hunter Unregulated and Alluvial Sources, 2009* (Water Sharing Plan).

4.7.1 Existing Environment

Biophysical Strategic Agricultural Land is not present in the proposed Project open cut extension areas and infrastructure areas, and a Site Verification Certificate has been issued by the DP&E confirming this (Attachment 10).

Groundwater Management and Monitoring

Groundwater monitoring and management at the Wilpinjong Coal Mine is currently undertaken in accordance with the Groundwater Monitoring Program and Surface and Groundwater Response Plan, which are both sub-plans of the Water Management Plan.

The Groundwater Monitoring Program outlines:

- the existing groundwater conditions and baseline data relevant to the Wilpinjong Coal Mine;
- groundwater impact assessment criteria and triggers;
- management measures for drilling and water supply bores;
- groundwater monitoring; and
- the process for validation of previous groundwater predictions.

The Surface and Groundwater Response Plan includes:

- processes to deal with a groundwater-related complaint;
- the groundwater impact investigation protocol; and
- a response plan, in the event that an investigation conclusively attributes an adverse impact to an existing groundwater supply user to Wilpinjong Coal Mine operations.

Appropriate contingency measures for an impact on a groundwater supply user may include:

- deepening the affected groundwater supply;
- construction of a new groundwater supply; or
- provision of a new alternative water supply.

The Water Management Plan includes a Complaint Response Protocol to reply to community concerns that relate to groundwater and other matters. There were no complaints received in relation to groundwater impacts in 2014 or January to August 2015.

Baseline Groundwater Data

Baseline geological and groundwater data was reviewed and compiled from a number of sources as part of the Groundwater Assessment including:

- Western Coalfield geology mapping;
- WCPL exploration (geological) data and logs;
- DPI Water NSW Pinneena Database records;
- existing water management (including groundwater licensing) records from the Wilpinjong Coal Mine;
- previous hydrogeological assessments and reviews undertaken at the Wilpinjong Coal Mine;
- previous 42 day pumping test, and hydrogeological slug tests conducted at Wilpinjong Coal Mine;
- groundwater level and pressure data from groundwater monitoring programs and investigations undertaken at the Wilpinjong Coal Mine and surrounding projects (e.g. Moolarben Coal Complex);
- groundwater quality data from the above monitoring programs and investigations;
- LiDAR survey data; and
- other regional topographic mapping data.

The existing baseline groundwater data was augmented with the results of a Project groundwater investigation programme undertaken by Groundwater Exploration Services in 2014 and 2015, the results of which are presented in Appendix C.

The Project groundwater investigation programme was undertaken in accordance with an approved Groundwater Management and Monitoring Programme for EL 7091 and EL 6169. The programme included extensions to the previous testing and monitoring network of the Wilpinjong Coal Mine, including:

- core testwork (horizontal and vertical permeability) on 26 drillcore samples from three drillholes;
- installation of additional standpipe piezometers;
- additional pumping tests in the vicinity of Wilpinjong Creek; and
- additional slug/aquifer tests.

In addition, to assist in delineating the extent and depth of alluvium in the vicinity of the Pit 3 open cut extension, a transect of six shallow drillholes (WTr1-WTr6) was completed and logged across Wilpinjong Creek.

To assist with further definition of alluvium in the vicinity of the Project (i.e. comparison with Quaternary alluvium mapped at a regional scale), and to validate and correlate the results from the transect of shallow drill holes, Groundwater Imaging Pty Ltd has also completed TEM surveys of sections of Wilpinjong Creek, Cumbo Creek and Pit 8. The TEM survey results are summarised in Appendix C.

Examination of the available baseline groundwater data has enabled an understanding of the existing groundwater systems, and the scale and nature of the effects of the existing operations at the Wilpinjong Coal Mine on local and regional groundwater systems.

Existing Groundwater Regime

A conceptual hydrogeological model of the existing groundwater regime was developed by HydroSimulations (2015) based on the review of the available groundwater data and the Water Sharing Plan.

The key geological features in the vicinity of the Project of relevance to hydrogeological processes are (Appendix C):

- elevated sandstone plateaus of the Narrabeen Group;
- a thin veneer of recent alluvium/colluvium along Wilpinjong Creek and alluvium along Cumbo Creek and Wollar Creek (with alluvial bodies being quite narrow);
- unconsolidated deposits in western portions of the Wilpinjong Coal Mine and extending into the Moolarben Coal Complex tenements with coarse-grained lithology up to almost 60 m deep;
- overburden, consisting of the Permian Illawarra Coal Measures (including the Moolarben Coal Member, which is a secondary economic coal resource);

- the Ulan Coal Seam (the primary economic coal resource);
- the Marrangaroo Sandstone and underlying Nile Sub-Group; and
- the Shoalhaven Group and older units acting as the 'basement'.

There is no evidence of major faulting over the Wilpinjong Coal Mine, although faults have been observed and mapped by WCPL. There are minor intrusions, dykes and sills in parts of the Wilpinjong Coal Mine area (Appendix C).

Alluvial deposits are associated with Wilpinjong and Cumbo Creeks in the vicinity of the Wilpinjong Coal Mine, along Wollar Creek to the east of Pit 8 and along Moolarben Creek (to the south-west of the Wilpinjong Coal Mine) (Appendix C).

Colluvial deposits are also evident along the north of Wilpinjong Creek below the escarpments of the Goulburn River National Park (Appendix C), which adjoins Peabody Energy-owned land north of Wilpinjong Creek (Figure 1-5a).

A prior drainage system and/or some other process has resulted in coarse-grained deposits which are located in areas of Pits 5 and 6 and extend to the west in the approved Moolarben Coal Complex tenements.

HydroSimulations has identified two distinct groundwater systems in the Wilpinjong Coal Mine area:

- Alluvial groundwater system – associated primarily with Wilpinjong Creek and Wollar Creek.
- Porous rock groundwater system – primarily the Illawarra Coal Measures.

None of the identified groundwater systems are significant aquifers (Appendix C).

The most permeable units are the Ulan Coal Seam, alluvium and Marrangaroo Formation (Marrangaroo Conglomerate), while the sandstones of the Narrabeen Group are of lower permeability (Appendix C).

The Illawarra Coal Measures also include layers of low permeability mudstones and siltstones.

Alluvial Aquifers

Alluvial deposits are associated with Wilpinjong and Cumbo Creeks in the Wilpinjong Coal Mine area, and Wollar Creek to the east of Pit 8.

TEM surveys conducted for WCPL by Groundwater Imaging Pty Ltd in 2014 indicate the extent of alluvial deposits are generally much narrower than the previous regional geological mapping, with long thin deposits along Wilpinjong Creek, Cumbo Creek, and in the northern part of Slate Gully.

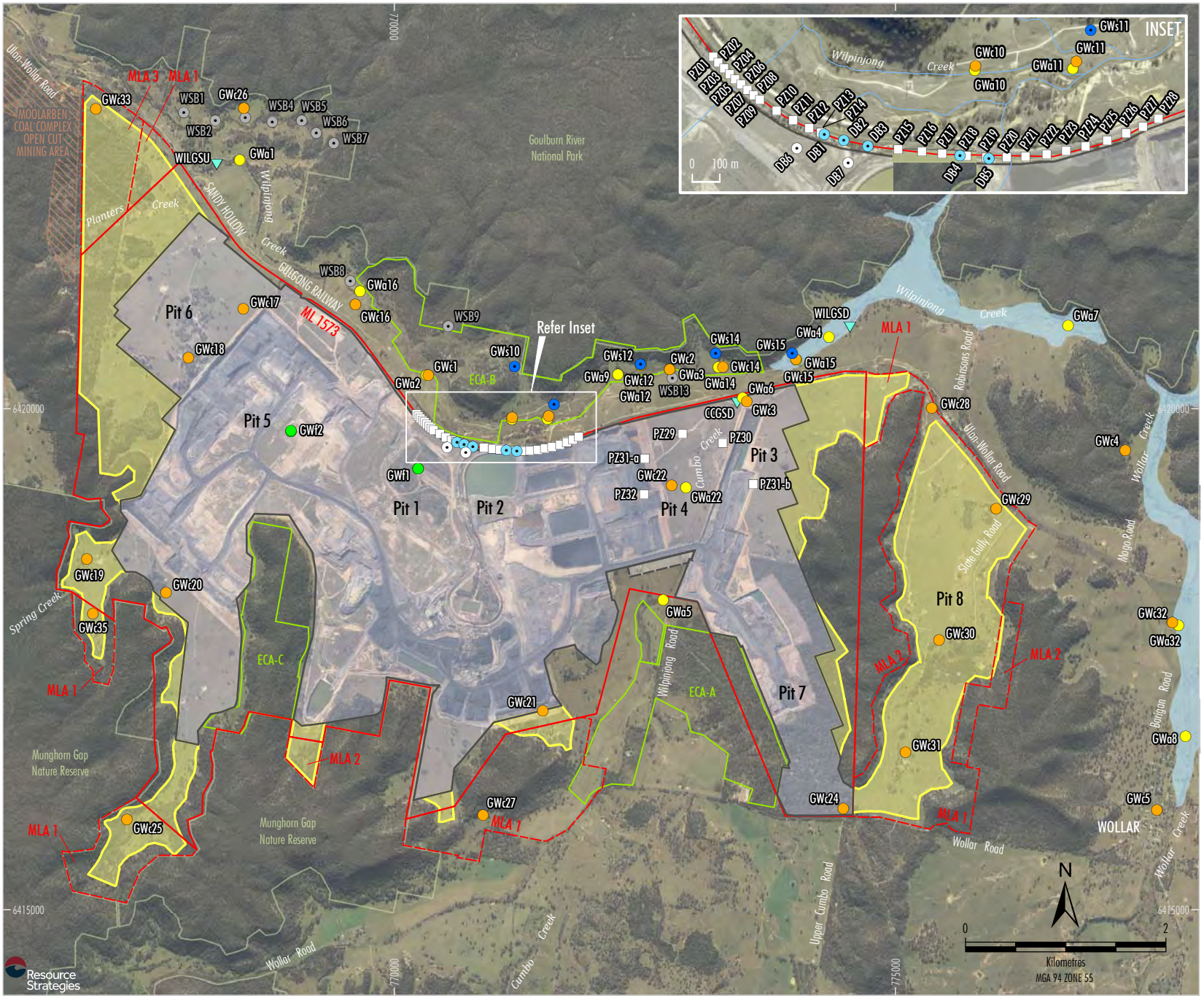
Bore logs from the NSW Pinneena database have been analysed comparing near surface lithology along Wilpinjong Creek (to the confluence with Cumbo Creek) and along Cumbo Creek. The distribution of unconsolidated material supports the TEM interpretation of a narrow alluvial body (Appendix C).

DPI Water has identified a portion of the alluvial aquifer associated with Wilpinjong Creek and lower Wollar Creek as 'highly productive' (Figure 4-12). It is noted that in the vicinity of the Project this 'highly productive' aquifer is largely confined to Peabody Energy-owned land.

In addition, HydroSimulations concluded that on the basis of the available data, including NSW Pinneena database records and water quality data, that it is unlikely that the current 'highly productive' classification for this area of the alluvial water source is valid. This conclusion was made in the context of recorded lithology and thickness of alluvium; the fact that no bores intersecting the declared 'highly productive' alluvium along Wollar Creek or Wilpinjong Creek have a recorded bore yield of greater than 5 litres per second in the Pinneena bore database; and also the distribution of groundwater salinity (Appendix C).

Unconsolidated Tertiary Deposits

Unconsolidated Tertiary deposits (i.e. a prior drainage system) have been interpreted as a Palaeochannel at the Moolarben Coal Complex, with the extent of these features being mapped by RPS Aquaterra (2011) and TEM surveys at Wilpinjong Coal Mine (Groundwater Imaging Pty Ltd, 2014). In addition, these features have been identified in Pit 5 of the Wilpinjong Coal Mine where channel-like deposits can be observed in the pit wall (Appendix C).



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Bore logs support the presence of such a feature, extending between the Moolarben Coal Complex and Wilpinjong Coal Mine, which has been filled with sandy unconsolidated material, with some bores showing greater than 20 m of sands and/or gravel.

These sediments are generally not coincident with modern drainage lines (Appendix C) and when encountered in Pit 5 at the Wilpinjong Coal Mine have typically been dry.

Groundwater Recharge

Recharge to the groundwater systems occurs from rainfall and runoff infiltration and lateral groundwater flow, especially from the elevated Narrabeen Group to the alluvium of Wilpinjong Creek. Seepage faces would be expected along the cliff faces bordering Wilpinjong Creek after rainfall events, and perched water tables might be sustained at high elevations due to the presence of occasional lower permeability beds between the sandstone layers.

Although groundwater levels are sustained by rainfall infiltration, they are controlled by topography, geology and surface water levels in local drainages (Appendix C).

Local groundwater tends to mound beneath hills but mounding is expected to be slight to the south of the Wilpinjong Coal Mine, because sub-cropping coal seams are dry there (Appendix C).

Wilpinjong Creek and Cumbo Creek are conceptualised by HydroSimulations as gaining systems under natural conditions. During short events of high surface flow, streams would lose water to the host aquifer, but during recession, the aquifer would discharge water slowly back into the stream from bank storage.

Groundwater, under natural conditions, is expected to discharge upwards from the Permian rocks to the alluvium associated with Wilpinjong Creek. Loss by evapotranspiration is likely along the creek corridors where the water table is near the ground surface (generally 2 to 3 m below ground level) (Appendix C).

In the main open cut areas associated with the Project the depth to groundwater can be as shallow as 5 m below ground but is more typically 10 m to 50 m below ground (Appendix C).

The direction of groundwater flow in the vicinity of the Wilpinjong Coal Mine is generally northward and down dip of the coal seams (Appendix C). A groundwater divide is present around the Moolarben Coal Complex, with flow in that area occurring to the north and north-west as well as to the east.

Groundwater Dependent Ecosystems

There are no 'high priority GDEs' identified in the Water Sharing Plan in the vicinity of the Project.

The *National Atlas of Groundwater Dependent Ecosystems* (BoM, 2015b) does not identify any potential GDEs in the vicinity of the Project.

Notwithstanding, *The NSW State Groundwater Dependent Ecosystems Policy* (NSW Department of Land and Water Conservation, 2002) also recognises the four Australian GDE types that can be found in NSW, namely (Hatton and Evans, 1998):

- terrestrial vegetation;
- baseflows in streams;
- aquifer and cave ecosystems; and
- wetlands.

The *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* (GDE guideline) (NOW, 2012) also identifies four above ground ecosystems that are considered GDEs, as follows:

- groundwater dependent wetlands;
- baseflow streams (surface water ecosystems);
- estuarine and near shore marine ecosystems; and
- phreatophytes – groundwater dependent terrestrial ecosystems.

Groundwater resources associated with the main local streams (i.e. Wilpinjong Creek, Cumbo Creek and Wollar Creek) are alluvial groundwater of unregulated tributaries of the Hunter River in the Wollar Creek Water Source.

No woodland or forest vegetation communities exhibiting characteristics of groundwater dependency were identified during the flora surveys, all being dry sclerophyll woodland (Appendix E).

There is potential for GDEs to occur on the plateaus in the vicinity of the Wilpinjong Coal Mine. However, any GDEs on these plateaus would be accessing perched groundwater systems associated with the Narrabeen Group and would not be affected by mining in the deeper strata (Appendix C).

Wilpinjong Creek is considered to be a GDE (i.e. the stream and associated riparian vegetation). Groundwater interaction between Wilpinjong Creek and the underlying alluvium varies with time. Wilpinjong Creek is generally a gaining stream, however, there have been occasions when in some sections there has been a brief reversal of gradient between the stream water level and the water table level (Appendix D).

The banks of Wilpinjong Creek have been subject to erosion, grazing by cattle and invasion by weeds such as Blackberry (*Rubus fruticosus*) and Rush (*Juncus acutus*). Generally, the riparian trees are sparse and discontinuous. There are patches of *Typha* and *Phragmites* rushes, both water dependent species, within Wilpinjong Creek. Other than these species, the vegetation along these creeks has been substantially cleared (Appendix E).

Wilpinjong Creek was given a poor to moderate rating for aquatic habitat due to exotic species, evidence of erosion and sedimentation (Appendix F).

Existing Effects of the Wilpinjong Coal Mine

Groundwater Levels

Records of groundwater levels in the vicinity of the Wilpinjong Coal Mine are available from as early as 2004. The monitoring network at the Wilpinjong Coal Mine has been progressively expanded over time to include the WCPL exploration tenements, and on Peabody Energy-owned land in and to the south of the Village of Wollar.

The current extent of the alluvial and hard rock (Ulan Coal Seam) groundwater monitoring network is shown on Figure 4-12.

An analysis of the available temporal data (including hydrographic plots) to illustrate cause-and-effect relationships with rainfall, mining and groundwater levels at the Wilpinjong Coal Mine and surrounds is provided in Appendix C.

In summary, this analysis indicates a general trend for mining-related drawdown to be apparent in coal seam hydrographs, typically within a few hundred metres of active mine areas, but drawdown is much less apparent, if apparent at all, in alluvial bore hydrographs (Appendix C).

HydroSimulations concluded this is due to the following properties and processes (Appendix C):

- alluvial bodies not being directly connected to or intersected by the footprint of the open cut pits;
- rock strata overlying the coal seams and underlying the alluvium serving to mitigate the drawdown response because of low vertical hydraulic conductivity; and
- unconfined conditions and a greater aquifer storage in the alluvium than in the confined coal seams resulting in much lower head variation (drawdown) in the alluvium.

No mining effects have been observed in any hard rock or alluvial monitoring bores in the Village of Wollar (Appendix C).

Groundwater Inflows/Pumping Rates

Records of pumped water volumes from operational open cuts at the Wilpinjong Coal Mine have been kept for water management and groundwater licensing purposes. The pumped water data has been collected in a number of different formats and is summarised in graphic form in Appendix C.

The recorded pumped volumes are however a combination of groundwater inflow, rainfall runoff, seepage from waste rock emplacements and between water storages and the pits. Therefore the pumping rates do not directly represent groundwater inflow rates.

The analysis conducted by HydroSimulations indicates that pumping rates at the Wilpinjong Coal Mine vary significantly between pits, but in total pit inflows were estimated to be approximately:

- 1-3 ML/day for the period 2006 to 2011;
- 2-4 ML/day for the period 2012 to 2014; and
- a peak between 4 and 6 ML/day in mid-2014.

Groundwater Use

Peabody Energy and other mining companies hold extensive landholdings in the vicinity of the Wilpinjong Coal Mine (Figure 1-5a).

The number of privately-owned bores in the vicinity of the Project is low due to the limited private ownership and variable groundwater yields and groundwater quality (particularly in the alluvium).

Bores on private or public land in the vicinity of the Project include:

- one bore at Wollar Public School that is used for watering recreational areas and gardens; and
- one privately-owned bore (GW063717) to the south-west of the Wilpinjong Coal Mine for stock and domestic use.

Groundwater Quality

An analysis of water quality attributes of groundwater at the Wilpinjong Coal Mine and surrounds is provided in Appendix C, including analysis of the following attributes:

- EC;
- total dissolved solids (TDS);
- pH;
- aluminium;
- As;
- barium;
- copper;
- iron;
- lead;
- manganese;
- nickel;
- Se;
- strontium;
- zinc;
- sodium;
- potassium;
- calcium;
- magnesium;
- carbonates;
- chloride; and
- sulphate.

Baseline groundwater salinity (i.e. measured EC) at the Wilpinjong Coal Mine and surrounds is analysed in Appendix C. The collated data is indicative of generally poor water quality, with a large range in EC values recorded. The highest groundwater salinity is associated with the alluvium along Wilpinjong, Wollar and Cumbo Creeks where groundwater EC exceeds 8,000 µS/cm at a number of monitoring sites.

Groundwater in the alluvium has a higher average salinity than the underlying coal measures.

Appendix C summarises the thresholds for groundwater use categories as recommended in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council [ANZECC] and Agriculture and Resource Management Council of Australia and New Zealand [ARMCANZ], 2000). Groundwater quality in the vicinity of the Project is highly variable but generally poor, with most groundwater suitable only for livestock and irrigation of some salt tolerant crops. Groundwater in some areas is too saline for livestock (Appendix C).

Value of Water Resource

The *Significant impact guidelines 1.3: Coal seam gas and large coal mining developments—impacts on water resources* (DotE, 2013a) (Significant Impact Guidelines for Water Resources) state:

> *The key factor that will be relevant in determining the value of a water resource will be its utility for all third party uses, including environmental and other public benefit outcomes...*

The potential value of the groundwater resource has been considered with respect to GDEs, anthropogenic use and the suitability of groundwater quality for beneficial use.

There is potential for GDEs to occur on the plateaus in the vicinity of the Wilpinjong Coal Mine. However, any GDEs on these plateaus would be accessing perched groundwater systems associated with the Narrabeen Group and would not be affected by mining in the deeper strata (Appendix C).

Wilpinjong Creek is considered to be a GDE due to groundwater interaction with the underlying alluvium. Wilpinjong Creek has been given a poor to moderate rating for aquatic habitat due to exotic species, evidence of erosion and sedimentation (Appendix F). There are no downstream surface water users on Wilpinjong Creek.

There are no High Priority GDEs or High Priority culturally significant sites defined in the Water Sharing Plan in the vicinity of the Project.

As described above, the number of privately-owned bores in the vicinity of the Project is low due to the limited private ownership and variable groundwater yields and groundwater quality (particularly in the alluvium).

As described above, groundwater quality in the vicinity of the Project is highly variable but generally poor, with most groundwater suitable only for livestock and irrigation of some salt tolerant crops. Groundwater in some areas is too saline for livestock (Appendix C).

4.7.2 Potential Impacts

Numerical modelling has been undertaken to inform the Groundwater Assessment (Appendix C) for the Project and to quantify the likelihood and magnitude of potential impacts, including consideration against the requirement of the NSW Aquifer Interference Policy (NSW Government, 2012).

The numerical groundwater model covers an active area of approximately 1,600 square kilometers (km^2) (40 km east-west and 40 km north-south) and incorporates the Moolarben Coal Complex located immediately to the west of the Wilpinjong Coal Mine. During the preparation of this EIS, WCPL has consulted with Moolarben Coal and has obtained and incorporated relevant data and information made available through an existing data sharing agreement.

Calibration was undertaken for the numerical groundwater model, including (Appendix C):

- *steady-state calibration* (for average groundwater levels to January 2006, prior to mining at Wilpinjong Coal Mine);
- *transient calibration* (for 697 head targets for the period between January 2006 to December 2014) of aquifer system properties against hydrographic responses at monitoring bores; and
- Wilpinjong Coal Mine observed and inferred pit inflows and stream baseflow.

Overall, the calibration of the numerical groundwater model showed good agreement across the whole range of measurements and there is no bias towards overestimation or underestimation (Appendix C).

Therefore, the numerical groundwater model was considered suitable to simulate the potential effects of the Project on the local and regional aquifer systems and groundwater users.

Using the calibrated numerical groundwater model, the following model scenarios were undertaken as part of the Groundwater Assessment (Appendix C):

- transient prediction (Wilpinjong Coal Mine incorporating the Project);
- transient prediction (cumulative including the Moolarben Coal Complex);
- transient recovery (Wilpinjong Coal Mine incorporating the Project); and
- steady state final void predictions.

A transient simulation was also undertaken for a climate change scenario with rainfall infiltration reduced by 3% in 2030, falling to a 25.5% reduction in rainfall infiltration in 2090.

A summary of the modelled potential impacts of the Project on the porous and alluvial groundwater systems, surface water resources, GDEs and existing groundwater users is presented below.

Staged groundwater drawdown contours during the Project life are provided in Appendix C.

Mine Inflows

The average predicted pit inflows (combined) over the life of the Project are predicted to generally range from approximately 0.7 ML/day to 4.5 ML/day and average approximately 1.9 ML/day (712 ML/year), with the majority derived from the porous rock groundwater system (Appendix C). Further breakdown is provided in Section 4.7.3.

Mine inflows would continue to be extracted from pit sumps and pumped to operational storages such as the Pit 2 West Dam.

Porous Rock Groundwater System

As mining operations progress, each open cut acts as a localised groundwater sink. This would cause a change in groundwater flow direction and, in some places, a localised reversal of flow direction.

There would also be a change in hydraulic properties where the waste rock is subsequently used to backfill the mine voids. As waste rock would have a higher permeability than natural rock material (associated with the porous rock groundwater system), there would be associated reductions in localised hydraulic gradients (Appendix C).

Numerical modelling conducted as part of the Groundwater Assessment predicts a substantial reduction in potentiometric head in the deeper porous rock groundwater system (Illawarra Coal Measures) in the near vicinity of the Project.

Recovery of the groundwater water table and pressures within the porous rock groundwater system is predicted to occur over many decades following the cessation of mining (Appendix C).

The Pit 2 and Pit 6 final void lakes would remain as permanent and localised groundwater sinks. The Pit 8 final void would frequently be dry, with the possibility of it acting as a flow-through system, mainly transmitting incident rainfall and runoff (Appendix C).

At equilibrium, natural groundwater flow direction is expected to be restored to a dominant northerly direction through the mine footprint toward Wilpinjong Creek, with the exception of around the Pit 2 and Pit 6 final voids (Appendix C).

The Groundwater Assessment concludes that there would be no discernible deterioration in groundwater quality in the porous rock groundwater system as a result of mining, including in the long-term (Appendix C).

Alluvial Groundwater System

The numerical modelling conducted for the Groundwater Assessment predicts minimal drawdown (approximately 1 m) in the aquifers of the shallow alluvial groundwater system along Wilpinjong Creek. Predicted drawdowns in the more distant alluvial aquifers associated with Wollar Creek are predicted to be lower (Appendix C).

The Groundwater Assessment concludes that there would be no discernible deterioration in groundwater quality in the alluvial groundwater system as a result of mining, including in the long-term (Appendix C).

Surface Water Resources

The existing surface water resources and their characteristics (i.e. streamflow and water quality) are described in Section 4.8.1.

The Groundwater Assessment (Appendix C) included examination of the stream-aquifer (surface water-groundwater) interaction status of the Goulburn River and Wollar, Wilpinjong, Murragamba, Moolarben and Cooyal Creeks.

The groundwater model simulation demonstrates that the total reduction in baseflow to the watercourses due to the Wilpinjong Coal Mine (incorporating the Project) is expected to be small and is consistent with estimates of baseflow capture for the approved Wilpinjong Coal Mine (Appendix C).

The reduction in baseflow is simulated to peak after the cessation of mining and continue for some time, particularly along Wilpinjong Creek (Appendix C).

The potential effects of baseflow reductions on flows in Wilpinjong Creek, Wollar Creek and the Goulburn River are described in Section 4.8.2.

Groundwater Dependent Ecosystems

The potential impacts of the Project on Wilpinjong Creek have been determined in accordance with the GDE guideline.

In accordance with the GDE guideline, Wilpinjong Creek is considered to be a low value GDE given (Appendices E and F):

- it is not reserved as a National Estate, a listed wetland or in *State Environmental Planning Policy No. 26 – Littoral Rainforests*;
- exotic species occur in large populations and multiple species; and
- it has undergone major changes in physical structure and species composition due to historical agriculture in the region.

Drawdown in the aquifers of the shallow alluvial groundwater system along Wilpinjong Creek would be minimal (approximately 1 m) (HydroSimulations, 2015).

Loss of groundwater discharge (or baseflow capture) to Wilpinjong Creek due to the Wilpinjong Coal Mine (incorporating the Project) would be minimal. HydroSimulations (2015) predict that incremental baseflow impacts in Wilpinjong Creek due to the Project would be negligible. During mining, impacts to flow due to a reduction in baseflow would continue to be counteracted to varying extents by the approved water discharges from the water treatment facility in accordance with EPL 12425. WCPL's existing licences in the Wollar Creek Water Source (under the Water Sharing Plan) are expected to be adequate for the Wilpinjong Coal Mine incorporating the Project.

The Project is predicted to have negligible impact on water quality in Wilpinjong Creek (Appendices C and D).

On this basis, the Project would present a low risk to Wilpinjong Creek (as defined in the GDE guideline) (Appendices E and F). WCPL would continue to conduct water quality and flow monitoring in Wilpinjong Creek.

Groundwater Users

No groundwater drawdown exceeding the NSW Aquifer Interference Policy (NSW Government, 2012) minimal harm criterion of 2 m at a sub-surface water supply construction such as a bore or well is predicted to occur on any privately-owned land (Appendix C).

Drawdown exceeding the NSW Aquifer Interference Policy (NSW Government, 2012) minimal harm criterion of 2 m is however predicted at one bore in the porous rock aquifer located on Crown land at the Wollar Public School (Appendix C).

The Wollar Public School bore is screened in the Shoalhaven Group, which is relatively low-yielding. The bore is 60 m deep, with approximately 40 to 50 m of available drawdown. The maximum predicted drawdown is 6 m, meaning that the bore is unlikely to go dry as a result of the Project (Appendix C).

Cumulative Impacts

The Groundwater Assessment included consideration of the cumulative impacts of the Project and the approved Moolarben Coal Complex.

The Ulan Mine Complex has not been simulated as it is immediately beyond the Moolarben Coal Complex. The Bylong Coal Project and Bowdens Silver Project have not been simulated as they are too far away to contribute to cumulative effects and are located outside the Wollar Creek Water Source (Appendix C).

Cumulative groundwater drawdown contours showing the magnitude and water table pattern caused by coincident mining at the Moolarben Coal Complex and the Project are presented in Appendix C.

Whilst conservative for assessment purposes, the cumulative groundwater modelling results indicate potential cumulative effects on baseflow to the Goulburn River of 0.092 ML/day (Appendix C). This reduction is considered to have a negligible impact on flows in the Goulburn River (Section 4.8.2).

There is predicted to be little change between the Project-specific and cumulative effects on creeks that run through or east of the Wilpinjong Coal Mine such as Cumbo Creek and Wollar Creek.

There is a single state-owned bore at Wollar Public School (referred to above) that is predicted to experience greater than 2 m mining related drawdown from the Project.

The Project is not predicted to result in any appreciable drawdown increase to bores affected by drawdowns associated with the Moolarben Coal Complex (Appendix C).

The Project is anticipated to have no effect on water quality in Wilpinjong Creek and Wollar Creek and therefore would not contribute to any potential cumulative water quality impacts on these streams.

Potential Impacts on Matters of National Environmental Significance

As described in Section 1.1, the Project was deemed a controlled action on 12 March 2015 (including water resources). The elements of the Project which require EPBC Act approval exclude the continuation of mining operations in the open cut pits and associated activities which are currently authorised by existing Wilpinjong Coal Mine approvals (including modifications and exploration activities).

Therefore, consideration of potential impacts on matters of national environmental significance is focused on the incremental impacts of the action.

Potential Impacts on Hydrological Characteristics

The Significant Impact Guidelines for Water Resources provide the following guidance on potential impacts of an action on hydrological characteristics:

> *A significant impact on the hydrological characteristics of a water resource may occur where there are, as a result of the action:*
>
> *a) changes in the water quantity, including the timing of variations in water quantity*
>
> *b) changes in the integrity of hydrological or hydrogeological connections, including substantial structural damage (e.g. large scale subsidence)*
>
> *c) changes in the area or extent of a water resource where these changes are of sufficient scale or intensity as to significantly reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes.*

As described in the assessment above, groundwater modelling completed for the Project indicates (Appendix C):

- minimal drawdown (approximately 1 m) in the aquifers of the shallow alluvial groundwater system along Wilpinjong Creek and less around Wollar Creek;
- negligible impact on access to water in known registered production bores licensed to external parties;
- no privately-owned bores predicted to experience greater than 2 m drawdown related to the activities of the Project;
- one state-owned registered bore, located at the Wollar Public School, predicted to experience greater than 2 m drawdown related to the activities of the Project;
- no effect on the Drip feature;
- no discernible effect on any perched groundwater or springs in the National Park or Munghorn Gap Nature Reserve (i.e. in the Triassic Wollar Sandstone/Narrabeen Group); and
- no change to loss of groundwater discharge (or baseflow capture) to Wilpinjong Creek.

Therefore, it is unlikely that the action would result directly or indirectly in a substantial change in the hydrology of groundwater resources.

Potential Impacts on Water Quality

The Significant Impact Guidelines for Water Resources provide the following guidance on potential impacts of an action on water quality:

> *A significant impact on a water resource may occur where, as a result of the action:*
>
> *a) there is a risk that the ability to achieve relevant local or regional water quality objectives would be materially compromised, and as a result the action:*
>
> *i. creates risks to human or animal health or to the condition of the natural environment as a result of the change in water quality*
>
> *ii. substantially reduces the amount of water available for human consumptive uses or for other uses, including environmental uses, which are dependent on water of the appropriate quality*
>
> *iii. causes persistent organic chemicals, heavy metals, salt or other potentially harmful substances to accumulate in the environment*
>
> *iv. seriously affects the habitat or lifecycle of a native species dependent on a water resource, or*
>
> *v. causes the establishment of an invasive species (or the spread of an existing invasive species) that is harmful*
>
> *vi. to the ecosystem function of the water resource, or*

b) *there is a significant worsening of local water quality (where current local water quality is superior to local or regional water quality objectives), or*

c) *high quality water is released into an ecosystem which is adapted to a lower quality of water.*

As described above, the Groundwater Assessment for the Project concludes there would be no discernible deterioration in groundwater quality as a result of mining, including in the long-term (Appendix C).

Therefore, the Project could not be considered to have a significant impact on groundwater quality.

Consideration of Cumulative Impacts

The Significant Impact Guidelines for Water Resources require the action to be:

> *considered with other developments, whether past, present or reasonably foreseeable developments.*

Cumulative groundwater drawdown contours showing the magnitude and water table pattern caused by coincident mining at the Moolarben Coal Complex and the Project are presented in Appendix C.

Whilst conservative for assessment purposes, the cumulative groundwater modelling results indicate potential cumulative effects on baseflow to the Goulburn River of 0.092 ML/day (Appendix C). This reduction is considered to have a negligible impact on flows in the Goulburn River (Section 4.8.2).

There is predicted to be little change between the Project-specific and cumulative effects on creeks that run through or east of the Wilpinjong Coal Mine such as Cumbo Creek and Wollar Creek.

The Project is not predicted to result in any appreciable drawdown increase to bores affected by drawdowns associated with the Moolarben Coal Complex (Appendix C).

As a result of the on-site containment and recycling of water with potentially elevated levels of contaminants, the Project would not contribute to localised or regional cumulative impacts (Appendix C).

Consideration of Potential for Significant Impact

Based on the assessment presented above, the action would not result in significant changes to the quantity or quality of water available to third party users or the environment (Appendix C).

Accordingly, the action would not have a significant impact on water resources (Appendix C).

4.7.3 Mitigation Measures, Management and Monitoring

Groundwater Licensing

Project groundwater licensing requirements are described in Attachment 6, including consideration of the Project against the water management principles and access licence dealing principles under the *Water Management Act, 2000*.

The predicted annual groundwater volumes required to be licensed over the life of the Project and post-mining are summarised in Table 4-15.

Table 4-15
Estimated Groundwater Licensing Requirements

Groundwater Source	Existing Peabody Energy/WCPL Licences (units)	Total Licensing Requirement (units)		
		During Mining	Post-Mining (2033-2045)	Post-Mining (2045-2100)
Wollar Creek Alluvium[1]	474	171	143	147
Porous Hard Rock[2]	2,021	1,099	Nil	Nil

Source: After Appendix C.

[1] Wollar Creek Water Source under the Water Sharing Plan. The predicted water take from the alluvium associated with the Goulburn River is negligible (Appendix C).

[2] Currently licensed under the *Water Act, 1912*. Will be licensed under the Sydney Basin – Upper Hunter groundwater source once the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources* commences.

Based on the groundwater modelling, WCPL currently hold licences sufficient to cover the modelled groundwater inflows from the alluvial and porous rock groundwater sources (Table 4-15). Sufficient licence allocations could be retired at the completion of the Project to account for groundwater inflows to the voids post-mining.

Water Management Plan

The existing Water Management Plan, including the Groundwater Monitoring Plan and the Surface and Groundwater Response Plan, would be revised to reflect the Project and the requirements of any associated water licences (subject to the conditions of any Development Consent for the Project).

Groundwater Monitoring

The existing groundwater monitoring network, as described in the Groundwater Monitoring Program, is considered adequate for providing information on the dynamics of the groundwater hydraulics and offers an adequate basis for groundwater model calibration and verification (Appendix C).

Consistent with HydroSimulations' (2015) recommendations, WCPL would:

- resume water level and quality monitoring at two piezometers located to the north of the Pit 2 West Dam; and
- install and monitor an additional bore in the final landform north of the Pit 8 final void.

Consistent with Geo-Environmental Management's (2015) recommendations, WCPL would add Mo to the groundwater quality monitoring program.

Hydraulic Permeability Sampling

WCPL would opportunistically undertake core sampling and testing during appropriate drilling within or near the Wilpinjong Coal Mine. Where practicable, aquifer properties such as effective porosity, horizontal permeability and vertical permeability would be determined.

WCPL would create and maintain a database of testing data, which would be used to constrain and validate model parameters and guide any future groundwater assessments.

Numerical Model and Water Balance Review

The numerical model developed and used for the Groundwater Assessment (Appendix C) would be used as a management tool for the periodic review and calibration of predicted groundwater impacts through the life of the Project. Consistent with Dr Frans Kalf's recommendation, this review would be undertaken at least every five years over the life of the Project (Attachment 4).

The results of the groundwater monitoring program would inform progressive refinement of the numerical model as each of the open cut mining areas are developed. Revised outputs from the numerical model would be reported in the Annual Review, as relevant over the life of the Project and used to inform regular site water balance reviews (Section 4.8.3).

Contingency Measures

Consistent with the requirements of the NSW Aquifer Interference Policy (NSW Government, 2012), WCPL would continue to implement appropriate contingency measures for Project related drawdown greater than 2 m at any relevant private or public groundwater bores.

The contingency measures developed for the existing/approved Wilpinjong Coal Mine are described in Section 4.7.1 and would continue to be implemented for the Project.

4.8 SURFACE WATER

A Surface Water Assessment for the Project was undertaken by WRM Water & Environment (2015) and is presented in Appendix D. The Surface Water Assessment was peer reviewed by Emeritus Professor Thomas McMahon (Emeritus Professor of the Department of Civil and Environmental Engineering at The University of Melbourne) who concluded that the assessment was completed in a professional and detailed manner. The review report is presented in Attachment 4.

The existing Wilpinjong Coal Mine and proposed Project water management systems are described in Sections 2.12.1 and 2.12.2.

A description of the existing surface water resources in the Wilpinjong Coal Mine area and surrounds, including baseline data, is provided in Section 4.8.1. Section 4.8.2 describes the potential impacts of the Project including cumulative impacts, while Section 4.8.3 outlines mitigation measures, management and monitoring.

The Surface Water Assessment has been guided by the SEARs for the Project, including recommendations from DPI Water, the DotE and has taken into account the *Information Guidelines for Independent Expert Scientific Committee advice on coal seam gas and large coal mining development proposals* (Independent Expert Scientific Committee, 2015).

4.8.1 Existing Environment

The discussion below presents a summary description of the baseline surface water data and the regional and local hydrology. Further detail is provided in Appendix D.

Surface Water Management and Monitoring

Surface water management and monitoring at the Wilpinjong Coal Mine is currently undertaken in accordance with the Site Water Balance, Erosion and Sediment Control Plan, Surface Water Management and Monitoring Plan and Surface and Groundwater Response Plan, which are components of the Water Management Plan.

The Site Water Balance describes the water management system at the Wilpinjong Coal Mine, tracks site water storage requirements through current water balance model predictions and outlines the on-site responsibilities with regard to the site water balance (e.g. monitoring of site water usage).

The Erosion and Sediment Control Plan outlines the erosion and sediment control strategy for the Wilpinjong Coal Mine including erosion and sediment control measures, design criteria and provisions for reporting on the effectiveness and performance of the system.

The Surface Water Management and Monitoring Program outlines:

- the existing surface water conditions and baseline data relevant to the Wilpinjong Coal Mine;
- surface water impact assessment criteria and triggers;
- surface water management measures; and
- surface water monitoring.

The Surface and Groundwater Response Plan includes:

- trigger action response plans for downstream impacts to flow, water quality and stream health;
- processes to deal with a surface water-related complaint;
- the surface water impact investigation protocol; and
- a response plan, in the event that an investigation conclusively attributes an adverse impact on an existing surface water supply user to Wilpinjong Coal Mine operations.

As described in the Surface and Groundwater Response Plan, appropriate contingency measures for an impact on a private surface water supply user may include:

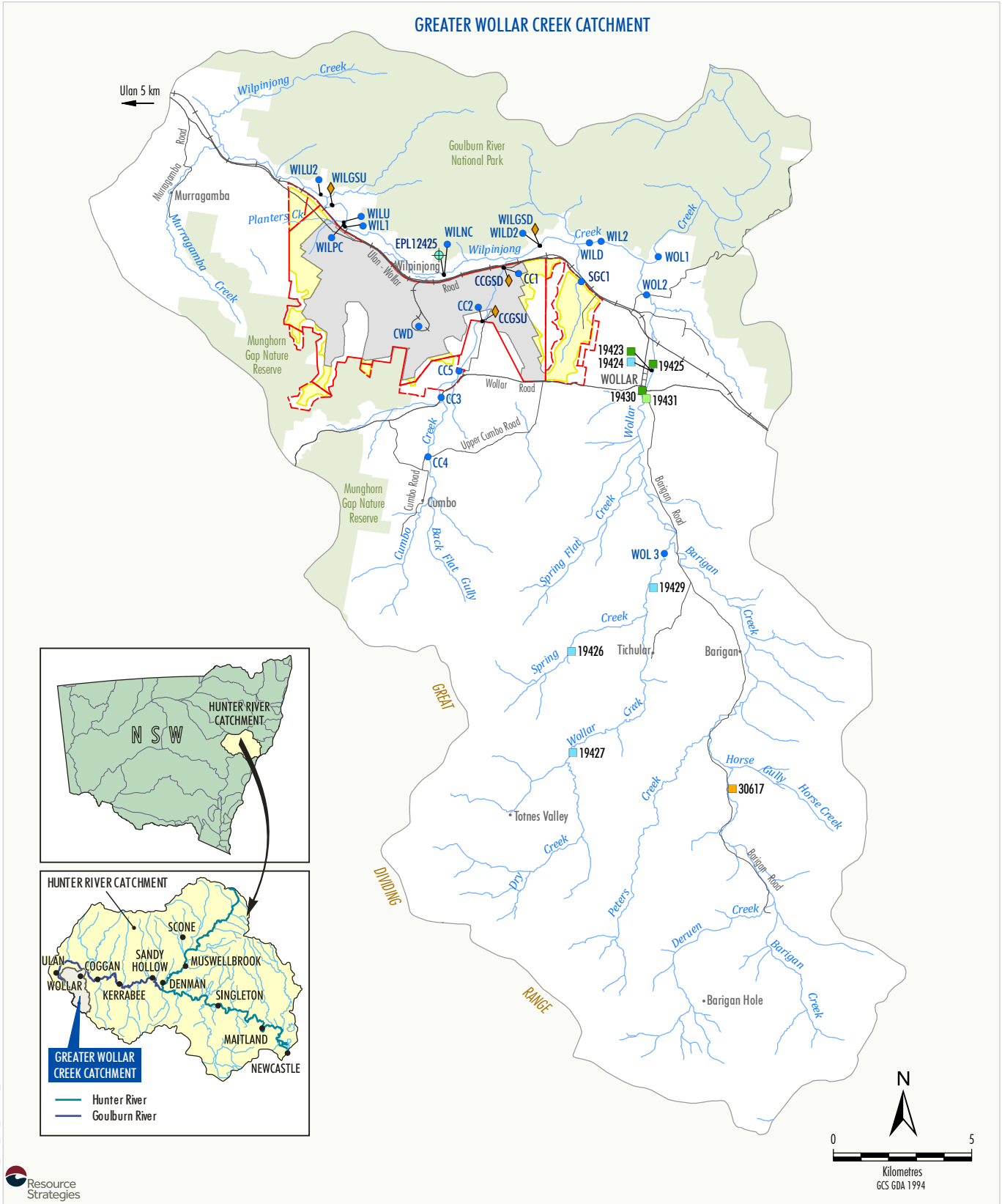
- provision of an alternative water source during the duration of the breach;
- review and refine the surface and groundwater monitoring programs;
- review Site Water Balance and predictive groundwater model; and
- review mine plan impacts on alluvial groundwater source.

The Water Management Plan includes a Complaint Response Protocol to respond to community concerns that relate to surface water and other matters. There were no complaints received in relation to surface water impacts in 2014 or January to August 2015.

Baseline Surface Water Data

WRM Water & Environment (2015) analysed WCPL databases and data made available by Commonwealth and State government agencies, including:

- rainfall and evaporation records from the BoM weather stations (Figure 4-1);
- rainfall records from the Wilpinjong Coal Mine weather station (Figure 4-1);
- DPI Water gauging station flow data on the Goulburn River (at Coggan);
- water quality data from WCPL monitoring sites for Wilpinjong Creek, Cumbo Creek and Wollar Creek (Figure 4-13);



LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Approved/Existing Open Cut and Contained Infrastructure Area
- Proposed Open Cut Extension Area

WCPL Monitoring

- Surface Water Monitoring Site
- WCPL Gauging Station
- EPL 12425 Licensed Discharge and Monitoring Point

Water Access Licences

- Aquifer
- Domestic and Stock
- Domestic and Stock [Domestic]
- Unregulated River

Note: WCPL and Moolarben Coal Water Access Licences not shown. Domestic and Stock [Domestic] Water Access Licence 36398 not shown as no location is registered for Work Approval 20CA212768. Water Access Licence 36398 has a total allocation of one unit.

Source: WCPL (2015); After DIPNR (2003); DPI Water (2015); NSW Land & Property Information (2013)

Peabody ENERGY

WILPINJONG EXTENSION PROJECT

Wilpinjong Coal Mine
Surface Water Monitoring Network and Regional Water Access Licences

Figure 4-13

- flow monitoring and continuous water quality monitoring data from WCPL gauging stations on Wilpinjong Creek (Figure 4-13; Plate 4-5);
- water usage and water quality data from the Wilpinjong Coal Mine water management systems;
- LiDAR survey data; and
- regional topographic data.

Water Use Regulation

The *Water Management Act, 2000* and the *Water Act, 1912* contain provisions for the licensing, allocation, capture and use of water resources.

Under the *Water Management Act, 2000*, water sharing plans are being introduced for water sources. Water sharing plans establish rules for sharing water between different users and between the various environmental sources (namely rivers or aquifers).

The provisions of the *Water Act, 1912* continue to apply to water sources that have not been designated under a water sharing plan.

The Wilpinjong Coal Mine is located within the Wollar Creek Water Source under the Water Sharing Plan.

Regional Hydrology

The Wilpinjong Coal Mine is located in the Upper Goulburn River catchment, which forms part of the Hunter River Basin. The Hunter River Basin drains some 22,000 km^2 of central-eastern NSW to the Pacific Ocean at Newcastle.

The Wilpinjong Coal Mine is located directly south of Wilpinjong Creek, a headwater tributary of Wollar Creek which joins the Goulburn River approximately 8 km to the north-east.

The catchment area of Wollar Creek at the confluence with the Goulburn River is approximately 530 km^2. The catchment area of the Goulburn River at the confluence is approximately 1,149 km^2 (Appendix D).

Plate 4-5: Wilpinjong Creek Gauging Station (Upstream)

The nearest active streamflow gauging station operated by DPI Water is the Goulburn River at Coggan (210006) gauge located approximately 85 km downstream of the Project. The gauge has been operating since 1913.

The flow frequency curve for the Goulburn River at Coggan (210006) gauge is shown on Figure 4-14 and indicates that daily streamflow has exceeded 4.9 ML/day for 90% of the flow record, and median daily flow is over 40 ML/day.

Streamflow was recorded for Wollar Creek at the Wollar Gauge (GS210082) between 1969 and 1997. Mean annual runoff at this gauge was estimated to be 2.4% of mean annual rainfall (Appendix D).

Local Hydrology

At a local level, the Wilpinjong Coal Mine lies in the Wilpinjong Creek catchment. A number of local watercourses are tributaries of Wilpinjong Creek including Cumbo Creek, Planters Creek, Spring Creek and Bens Creek (Figure 4-13).

Wilpinjong Creek flows into Wollar Creek approximately 4 km downstream of the confluence of Cumbo and Wilpinjong Creeks (Figure 4-13).

Wilpinjong Creek is incised into the valley floor and forms a series of semi-permanent soaks fed primarily from drainage from the surrounding alluvial plain and colluvium which is recharged by runoff.

Spring Creek, Narrow Creek, Bens Creek and other unnamed drainage paths crossing the Wilpinjong Coal Mine are natural drainage lines which range from small ephemeral and semi-perennial spring-fed streams in the upper reaches near the Munghorn Gap Nature Reserve to wide ill-defined ephemeral creeks in the lower reaches near Wilpinjong Creek.

Most of these drainage lines have been either diverted or intercepted by the approved mining operations, and the pre-mine catchment areas of Wilpinjong and Cumbo Creeks are progressively reduced by the development of open cut pits as part of the approved Wilpinjong Coal Mine. Pre-mine catchments will be progressively restored as mining areas are rehabilitated. However, during mining, flow reductions in Wilpinjong Creek associated with catchment excision are offset to varying extents by the approved water discharges from the water treatment facility in accordance with EPL 12425.

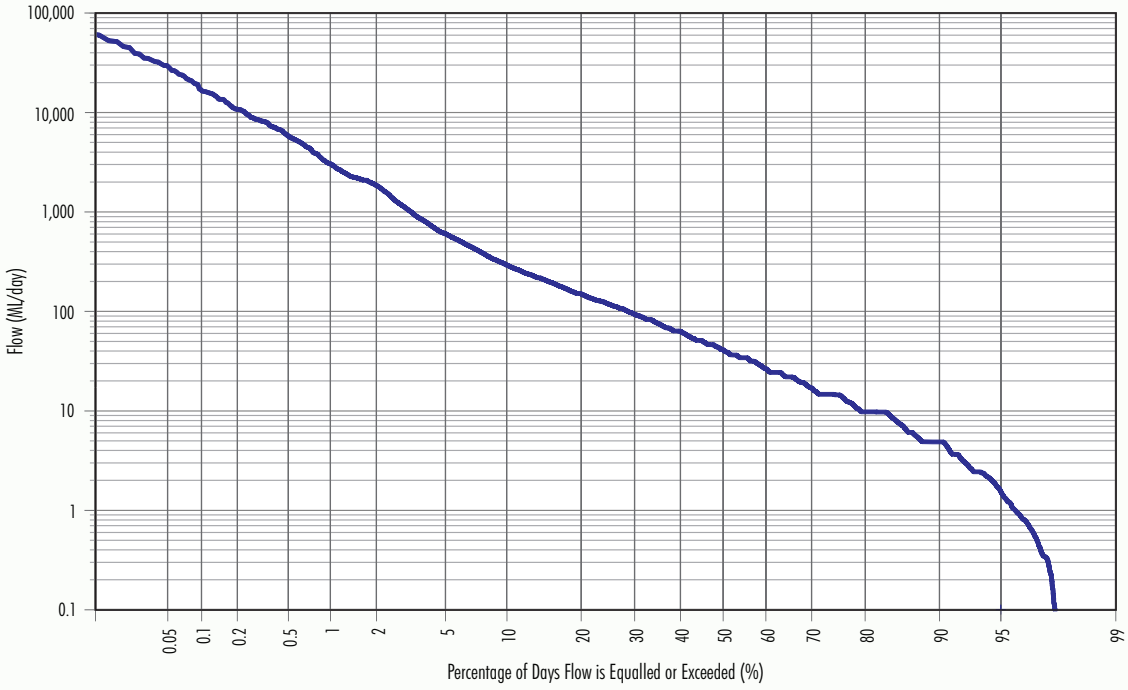
In accordance with Project Approval 05-0021, WCPL will minimise the drainage catchment of the approved final voids so far as is reasonable and feasible. The residual catchment excision (i.e. reporting to the approved final voids) at the completion of mining at the Wilpinjong Coal Mine has been estimated in Table 4-16.

Cumbo Creek, the largest tributary crossing the existing/approved Wilpinjong Coal Mine, is a 5th order stream, and has a pre-mine catchment area of approximately 70 km^2. The downstream reaches of Cumbo Creek are approved to be relocated and the existing creek alignment mined as part of approved mining operations.

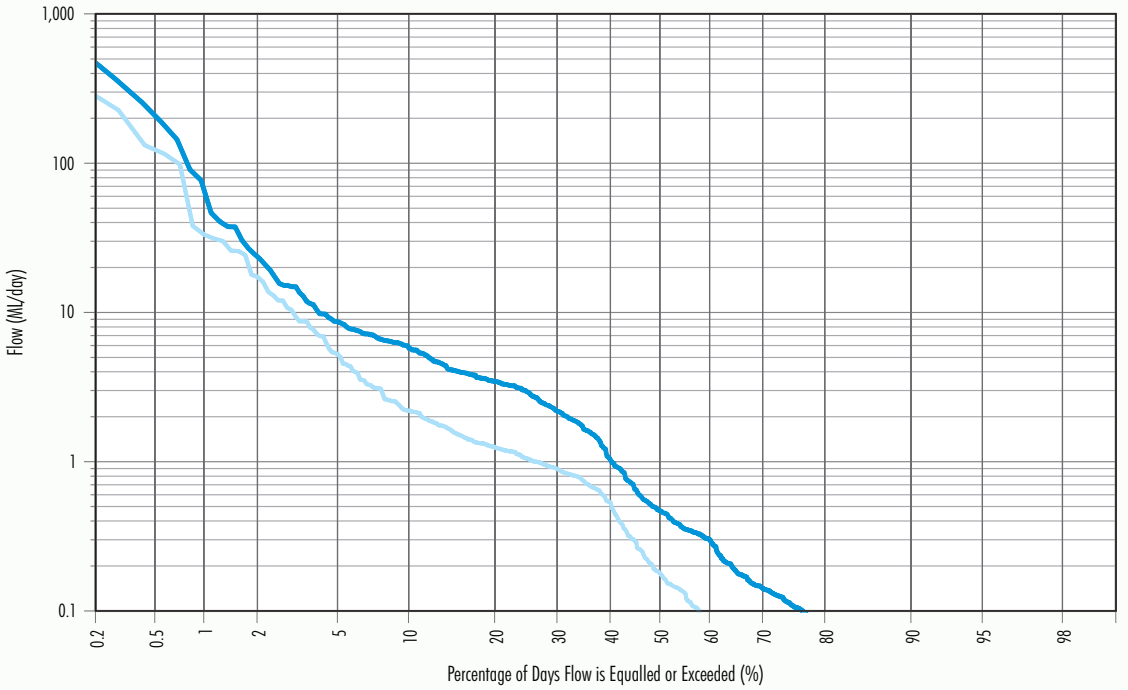
Table 4-16
Existing/Approved Sub-Catchment Area Summary

Catchment	Total Catchment Area (km^2)	Area of Catchment Excised at end of Existing/Approved Wilpinjong Coal Mine (km^2)	Catchment Excised at end of Existing/Approved Wilpinjong Coal Mine
Wilpinjong Creek to Wollar Creek confluence	213.8	0.2	0.09%
Cumbo Creek to Wilpinjong Creek confluence	69.3	0.1	0.14%
Wollar Creek to Goulburn River confluence	530.6	0.2	0.04%
Goulburn River to Hunter River confluence	7,965	0.2	<0.01%

Source: After Appendix D.



Goulburn River



Wilpinjong Creek

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Resource Strategies

LEGEND
- Goulburn River at Coggan (210006)
- Wilpinjong Creek Upstream (WILGSU)
- Wilpinjong Creek Downstream (WILGSD)

Source: WCPL (2015); WRM (2015)

Peabody ENERGY

WILPINJONG EXTENSION PROJECT

Streamflow Characteristics - Goulburn River and Wilpinjong Creek

Figure 4-14

The unnamed drainage line located west of Slate Gully Road, which would be impacted by mining associated with the proposed Pit 8, is a 2nd order stream. The unnamed drainage line is ephemeral (Appendix D). The unnamed drainage line was inspected as part of the Aquatic Ecology surveys which found that the drainage line was restricted to occasional small dams and many reaches appeared to have been grazed recently (Appendix F). The unnamed drainage line was given a poor rating for aquatic habitat (Appendix F).

WCPL monitors streamflow on Wilpinjong Creek both upstream and downstream of the licensed discharge location, as well as water level on Cumbo Creek immediately upstream of its confluence with Wilpinjong Creek.

The recorded stream flow data for Wilpinjong Creek is presented on Figure 4-14.

Wilpinjong Creek is generally a gaining stream, however, there have been occasions when in some sections there has been brief reversals of gradient (Appendix D).

The monitoring results show Wilpinjong Creek and Cumbo Creek are ephemeral. However, the approved mine release of reverse osmosis plant-treated water into Wilpinjong Creek (in accordance with EPL 12425) increases flow downstream of the release point. Between 2011 and 2014, the median daily flow in Wilpinjong Creek was approximately 0.2 ML/d upstream of the mine and 0.5 ML/d downstream of the confluence with Cumbo Creek and the Wilpinjong Coal Mine.

Surface Water Quality

Regional Surface Water Quality

Wollar Creek is the regional surface water resource of relevance to this Project. Further downstream, Wollar Creek flows into the Goulburn River and then the Hunter River.

Figure 4-13 shows existing regional and local surface water quality monitoring sites and sampling locations in the vicinity of the Project.

Regional water quality data is available for Wollar Creek at several locations. A summary of the local regional water quality data, including comparison to the ANZECC and ARMCANZ (2000) guideline trigger values for the protection aquatic ecosystems, primary industries (irrigation and livestock drinking water) and the *Australian Drinking Water Guidelines* (National Health and Medical Research Council [NHMRC], 2011), is provided in Table 4-17 and is presented in more detail in Appendix D.

Local Surface Water Quality

Local water quality sampling has been conducted on Wilpinjong Creek and Cumbo Creek upstream and downstream of the Wilpinjong Coal Mine. Local water quality monitoring sites are shown in Figure 4-13.

A summary of local surface water monitoring results is provided in Table 4-18.

Average pH in local creeks has a tendency towards slightly alkaline levels (Appendix D).

EC in Wilpinjong Creek is higher in downstream samples relative to upstream samples. This is likely due to the influence of higher EC levels in Cumbo Creek (see below), which joins Wilpinjong Creek between the two stations (Appendix D).

Average EC is elevated in Cumbo Creek, with some readings exceeding 10,000 µS/cm. This is likely due to the contribution of saline baseflow associated with Permian coal measure formations or the underlying Shoalhaven Group. Alluvial groundwaters are generally more saline than the coal seam waters and this suggests the alluvial waters are sourced from Permian sediments and are concentrated through evapotranspiration (Appendix D).

Recorded sulphate data shows similar behaviour, with average values in Wilpinjong Creek below the ANZECC and ARMCANZ (2000) guideline trigger value, while average values in Cumbo Creek are above the guideline value (Appendix D).

Table 4-17
Summary of Regional Average Surface Water Quality Data – Wollar Creek

Location (refer Figure 4-13)	Parameter[1]			
	pH	EC (µS/cm)	Turbidity (NTU)	Sulphate (mg/L)
Wollar Creek (Downstream of Confluence with Wilpinjong Creek)				
• Wollar Creek downstream of Wilpinjong Creek confluence (WOL 1)	8.1	1,954	10.1	508
Wollar Creek (Upstream of Confluence with Wilpinjong Creek)				
• Wollar Creek upstream of Wilpinjong Creek confluence (WOL 2)	7.7	2,246	10.6	346
• Wollar Creek upstream of Barigan Creek confluence (WOL 3)				
ANZECC and ARMCANZ (2000) Guideline Trigger Values				
• Protection of Aquatic Ecosystems	6.5 – 8.0[2]	30 – 350	2 – 25	-
• Primary Industries (Livestock Drinking Water)	6 – 9	2,850[3]	-	1,000
NHMRC (2011) Australian Drinking Water Guideline Values				
• Aesthetic	6.5 – 8.5	-	5	-

Source: After Appendix D.

[1] Sample counts for each parameter varies for each location and are provided in Appendix D.

[2] Value for NSW lowland rivers (<150 m above sea level).

[3] Equivalent to 2,000 mg/L TDS with a conversion factor of 0.67 applied.

NTU = nephelometric turbidity unit.

Table 4-18
Summary of Local Average Surface Water Quality Data – Wilpinjong and Cumbo Creeks

Location (refer Figure 4-13)	Parameter[1]			
	pH	EC (µS/cm)	Turbidity (NTU)	Sulphate (mg/L)
Wilpinjong Creek (Upstream of the Wilpinjong Coal Mine)				
• Wilpinjong Creek upstream of Planters Creek confluence (WILU)	7.1	1,604	25	75
• Wilpinjong Creek upstream of Planters Creek confluence (WILU2)				
• Wilpinjong Creek upstream of Planters Creek confluence (WIL1)				
• Wilpinjong Creek upstream at Planters Creek confluence (WILPC)				
Cumbo Creek				
• Cumbo Creek at gauging station (CC1)	7.9	4,803	5.3	1,626
• Cumbo Creek at ML 1573 boundary (CC2)				
• Cumbo Creek at Wollar Road (CC3)				
• Cumbo Creek at Upper Cumbo Road (CC4)				
• Cumbo Creek between ML 1573 boundary and Wollar Road (CC5)				

Table 4-18 (Continued)
Summary of Local Average Surface Water Quality Data – Wilpinjong and Cumbo Creeks

Location (refer Figure 4-13)	Parameter[1]			
	pH	EC (µS/cm)	Turbidity (NTU)	Sulphate (mg/L)
Wilpinjong Creek (Downstream of the Wilpinjong Coal Mine and/or Cumbo Creek)				
• Wilpinjong Creek at Narrow Creek confluence (WILNC)	7.7	2,707	22	559
• Wilpinjong Creek downstream of Cumbo Creek confluence (WILD2)				
• Wilpinjong Creek downstream of Cumbo Creek confluence (WILD)				
• Wilpinjong Creek upstream of Cumbo Creek confluence (WIL2)				
ANZECC and ARMCANZ (2000) Guideline Trigger Values				
• Protection of Aquatic Ecosystems	6.5 – 8.0[2]	30 – 350	2 – 25	-
• Primary Industries (Livestock Drinking Water)	6 – 9	2,850[3]	-	1,000
NHMRC (2011) Australian Drinking Water Guideline Values				
• Aesthetic	6.5 – 8.5	-	5	-

Source: After Appendix D.

1 Sample counts for each parameter varies for each location and are provided in Appendix D.

2 Value for NSW lowland rivers (<150 m above sea level).

3 Equivalent to 2,000 mg/L TDS with a conversion factor of 0.67 applied.

NTU = nephelometric turbidity unit.

Mine Water Dams and Sediment Dams

Water quality sampling is undertaken at the Wilpinjong Coal Mine in accordance with the Water Management Plan which has been prepared to satisfy the requirements of Project Approval 05-0021 and EPL 12425.

The dams at the Wilpinjong Coal Mine are generally classified as mine water dams or sediment dams. Mine water dams hold mine affected water, including pit water and tailings return water. Sediment dams usually capture runoff from disturbed areas such as waste rock emplacements and areas under rehabilitation, but not mine affected water. However, some sediment dams have been used to store mine-affected water in the past, and this is reflected in the observed water quality (Appendix D).

A full suite of surface water quality results for mine water dams and sediment dams on-site is provided in Appendix D.

As described in Section 2.12.1, an objective of the on-site water management for the Wilpinjong Coal Mine is to operate such that there is no mine water storage overflow.

Surface Water Users

There are a total of 12 WALs in the Wollar Creek Water Source with a total licensed allocation of 880 units. Peabody Pastoral Holdings Pty Ltd and WCPL jointly hold WAL 21499 with a licensed allocation of 474 units and Moolarben Coal also holds WAL 36340 for 218 units. Therefore, only 188 units remain licensed for irrigation and stock and domestic purposes in the Wollar Creek catchment.

Privately-owned WALs in the Wollar Creek catchment are shown on Figure 4-13, which indicates that all privately-owned WALs are located on Wollar Creek upstream of its confluence with Wilpinjong Creek (i.e. upstream of any potential impacts of the Wilpinjong Coal Mine incorporating the Project).

Flooding

Anecdotal advice provided by landholders indicates that major floods in the past have not resulted in extensive flooding outside the creek banks (Gilbert & Associates, 2005).

The largest flood in living memory occurred in February 1955. The available rainfall records for the area confirm that it would have been the largest event since rainfall records started late in the 19th century. Local knowledge confirms that there has not been any event since which has been particularly significant in terms of inundation or damage to property along Wilpinjong Creek (Gilbert & Associates, 2005).

The Sandy Hollow Gulgong Railway embankment was constructed during the Second World War and acts as an existing flood barrier between Wilpinjong Creek and the Wilpinjong Coal Mine (i.e. the embankment levels have been selected to provide immunity to floods significantly larger than the 1 in 100 year Annual Exceedance Probability [AEP] criteria used for culvert sizing). There is no anecdotal evidence of the railway embankment having been overtopped during the 1955 flood or at any other time since (Gilbert & Associates, 2005).

The existing Wilpinjong Coal Mine is located outside the extent of flooding from Wilpinjong Creek in the 1 in 1,000 AEP design flood. Flood mitigation works for open cut infrastructure in the vicinity of Cumbo Creek are already being implemented at the Wilpinjong Coal Mine and no Project open cut extension areas are located proximal to Cumbo Creek (Figure 1-4). The existing TransGrid Wollar to Wellington 330 kV ETL and parts of Ulan-Wollar Road are located within the 1 in 1,000 AEP design flood (Appendix D).

Value of Water Resource

The Significant Impact Guidelines for Water Resources provide the guidance on determining the value of a water resource (Section 4.7.1)

The potential value of Wilpinjong Creek has been considered with respect to aquatic ecology, anthropogenic use and the suitability of surface water quality for beneficial use.

Wilpinjong Creek has been given a poor to moderate rating for aquatic habitat due to exotic species, evidence of erosion and sedimentation (Appendix F).

There are no downstream surface water users on Wilpinjong Creek.

Wollar Creek and the Goulburn River are located further downstream and are unlikely to be significantly impacted by the action.

Average pH in local creeks has a tendency towards slightly alkaline levels. EC in Wilpinjong Creek is higher in downstream samples relative to upstream samples. This is likely due to the influence of Cumbo Creek, which joins Wilpinjong Creek between the two stations. Recorded sulphate data indicates average values in Wilpinjong Creek are below the ANZECC and ARMCANZ (2000) guideline trigger value for livestock drinking water (Appendix D).

4.8.2 Potential Impacts

The following sub-sections describe the potential operational and post-mining impacts of the Project on surface water flow regimes and surface water quality, including consideration of potential cumulative impacts.

Surface Water Flow Regimes

Catchment Excision During Mining

During active mining operations, the mine water management system would continue to capture runoff from areas that would have previously flowed to the receiving waters of Wilpinjong Creek, Cumbo Creek and Wollar Creek.

The maximum catchment intercepted by the existing/approved Wilpinjong Coal Mine is 24.1 km^2. Under the modified water management system for the Project, the catchment area of the containment system would peak in 2018 at 23.8 km^2 (Appendix D).

During mining, flow reductions in Wilpinjong Creek associated with catchment excision are counteracted to varying extents by the approved water discharges from the water treatment facility in accordance with EPL 12425. During dry periods these approved releases would typically result in an increase in flows downstream of the mine (Appendix D).

Catchment Excision Post-Mining

The expected maximum catchment excision would gradually reduce as the area captured in the water management system reduces over time (Appendix D).

In accordance with Project Approval 05-0021, WCPL is required to minimise the drainage catchment of the approved final voids so far as is reasonable and feasible.

The residual catchment excision (i.e. reporting to the approved final voids) at the completion of the Project is estimated in Table 4-19.

Table 4-19 indicates that the additional catchment excision at the completion of mining due to the Project is negligible, representing less than 0.1% of the Wilpinjong Creek catchment.

Surface Water Flow

The expected reduction in groundwater baseflow to nearby streams due to the Project has been modelled by HydroSimulations (2015) and is presented in Table 4-20.

The predicted maximum effect of runoff capture and potential reduction of baseflow on flows in Wilpinjong Creek and Wollar Creek (downstream of the confluence with Wilpinjong Creek) is assessed in Appendix D.

The Wilpinjong Coal Mine is estimated to result in approximately 37% more days with less than 0.1 ML/day flow in Wilpinjong Creek relative to pre-mining conditions. However, the Wilpinjong Coal Mine results in negligible changes to the frequency of higher flows (e.g. greater than 1 ML/day). The maximum incidence of days with less than 0.1 ML/day flow for the Wilpinjong Coal Mine (incorporating the Project) would be effectively unchanged from the impacts of the existing/approved Wilpinjong Coal Mine. The Project would therefore have no measurable incremental impact on flow in Wilpinjong Creek (Appendix D).

Table 4-19
Wilpinjong Coal Mine Post-Mining Excised Catchment Areas

Catchment	Total Catchment Area (km^2)	Area of Catchment Excised at end of Existing/Approved Wilpinjong Coal Mine (km^2)	Area of Catchment Excised at end of Project (km^2)	Increase in Excised Catchment Due to the Project (km^2)
Cumbo Creek to Wilpinjong Creek confluence	69.3	0.1	Nil	Nil
Wilpinjong Creek to Wollar Creek confluence	213.8	0.2	0.3	0.1
Wollar Creek to Goulburn River confluence	530.6	0.2	0.3	0.1
Goulburn River to Hunter River confluence	7,965	0.2	0.3	0.1

Source: After Appendix D.

Table 4-20
Modelled Baseflow Impacts

Catchment	Existing/Approved Wilpinjong Coal Mine (ML/day)	Wilpinjong Coal Mine including the Project (ML/day)	Increase in Baseflow Loss due to the Project (ML/day)
Wilpinjong Creek to Wollar Creek confluence	0.37	0.37	Nil
Wollar Creek to Goulburn River confluence	0.37	0.40	0.03
Goulburn River to Hunter River confluence	0.37	0.41	0.04

Source: After Appendix D.

While the Project is anticipated to have some small incremental increase in the baseflow losses of Wollar Creek and the Goulburn River (Table 4-20), the significant additional catchment of these larger streams means potential impacts on flow frequency are expected to be negligible (Appendix D).

As there are no private surface water users on Wilpinjong or Wollar Creeks downstream of the Wilpinjong Coal Mine, any impact on other private water users (i.e. downstream on the Goulburn River) due to the Wilpinjong Coal Mine (incorporating the Project) would be too small to measure (Appendix D).

Surface Water Quality

Surface water runoff from disturbed areas could potentially contain sediments, dissolved solids, oil, grease, metals and salts.

As described in Section 2.12.2, sediment dams would be sized to capture runoff from a 90th percentile rainfall event with a duration of five days (Landcom, 2004 and DECCW, 2008).

Some overflow of water from sediment dams may occur during wet periods that exceed the design standard of the sediment control system. Overflows would only occur during significant rainfall events which would also generate runoff from surrounding undisturbed catchments. Hence, it is unlikely that sediment dam overflows would have a measurable impact on receiving water quality (Appendix D).

Contained water storages would continue to be managed and operated for no release to downstream watercourses (Section 2.12.2).

The site water balance model results indicate that there would be no uncontrolled releases of mine water from the Project water management system (Appendix D).

WCPL would continue to undertake approved water discharges from the water treatment facility in accordance with EPL 12425. The EPL criteria have been selected such that the released water would generally be similar to or better than the receiving water quality (Appendix D).

With the implementation of management measures in the existing Wilpinjong Coal Mine Water Management Plan, the potential adverse effects of the Project on downstream water quality would be negligible (Appendix D).

Acid Rock Drainage

A Geochemistry Assessment was conducted by Geo-Environmental Management (2015) and is presented in Appendix K.

The results of the Geochemistry Assessment indicate that the waste rock and coal rejects generated from the Project would have similar geochemical characteristics as those generated by the existing/approved Wilpinjong Coal Mine (Appendix K).

The analysis of water extracts from selected waste rock samples indicated most metals would be relatively insoluble under the prevailing neutral to slightly alkaline pH conditions. Mo and Se are however likely to be soluble under these prevailing pH conditions (Appendix K).

The Geochemistry Assessment (Appendix K) concluded that the waste rock materials generated from the Project would typically be neutral to slightly alkaline and generally non-saline.

The waste rock is expected to range from non-sodic to moderately sodic (Appendix K).

The Geochemistry Assessment (Appendix K) concluded that the waste rock materials generated from the Project would generally be expected to be NAF. The acid base accounting test work indicates however that a small quantity of overburden associated with the lower plies of the Ulan Coal Seam would be PAF-LC and coal from the Goulburn and Turill Seams[2] would be PAF or PAF-LC (Appendix K).

The management of PAF waste rock material is described in Section 2.10.4.

Based on the successful implementation of management strategies and monitoring recommended in the Geochemistry Assessment (Appendix K), the risks of elevated dissolved solids and other contaminants impacting downstream waters is considered to be low (Appendix D).

[2] These seams are both considered to be uneconomic to mine and therefore, where they occur at the Project, would be excavated and disposed of with the waste rock.

Flooding

The Project open cut extension areas are located outside the extent of flooding in the 1 in 1,000 AEP design flood.

There are no private landholders downstream of the Wilpinjong Coal Mine on either Wilpinjong Creek or Wollar Creek.

The connection between the proposed realigned and the existing TransGrid Wollar to Wellington 330 kV ETL and the relocation of Ulan-Wollar Road are located within the 1 in 1,000 AEP design flood. However, both of these are already located within the 1 in 1,000 AEP flood extent and therefore the Project is not anticipated to have any impact on flood levels or velocity (Appendix D).

Geomorphology

During Mining

No change to the approved daily water discharge volume under EPL 12425 is proposed. Therefore there would be no downstream geomorphological impacts to Wilpinjong Creek as a result of the Project (Appendix D).

Post-Mining

Where relevant, the existing Wilpinjong Coal Mine rehabilitation objectives would be modified or built upon for the Project. As a result, the proposed post-mining final landform plan (at the completion of mining) is generally consistent with the approved final landform for the Wilpinjong Coal Mine.

Therefore the risk of potential geomorphological changes to Wilpinjong and Wollar Creeks due to the Project final landform is considered to be negligible (Appendix D).

Final Voids

The accumulation of surface runoff combined with groundwater inflows may result in the formation of a pond of water in the void which would rise until the average rate of inflow is balanced by evaporation from its surface (Appendix D).

The Project would result in three final voids (i.e. one additional void to the two voids associated with the approved Wilpinjong Coal Mine) (Section 5).

WRM Water & Environment (2015) have simulated the long-term behaviour of the final voids. Groundwater inflows and outflows were modelled using storage level versus flow relationships developed from the groundwater model by HydroSimulations (2015).

The simulated water level in the Pit 8 final void reaches a maximum of approximately 2 m, which is 33 m below the crest of the void. The void would regularly be dry (Appendix D).

Final void water levels in Pit 2 and Pit 6 are expected to reach an equilibrium within approximately 100 years. The maximum void water levels are also expected to be well below the crest of the void and hence would not spill to the environment (Appendix D).

Surface and groundwater inflows would bring salt into Pit 2 and Pit 6 final voids over the long-term. The salinity of the water in the final voids would therefore gradually increase over time (Appendix D).

Cumulative Impacts

The Surface Water Assessment (Appendix D) included consideration of the cumulative impacts of the Project (including the existing Wilpinjong Coal Mine), the existing/approved Moolarben Coal Complex and Ulan Mine Complex and the proposed Bylong Coal Project. The Project's incremental contribution to any potential cumulative impacts on surface water quality, flow or availability are expected to be negligible (Appendix D).

Potential Impacts on Matters of National Environmental Significance

Consideration of potential impacts on matters of national environmental significance is focused on the incremental impacts of the action (Section 4.7.2).

Potential Impacts on Hydrological Characteristics

The Significant Impact Guidelines for Water Resources provide guidance on determining potential impacts of an action on hydrological characteristics (Section 4.7.2).

The Project would have no measurable incremental impact on flow in Wilpinjong Creek (i.e. potential impacts associated with the Project are consistent with those of the existing Wilpinjong Coal Mine) (Appendix D).

Therefore, the Project could not be considered to have a significant impact on surface water hydrology.

Potential Impacts on Water Quality

Based on the successful implementation of management strategies and monitoring recommended in the Geochemistry Assessment (Geo-Environmental Management, 2015), the risk of elevated dissolved solids and other contaminants impacting downstream waters is considered to be low (Appendix D).

With the implementation of management measures consistent with the existing Wilpinjong Coal Mine Water Management Plan, the potential adverse effects of the Project on downstream water quality would be negligible (Appendix D).

Consideration of Cumulative Impacts

The Significant Impact Guidelines for Water Resources require the action to be:

> *considered with other developments, whether past, present or reasonably foreseeable developments.*

The Surface Water Assessment (Appendix D) included consideration of the cumulative impacts of the Project (including the existing Wilpinjong Coal Mine), the existing/approved Moolarben Coal Complex and Ulan Mine Complex and the proposed Bylong Coal Project. The Project's incremental contribution to any potential cumulative impacts on surface water quality, flow or availability are expected to be negligible (Appendix D).

Consideration of Potential for Significant Impact

Based on the assessment presented above, the action would not result in significant changes to the quantity or quality of water available to third party users or the environment (Appendix D).

Accordingly, the action would not have a significant impact on water resources on a local, regional, state or national scale (Appendix D).

4.8.3 Mitigation Measures, Management and Monitoring

Water Flow Management Measures

Up-catchment Control Structures

A summary of additional up-catchment runoff water control structures to be developed for the Project is provided in Section 2.12.2, including up-catchment water management structures:

- south of the Pit 1 South Dam and Pit 2;
- on the eastern boundaries of Pit 3 and Pit 7;
- in advance of mining in Pit 5;
- in advance of mining in Pit 6; and
- in advance of mining in Pit 8.

Permanent up-catchment diversion bunds/drains would remain around final voids to minimise their drainage catchment so far as is reasonable and feasible (Section 5).

Flood Embankments

As described in Section 4.8.2, all open cut extension areas associated with the Project would be outside the extent of flooding in the 1 in 1,000 AEP flood event (Appendix D).

Water Quality Management

The Project water management system would continue to maintain separation between runoff from areas undisturbed by mining and water generated within active mining areas. An objective of the on-site water management for the Wilpinjong Coal Mine is to operate such that there is no mine water storage overflow (Section 2.12.2).

The water management system would include a combination of permanent structures (e.g. final void diversion bunds) that would continue to operate post-mine closure, and temporary structures that would only be required until the completion of the rehabilitation works (e.g. sediment dams).

The existing water quality monitoring regime (including sites and parameter suite) for the approved Wilpinjong Coal Mine would be augmented to include total alkalinity/acidity, As and Mo.

Erosion and Sediment Control

As described in Section 2.12.2, sediment dams would be sized to capture runoff from a 90th percentile rainfall event with a duration of five days (Landcom, 2004 and DECCW, 2008). Sediment dams would be sized consistent with the sizing criteria at the Wilpinjong Coal Mine (Section 2.12.1). Following rainfall events, accumulated water would be transferred to mine water storages until the design capacity of the sediment dam is restored.

The site sediment and erosion control system would continue to be managed in accordance with the Erosion and Sediment Control Plan (part of the overarching Water Management Plan). The Water Management Plan (including the Erosion and Sediment Control Plan) would be reviewed and updated subject to the conditions of any Development Consent for the Project.

Sediment dams would be maintained until such time as runoff has similar water quality characteristics to areas that are undisturbed by mining activities.

Acid Rock Drainage Management

Existing Wilpinjong Coal Mine PAF management measures, as described in Sections 2.10.4 and 2.11, would continue to be implemented for the Project, such as:

- blending PAF with NAF or acid-consuming waste rock, to produce an overall NAF material;
- encapsulating PAF material with NAF waste rock; and
- lime dosing of PAF tailings if required when disposal to dedicated tailings storage facilities occurs.

In accordance with the recommendations of the Geochemistry Assessment (Appendix K), the following geochemical characterisation and investigation would be undertaken for the Project:

- Development of a testing program to confirm the waste rock scheduled to be placed within the final outer surface of the backfilled mine voids (i.e. outer 2 m) and the approved elevated waste rock emplacement in Pit 2 (i.e. outer 5 m) is NAF.
- Continued pH monitoring of the decant water in the tailings dams. If acid generation is observed, alkali material (i.e. crushed limestone, agricultural lime) would be added to the surface of the tailings at an application rate adequate to neutralise the generated acid.
- Continued testing of the coarse reject and tailings in accordance with the Life of Mine Tailings Strategy (within the Waste Management Plan) to confirm the geochemical characteristics of these materials and the co-disposal material.
- Inclusion of total alkalinity/acidity, As and Mo into the existing water quality monitoring regime for the Wilpinjong Coal Mine.

Further details on these measures are provided in Appendix K.

The existing Life of Mine Tailings Management Strategy would be generally retained with updates to reflect the management measures above.

WCPL would continue to monitor the water quality of contained water storages (i.e. pH and solute concentrations) during the life of the Project as part of the existing surface water monitoring program. In the event acid rock drainage is identified through the surface water monitoring program (refer below), specific acid rock drainage controls would be implemented.

Concentrate Management

Concentrate from the reverse osmosis plant (part of the water treatment facility) would continue to be managed in accordance with the existing measures at the Wilpinjong Coal Mine, which are described in Section 2.12.5.

The rehabilitation of operational dams is described in Section 5.

Water Management Plan

The existing Water Management Plan would be reviewed and revised to incorporate the Project subject to the conditions of any Development Consent for the Project. The Water Management Plan describes the operational site water management system and would include provisions for review of the site water balance, erosion and sediment controls, surface water (and groundwater) monitoring and management.

The Water Management Plan would describe the water management protocols and response procedures for the water management system that would be adhered to throughout the operation of the Project. The water management protocols (to avoid overflows or releases from contained water storages) are described in Appendix D.

Site Water Balance

Review and progressive refinement of the site water balance would continue to be undertaken annually over the life of the Project to record the status of inflows (water capture), storage and consumption (e.g. CHPP usage, return water from co-disposal areas, dust suppression and water treatment facility licensed discharges) and to optimise water management performance.

The results of site water balance reviews would be reported in the Annual Review.

Erosion and Sediment Control Plan

The Erosion and Sediment Control Plan would be reviewed and updated for the Project (i.e. to address the open cut extension areas and relevant construction activities) subject to the conditions of any Development Consent for the Project.

The Erosion and Sediment Control Plan identifies activities that could cause soil erosion and generate sediment and describe the specific controls (including locations, function and structure capacities) to minimise the potential for soil erosion and transport of sediment off-site (as described above in Water Quality Management Measures sub-section).

Surface Water Management and Monitoring Plan

The existing surface water monitoring program (Figure 4-13) which is included in the Surface Water Management and Monitoring Plan of the Water Management Plan would be retained for the Project and updated (i.e. with respect to monitoring locations, parameters and frequency) subject to the conditions of any Development Consent for the Project.

In accordance with the recommendations in the Geochemistry Assessment (Appendix K), the surface water monitoring program would be updated to include the following water quality parameters:

- total alkalinity/acidity;
- As[3]; and
- Mo.

Water quality monitoring would continue to be undertaken in accordance with the ANZECC and ARMCANZ (2000) guidelines and the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DEC, 2004b).

On-site meteorological monitoring (including on-site rainfall) would also continue and is described in Section 4.2.1.

Surface and Groundwater Response Plan

The existing Surface and Groundwater Response Plan, which is included in the Water Management Plan for the Wilpinjong Coal Mine, would be reviewed and revised for the Project subject to the conditions of any Development Consent for the Project.

The Surface and Groundwater Response Plan would describe any additional measures and procedures that would be implemented over the life of the Project to respond to any potential exceedances of surface water related criteria and contingent mitigation, compensation, and/or offset options if downstream surface water users (of which there are none on Wilpinjong Creek, Cumbo Creek or Wollar Creek downstream of the Wilpinjong Coal Mine) or riparian vegetation are adversely affected by the Project.

Cumbo Creek Relocation Plan

WCPL will prepare a Cumbo Creek Relocation Plan prior to works associated with the relocation of the creek and mining of the existing alignment. The plan will detail the final alignment of the relocated creek and required water management infrastructure, hydrological and ecological baseline conditions, design specifications, performance and completion criteria and associated monitoring.

[3] The Geochemistry Assessment (Appendix K) indicates that As is likely to be significantly enriched in some of the waste rock and coal rejects but is not readily soluble. Notwithstanding, As would be conservatively added to the surface water monitoring program.

Surface Water Licensing

The Wilpinjong Coal Mine is located within the Wollar Creek Water Source under the Water Sharing Plan.

As no surface water is proposed to be directly extracted from Wilpinjong Creek for the Project, unregulated river licences are not required for the Project.

Further details are provided in Attachment 6 including consideration of the Project against the water management principles and access licence dealing principles under the *Water Management Act, 2000*.

As described in Section 2.12.2, an objective of the water management on-site throughout the Project life is to maintain separation between runoff from areas undisturbed by mining and water generated within active mining areas. WRM Water & Environment (2015) has concluded that no access licences or approvals would be required for construction or use and the taking of water from the Project surface water containments.

This conclusion was made on the basis that Project water storages would be relevant excluded works under Schedule 1 (clauses 1 to 3) of the *Water Management (General) Regulation, 2011* (Appendix D).

Maximum Harvestable Right Dam Capacity

Notwithstanding the above conclusion, based on the area of Peabody Energy's contiguous land holdings (Figure 1-5a), the harvestable right dam capacity potentially available to Peabody Energy has been determined to be 1,295 ML (Appendix D).

Post-Mining Surface Water Management

The management of surface water resources post-mining, including drainage across the final mine landforms and final void water management is described in Section 5.

4.9 BIODIVERSITY

A terrestrial ecology assessment (i.e. the Biodiversity Assessment Report and Biodiversity Offset Strategy) (Appendix E) was prepared for the Project by Dr Colin Driscoll (Hunter Eco) (2015a). A separate aquatic ecology assessment was prepared by Bio-Analysis (Appendix F).

The biodiversity assessments were prepared in accordance with the SEARs for the Project and relevant State and Commonwealth requirements. In regard to the State requirements, the recently released NSW *Biodiversity Offset Policy for Major Projects* (the NSW Offset Policy) (OEH, 2014a) (and supporting NSW *Framework for Biodiversity Assessment* [OEH, 2014b]) was generally applied. The NSW Offset Policy commenced in October 2014 for a 12 to 18 month transitional period.

The Biodiversity Assessment Report Development Site Footprint (Figure 4-15) is referred to throughout the Biodiversity Assessment Report and Biodiversity Offset Strategy (Appendix E) and is defined as the development site construction and operational footprint for the purposes of the terrestrial ecology assessment. A fixed Project footprint is required in order to evaluate the biodiversity impacts of the Project under the NSW *Framework for Biodiversity Assessment* (OEH, 2014b).

In practice, the location of the Project supporting infrastructure would be subject to detailed design and therefore disturbance areas would be expected to vary (e.g. following detailed designed of up-catchment diversion structures). For this reason the Biodiversity Assessment Report Development Site Footprint is shown on figures that relate to the terrestrial ecology assessment. While changes to the Biodiversity Assessment Report footprint would be expected over the life of the Project, any such changes are expected to be minor relative to the total Project footprint and subject to relevant due diligence assessments completed in accordance with the Environmental Management Strategy.

A description of the existing environment relating to the biodiversity values of the Project open cut extension and infrastructure areas is provided in Section 4.9.1. Section 4.9.2 describes the potential impacts of the Project, Section 4.9.3 outlines mitigation measures, management and monitoring and Section 4.9.4 describes the biodiversity offset strategy.

4.9.1 Existing Environment

Landscape Features

The Project is located within the north-western extent of the Sydney Basin Interim Biogeographic Regionalisation for Australia Bioregion.

The Wilpinjong Coal Mine is situated on the valley floor between hills and escarpments of the Goulburn River National Park to the north and Munghorn Gap Nature Reserve to the south. The Project is mostly within the Upper Goulburn Valleys and Escarpment Mitchell Landscape (OEH, 2015a; Mitchell, 2002).

As described in Section 4.8, the Project is located at the south-western extent of the Hunter Catchment and the main drainage line in the vicinity of the Wilpinjong Coal Mine is Wilpinjong Creek.

Native Vegetation and Threatened Ecological Communities

Hunter Eco (2015b) (Attachment C of Appendix E) surveyed the vegetation within the Project open cut extension and infrastructure areas and surrounds. The vegetation surveys included sampling of floristic plots, collection of Biometric data (OEH, 2014b) and targeted searches for threatened ecological communities listed under the NSW *Threatened Species Conservation Act, 1995* (TSC Act) and EPBC Act that could potentially occur.

The Project open cut extension and infrastructure areas are mostly (65%) cleared land although 354 ha of native vegetation is present, which comprises dry sclerophyll forests and grassy woodlands in moderate to good condition (Figure 4-15). Some forest/woodland areas were previously cleared for past agricultural land use and now contain regeneration.

Twelve native vegetation communities were identified in the Project open cut extension and infrastructure areas (Table 4-21; Figure 4-15). Of these, three are listed as threatened ecological communities under the TSC Act and/or EPBC Act (Figure 4-16).

Table 4-21
Mapped Vegetation Communities

Mapping Unit	Community	Biometric Vegetation Type
Grassy Woodlands		
1	Blakely's Red Gum Woodland (grassy)[1]	HU681
2	Fuzzy Box Woodland	HU547
3a	Rough-barked Apple – Black Cypress Pine Woodland	HU981
3b	Rough-barked Apple – Black Cypress Pine Woodland – regeneration	HU981
4a	Rough-barked Apple Woodland – alluvial	HU981
4b	Rough-barked Apple Woodland – alluvial – regeneration	HU981
5	Yellow Box Woodland (grassy)[1]	HU732
6	Blakely's Red Gum Woodland (shrubby)	HU910
Dry Sclerophyll Forests (Shrubby sub-formation)		
7	Grey Gum – Narrow-leaved Stringybark Forest	HU843
8a	Red Ironbark Forest	HU886
8b	Red Ironbark Forest – regeneration	HU886
9	Slaty Box Forest[2]	HU618
10a	White Box Woodland (shrubby)	HU824
10b	White Box Woodland (shrubby) – regeneration	HU824
Dry Sclerophyll Forests (Shrub/grass sub-formation)		
11	Western Grey Box Woodland	HU962
12	Narrow-leaved Ironbark Forest	HU825

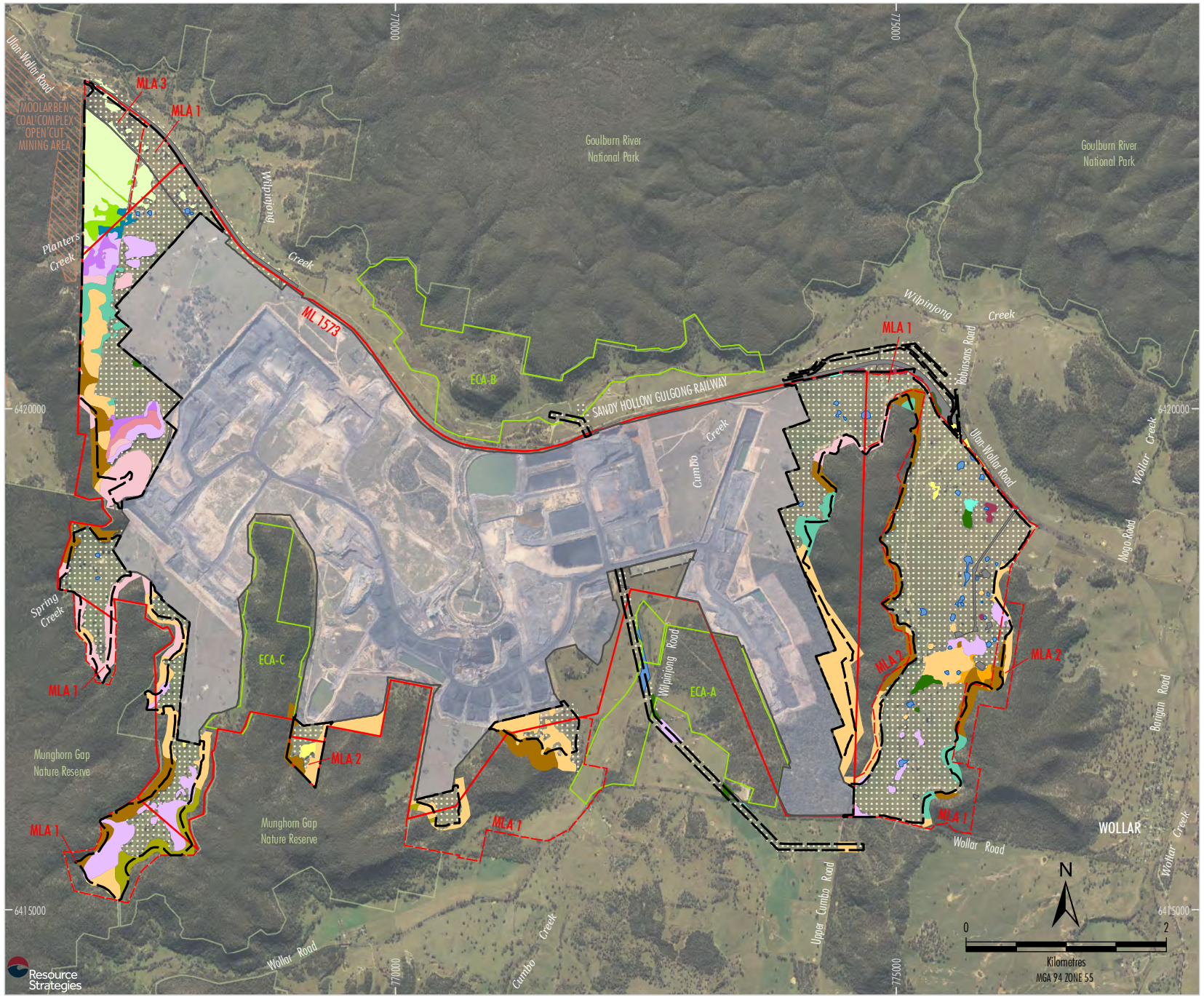
Source: Appendix E.

[1] Equivalent to the Box-Gum Woodland EEC/Critically Endangered Ecological Community (CEEC).

[2] Equivalent to the Slaty Gum Vulnerable Ecological Community (VEC) .

Small patches of Blakely's Red Gum Woodland (grassy) (Vegetation Community 1) and Yellow Box Woodland (grassy) (Vegetation Community 5) (Plate 4-6) were assessed to equate to:

- *White Box - Yellow Box - Blakely's Red Gum Woodland Endangered Ecological Community* (Box-Gum Woodland EEC) under the TSC Act; and
- *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community* (Box-Gum Woodland CEEC) under the EPBC Act.



LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Approved/Existing Open Cut and Contained Infrastructure Area
- Relocated Block Bank and Cumbo Creek Disturbance Area
- Biodiversity Assessment Report Development Site Footprint
- Enhancement and Conservation Area

VEGETATION COMMUNITIES

Grassy Woodlands - Western Slopes Grassy Woodlands

- 1 Blakely's Red Gum Woodland (grassy) (HU681)
- 2 Fuzzy Box Woodland (HU547)
- 3a Rough-barked Apple - Black Cypress Pine Woodland (HU981)
- 3b Rough-barked Apple - Black Cypress Pine Woodland (HU981) - regen
- 4a Rough-barked Apple Woodland – alluvial (HU981)
- 4b Rough-barked Apple Woodland – alluvial (HU981) - regen
- 5 Yellow Box Woodland (grassy) (HU732)

Grassy Woodlands - Coastal Valley Grassy Woodlands

- 6 Blakely's Red Gum Woodland (shrubby) (HU910)

Dry Sclerophyll Forests (Shrubby Sub-formation) - Western Slopes Dry Sclerophyll Forests

- 7 Grey Gum - Narrow-leaved Stringybark Forest (HU843)
- 8a Red Ironbark Forest (HU886)
- 8b Red Ironbark Forest (HU886) - regen
- 9 Slaty Box Forest (HU618)
- 10a White Box Woodland (shrubby) (HU824)
- 10b White Box Woodland (shrubby) (HU824) - regen

Dry Sclerophyll Forests (Shrub/Grass Sub-formation) - North-west Slopes Dry Sclerophyll Woodlands

- 11 Western Grey Box Woodland (HU962)
- 12 Narrow-leaved Ironbark Forest (HU825)

Cleared Land

- Pasture Improved Grassland/Stubble Field/ Slashed Power Easement
- Existing Infrastructure
- Dam/Typha

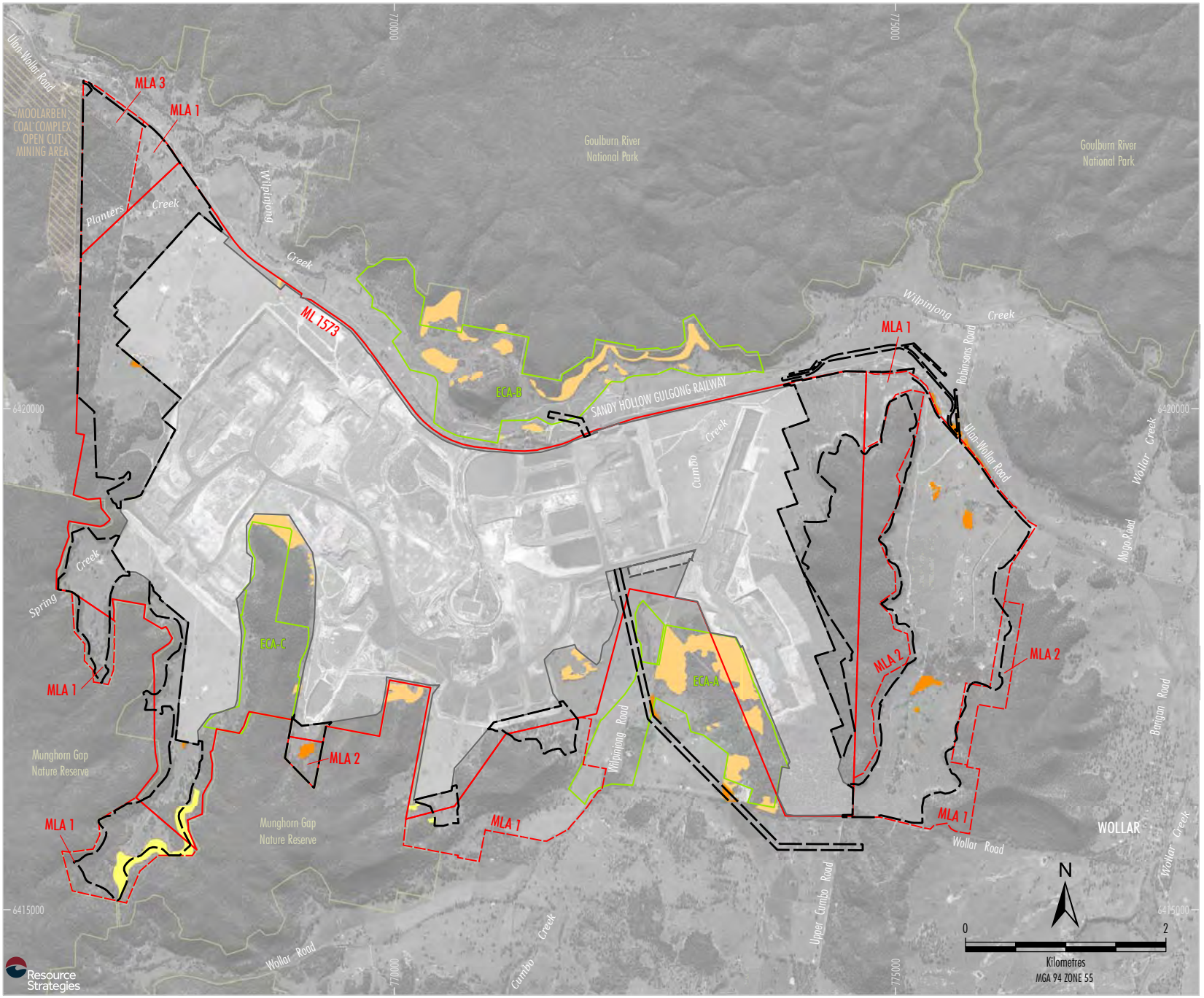
Source: WCPL (2015); Hunter Eco (2015); NSW Dept of Industry (2015)
Orthophoto: WCPL (Jun 2015; Jun 2014)

Peabody ENERGY

WILPINJONG EXTENSION PROJECT

Mapped Vegetation Communities

Figure 4-15



LEGEND

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Threatened Ecological Communities

- Box-Gum Woodland Endangered Ecological Community/ Critically Endangered Ecological Community [1]
- Box-Gum Woodland Endangered Ecological Community [2]
- Slaty Gum Woodland Vulnerable Ecological Community [1]

Reference: 1 Hunter Eco (2015)
2 FloraSearch (2005)

Source: WCPL (2015); NSW Dept of Industry (2015)
Orthophoto: WCPL (Jun 2015; Jun 2014)

Peabody ENERGY

WILPINJONG EXTENSION PROJECT

Mapped Threatened Ecological Communities

Figure 4-16

Plate 4-6: Yellow Box Woodland in the Project Area

Slaty Box Forest (Vegetation Community 9) (in the south-west corner of the Project open cut extension areas) was also assessed to equate to the *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion Vulnerable Ecological Community* (Slaty Gum VEC) under the TSC Act.

GDEs are described in Section 4.7.

Aquatic Habitat

A number of aquatic surveys, monitoring programs and assessments have been undertaken in the vicinity of the Project from 2005 to present by Bio-Analysis (2005), Roberts (2006; 2008; 2009), Landline Consulting (2010; 2011; 2012; 2013a) and Barnson (2014). Bio-Analysis (2015) (Appendix F) undertook contemporary aquatic ecology surveys of Wilpinjong, Wollar, Cumbo, Planters and Spring Creeks to complement the previous surveys and monitoring conducted at the Wilpinjong Coal Mine and surrounds.

Aquatic habitat were characterised by collecting data on water quality, macrophytes, fish assemblages and macroinvertebrates (using the Australian River Assessment System technique) (Appendix F).

Riparian and instream habitats in the vicinity of the Wilpinjong Coal Mine and the Project have been substantially altered by historical and ongoing agricultural land use practices. These areas are considered to provide poor aquatic habitat due to a low diversity of aquatic plants, with some areas heavily infested by riparian and aquatic weeds; having macroinvertebrate assemblages generally dominated by pollution-tolerant taxa; and little to no ecological value for fish species (Bio-Analysis, 2015).

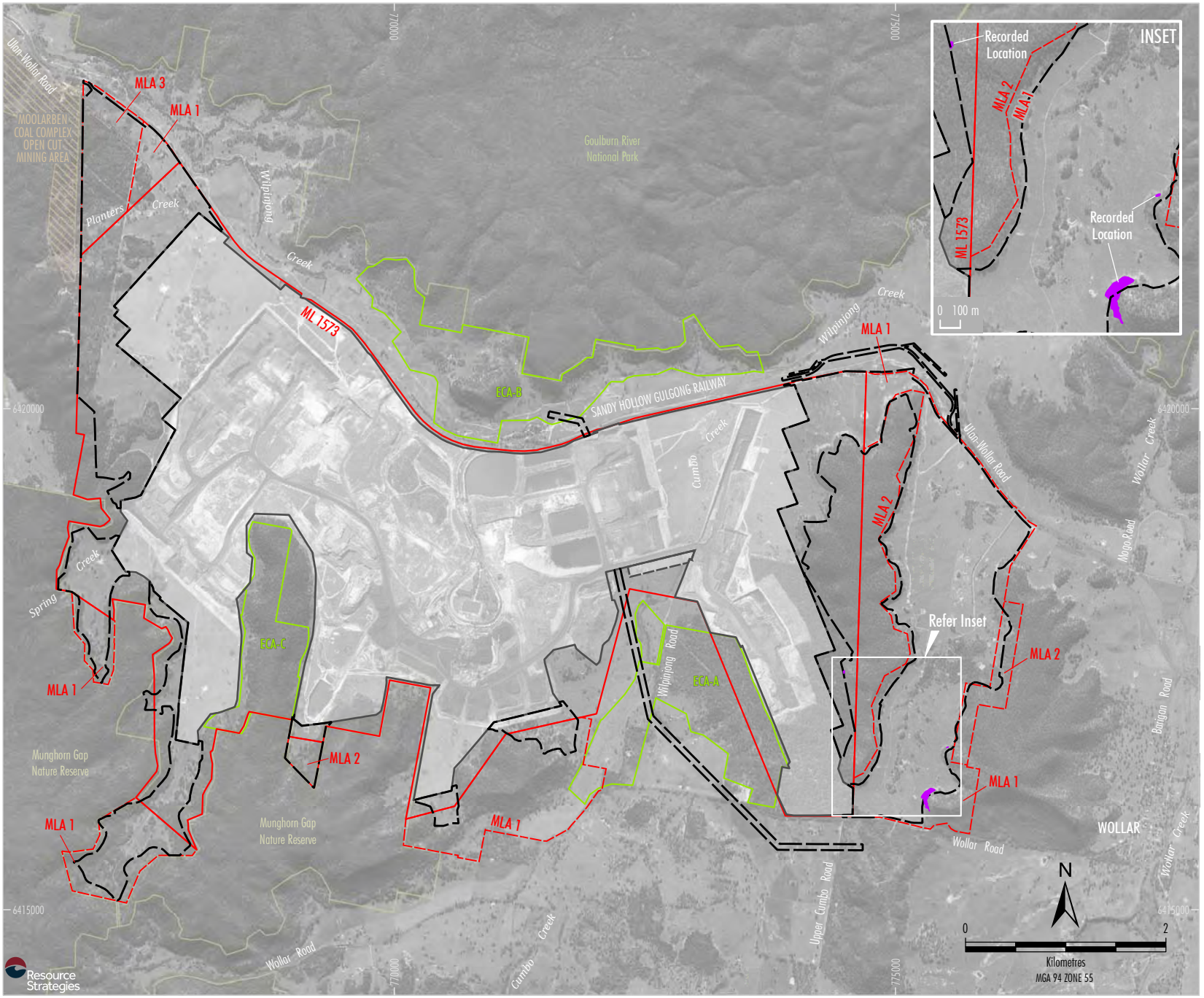
Aquatic environments downstream of the Wilpinjong Coal Mine are considered to provide moderate to poor aquatic habitat. Some sites downstream of the Project provide habitat for aquatic fauna with no artificial barriers and presence of native aquatic macrophytes. However, many areas exhibit poor water visibility, weed dominated riparian vegetation, a fish assemblage mostly dominated by introduced species and evidence of erosion, streambank degradation and sedimentation (Bio-Analysis, 2015).

Threatened Flora Species

Targeted surveys for potentially occurring threatened terrestrial flora species listed under the TSC Act and EPBC Act were previously undertaken by FloraSearch (2005), Hunter Eco (2013) and Lesryk Environmental Consultants (2013), and additional targeted searches were undertaken by Hunter Eco (2015b) during 2014 and 2015 (Appendix E).

One threatened flora species occurs within the Project open cut extension and infrastructure areas, being *Ozothamnus tesselatus*, listed as 'Vulnerable' under both the TSC Act and EPBC Act (Figure 4-17). Three populations of *Ozothamnus tesselatus* were found equating to a direct count of 1,090 plants (Appendix E). A much larger population of this species was also found in a Project biodiversity offset area (exceeding 6,400 plants) (Section 4.9.4).

No threatened aquatic flora species listed under the NSW *Fisheries Management Act, 1994* (FM Act), TSC Act or EPBC Act are likely to occur in the Project open cut extension and infrastructure areas or downstream creeks (Appendix F).



LEGEND

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Threatened Flora Species

- *Ozothamnus tesselatus*

Source: WCPL (2015); Hunter Eco (2015); NSW Dept of Industry (2015)
Orthophoto: WCPL (Jun 2015; Jun 2014)

Peabody ENERGY

WILPINJONG EXTENSION PROJECT

Mapped Threatened Flora Species

Figure 4-17

Threatened Fauna Species

Threatened fauna of the Project open cut extension and infrastructure areas and surrounds has been comprehensively surveyed over the past 10 years (Mount King Ecological Surveys, 2005; Greg Richards and Associates, 2005; EcoVision, 2006; Biodiversity Monitoring Services, 2013; Lesryk Environmental Consultants, 2013). In 2014 and 2015 additional fauna surveys were undertaken by Biodiversity Monitoring Services (2015a) which included a range of fauna survey techniques consistent with relevant State and Commonwealth guidelines (DEC, 2004c; DECC, 2009b; Department of Sustainability, Environment, Water, Population and Communities [SEWPaC], 2010a; 2010b; 2010c; 2011a; 2011b). A detailed description of the fauna survey methods is provided in Appendix E.

Targeted surveys were undertaken by Biodiversity Monitoring Services for all potentially occurring threatened terrestrial fauna species listed under the TSC Act and EPBC Act, even though the NSW *Framework for Biodiversity Assessment* (OEH, 2014b) only requires surveys for species credit species (i.e. species that cannot be predicted based on habitat and therefore generate separate offset requirements).

Threatened fauna species recorded in past and current surveys and database records are shown on Figures 4-18 and 4-19. A total of 20 threatened fauna species listed under the TSC Act have been recorded within the Project open cut extension and infrastructure areas during current and previous surveys, comprising 13 birds and seven bats. Under the NSW Offset Policy (OEH, 2014a), these threatened fauna species are classed as ecosystem species (i.e. species that can be predicted to be present based on a habitat assessment).

Targeted surveys were also undertaken by Bio-Analysis (2015) (Appendix F) for threatened aquatic fauna species listed under the TSC Act, FM Act and EPBC Act that may occur. No threatened aquatic fauna species were recorded in the vicinity of the Project (Appendix F).

Threatened Species - Species Credit Species under the NSW Offset Policy

One threatened flora species which is a species credit species has been recorded within the Project open cut extension and infrastructure areas, being *Ozothamnus tesselatus.*

No threatened fauna species which are species credit species have been recorded inside the Project open cut extension and infrastructure areas.

Potential habitat occurs in the Project open cut extension and infrastructure areas for the following two threatened fauna species which are species credit species:

- Regent Honeyeater (*Anthochaera phrygia*) (listed as 'Critically Endangered' under both the TSC Act and EPBC Act[4]); and
- Koala (*Phascolarctos cinereus*) (listed as 'Vulnerable' under both the TSC Act and EPBC Act).

Threatened Species/Communities That Require Further Consideration under the NSW Offset Policy

The OEH's comments in the SEARs for the EIS requested further consideration of the impacts on Box-Gum Woodland EEC, *Ozothamnus tesselatus* and Regent Honeyeater (in accordance with the NSW *Framework for Biodiversity Assessment* [OEH, 2014b]). These matters are therefore considered further by Hunter Eco (2015a) (Appendix F).

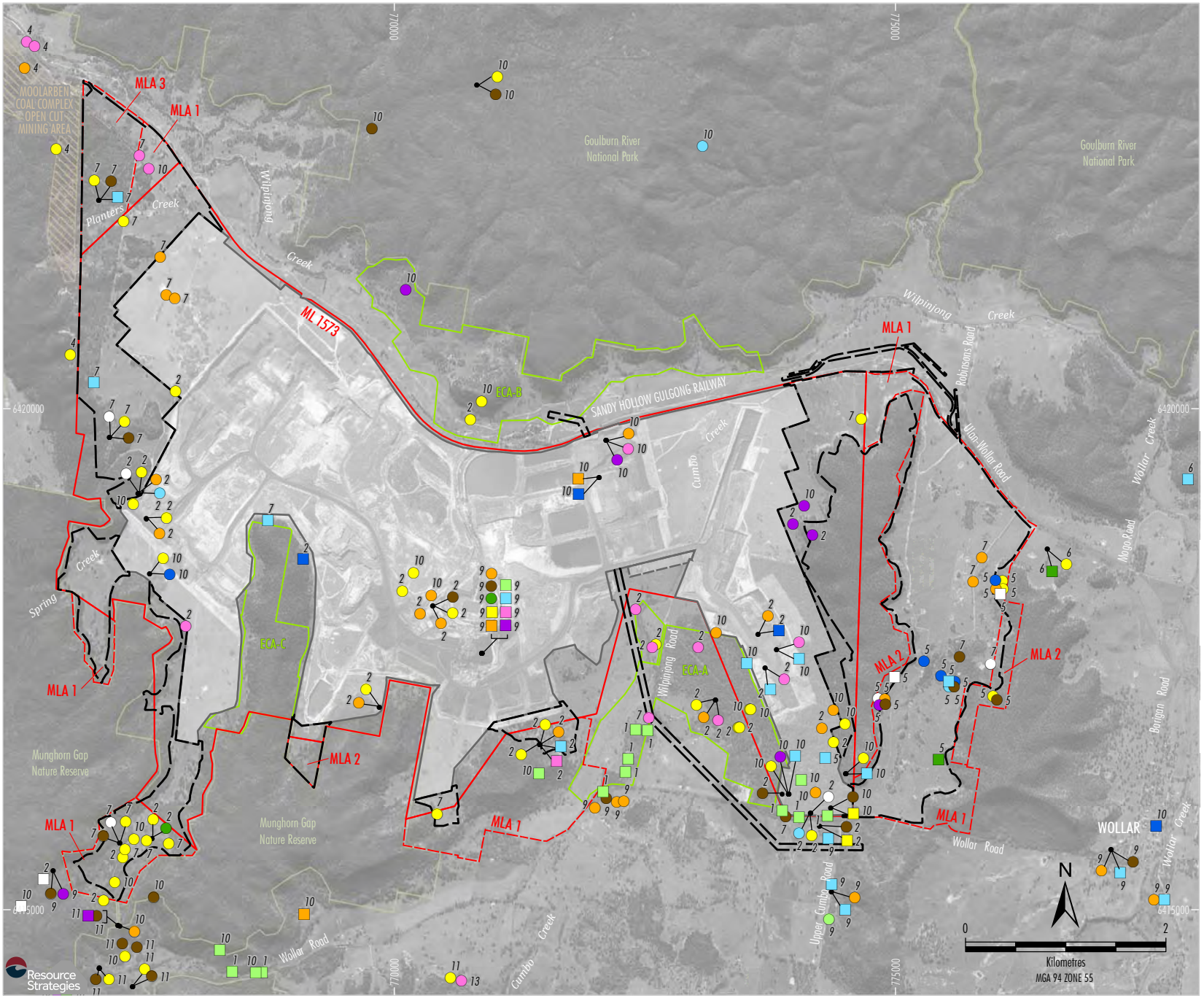
Introduced Flora and Noxious Weeds

Of the 282 flora species identified during surveys, 61 species (i.e. 21.6%) were introduced. Six of the introduced flora species are noxious weeds under the NSW *Noxious Weeds Act, 1993,* namely, Blue Heliotrope, St. John's Wort, Common Prickly Pear, Sweet Briar, Noogoora Burr and Bathurst Burr.

Introduced Fauna and Declared Animals

Of the 151 fauna species recorded during surveys, eight species were introduced. Three of the introduced fauna species are declared pests under the *Local Land Services Act, 2013,* namely the Red Fox, Feral Pig and European Rabbit.

[4] Listed as 'Endangered' under the EPBC Act at the time of the controlled action decision (12 March 2015) and therefore assessed under the Commonwealth offset policy as 'Endangered' not 'Critically Endangered' (refer section 158A of the EPBC Act).



LEGEND

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Threatened Birds

- Black-chinned Honeyeater (eastern subspecies)
- Brown Treecreeper (eastern subspecies)
- Diamond Firetail
- Flame Robin
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Grey-crowned Babbler (eastern subspecies)
- Hooded Robin (south-eastern form)
- Little Eagle
- Little Lorikeet
- Masked Owl
- Painted Honeyeater
- Powerful Owl
- Regent Honeyeater
- Scarlet Robin
- Speckled Warbler
- Square-tailed Kite
- Turquoise Parrot
- Varied Sittella

Reference:

1 *DECC (2005)*
2 *Mount King Ecological Surveys (2005)*
4 *EcoVision (2006)*
5 *Lesryk Environmental Consultants (2013)*
6 *Biodiversity Monitoring Services (2013)*
7 *Biodiversity Monitoring Services (2015a)*
9 *Birdlife (2014)*
10 *OEH (2015)*
11 *Biodiversity Monitoring Services (2015b)*

Note: There are no references 3 or 8 on this figure.

Source: WCPL (2015); NSW Dept of Industry (2015)
Orthophoto: WCPL (Jun 2015; Jun 2014)

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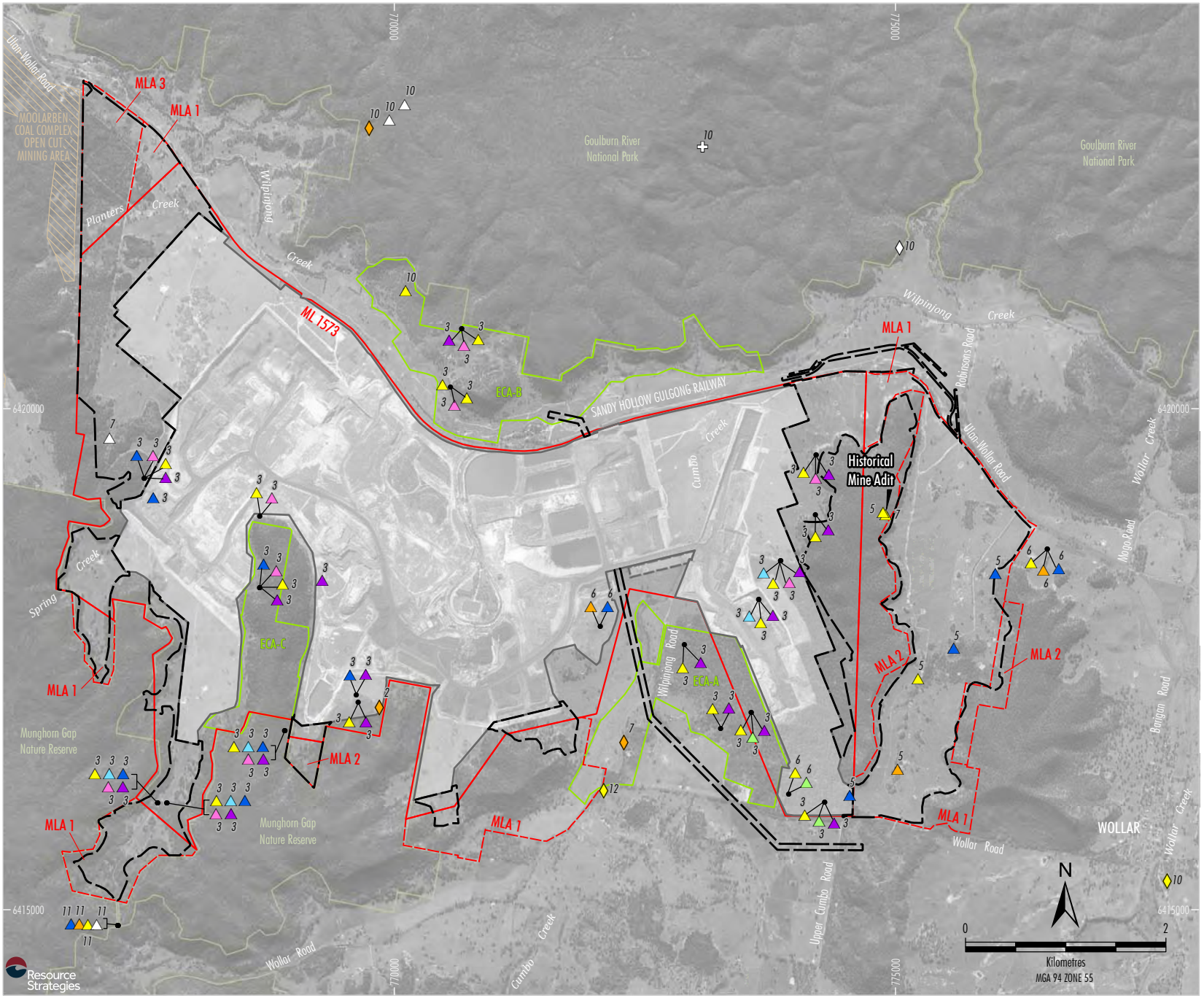
WILPINJONG EXTENSION PROJECT

Records for Threatened Birds

Figure 4-18



Peabody ENERGY

WILPINJONG EXTENSION PROJECT

Records for Threatened Mammals and Amphibian

Figure 4-19

Matters of National Environmental Significance

One threatened ecological community, one threatened flora species and two threatened fauna species listed under the EPBC Act have been recorded in the Project open cut extension and infrastructure areas, namely, the Box-Gum Woodland CEEC (Section 4.9.1), *Ozothamnus tesselatus*, Corben's Long-eared Bat (*Nyctophilus corbeni*) and Large-eared Pied Bat (*Chalinolobus dwyeri*).

Existing Mitigation Measures at the Wilpinjong Coal Mine

A range of existing measures to avoid and minimise impacts on biodiversity are implemented at the Wilpinjong Coal Mine. A summary of the existing measures is provided in Table 4-22. These existing measures would be continued for the Project.

Further information on rehabilitation is provided in Section 5.

Existing Biodiversity Offset Strategy at the Wilpinjong Coal Mine

The existing Biodiversity Offset Strategy for the Wilpinjong Coal Mine is outlined in Table 4-23 and shown on Figure 4-20. The ECAs A to C were approved by DP&E in February 2006 and Biodiversity Offset Areas D and E were approved by DP&E in February 2014. The existing offset areas cover a total area of 691 ha. In addition, an area at Nullo Mountain was provided to the NPWS as an addition to Wollemi National Park in 2006.

A Biodiversity Management Plan has been prepared for the management of the existing Biodiversity Offset Strategy. The Biodiversity Management Plan provides a description of measures that will be implemented in the existing offset areas, such as grazing and stock management, habitat augmentation, revegetation, weed management, vertebrate pest management and bushfire management.

The Biodiversity Management Plan would, as relevant, be revised for the Project (subject to the conditions of any Development Consent for the Project).

Table 4-22
Existing Biodiversity Impact Avoidance and Mitigation Measures

Measure	Description
Progressive Site Rehabilitation	• Surface development areas are progressively rehabilitated and revegetated. • Revegetation of rehabilitation areas will aim to result in a combination of woodland, pasture and mixed woodland/pasture areas. • Revegetation will include the use of endemic plant species characteristic of the surrounding vegetation to produce a net increase in woodland vegetation. • Revegetation will aim to increase the continuity of woodland vegetation by establishing links between woodland vegetation in the rehabilitation areas, regeneration areas and existing remnant vegetation in the Munghorn Gap Nature Reserve, Goulburn River National Park and the ECAs. • Regeneration areas, which predominantly comprise cleared agricultural land, will be established to increase the continuity of existing native vegetation with the rehabilitation.
Creek Rehabilitation	• The banks of Wilpinjong and Cumbo Creeks in the rehabilitation areas and regeneration areas will be revegetated to increase the quantity of riparian vegetation along these creeks.
Vegetation Clearance Protocol (and Threatened Species Management Protocol)	• A Ground Disturbance Permit is completed prior to the commencement of new ground disturbance. • Areas to be cleared of native vegetation are delineated to prevent accidental damage during vegetation clearance activities or other works. • Pre-clearance habitat surveys are undertaken and impacts on fauna during clearance activities are managed.
Salvage and Re-Use of Material From The Mine Area for Habitat Enhancement	• Habitat features such as logs, fallen limbs and hollows are collected/salvaged where practicable to provide habitat features for fauna in rehabilitation areas, regeneration areas and ECAs.

Table 4-22 (Continued)
Existing Biodiversity Impact Avoidance and Mitigation Measures

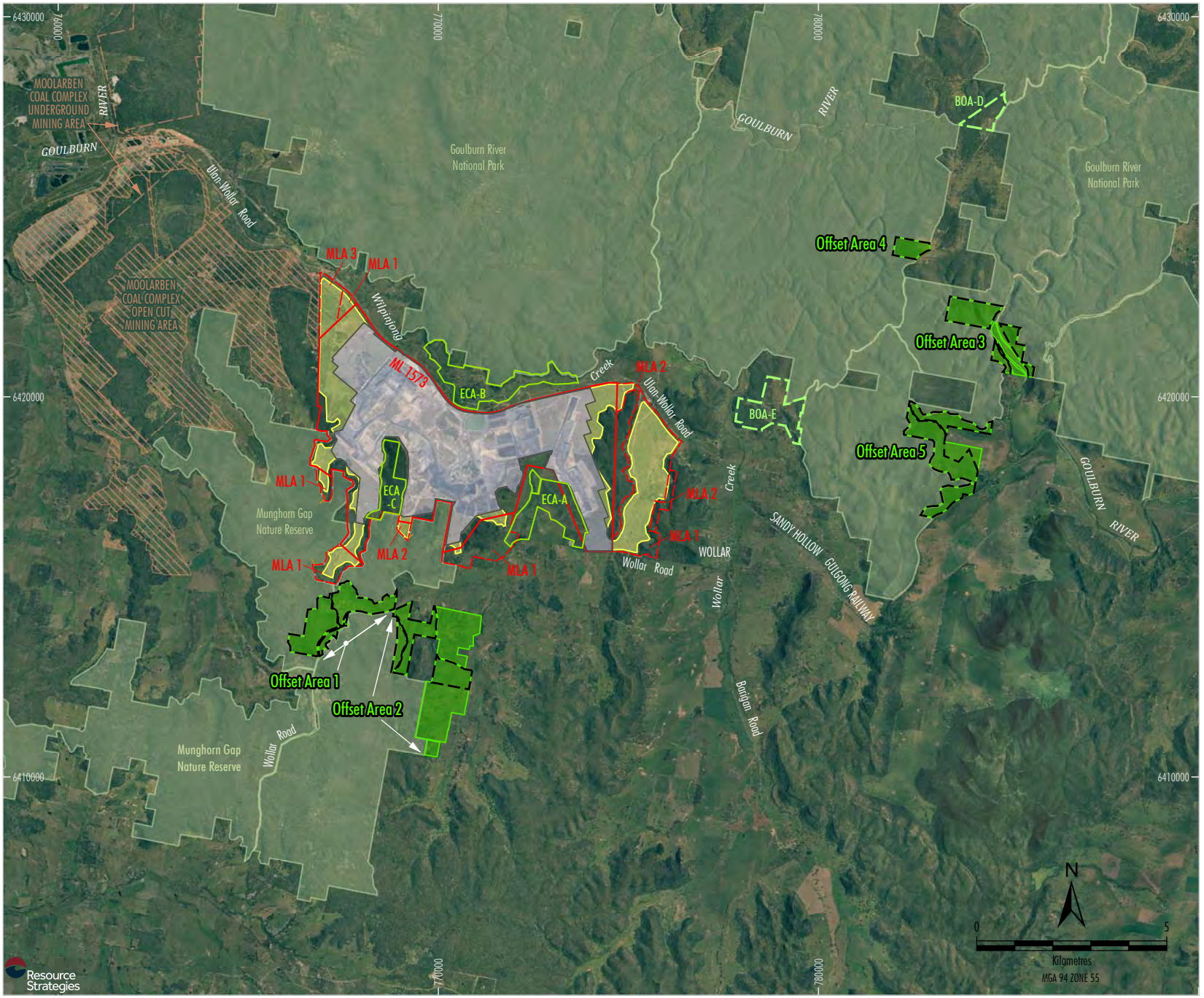
Measure	Description
Collection and Propagation of Seed for Rehabilitation Works	• Trees are examined for their provision of seed prior to vegetation clearance. • Native seed is collected from the local area to augment revegetation resources. • A seed inventory is maintained which records the amount of seed collected, species type and treatment and propagation specifications.
Feral Pest Control	• Regular property inspections are undertaken to assess the status of pest populations within WCPL-owned land. • Control of declared pests is undertaken (e.g. control of feral pigs and rabbits).
Weed Control	• Regular inspections of WCPL-owned lands to identify areas requiring the implementation of weed management measures. • Control of noxious weeds identified on WCPL-owned land is undertaken considering the relevant control category.
Erosion Control	• Minimising surface disturbance and restricting access to undisturbed areas. • Construction of suitable erosion and sediment controls such as drains and sediment dams to control, contain and manage sediment laden surface runoff.
Managing Grazing and Agriculture	• WCPL has currently excluded all domestic stock from the regeneration areas and woodland rehabilitation areas on-site.
Restrictions On Site Access	• Rehabilitation areas will be fenced and signposted to limit access to authorised personnel only.
Bushfire Management	• The training of WCPL employees and contractors in general fire awareness and preventative measures. • The provision and maintenance of on-site fire fighting equipment.
Water Management	• Construction of up-catchment control structures to divert water around active mine workings. • Discharge of treated water from the reverse osmosis plant/water treatment facility in accordance with EPL 12425. • Contained water storages are managed and operated for no release to downstream watercourses.
Erosion and Sediment Control	• Minimising surface disturbance and restricting access to undisturbed areas. • Construction of suitable erosion and sediment controls such as drains and sediment dams to control, contain and manage sediment laden surface runoff.

Source: After WCPL (2011; 2014d, 2014f, 2015a).

Table 4-23
Existing Biodiversity Offset Strategy

Offset Area	Size (ha)	Location	General Description
Enhancement and Conservation Areas A to C	480	ECA-B is located immediately north of the Wilpinjong Coal Mine adjoining Goulburn River National Park, and ECA-A and ECA-C are immediately to the south.	These offset areas comprise approximately 295 ha of native vegetation, including 80 ha of Box-Gum Woodland EEC. The remaining 185 ha is cleared land.
Biodiversity Offset Areas D and E	211	Biodiversity Offset Area D is approximately 3 km east of the site and Biodiversity Offset Area E is approximately 12 km north-east of the site, to the adjoining Goulburn River National Park.	These offset areas comprise approximately 211 ha of native vegetation, including: • 193 ha of woodland (including 47.8 ha of Box-Gum Woodland EEC); • 13.6 ha of shrubby regeneration; and • 4.4 ha of derived native grassland.
Total	**691**		

Source: Appendix E.



LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Approved/Existing Open Cut and Contained Infrastructure Area
- Proposed Open Cut Extension Area
- Enhancement and Conservation Area
- Existing Biodiversity Offset Area
- Proposed Biodiversity Offset Area
- Commonwealth Offset Area
- National Park/Nature Reserve

Source: WCPL (2015); NSW Dept of Industry (2015)
Orthophoto: WCPL (Jun 2015, 2011)

Peabody ENERGY

WILPINJONG EXTENSION PROJECT

Existing and Proposed Biodiversity Offset Areas

Figure 4-20

4.9.2 Potential Impacts

The likely direct and indirect impacts of the Project on biodiversity have been assessed and impact avoidance and mitigation measures are described below.

Native Vegetation and Threatened Ecological Communities

The Project would require clearance of approximately 354 ha of native vegetation in the Project open cut extension and infrastructure areas (Table 4-24; Figure 4-15).

The Project would result in the clearance of 9.5 ha of Box-Gum Woodland EEC/CEEC (Table 4-24). The Box-Gum Woodland EEC/CEEC is fragmented in 11 small patches (Figure 4-16).

A number of measures to avoid and minimise impacts on biodiversity are currently implemented at the Wilpinjong Coal Mine (Table 4-22) and these would be continued for the Project (e.g. vegetation clearance protocols and weed management).

Potential indirect impacts from the Project on vegetation (and other terrestrial biodiversity) have been assessed in Appendix E. It is concluded that there would be no significant indirect impacts on the surrounding biodiversity as a result of the Project.

The NSW *Framework for Biodiversity Assessment* (OEH, 2014b) requires the use of an online programme (the *Credit Calculator for Major Projects and BioBanking* [the Credit Calculator]) to assess biodiversity impacts and determine the biodiversity offset requirements for those impacts.

Table 4-24
Vegetation Communities – Project Clearance and Associated Credit Requirements

Mapping Unit	Community	Biometric Vegetation Type	Clearance Area (ha)	Credit Requirement
Grassy Woodlands				
1	Blakely's Red Gum Woodland (grassy)[1]	HU681	6	254
2	Fuzzy Box Woodland	HU547	1.5	36
3a	Rough-barked Apple - Black Cypress Pine Woodland	HU981	51.5	5,155
3b	Rough-barked Apple - Black Cypress Pine Woodland – regeneration	HU981	7.5	
4a	Rough-barked Apple Woodland – alluvial	HU981	58	
4b	Rough-barked Apple Woodland - alluvial – regeneration	HU981	9	
5	Yellow Box Woodland (grassy)[1]	HU732	3.5	116
6	Blakely's Red Gum Woodland (shrubby)	HU910	4	170
Dry Sclerophyll Forests (Shrubby sub-formation)				
7	Grey Gum - Narrow-leaved Stringybark Forest	HU843	42.5	2,216
8a	Red Ironbark Forest	HU886	33.5	2,129
8b	Red Ironbark Forest – regeneration	HU886	6	
9	Slaty Box Forest[2]	HU618	9.5	511
10a	White Box Woodland (shrubby)	HU824	95	3,947
10b	White Box Woodland (shrubby) – regeneration	HU824	3	
Dry Sclerophyll Forests (Shrub/grass sub-formation)				
11	Western Grey Box Woodland	HU962	3	74
12	Narrow-leaved Ironbark Forest	HU825	20.5	706
		Total	**354**	**15,314**

Source: Appendix E.

[1] Box-Gum Woodland EEC/CEEC.

[2] Slaty Gum VEC.

The result of running the Credit Calculator is that the Project requires a Biodiversity Offset Strategy which accounts for a total of 15,314 ecosystem credits (Table 4-24).

Threatened Communities That Require Further Consideration under the NSW Offset Policy

Further consideration is given to the impacts on Box-Gum Woodland EEC in Appendix E, in accordance with the OEH comments in the SEARs for the EIS. It is concluded that with the proposed measures to avoid, mitigate and offset it is appropriate for these impacts to occur without modifications to the Project or additional offsets.

Aquatic Ecology

Bio-Analysis (2015) concludes there would be nil or negligible change to the aquatic ecology in Wilpinjong Creek due to surface water flows given the Project would have no material incremental impact on flows in the creek (Section 4.8 and Appendix D). Further, there would be nil or negligible change to the aquatic ecology in Wilpinjong Creek due to surface water quality given the range of controls incorporated into the Project (Section 4.8).

Threatened Species - Species Credit Species under the NSW Offset Policy

The Project requires a Biodiversity Offset Strategy which accounts for species credits for *Ozothamnus tesselatus,* Regent Honeyeater and Koala (Table 4-25).

Table 4-25
Project Species Credit Requirements

Species	Clearance Area (ha/individuals)	Credit Requirement
Ozothamnus tesselatus	589 individuals	23,560
Regent Honeyeater (*Anthochaera phrygia*)	273 ha of potential habitat	21,021
Koala (*Phascolarctos cinereus*)	165 ha of potential habitat	4,290

Source: Appendix E.

To avoid and minimise impacts on *Ozothamnus tesselatus*, clearance areas would be clearly delineated and temporary fencing would be installed during vegetation clearance near the known occurrences of this species to minimise the potential for accidental disturbance.

The Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) can potentially be a species credit species where there is disturbance to breeding habitat. Vibration from mine-related blasting has the potential to indirectly impact the Eastern Bentwing-bat in a historical mine adit which is located approximately 152 m west of the proposed Pit 8 (Figure 4-19). The adit is a mining-related man-made structure that will collapse at some stage, irrespective of the Project. Further, the current stability of the adit appears to be adversely affected by a large tree root which is breaking through the adit roof and causing rockfall around the entrance.

To mitigate the potential for future collapse of the entrance, a concrete or steel pipe would be installed to help maintain an opening in the event of any further rockfall around the entrance. As a result, the Project does not require 'species credits' for potential indirect impacts on the Eastern Bentwing-bat breeding habitat.

Threatened Species That Require Further Consideration under the NSW Offset Policy

Further consideration is given to the impacts on *Ozothamnus tesselatus* and Regent Honeyeater in Appendix E, in accordance with the OEH comments in the SEARs for the EIS. It is concluded that with the proposed measures to avoid, mitigate and offset it is appropriate for these impacts to occur without modifications to the Project or additional offsets.

Threatened Species - Assessment of Significance under Section 5A of the EP&A Act

Assessments of significance under section 5A of the EP&A Act were undertaken for one threatened ecological community, one threatened flora species and a total of 32 threatened fauna species listed under the TSC Act (Appendix E).

Hunter Eco (2015a) concludes the Project is unlikely to significantly impact any threatened species or communities listed under the TSC Act.

Koala Habitat Assessment under State Environmental Planning Policy No 44 – Koala Habitat Protection

No core Koala habitat (defined by *State Environmental Planning Policy No 44 – Koala Habitat Protection* [SEPP 44]) occurs in the Project open cut extension and infrastructure areas (Appendix E).

Munghorn Gap Nature Reserve

The Project would not directly impact the Munghorn Gap Nature Reserve, but would involve clearing vegetation adjoining the reserve (Figure 1-4).

The duration of this impact would be short to medium term. The pits would be progressively mined and rehabilitated. A key objective of the rehabilitation is to increase the continuity of woodland vegetation by establishing links between woodland vegetation in the rehabilitation areas and existing vegetation in the Munghorn Gap Nature Reserve (i.e. a post-mining improvement in ecological connectivity).

Matters of National Environmental Significance

An analysis of the nature and extent of the likely impacts of the Project on threatened species and communities listed under the EPBC Act in accordance with the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DotE, 2013b) was undertaken for one threatened ecological community, one threatened flora species and a total of seven threatened fauna species listed under the EPBC Act (Appendix E).

Hunter Eco (2015a) concludes that the Project would not significantly impact any threatened species or communities listed under the EPBC Act.

A summary of the SEARs is provided in Table 1-2, as well as the relevant section of the EIS where the SEARs are addressed. In addition, a summary and index indicating where the supplementary SEARs relating to the EPBC Act have been addressed in the EIS is provided in Attachment 2.

Existing Voluntary Conservation Agreements

Wilpinjong Coal Mine has established three ECAs that are managed under a voluntary conservation agreement with the NSW Minister administering the NPW Act and comprise approximately 480 ha of land.

Short sections of the proposed relocation of the TransGrid Wollar to Wellington 330 kV ETL (Figure 1-4) would traverse parts of two of the ECAs (i.e. ECA-A and ECA-B). The proposed ETL easements are through predominantly cleared land (Figure 4-15) and the Project would require excision of an area of approximately 3 ha from the existing voluntary conservation agreement.

WCPL is consulting with OEH in relation to a possible amendment of the voluntary conservation agreement, so the total area of the ECAs (480 ha) would be maintained, consistent with Project Approval 05-0021.

Cumulative Impacts

The approved Wilpinjong Coal Mine was established in a widely cleared landscape. At its full extent, the approved Wilpinjong Coal Mine will clear some 318 ha of native vegetation and, excluding the Nullo Mountain area, has an offset area of 691 ha (comprising 480 ha within the ECAs and 211 ha within the Biodiversity Offset Areas).

Relevant approved or proposed mining operations near the Project include:

- Moolarben Coal Complex, located adjacent to the Project to the west of the Wilpinjong Coal Mine;
- Ulan Mine Complex, located approximately 11 km to the north-west of the Wilpinjong Coal Mine;
- the proposed Bowdens Silver Project, located approximately 30 km to the south of the Wilpinjong Coal Mine; and
- the proposed Bylong Coal Project, located approximately 15 km east-southeast of the Wilpinjong Coal Mine.

In addition to potential cumulative impacts, these approved or proposed mining operations also have potential cumulative benefits in the form of rehabilitation and biodiversity offset areas.

The potential cumulative impact on threatened species and communities has been considered in assessments in Attachments A and B of Appendix E. The potential change in cumulative impacts on threatened species and communities arising from the Project is considered to be minimal.

The Project would result in the loss of 354 ha of native vegetation, though it includes an additional Biodiversity Offset Strategy to compensate for the loss (Section 4.9.4). The Project Biodiversity Offset Strategy would address the potential residual impacts on biodiversity values associated with the proposal, such that biodiversity values of the region are maintained and improved in the medium to long-term.

4.9.3 Mitigation Measures and Management

The existing impact avoidance and mitigation measures for the Wilpinjong Coal Mine would continue to be implemented for the Project, and are listed in Section 4.9.1.

Additional impact avoidance and mitigation measures are summarised in Table 4-26.

The Biodiversity Management Plan would, as relevant, be revised for the Project (subject to the conditions of any Development Consent for the Project).

The Project open cut extension and infrastructure areas would be progressively rehabilitated throughout the life of the mine as described in Section 5.

The existing MOP would be updated to include the Project (including the vegetation clearance protocol and rehabilitation measures) in consultation with the relevant government agencies, and in accordance with the relevant DRE rehabilitation and mine closure guidelines.

4.9.4 Project Biodiversity Offset Strategy

The existing Biodiversity Offset Strategy for the Wilpinjong Coal Mine (Section 4.9.1) would be augmented with an additional Biodiversity Offset Strategy for the Project (Appendix E).

The Project Biodiversity Offset Strategy has been developed to address the potential residual impacts on biodiversity values associated with the proposal, such that biodiversity values of the region are maintained and improved in the medium to long-term (as required by the SEARs for the Project).

The sub-sections below describe how the Project Biodiversity Offset Strategy addresses both Commonwealth and NSW biodiversity offset requirements.

NSW Biodiversity Offset

The NSW offset requirements would be addressed by offsetting through land based offset areas and rehabilitation of the additional disturbance associated with the Project, consistent with the NSW Offset Policy.

Table 4-26
Additional Biodiversity Impact Avoidance and Mitigation Measures

Measure	Description
Avoidance	
Minimisation of disturbance to native vegetation	Refinements to the mine design have resulted in minimising additional land disturbance and associated impacts on flora, fauna and associated habitats (e.g. use of existing infrastructure).
Realignment of the TransGrid Wollar to Wellington 330 kV ETL	The ETL is proposed to be predominantly constructed in cleared land (without threatened species habitat or the threatened ecological communities). In order to minimise the potential land disturbance associated with the relocation it is proposed to realign the ETL over backfilled mine voids in Pit 4.
Mitigation	
Delineation of areas to be cleared near *Ozothamnus tesselatus* to avoid accidental clearance	Use of temporary fencing around *Ozothamnus tesselatus* during vegetation clearance near to the known occurrences to avoid accidental clearance.
Germination trials for *Ozothamnus tesselatus*	Collection of seed from *Ozothamnus tesselatus* for a trial of germination and (if successful) planting of viable seedlings on the post-mine landforms.
Installation of a pipe to help maintain opening of the historical mine adit (Eastern Bentwing-bat roost site)	A concrete or steel pipe would be installed to help maintain the opening of the historical mine adit in the event of any further rockfall around the entrance.

Source: Appendix E.

The *Biobanking Assessment Methodology 2014* (OEH, 2014c) and Credit Calculator were used to assess the biodiversity values of five land-based offset areas (Offset Areas 1 to 5). Figure 4-20 shows the location of offset areas relative to the Project. These offset areas are located on land owned by Peabody Energy.

The offset areas are strategically located next to Goulburn River National Park and Munghorn Gap Nature Reserve, with the potential to increase the extent of these existing protected areas.

The offset areas are 1,100 ha in size, comprising approximately 996 ha of native vegetation (Table 4-27).

Table 4-27
Quantification of Project Biodiversity Offset Areas

Offset Area	Overall Extent of Offset Areas (ha) [1]
1	201
2	441
3	164
4	39
5	255
Total	**1,100**

Source: Appendix E.

[1] Includes native vegetation, pasture/cultivation, dams, rivers and existing infrastructure.

Flora surveys of the offset areas were undertaken by Hunter Eco (2015b) and three threatened flora species were recorded in Offset Area 5, namely, *Ozothamnus tesselatus*, Scant Pomaderris (*Pomaderris queenslandica*) and *Tylophora linearis*. Of these species, only *Ozothamnus tesselatus* occurs in the area to be cleared for the Project. Vegetation communities within the offset areas are listed in Table 4-28. Plate 4-7 provides an illustration of an example of a native vegetation community in Offset Area 2.

Fauna surveys of the offset areas were undertaken by Biodiversity Monitoring Services (2015b) targeting all potentially occurring threatened fauna species ecosystem credit species and species credit species. Sixteen threatened fauna species were recorded within Offset Areas 1 to 5. An additional three fauna species were opportunistically recorded by Hunter Eco (2015b) during the flora survey work, and a further five fauna species have database records within the offset areas.

In total, there are records of 24 threatened fauna species within Offset Areas 1 to 5.

Table 4-29 provides a summary of the proposed NSW Biodiversity Offset Strategy for the Project and demonstrates that the proposed NSW Biodiversity Offset Strategy for the Project produces a range of credits that are generally consistent with the type and number of credits required by the Credit Calculator for the Project open cut extension and infrastructure areas.

The NSW *Framework for Biodiversity Assessment* (OEH, 2014b) and associated Credit Calculator were applied to the Project during the transitional period of the NSW Offset Policy (OEH, 2014a). In this process, some limitations with the new system were identified and addressed by Hunter Eco (2015a) consistent with the objective of improving the biodiversity values of the region in the medium to long-term (as required by the SEARs for the Project). Limitations and the ways in which they were overcome are summarised below and described in further detail in Appendix E.

All species credit requirements would be met by the proposed Project Biodiversity Offset Strategy except the credit requirements for the Regent Honeyeater. The offset areas do not generate enough credits for this species according to the NSW *Framework for Biodiversity Assessment* (OEH, 2014b), however, the Project species credit requirement for the Regent Honeyeater is very large considering the area of potential habitat to be disturbed.

Hunter Eco (2015a) consider that Offset Areas 1 to 5 provide an adequate offset for the Regent Honeyeater because:

- The habitat in the offset areas is twice as large as that in the Project open cut extension and infrastructure areas.
- Offset Area 1 contains multiple records of the Regent Honeyeater (i.e. the offset area contains records of this species whereas the Project open cut extension and infrastructure areas contain no records, only potential habitat).
- The NSW *Framework for Biodiversity Assessment* (OEH, 2014b) does not give consideration to the quality of the habitat being impacted or offset and instead treats all habitat the same (some habitat in the offset areas is known to be used by the Regent Honeyeater whereas the habitat in the Project open cut extension and infrastructure areas is only potential habitat).

Table 4-28
Vegetation Communities in the Offset Areas

Biometric Vegetation Type	Vegetation Community
Grassy Woodlands – New England Grassy Woodlands	
HU681	5 ha of Blakely's Red Gum Woodland (grassy)[1]
Grassy Woodlands – Western Slopes Grassy Woodlands	
HU732	29 ha, comprising: • 3 ha of Yellow Box Woodland[1] • 26 ha of Yellow Box Woodland (derived native grassland)[1]
HU690	13.5 ha of White Box Grassy Woodland[1]
HU981	13 ha of Rough-barked Apple Forest
Grassy Woodlands – Coastal Valley Grassy Woodlands	
HU910	215 ha, comprising: • 175 ha of Blakely's Red Gum - Rough-barked Apple Woodland • 40 ha of Blakely's Red Gum - Rough-barked Apple Woodland (derived native grassland)
Dry Sclerophyll Forests (Shrubby sub-formation) – Western Slopes Dry Sclerophyll Forests	
HU843	85.5 ha, comprising: • 36.5 ha of Grey Gum - Blue-leaved Stringybark Forest • 49 ha of Grey Gum - Narrow-leaved Stringybark Forest
HU618	206 ha of Slaty Box Forest[2]
HU891	66.5 ha, comprising: • 40.5 ha of Caley's Ironbark Woodland • 26 ha of Caley's Ironbark Woodland (derived native grassland)
HU697	1.5 ha of Mugga Ironbark
HU888	76 ha Red Ironbark/Brown Bloodwood Forest
HU890	7.5 ha of Scribbly Gum Forest
HU877	1 ha of Spinifex Woodland
Dry Sclerophyll Forests (Shrub/grass sub-formation) – North-west Slopes Dry Sclerophyll Woodlands	
HU801	271.5 ha, comprising: • 158 ha of White Box Shrubby Woodland • 113.5 ha of White Box Shrubby Woodland (derived native grassland)
Dry Sclerophyll Forests (Shrubby sub-formation) – Sydney Hinterland Dry Sclerophyll Forests	
HU828	3.5 ha of Grey Myrtle Dry Rainforest
Dry Sclerophyll Forests (Shrub/grass sub-formation) – Hunter Macleay Dry Sclerophyll Forests	
HU962	1.5 ha of Western Grey Box Woodland
Total	**996 ha**

Source: Appendix E.

[1] The occurrence of the Biometric Vegetation Type in the offset areas equates to the Box-Gum Woodland EEC/CEEC.

[2] The occurrence of the Biometric Vegetation Type in the offset areas equates to the Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion VEC.

Plate 4-7: Yellow Box Woodland in Offset Area 2

Table 4-29
Summary of the NSW Biodiversity Offset Strategy

Offset Component	Credits Produced	Number of Credits Generated from the Biodiversity Offset Strategy	Number of Credits Required from the Project Open Cut Extension and Infrastructure Areas
Species Credits			
Land-based Offset Areas 1 to 5	Species credits produced which match the Project credit profile (*Ozothamnus tesselatus*, Regent Honeyeater and Koala)	32,263	
	Species credits produced which are additional to the credits required in the Project credit profile (*Ozothamnus tesselatus*, Scant Pomaderris, *Tylophora linearis* and Koala)	22,969	
Rehabilitation	Regent Honeyeater species credits that would be produced by mine site rehabilitation	3,230	
	Total	**58,462**	**48,871**

Table 4-29 (Continued)
Summary of the NSW Biodiversity Offset Strategy

Offset Component	Credits Produced	Number of Credits Generated from the Biodiversity Offset Strategy	Number of Credits Required from the Project Open Cut Extension and Infrastructure Areas
Ecosystem Credits			
Land-based Offset Areas 1 to 5	Ecosystem credits produced which match the Project credit profile	5,837	
	Ecosystem credits produced which do not match the Project credit profile but match the same vegetation formation (subject to the Variation Rules)	2,903	
	Ecosystem credits produced (HU801) which do not match the Project credit profile or formation but are equivalent White Box Shrubby Woodland[1]	2,153	
	Ecosystem credits produced by revegetation of cleared land[2]	1,056	
Rehabilitation	Ecosystem credits that would be produced by mine site rehabilitation[3]	3,415	
	Total	**15,364**	**15,314**

Source: After Appendix E.

1 The White Box Shrubby Woodland in the Project open cut extension and infrastructure areas (assigned to HU824) is comparable to the White Box Shrubby Woodland in the offset area (assigned to HU801). HU824 belongs to Dry Sclerophyll Forests (Shrubby sub-formation) and HU801 to Dry Sclerophyll Forests (Shrub/grass sub-formation).

2 Approximately 101.5 ha of exotic pasture/cultivation in the offset areas would be revegetated. The Credit Calculator has been run with the inclusion of the exotic pasture/cultivation as likely low condition vegetation types.

3 The maximum increases in site values were applied (except no increase for tree hollows and a 1.5 increase in species richness as additional species would be added to the seed mix/tubestock list).

- The NSW *Framework for Biodiversity Assessment* (OEH, 2014b) does not give consideration to the strategic location of proposed offset areas (which are suitably located to augment NPWS estate and include approximately 2 km of riparian land along the Goulburn River).

Notwithstanding, additional species credits for the Regent Honeyeater would also be generated through mine site rehabilitation for the Project (described below).

The offset areas produce 22,969 excess species credits (for *Ozothamnus tesselatus*, Scant Pomaderris, *Tylophora linearis* and Koala) which are not specifically required for the Project. Under this Offset Strategy, these excess species credits would be retired for the Project, which would otherwise have not been included in the offset package under the NSW *Framework for Biodiversity Assessment* (OEH, 2014b).

NSW Offset Policy (OEH, 2014a) requires a total of 15,314 ecosystem credits to be retired for the Project. The offset areas and rehabilitation produce 15,364 ecosystem credits (an excess of 50 ecosystem credits which would be retired for the Project) (Table 4-29).

As described above, there are a number of values associated with the Project Biodiversity Offset Strategy that are not recognised or considered under the NSW *Framework for Biodiversity Assessment* (OEH, 2014b).

In addition to the values described above, Offset Area 3 also includes some 2 km of sandstone escarpment with numerous caves which are likely to provide bat roosting habitat (Plate 4-8). This is despite no similar series of caves being cleared by the Project, the benefit of which is not recognised under the NSW *Framework for Biodiversity Assessment* (OEH, 2014b).

Plate 4-8: An Example of Caves in Offset Area 3

It is concluded that, with the implementation of the proposed Biodiversity Offset Strategy as required by the Project SEARs, the Project would improve the biodiversity values of the region in the medium to long-term.

Management of the Offset Areas

A management plan (or plans) may be prepared that describes the management of the proposed additional offset areas depending on the security mechanism (e.g. if the offset areas are added to the Munghorn Gap Nature Reserve and Goulburn National Park then the offset areas would be managed by the NSW Government under the management plans for these protected areas).

As a minimum, management of the offset areas would include:

- weed control;
- feral animal control;
- progressive removal of livestock grazing;
- removal of disused infrastructure; and
- revegetation of exotic pasture/cultivation.

WCPL has completed programs to control large infestations of blackberry and other woody weeds along the Goulburn River in Offset Area 3 (Landscape Constructions, 2014a; 2014b).

Rehabilitation

Mine site rehabilitation would also satisfy part of the NSW offset requirements by progressively establishing woodland vegetation. Further detail is provided in Appendix E and Section 5.

Commonwealth Biodiversity Offset

The significance of potential residual impacts on protected matters under the EPBC Act have been evaluated and it is concluded that none of the protected matters are likely to be significantly impacted after consideration of the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DotE, 2013b) and other relevant plans and agreements (Appendix E).

Under the EPBC Act, an offset is only required if residual impacts on protected matters are significant (SEWPaC, 2012a).

In the event that DotE form a different conclusion in regard to the significance of the impacts, this section describes how the Commonwealth Offset Areas 1 to 5 would also provide positive benefits for protected matters under the EPBC Act (i.e. a Commonwealth offset package).

The Commonwealth offset package comprises land-based offset areas which are a subset of Offset Areas 1 to 5. Commonwealth offset areas equate to Offset Area 1, 4 and a subset of Offset Areas 2, 3 and 5 (Figure 4-20). The Commonwealth offset areas are restricted to areas of native vegetation, comprising a total area of 724 ha (Table 4-30).

Table 4-30
Quantification of Project Commonwealth Biodiversity Offset Areas

Commonwealth Offset Area	Area (ha)
1	199
2	152
3	121.5
4	38
5	213.5
Total	**724**

Source: Appendix E.

In accordance with the DotE comments in the SEARs for the EIS, the Commonwealth offset package aligns with conservation priorities for the relevant threatened species and is tailored specifically to the attributes of the species that are potentially impacted by the Project. Table 4-31 provides the area of habitat for each relevant protected matter to be impacted by the Project and the area of habitat provided by the Commonwealth offset areas.

The Commonwealth offset package is consistent with the principles of the *EPBC Act Environmental Offsets Policy* (SEWPaC, 2012a) (Section 4.3.5) and the *EPBC Act Offsets Assessment Guide* (SEWPaC, 2012b) was used to determine the appropriate size of the Commonwealth Offset Areas 1 to 5 in order to exceed 100% of the offset requirement. A detailed description is provided in Appendix E.

The Biodiversity Offset Strategy is proposed by WCPL to address the residual impacts from the Project. Based on land management priorities and agricultural activities within the offset lands at the time (and subject to achieving a similar or improved biodiversity offset outcome) WCPL may make some minor adjustments to the boundaries of Offset Areas 1 to 5 to the satisfaction of DP&E (NSW Offset Package) and DotE (Commonwealth Offset Package) by replacing some existing cleared grazing land in an offset area with a compensatory area of natural vegetation.

Table 4-31
Commonwealth Biodiversity Offset Requirement Met by Commonwealth Offset Areas 1 to 5

Common Name	Scientific Name	Conservation Status[1]		Impact (ha)	Habitat within Commonwealth Offset Areas[2]
		TSC Act	EPBC Act		
Box-Gum Woodland		E	CE	9.5 ha of woodland	43.5 ha (20 ha of woodland and 23.5 ha of derived native grassland)
-	*Ozothamnus tesselatus*	V	V	589 individuals	6,458 individuals
Regent Honeyeater	*Anthochaera phrygia*	CE	CE[3]	273 ha of potential foraging habitat	545 ha of existing potential foraging habitat
Swift Parrot	*Lathamus discolour*	E	E	111 ha of potential foraging habitat	341 ha of existing potential foraging habitat
Koala	*Phascolarctos cinereus*	V	V	165 ha of potential habitat	557 ha of existing potential foraging habitat
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V	328.5 ha of foraging habitat, of which a portion with tree hollows is breeding habitat	643 ha of existing foraging habitat, of which a portion with tree hollows is breeding habitat
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	273.5 ha of foraging habitat	643 ha of existing potential foraging habitat, including breeding habitat in caves

Source: Appendix E.

1 Threatened fauna species status under the TSC Act and/or EPBC Act (current at October 2015).
V = Vulnerable; E = Endangered; CE = Critically Endangered.

2 Additional habitat would also be created through revegetation of derived native grassland and cleared land.

3 Listed as 'Endangered' under the EPBC Act at the time of the controlled action decision (12 March 2015) and therefore assessed under the Commonwealth offset policy as 'Endangered' not 'Critically Endangered' (refer section 158A of the EPBC Act).

4.10 ABORIGINAL CULTURAL HERITAGE

An ACHA was undertaken for the Project by South East Archaeology (2015) and is presented in Appendix G[5].

The ACHA for the Project has been undertaken in accordance with the following guidelines and regulations:

- *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010a).
- *Ask First: A Guide to Respecting Indigenous Heritage Places and Values* (Australian Heritage Commission, 2002).
- Clause 80C of the NSW *National Parks and Wildlife Regulation, 2009*.
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b).
- *Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DEC, 2005b).
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011).
- *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects* (NSW Minerals Council, 2010).
- The Australian International Council on Monuments and Sites (ICOMOS) *Burra Charter* (Australia ICOMOS, 1999).

A description of Aboriginal heritage (cultural and archaeological) in the vicinity of the Project and the consultation undertaken is provided in Section 4.10.1. Section 4.10.2 describes the potential impacts of the Project on Aboriginal heritage, while Section 4.10.3 outlines mitigation measures, management and monitoring.

4.10.1 Existing Environment

Aboriginal Cultural Heritage Assessment

The ACHA (Appendix G) includes:

- results from extensive fieldwork and archaeological investigations undertaken previously by archaeologists and representatives of the Aboriginal community at the Wilpinjong Coal Mine and surrounds;
- search results from the Aboriginal Heritage Information Management System (AHIMS) database and other heritage registers;
- results from extensive consultation with the Aboriginal community regarding archaeological and cultural heritage values;
- a detailed description of the methods implemented and the results of archaeological and cultural surveys conducted by archaeologists and representatives of the Aboriginal community for the Project in 2014; and
- a detailed description of the consultation undertaken for the Project from 2012 to 2015.

The key steps involved in the preparation of the ACHA and associated consultation are described below.

Aboriginal History

The Wilpinjong Coal Mine is primarily located on land that was once occupied by members of the north-eastern clan of the Wiradjuri tribe, centred around Mudgee and Rylstone (South East Archaeology, 2009). Interactions with and visitation from members of neighbouring cultural groups (particularly the Kamilaroi) may also have sporadically occurred (Appendix G).

Pearson (1981) inferred from ethnohistorical evidence that the upper Macquarie was inhabited by large localised groups of Aboriginal people, who in the normal course of life were divided into small groups of up to 20 people. These groups would come together for short periods for subsistence, ceremonial or social reasons (Appendix G).

Displacement of Aboriginal people from the area occurred between 1850 and 1870 as settlers sought to gain land during the gold rush for agricultural and pastoral utilisation (and later mining) (Appendix G).

[5] Following finalisation of the ACHA, the need for minor additional water management infrastructure was identified. An addendum report was prepared by South East Archaeology to assess the potential impacts of these works on Aboriginal heritage. The assessment of potential impacts and proposed management described in Section 4.10 also applies to these works. A copy of the addendum report is provided in Attachment 12 of the EIS.

There remains a vibrant Aboriginal population in the region today which takes an active interest in the management of their heritage (Appendix G).

Zones of Aboriginal Occupation

Aboriginal occupation was predominantly focused on primary resource zones, the relatively more abundant and diverse resource rich zones within the north-east Wiradjuri territory, particularly along higher order watercourses such as the Goulburn River and Talbragar River (Appendix G).

Outside of these primary resource zones, occupation was focused on watercourses and swamps/wetlands, particularly within close proximity of higher order watercourses and associated flats and terraces (e.g. the higher order portions of Cumbo Creek, Wilpinjong Creek, etc.) (Appendix G).

Away from these secondary resource zones, occupation was sporadic and tended to involve transitory movements associated with hunting and gathering or the procurement of stone materials (Appendix G).

Aboriginal occupation in the area primarily comprised secondary resource zones within close proximity to higher order watercourses and associated flats and terraces. It is considered that the Project open cut extension and infrastructure areas would have been predominantly utilised for camps by small parties of hunter/gatherers and family groups on a seasonal basis. It is likely that occupation was sporadic rather than continuous (Appendix G).

Heritage Register Searches

Searches of the following heritage registers and planning instruments were undertaken:

- AHIMS database;
- *Mid-Western Regional Local Environmental Plan 2012*;
- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*; and
- Commonwealth Heritage List and National Heritage List (via the Australian Heritage Database).

A total of 156 Aboriginal heritage sites and/or potential archaeological deposits (PADs) registered on the AHIMS database were identified within the Project open cut extension and infrastructure areas and immediate surrounds. These sites included open artefact sites[6], waterholes, rock shelters and scarred trees.

Searches of the remaining heritage registers and planning instruments did not identify any further listed Aboriginal heritage sites.

Previous Archaeological Investigations

A number of Aboriginal heritage surveys and assessments have previously been undertaken at the Wilpinjong Coal Mine and surrounds. The investigations and surveys undertaken in the immediate area included:

- a survey for the original Wilpinjong Coal Project EIS (Navin Officer Heritage Consultants [Navin Officer], 2005a);
- a survey for the Wilpinjong Coal Mine Modification 5 (South East Archaeology, 2013a)
- a series of reports on the cultural heritage works program arising from the original Wilpinjong Coal Project EIS, including salvage works, excavation, further surveys and detailed recording (Navin Officer, 2005b, 2006a, 2006b, 2006c, 2006d; Kayandel Archaeological Services, 2006a; South East Archaeology, 2013b, 2013c, 2014a; Apex Archaeology, 2013a, 2014a, 2014b, 2014c);
- draft reports on investigations for sites WCP33 and WCP216, including archaeological excavations and salvage (Hubschmann and Markus, 2011; Syme *et al*, 2013);
- reports on rock art monitoring (Brennan, 2013; Navin Officer, 2015); and
- various due diligence assessments (South East Archaeology, 2013d, 2014b, 2014c, 2014d; Apex Archaeology, 2013b, 2013c, 2013d).

[6] The term 'open artefact site' refers to both artefact scatters and isolated finds.

In addition to the above, a number of relevant archaeological investigations have been undertaken for nearby mines and in the broader region including:

- surveys and investigations for the nearby Moolarben Coal Complex (Hamm, 2006a, 2006b, 2008a, 2008b; Hamm and Foley, 2010; South East Archaeology, 2013e);
- surveys and investigations for the nearby Ulan Mine Complex (Haglund, 1980a, 1981a, 1981b, 1992, 1996a, 1996b, 1999a, 1999b, 1999c, 1999d, 2001a, 2001b; Corkill, 1991; Edgar, 1997; White, 2001a, 2001b; Therin, 2000; South East Archaeology, 2000a, 2002, 2004, 2009, 2010, 2011, 2012, 2013f; Kuskie and Clarke, 2003, 2005a, 2005b, 2007; Kuskie and Webster, 2001); and
- other investigations in the broader region (Moore, 1970, 1981; Pearson, 1981; Haglund, 1980b, 1981c, 1985; South East Archaeology, 2006b; Purcell, 2002; Kuskie and Clarke, 2004; OzArk, 2005, 2008; Kayandel Archaeological Services, 2006b; Besant and Wyatt, 2011; Maynard, 2011).

A detailed description of these investigations is provided in Appendix G.

Community Consultation

Consultation for the Project was undertaken in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010a) and the *Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DEC, 2005b).

As part of the ACHA process, consultation was undertaken with members of the Aboriginal community that were identified as RAPs, including:

- Binjang WWHS;
- Mudgee LALC;
- MGATSIC;
- NEWCO;
- Paul Brydon;
- Wanaruah LALC;
- WNTCAC; and
- WVWAC.

Table 4-32 summarises the main stages of the community consultation process undertaken for the Project.

A detailed account of the consultation process (including consultation records and a detailed consultation log), is provided in Appendix G. Consultation with the RAPs regarding the existing Wilpinjong Coal Mine and the Project has been extensive and involved various methods including public notices, meetings, written and verbal correspondence, archaeological survey attendance and site inspections.

Survey Methodology

The archaeological and cultural surveys were undertaken to ground truth sites previously recorded within the investigation areas, in addition to identifying new sites and determining the visible extent of previously recorded and new artefact scatter sites. The investigation area addressed the Project open cut extension areas, ancillary development and surrounds and was sub-divided into a number of separate survey areas.

Each survey area was further divided into landform and slope categories to provide terrain units for sampling. During the survey and throughout the consultation process, the representatives of the RAPs were also asked of their knowledge of any areas of cultural significance within the investigation area (Appendix G).

Summary of Archaeological/Cultural Findings

A total of 293 tangible Aboriginal heritage sites (Table 4-33) are located within the Project open cut extension and infrastructure areas, including 137 newly recorded sites identified during the 2014 surveys. In addition, members of the RAPs identified three key cultural areas/values (Appendix G).

A detailed description of each of the Aboriginal heritage sites and cultural areas/values identified during the survey is provided in Appendix G.

Table 4-32
Summary of Aboriginal Heritage Consultation Undertaken for the Project

Date	Consultation
Notification of Project and Registrations	
18 October 2012	Letters requesting the names of Aboriginal parties or groups that may have been interested in registering for the consultation process were sent to the Office of the Registrar (*Aboriginal Land Rights Act, 1983*), the OEH Dubbo Environment Protection and Regulation Group, the MWRC, NTSCORP, Mudgee LALC, the Hunter – Central Rivers Catchment Management Authority (now the Central Tablelands Local Land Services) and the National Native Title Tribunal, in order to identify Aboriginal stakeholders.
22 – 30 October 2012	Responses to the above request were received from the Office of the Registrar (*Aboriginal Land Rights Act, 1983*), the MWRC, the OEH, the NTSCORP and the National Native Title Tribunal.
7 November 2012	Letters seeking registrations of interest were sent to the Aboriginal parties identified by the above step.
9 November 2012	A public notice was placed in the Mudgee Guardian inviting interested Aboriginal parties or groups to register.
23 November 2012	Eight organisations and/or individuals were registered as RAPs for the Project during the registration period (7 November 2012 – 23 November 2012).
4 December 2012	Record of names of RAPs provided to the OEH and Mudgee LALC.
Proposed Methodology Review, Information Sessions and Site Tours	
18 October 2013	Provision of the Proposed Methodology for undertaking the ACHA was distributed to the RAPs. A request for comments on the Proposed Methodology and an invitation to attend an information session on 11 November 2013 to discuss the Project and Proposed Methodology were included.
11 November 2013	An information session and a reconnaissance inspection was held for all RAPs. Representatives from Mudgee LALC, NEWCO, MGATSIC and WNTCAC attended.
15 November 2013	Copies of the presentation given at the information session on 11 November 2013 were provided to Binjang WWHS, Paul Brydon, Wanaruah LALC and WVWAC.
19 November 2013	RAPs were contacted requesting feedback on the Proposed Methodology.
26 November 2013	Feedback from the RAPs in regard to the Proposed Methodology was received, and consideration was given to all comments.
Field Surveys	
19 December 2013	Invitation sent to the RAPs to attend field surveys for the Project.
18 February 2014	Advised the RAPs of survey fieldwork dates.
17 – 21 March, 29 April – 3 May and 12 – 16 May 2014	Aboriginal cultural heritage survey was conducted by archaeologists from South East Archaeology accompanied by representatives of the RAPs. The cultural significance of the Project area and Aboriginal heritage sites was discussed with the representatives of the RAPs.
16 June 2014	Advised the RAPs of additional fieldwork.
24 – 25 June 2014	Aboriginal cultural heritage survey was conducted by archaeologists from South East Archaeology accompanied by representatives of the RAPs. The cultural significance of the Project area and Aboriginal heritage sites was discussed with the representatives of the RAPs.
Draft ACHA Review, Information Sessions and Site Inspection	
19 March 2015	All RAPs and the additional interested stakeholder were invited to attend an information session and an inspection of a selection of sites to discuss the survey results, Aboriginal cultural values and draft ACHA.
2 April 2015	The draft ACHA was issued to the RAPs for review, with a request for comment.
2 April 2015	An information session to present information about the Project and the draft ACHA was held for all RAPs. Inspections of sites along Wilpinjong Creek and Slate Gully (including the rocky hill in Slate Gully and other rock shelters). Attended by representatives of MGATSIC, Mudgee LALC, NEWCO, Paul Brydon, WNTCAC and WVWAC.
29 April 2015 – 8 May 2015	Comments received on the draft ACHA were reviewed and addressed in the ACHA.

Table 4-32 (Continued)
Summary of Aboriginal Heritage Consultation Undertaken for the Project

Date	Consultation
Addendum Report	
22 October 2015	A copy of the draft ACHA addendum report was provided to the RAPs for their review, with a request for comment.
November 2015	Comments received on the draft addendum report were reviewed and addressed in the addendum report (Attachment 12).

Source: After Appendix G and Attachment 12.

Table 4-33
Summary of Aboriginal Heritage Sites/Values Identified within the Project Open Cut Extension and Infrastructure Areas

Site Type	Local Significance	Regional Significance	Number of Sites
Cultural Area/Value[1]	Low	Low	2
	High	Low	1
Open Artefact Site	Low	Low	109
	Low-Possibly Moderate	Low	22
	Low-Moderate	Low	1 (WCP539)
	Moderate	Low	1 (WCP282)
Rock Shelter with Artefacts	Low	Low	7
	Moderate	Low	2 (WCP118/ WCP119[2])
Rock Shelter with Artefacts and Art	High	Low-Possibly Moderate	1 (WCP578)
Rock Shelter with Artefacts and Ochre Quarry	High	Low-Possibly Moderate	1 (WCP579)
Rock Shelter with Artefacts and Waterhole/Well	Low	Low	1
Rock Shelter with PAD	Low	Low	118
	Low-Possibly Moderate	Low	6
Possible Scarred Tree[3]	Low	Low	18
Scarred Tree	Low	Low	2
Waterhole/Well	Low	Low	4
Total			**296**

Source: After Appendix G.

1 Effectively a single site although counted individually.

2 The scarring on these trees has been identified as being potentially of Aboriginal origin. Due to inaccuracies in the grid references for these trees at the time of their original recording, they were unable to be relocated during the recent survey effort for further assessment.

3 The use of subsistence and other resources was also identified as a cultural value across the area.

Note: Some existing sites were recorded during previous archaeological investigations and/or entered into the AHIMS database without a significance assessment at the time of recording. While efforts were made, some of these sites were unable to be identified during surveys undertaken for the Project and are therefore listed as 'uncertain' significance in Appendix G. These sites were assessed as having low significance (Appendix G) and are therefore presented in the table as having low significance. Further detail regarding these sites is available in Appendix G.

With regard to the local context, archaeological significance of the 296 Aboriginal heritage sites identified (including the three intangible cultural areas/values) can be summarised as follows (Table 4-33) (Appendix G):

- three were assessed as being of high significance (rocky hill in Pit 8, incorporating WCP578 and WCP579);
- three were assessed as being of moderate significance (WCP118/WCP119 [effectively a single site although counted individually] and WCP282);
- one was assessed as being of low to moderate significance (WCP539);
- 28 were assessed as being of low to possibly moderate significance; and
- 261 were assessed as being of low significance.

With regard to the regional context, only two sites (WCP578 and WCP579) were assessed as having higher than low significance, with both limited to a 'low to moderate' rating.

The remaining 294 Aboriginal heritage sites were assessed as having low significance in a regional context.

The locations of sites with a 'Moderate' or 'High' local significance located directly within, or immediately adjacent to, the Project open cut extension and infrastructure areas are shown on Figure 4-21.

4.10.2 Potential Impacts

Direct impacts would be expected to occur to 92 of the identified Aboriginal heritage sites and/or cultural areas/values located within the Project open cut extension areas. No impacts are expected to occur to 66 of the identified Aboriginal heritage sites and the remaining 138 sites would potentially be subject to impacts depending upon the detailed design of ancillary infrastructure (Appendix G). However, for the purpose of assessment in Appendix G, it has been conservatively assumed that all of these 138 sites would be impacted.

Direct Impacts

The key direct impact on cultural and archaeological values would be to the rocky hill in Pit 8 (one of the cultural areas/values), which hosts a rock shelter with artefacts and art (WCP578) (high local archaeological significance), a rock shelter with artefacts and ochre quarry (WCP579) (high local archaeological significance), a rock shelter with PAD (WCP580) (low local archaeological significance), a waterhole/well (WCP594) (low local archaeological significance) and an artefact scatter (WCP577) (low local archaeological significance) (Appendix G).

Indirect Impacts

Possible causes of indirect impacts for Aboriginal heritage sites in close proximity to the Project include:

- accidental damage during construction;
- potential damage due to vibration; and
- increased dust deposition due to emissions.

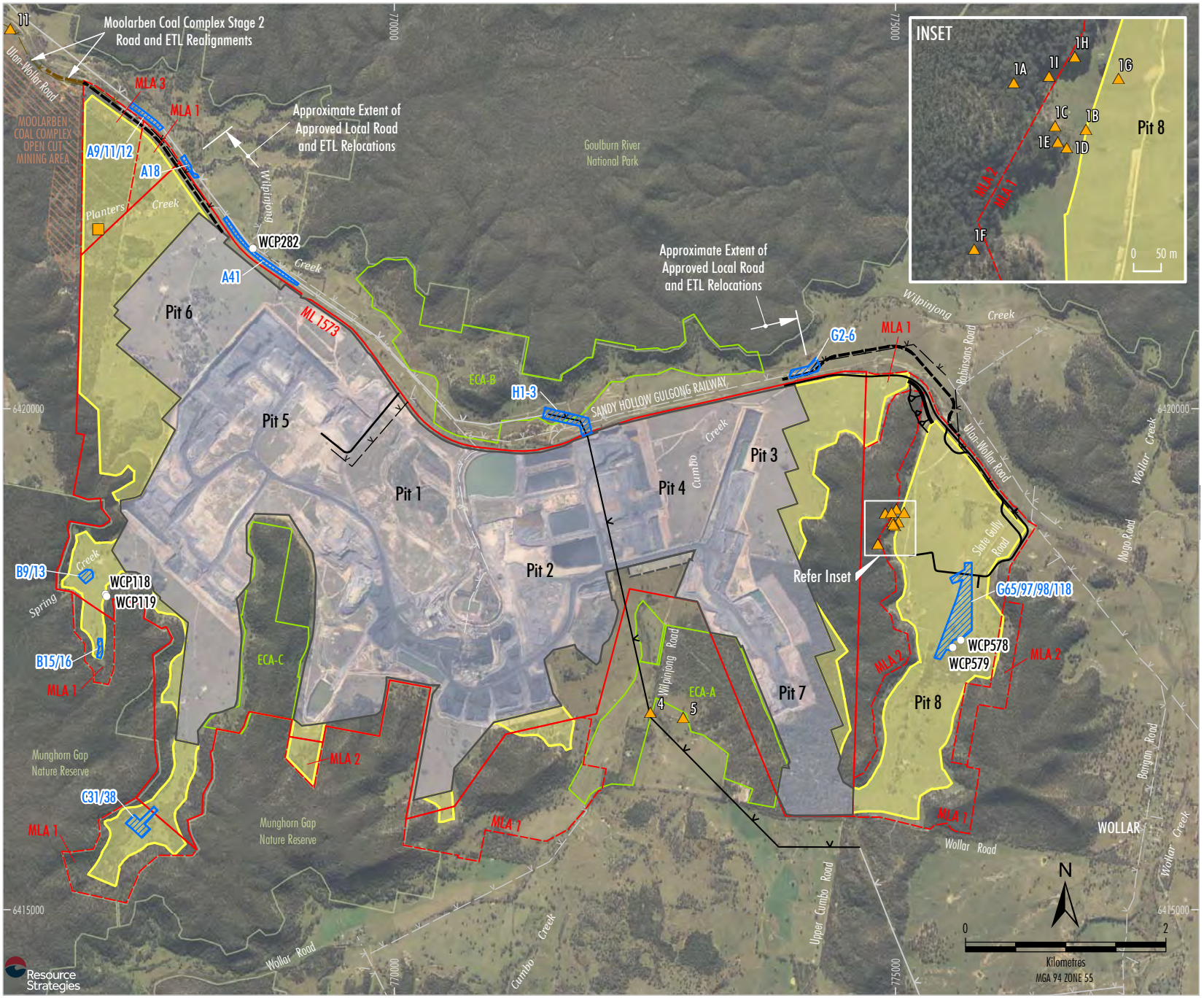
The nature of open artefact sites and PADs is such that vibration and dust deposition pose minimal risk.

Based on the blasting assessment conducted by SLR Consulting (2015) (Section 4.5), a conservative safe working distance for rock shelters is approximately 100 m from open cut blasting activities. There are 60[7] rock shelter sites located within 100 m of the open cut pit boundaries, all of which are of 'low' regional significance.

Of these, two (WCP118/WCP119) have 'moderate' local significance and are potentially impacted by ancillary infrastructure. Their potential impact and management is therefore assessed/proposed on the basis of assumed direct impact. Of the remaining 58, four have a 'possibly moderate' local significance. Appendix G concludes that one of these sites (WCP504) warrants test excavation if direct impacts cannot be avoided (determined post approval during detailed mine planning).

Appendix G concludes that no further management is warranted for the 54 remaining rock shelter sites with 'low' local significance (i.e. management of blast vibration levels is not required at most of the rock shelter sites).

[7] Excluding sites around the margin of the approved Wilpinjong Coal Mine open cut pits (including WCP72, WCP152 and WCP153) as these sites are managed in accordance with the existing approved Aboriginal Cultural Heritage Management Plan (ACHMP).



LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Approved/Existing Open Cut and Contained Infrastructure Area
- Relocated Block Bank and Cumbo Creek Disturbance Area
- Proposed Open Cut Extension Area
- Proposed Public Road Realignment
- Proposed Pit 3/8 Haul Road
- Proposed Service Road
- Proposed Local ETL Realignment/Relocation
- Proposed Relocated TransGrid 330 kV ETL
- Existing Local ETL
- Existing TransGrid 330 kV ETL
- Enhancement and Conservation Area

Heritage Sites

- Relevant Historical Heritage Site
- Former St James Church Allotment
- Aboriginal Heritage Site of moderate or high significance*
- Aboriginal Heritage Test Excavation Sampling Site (if subject to surface disturbance)

* Located within, or immediately adjacent to the Proposed Open Cut Extension Area

Source: WCPL (2015); Niche Environment and Heritage (2015); South East Archaeology (2015); NSW Dept of Industry (2015)
Orthophoto: WCPL (Jun 2015; Jun 2014)

Peabody ENERGY

WILPINJONG EXTENSION PROJECT

Key Heritage Sites

Figure 4-21

Dust deposition is another potential cause of indirect impacts to rock shelter sites that host art. A total of eight rock shelter sites that host art were identified by the ACHA investigation and are currently recorded on the WCPL Aboriginal Site Database. Apart from those described above as potentially directly impacted, none of these sites are located in close proximity to the proposed extensions, and therefore no significant changes would be expected (Appendix G).

With the implementation of mitigation measures and management strategies, the impacts of the Project on Aboriginal heritage would be low within a local context and very low within a regional context (Appendix G).

Cumulative Impacts

A consideration of the potential cumulative impacts associated with the Project has been undertaken and is presented in Appendix G. This assessment includes a consideration of the known and potential heritage resource that may be impacted by surrounding projects such as the existing Wilpinjong Coal Mine, the Moolarben Coal Complex and the Ulan Mine Complex.

The proposed Project would not cause, within a regional context, a loss of heritage resources that could be viewed as being very rare or unique or unlikely to exist elsewhere (Appendix G).

Impacts to the rocky hill in Pit 8, which is considered to be a less commonly reported an unusual example of evidence, would be considered as a low regional impact (Appendix G). Implementation of the proposed mitigation measures and management strategies (Section 4.10.3) would further lessen the impacts of the Project on this site (Appendix G).

Notwithstanding, similar heritage evidence is known to exist within nearby conservation areas including the Munghorn Gap Nature Reserve and the Goulburn River National Park (Appendix G).

Therefore the Project would not result in any significant cumulative impact on Aboriginal heritage in the region.

4.10.3 Mitigation Measures, Management and Monitoring

The mitigation, management and monitoring measures detailed below have been developed in consultation with the RAPs, in consideration of the cultural and archaeological significance of the Aboriginal heritage sites predicted to be impacted, and the cultural significance of the area.

Surface Disturbance

For those areas where Aboriginal heritage sites may be subject to direct surface disturbance as a result of the Project, a number of mitigation measures and management strategies have been identified, including (Appendix G):

- Systematic surface collection of the identified artefact evidence from open artefact sites.
- Test excavation, broad area hand excavation and surface scrapes with localised hand excavation of PADs, within a sample of areas of moderate to high heritage potential if subject to surface impacts (identified within survey areas A9/11/12, A18, A41, B9/13, B15/16, C31/38, G65/97/98/118, G2-6 and H1-3) (Figure 4-21).
- For sites WCP578 and WCP579 associated with the rocky hill in Slate Gully, salvage excavation of deposits, surface collection of identified artefact evidence, detailed recording of the ochre quarry evidence and rock art (including by photography and accurate surveying, such as laser scanning) and where feasible, removal of samples for further analysis (e.g. chemical analysis and dating).
- Surface collection and salvage excavation for WCP118 and WCP119.
- All potential direct disturbance areas that have not yet been subject to systematic survey sampling would be subject to survey.
- Attempts would be made to locate all sites that had potentially incorrect grid references in earlier investigations, by searching the potential alternative locations (i.e. AMG vs. MGA locations) within a sufficient margin of error. If found, the site would be recorded to an appropriate level of detail, the significance assessed, and appropriate management strategies determined in accordance with the existing approved ACHMP.

- For any possible scarred trees that may be subject to surface disturbance, verification of the precise location of the trees, the nature of the scar and a reassessment of significance would occur[8].

Management strategies for identified Aboriginal heritage sites and cultural areas/values would be guided initially by a reassessment of potential impacts for sites and areas potentially impacted by ancillary and/or indirect impacts after detailed design plans are finalised. Appendix G provides details on the recommended management strategy for each site if impacts due to ancillary development cannot be avoided. These details would be reflected in the updated ACHMP.

General Measures

Where the above specific mitigation measures and management strategies are not applicable, a number of general measures have been formulated in consultation with the RAPs to mitigate impacts, including:

- Documenting all heritage mitigation measures and management strategies undertaken for the Project with reference to relevant OEH guidelines.
- Providing reports to relevant stakeholders, such as the DP&E, OEH and RAPs, within appropriate timeframes.
- Curation of all heritage evidence salvaged under the Project in an appropriate manner, as determined in consultation with the RAPs and the OEH during preparation of the revised ACHMP. If required, an application would be made to the OEH under section 85A of the NPW Act for the curation of any salvaged items that are removed from any Aboriginal heritage site. Temporary storage of items at locations off the mine site (for example, during analysis and recording) would be allowed.
- Site-specific precautionary measures, such as informing relevant staff and contractors of the nature and location of items and the need to avoid impacts, potentially along with temporary demarcation, would be implemented for Aboriginal heritage sites in close proximity to the area of works.
- All relevant contractors and staff engaged on the Project who may have interactions with Aboriginal heritage would receive heritage awareness training prior to commencing work on-site. The current training package at the Wilpinjong Coal Mine would be reviewed in consultation with the RAPs.
- The WCPL Aboriginal Site Database established for the Project would be updated following Project approval, and would continue to be updated and maintained regularly, with copies of data available to any RAPs and the updated database made available to the OEH for their records.
- Aboriginal Site Recording Forms would be lodged in a timely manner with the OEH for any previously unrecorded Aboriginal heritage evidence that is identified during the course of operations and/or further heritage assessments.
- Aboriginal Site Impact Recording Forms would be lodged in a timely manner with the OEH for any site that is subject to salvage or development impacts.
- Provisions would be included to guide the assessment of any future alterations that may be proposed to the mine plan or ancillary works within the Development Application area. This would include an assessment of the potential impacts and formulation of management strategies consistent with procedures outlined in the ACHMP.
- Provisions would be included to guide the management of any previously unrecorded Aboriginal heritage sites that may be identified during future investigations or works. Management provisions could include temporary protection, further investigation, longer-term conservation or avoidance of impacts, mitigation, monitoring or unmitigated impact.
- Should any skeletal remains be detected during the course of the Project, work in that location would cease immediately and the find would be reported to the relevant authorities (including the Police, the OEH and RAPs). Subject to the Police requiring no further involvement, the management of any Aboriginal skeletal remains would be determined in consultation with the DP&E, the OEH and the RAPs.

[8] The management of any scarred trees confirmed to be of Aboriginal origin would be undertaken in accordance with an approved ACHMP.

- Archaeological investigations would only be undertaken by archaeologists qualified and experienced in Aboriginal heritage, in consultation with the RAPs and prior to any development impacts occurring to those specific areas or sites.
- Provisions would be included to ensure that Aboriginal community representatives would be permitted access to any identified sites or cultural areas within WCPL controlled land when requested, subject to consideration of safety and operational requirements at the time.

Aboriginal Cultural Heritage Management Plan

The existing ACHMP for the approved Wilpinjong Coal Mine would be revised to incorporate the recommended mitigation measures and management strategies for the Project. Existing protocols for the involvement of Aboriginal stakeholders specified in the ACHMP would be revised in consultation with all RAPs. The revised ACHMP would be regularly verified to establish that it is functioning as designed, to the standard required.

4.11 HISTORICAL HERITAGE

A Historical Heritage Impact Assessment for the Project was undertaken by Niche (2015) and is presented in Appendix H.

The assessment was prepared in consideration of the relevant principles and articles contained in the *Burra Charter* (Australia ICOMOS, 1999), the *NSW Heritage Manual* (NSW Heritage Office and NSW Department of Urban Affairs and Planning, 1996) and Statements of Heritage Impact (OEH, 1996).

A description of existing historical heritage within the Project open cut extension and infrastructure areas is provided in Section 4.11.1. Section 4.11.2 describes the potential impacts of the Project on historical heritage, while Section 4.11.3 outlines mitigation and management measures.

4.11.1 Existing Environment

Historical Overview

William Lee is thought to be the first European settler in the region, occupying land in Bylong from the mid 1820s. In addition, James Blackman and William Lawson both made separate exploration expeditions to the Mudgee area from Bathurst in 1821. The Hunter Valley was opened up for settlement in the early 1820s and settlement of Mudgee occurred in 1822 (Appendix H).

When Governor Ralph Darling redefined the 'Limits of Location' as the furthest boundaries of settlement in 1826, the entire Central Tableland was opened to private settlement. Settlement of the Wilpinjong area soon followed in the 1830s (Appendix H).

The site of Wollar was recorded on the Crown Plan of Robert Fitzgerald's land in 1837 (NSW Government Land and Property Information, 1837). The Village of Wollar is shown on maps as early as 1867, but was not declared a village until 1885 (McDermott and Robinson, 2012).

The initial land use in the region was the grazing of cattle, with sheep being introduced as settlement developed. Dairying income was later significant for the local small farmers in the nineteenth century (WCPL, 2005).

Shale in the Wollar area was identified as early as 1887, however it was not mined until 1929. Shale mining in the area was short-lived, with the Historical Shale Oil Mine Complex, located in Slate Gully, being abandoned in 1933 (Appendix H).

Further discussion on the contextual history of the Wilpinjong area including exploration, settlement, mining activities, townships, education, national parks and transport is provided in Appendix H.

Heritage Register Searches

Niche completed historical and archival research and a review of heritage registers prior to the survey of the Project open cut extension and infrastructure areas.

Searches of the Commonwealth Heritage List, National Heritage List and Register of the National Estate were undertaken. No registered sites were located within, or adjacent to, the Project (Appendix H).

A search of the National Trust Register (a non-statutory register) identified four registered sites within the Village of Wollar, including (Appendix H):

- the Roman Catholic Church[9];
- the St Luke's Anglican Church;
- the St Luke's Anglican Church Cemetery; and
- the Wollar Cemetery.

Niche also undertook searches of the State Heritage Register and State Heritage Inventory. No registered sites of state significance were listed within, or adjacent to, the Project (Appendix H).

Sites with identified heritage value in the vicinity of the Project listed in the Mid-Western Regional LEP included two landscape areas adjacent to the Project and four historical heritage sites located in the Village of Wollar (three of which were also listed in the National Trust Register), including (Appendix H):

- the Goulburn River National Park;
- the Munghorn Gap Nature Reserve;
- the Catholic Church[10];
- the St Luke's Anglican Church;
- the St Luke's Anglican Church Cemetery; and
- Wandoona Homestead.

All of these sites are listed as being of local heritage significance in Schedule 5 of the Mid-Western Regional LEP. They are all located outside of the Project open cut extension and infrastructure areas (Appendix H).

Potential Project impacts on the Goulburn River National Park and the Munghorn Gap Nature Reserve are further described/assessed from an ecological perspective in Section 4.9 and Appendix E.

Previous Archaeological Investigations

Heritage Management Consultants (2004) identified nine sites of local heritage significance in the vicinity of the Wilpinjong Coal Mine. No items of state significance were identified.

Archival recording was undertaken for the following sites of local heritage significance (Appendix H):

- Cumbo Creek;
- Hillside;
- Keylah;
- Warrawong;
- Atcheson's Cottage (Wyangle Portion 19, Parish of Wilpinjong);
- Loy's Cottage;
- Pine Park Woolshed;
- Post and Rail Fence (Portion 106, Parish of Cumbo); and
- Road Embankment (Portion 26, Parish of Cumbo).

Archaeological investigations have also been undertaken for the Moolarben Coal Complex, located adjacent to the Wilpinjong Coal Mine. These include Veritas Archaeology and History Service (2005), Heritas Architecture (2008) and EMGA Mitchell McLennan (2013).

Heritage Items of Relevance to the Project

Following a desktop assessment and review of previous investigations, Niche (2015) conducted a site investigation of the Project open cut extension and infrastructure areas (Appendix H).

As a result of this investigation, in the vicinity of the Project 24 items were documented, including 21 sites of local historical heritage significance and three items with no historical heritage significance. For a full description and location of each item, refer to Appendix H.

Of the identified 21 sites of local heritage significance, four have the potential to be impacted by the Project. One site, namely the Historical Shale Oil Mine Complex (Site 1) is located in Slate Gully, partially within the Project open cut boundaries. The Road Embankment (Site 4) is located within the potential construction area for the proposed realignment of the TransGrid Wollar to Wellington 330 kV ETL.

A further two sites (Pine Park [Site 5] and William Carr's Hut [Site 11]) are located in relatively close proximity to the Project (Table 4-34) (Appendix H).

[9] The St Laurence O'Toole Catholic Church.

[10] *Ibid*.

Table 4-34
Potentially Impacted Local Historical Heritage Sites

Site Number[1]	Historical Heritage Site	Structure Type[2]	Potential Impact
Historical Shale Oil Mine Complex			
1	1A – Adit	Abandoned historical shale oil mine adit, reinforced with timber beams.	Direct impacts due to open cut excavations would occur to Items 1B and 1G. Direct impacts due to ancillary development could also occur to Items 1C, 1D, 1E, and 1H. Indirect impacts due to blasting at all Items.
	1B – Retort	Large concrete blocks lying next to a concrete slab.	
	1C – Ramp leading to Retort	Gravelled ramp extending partway between the adit and ramp.	
	1D – Post and Rail Fence Remains	Collapsed timber post and rail fence.	
	1E – Glass Bottles	Three discarded glass bottles, located near the post and rail fence.	
	1F – Ventilation Shaft	Vertical shaft, much smaller than the mine adit, most likely used for ventilation.	
	1G – Possible Location of Caretaker's Cottage	Level area of land with brick fragments.	
	1H – Fireplace Remains	Cement and stone fireplace. The only obvious remains of the Caretaker's Cottage.	
	1I – Cut Timber Stockpile	A cut hardwood timber stockpile near the entrance to the mine adit.	
4	Road Embankment	The downslope retaining wall of the road, built with un-coursed stone to create an embankment.	Direct impacts due to the TransGrid Wollar to Wellington 330 kV ETL realignment could occur. Indirect impacts due to blasting.
5	Pine Park	Comprised of a homemade grain silo, a large open pole shed and a woolshed.	Indirect impacts due to blasting.
11	William Carr's Hut	A c1883 hut with multiple extensions.	Indirect impacts due to blasting and direct impact from Moolarben Coal Complex.

Source: Appendix H.

[1] The site number correlates with the numbers presented on Figure 4-21.

[2] A detailed description of each site is provided in Appendix H.

The locations of these four sites are shown on Figure 4-21.

The remaining 17 sites are located outside of the Project open cut extension and infrastructure areas, within the Village of Wollar and the broader surrounds. There would be no impacts caused by the Project (in particular blasting) to these historical heritage sites (Appendices A and H) and they are not described further below.

4.11.2 Potential Impacts

Potential Direct Impacts

The Historical Shale Oil Mine Complex (Site 1) is comprised of multiple items. Two items are located within the proposed Project open cut extension areas (the Retort [Item 1B] and the Possible Location of Caretaker's Residence [Item 1G]) and would experience direct impacts as a result of the Project (Appendix H).

A number of items that are a part of the Historical Shale Oil Mine Complex (Site 1) are also potentially within ancillary development areas and may potentially experience direct or indirect impacts associated with the Project (Appendix H).

The Road Embankment (Site 4) would potentially experience direct or indirect impacts associated with the realignment of the TransGrid Wollar to Wellington 330 kV ETL, which would be located to avoid impacts to this site where practicable.

Ancillary development is subject to final design, and where practicable, would be located to avoid historical heritage sites.

Potential Indirect Impacts

Pine Park (Site 5), William Carr's Hut (Site 11) and three items that are a part of the Historical Shale Oil Mine Complex (Site 1) (the Adit [Item 1A], the Ventilation Shaft [Item 1F] and the Cut Timber Stockpile [Item 1I]) may also potentially experience indirect impacts associated with continued blast vibration (Appendix H). Appendix A and Section 4.5 present blasting predictions for these sites.

Cumulative Impacts

William Carr's Hut (Site 11) is located within the approved limits of Moolarben Coal Complex open cut development.

No cumulative impacts to the remaining sites are expected due to other projects (Appendix H).

4.11.3 Mitigation and Management Measures

Management measures for the identified historical heritage sites would be described in a Heritage Management Plan developed for the Project.

Specific management measures for the historical heritage sites that would potentially experience direct or indirect impacts are provided in Table 4-35.

Additionally, a stop work provision would apply during excavation in the area of the former St James Church allotment (no historical heritage significance) in Pit 6 (Figure 4-21). In the unlikely event that grave cuts, or unusual features including human remains, are identified, site work would stop immediately in the vicinity and the relevant authorities (including the Police and NSW Heritage Branch) would be notified immediately.

Table 4-35
Management Measures for Relevant Historical Heritage Sites

Site Number[1]	Historical Heritage Site	Management Measures
1	Historical Shale Oil Mine Complex, Slate Gully	• WCPL would engage a suitably qualified heritage consultant to conduct archival recording[2] of all the features of the Historical Shale Oil Mine Complex prior to the commencement of any works associated with the open cut in Pit 8. • Copies of the archival record would be lodged with the Mudgee Historical Society, Mudgee Library and the NSW Heritage Branch Library. • Archaeological test excavation would occur at the possible location of the Caretaker's Cottage (Item 1G) to verify the presence of subsurface archaeological material. This test excavation would be done by a qualified historical archaeologist and would occur prior to surface disturbance activities at the inferred location of the cottage. If relics are located, their discovery would be reported in accordance with section 146 of the NSW *Heritage Act, 1977*.
4	Road Embankment	• Avoidance of the Road Embankment would be considered during detailed design of the TransGrid Wollar to Wellington 330 kV ETL realignment. • If impacts to the Road Embankment cannot be avoided, no further historical heritage assessment is required as a photographic recording of the item has already been completed and provided to the Mudgee Historical Society.
5	Pine Park	• The item may experience continued indirect impacts from blasting, however no further historical heritage assessment is required as a photographic record has already been produced and provided to the Mudgee Historical Society.
11	William Carr's Hut	• Moolarben Coal has advised WCPL that archival recording of William Carr's Hut has already been undertaken in accordance with Project Approval 08_0135. • No further measures are required.

Source: Appendix H.

[1] The site number correlates with the numbers presented on Figure 4-21.

[2] The NSW Heritage Branch Guidelines are stated in the 'Photographic Recording of Heritage Items Using Film or Digital Capture'. The record would include, as a minimum, a photographic record with notes and cross-referencing to base plans.

4.12 LAND RESOURCES AND AGRICULTURAL PRODUCTION

A description of the existing environment relating to land resources and agricultural production is provided in Section 4.12.1. Section 4.12.2 describes the potential impacts of the Project on land resources and agricultural production, and Section 4.12.3 describes applicable management, mitigation and monitoring measures.

4.12.1 Existing Environment

Land Use

The Project is primarily located on land that was once occupied by members of the north-eastern clan of the Wiradjuri tribe, centred around Mudgee and Rylstone. Interactions with and visitation from members of neighbouring cultural groups (particularly the Kamilaroi) may also have sporadically occurred (Appendix G).

Contemporary land use in the vicinity of the Project is characterised by a combination of coal mining operations, agricultural land uses and conservation areas.

Agricultural land uses in the Project open cut extension areas are dominated by beef and, to a lesser extent, wool production. Some dryland cropping has also occurred in previous decades in the Project open cut extension and infrastructure areas (Appendix I).

Settlements located in the vicinity of the Project include the Village of Wollar (Figure 1-3).

Soils

A Land and Soil Assessment was undertaken for the Project by McKenzie Soil Management Pty Ltd (McKenzie Soil Management) (2015) and is included in Appendix I.

The main soil types mapped in the Project open cut extension areas are Rudosols (31%), Chromosols (20%) and Sodosols (18%), while lesser areas of Dermosols, Kurosols, Kandosols and Tenosols were also observed (Appendix I).

Soil landscape units containing groupings of the above soil types identified during the soil survey are listed below (Appendix I):

- Lower Slopes dominated by either Sodosols or Chromosols/Dermosols/Kurosols.
- Mid-slopes (Colluvial Outwash) dominated by Rudosols.
- Mid-slopes dominated by Chromosols.
- Mid-slopes (Gravelly Sands) dominated by Rudosols.
- Steep Zones consisting of Chromosols, Dermosols, Kandosols, Kurosols, Rudosols and Tenosols.

Soil Condition

A broad range of soil physical and chemical constraints for agricultural land use were identified in the Project open cut extension areas including (Appendix I):

- acidity in topsoil;
- compaction in subsoil;
- dispersivity in subsoil;
- nutrient deficiency in topsoil and subsoil; and
- poor organic content in subsoil.

Land and Soil Capability

The Land and Soil Capability system is used to give an indication of the land management practices that can be applied to a parcel of agricultural land.

Agricultural land is classified by evaluating biophysical features of the land and soil including landform position, slope gradient, drainage, climate, soil type and soil characteristics to derive detailed rating tables for a range of land and soil hazards (OEH, 2012).

McKenzie Soil Management (2015) mapped Land and Soil Capability Classes in the Project open cut extension areas. The majority of the Project open cut extension areas were identified as having a Land and Soil Capability Class of greater than 5 which indicates that the land is suitable for a limited set of land uses (grazing, forestry, nature conservation and some horticulture) (Appendix I).

For example, Class 6 Land and Soil Capability is defined as (OEH, 2012):

> *Low capability land: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.*

Agricultural Activities and Productivity

Approximately 540 ha of existing agricultural lands currently occur in the Project open cut extension areas (Appendix I).

Agricultural activities known to have been conducted in the Project open cut extension areas include cattle and sheep grazing for meat and wool production, respectively. The majority of these grazing areas have been subject to some form of historical pasture improvement. As the majority of these areas of previously improved pasture have not been consistently maintained, they are presently considered to have a similar productivity to unimproved pasture (Appendix I).

Some dryland cropping has occurred previously in the Project open cut extension and infrastructure areas (Appendix I).

Peabody Energy also owns the majority of land adjoining the Project Development Application area. These lands are typically utilised for similar agricultural land uses.

Existing biodiversity offset areas associated with the Wilpinjong Coal Mine include approximately 211 ha of land located outside of ML 1573 and the ECAs (ECA-A to ECA-C) located adjacent to the operating mine (Figure 1-3). Additional biodiversity offset areas would be set aside as part of the Project, as described in Section 4.9.4.

WCPL has identified five potential biodiversity offset areas, which include an estimated 310 ha of potential agricultural land along with large areas of remnant vegetation. A portion of these biodiversity offset areas is typically utilised for similar agricultural land uses (i.e. cattle and sheep grazing for meat and wool production).

Strategic Agricultural Land Assessment

The *State Environmental Planning Policy (Mining, Petroleum and Extractive Industries* (Mining SEPP) includes mapping of lands identified as Biophysical Strategic Agricultural Land. The closest regionally mapped Biophysical Strategic Agricultural Land in the Mining SEPP is located approximately 18 km south-east of the Project (Appendix I).

WCPL lodged an application for a Site Verification Certificate for the Project with the DP&E in August 2014.

A Site Verification Certificate was subsequently issued by the Secretary of the DP&E on 17 October 2014, certifying that the land within the application area is not Biophysical Strategic Agricultural Land.

Similarly, adjoining Peabody Energy-owned lands and the five proposed Project biodiversity offset areas also do not comprise Biophysical Strategic Agricultural Lands, based on the available mapping information.

Contaminated Land

A Land Contamination Assessment was undertaken in accordance with *Managing Land Contamination Planning Guidelines State Environmental Planning Policy No 55 – Remediation of Land* (SEPP 55) by Lloyd Consulting Environmental Services (Appendix L). The Land Contamination Assessment was undertaken in the form of a Stage 1 preliminary investigation as detailed in SEPP 55.

As part of the preliminary investigation, a site inspection was undertaken that determined a soil sampling and analysis program for the Historical Shale Oil Mine Complex, located in Slate Gully, was considered necessary (Appendix L).

Results from the soil sampling and analysis program indicated that the Historical Shale Oil Mine Complex is considered to pose a low risk to the environment and/or human health (Appendix L).

On the basis of the Stage 1 preliminary investigation, the land use proposed by the Project is considered to be suitable (Appendix L).

Bushfire Regime

The Project is located within the jurisdiction of the Cudgegong Bush Fire Management Committee Bush Fire Management Plan area (Cudgegong Bush Fire Management Committee, 2012).

The bushfire season is generally from September to March with the start of the normal fire season coinciding with low humidity and strong north-west winds, which often prevail during November and December.

Lightning strikes account for the majority of ignitions in the area however sparks from trains on the Sandy Hollow Gulgong Railway are also common. Arson is not considered a significant issue, although human ignition from farming machinery and burn-offs is known to occur.

The Wilpinjong Coal Mine is suitably equipped to respond to fires on site and assist the RFS and emergency services if there is a fire in the area.

Bushfire management at the Wilpinjong Coal Mine is conducted in accordance with the Bushfire Management Plan.

4.12.2 Potential Impacts

Soils

Potential impacts of the Project on soils would relate primarily to:

- disturbance of *in situ* soil resources within additional disturbance areas (e.g. development of new open cut mining areas);
- alteration of soil structure beneath infrastructure items, hardstand areas and roads;
- possible soil contamination resulting from spillage of fuels, lubricants and other chemicals;
- increased erosion and sediment movement due to exposure of soils during construction (e.g. road realignments); and
- alteration of physical and chemical soil properties (e.g. structure, fertility, permeability and microbial activity) due to soil stripping and stockpiling operations.

A review of the physical and chemical properties of the soils has established that there are soil resources present that would be suitable as a rehabilitation medium for pasture establishment and native plant revegetation on the Project site post-mining (Appendix I).

Land Contamination Potential

Potential land contamination risks were identified as part of the Preliminary Hazard Analysis (Section 4.19) and include leaks/spills, fires and explosions associated with the transport, storage and use of hydrocarbon and chemicals.

Agricultural Activities and Productivity

The rehabilitation and mine closure strategy for the Project includes the restoration of some agricultural land suitable for grazing (Section 5). However, the Project (including a portion of the potential Project biodiversity offset areas) would result in the long-term disturbance or alteration of some existing agricultural lands. The majority of these agricultural lands is suitable for a limited set of land uses (e.g. grazing) (Section 4.12.1).

The re-establishment of agricultural lands would be undertaken progressively as a component of the Project rehabilitation programme.

A summary of the estimated area of agricultural lands in these areas before and post-mining is provided in Table 4-36.

Table 4-36
Summary of Potential Impacts on Agricultural Lands

Locality	Approximate Area of Agricultural Land (ha)		
	Existing	Post-Mining	Net Change
Project Disturbance Area	668	322	-346
Project Biodiversity Offset Areas 1-5	310	0[1]	-310

Source: After Appendices E and I.

[1] Subject to finalisation of the biodiversity offset package to the satisfaction of the Secretary of the DP&E.

The Project and the potential biodiversity offset areas would result in a long-term reduction of the area of agricultural land of approximately 656 ha, subject to finalisation of the Project biodiversity offset package (Table 4-36).

These potentially sterilised agricultural lands are not Biophysical Strategic Agricultural Land (Appendix I).

Consideration of the economic value of lost agricultural production on these lands is provided in Appendix M.

Bushfire Hazard

Any uncontrolled fires originating from Project activities may present potentially serious impacts to nearby rural properties, the Munghorn Gap Nature Reserve and the Goulburn River National Park.

Similarly, fires originating in nearby rural areas and reserved areas could pose a significant risk to Project infrastructure and WCPL staff, contractors and equipment.

The degree of potential impact of a bushfire would vary with climatic conditions (e.g. temperature and wind) and the quantity of available fuel.

The continuation and expansion of the existing Wilpinjong Coal Mine operations for the Project could increase the potential for fire generation. However, given the range of management measures in place, the overall risk of increased bushfire frequency due to the Project is likely to be low.

The Project would not prevent access to existing fire trails. WCPL is working co-operatively with the NPWS to provide access to reserved lands via Peabody Energy-owned land as required.

4.12.3 Mitigation Measures, Management and Monitoring

Soils

General soil management practices would include the stripping and stockpiling of soil resources for use in rehabilitation. The objectives of soil resource management for the Project site would be to:

- identify and quantify potential soil resources for rehabilitation;
- optimise the recovery of usable soil reserves during soil stripping operations;
- preferentially replace stripped soil directly on completed sections of the final landform;
- manage soil reserves so as not to degrade the resource when stockpiled; and
- establish effective soil amelioration procedures to maximise the availability and suitability of soil reserves for future rehabilitation works.

Pre-disturbance soil investigations would be progressively conducted in disturbance areas to confirm soil characteristics, stripping depth and ameliorant requirements (e.g. ameliorant type, application rate and application methodology [i.e. application during the stripping or during stockpiling]).

The following management measures would be implemented during the stripping of soils at the Project:

- Areas of disturbance requiring soil stripping would be clearly defined following vegetation clearing.
- Where the pre-disturbance soil investigation determines that ameliorants (e.g. lime, gypsum and fertiliser) should be applied during stripping to improve the condition of the soil, they would be applied to the soil surface prior to stripping.
- Areas of disturbance would be stripped progressively, as required, to reduce potential erosion and sediment generation, and to minimise the extent of topsoil stockpiles and the period of soil storage.
- Topsoil and subsoil stripping depth intervals would be minimised (subject to mobile equipment availability).
- Topsoil and subsoil stripping during periods of high soil moisture content (i.e. following heavy rain) would be avoided to reduce the likelihood of damage to soil structure.
- In preference to stockpiling, wherever practicable, stripped soil would be directly replaced on completed sections of the final landforms.

Any long-term soil stockpiles would be managed to maintain long-term soil viability through the implementation of the following management practices as listed below:

- Soil stockpiles would be retained at a height of 2 m, with slopes no greater than 1:2 (vertical:horizontal) and a slightly roughened surface to minimise erosion.
- Topsoil stockpiles would be constructed to minimise erosion, encourage drainage, and promote revegetation.

- Where the pre-disturbance soil investigation determines that ameliorants (e.g. lime, gypsum and fertiliser) should be applied during stockpiling to improve the condition of soil being stockpiled, they would be applied to the stockpiles in-between the application of separate layers.
- Wherever practicable, soil would not be trafficked, deep ripped or removed in wet conditions to avoid breakdown in soil structure.
- All topsoil and subsoil stockpiles would be protected with a non-persistent cover crop to reduce erosion potential as soon as practicable after completion of stockpiling. Where seasonal conditions preclude adequate development of a cover crop, stockpiles would be treated with a straw/vegetative mulch to improve stability.
- Soil stockpiles would be located in positions to avoid surface water flows. Silt stop fencing would be placed immediately down-slope of stockpiles until stable vegetation cover is established.
- An inventory of soil resources (available and stripped) on the Project site would be maintained and regularly reconciled with rehabilitation requirements.
- Weed control programmes would be implemented on soil stockpiles if required.

To address the soil physical and chemical constraints for agricultural land use identified in the Project open cut extension areas (Section 4.12.1), the following ameliorants would be applied:

- Topsoil – limestone and fertiliser would be applied to address acidity and nutrient deficiency constraints.
- Subsoil – limestone, gypsum, organic amendments and fertiliser would be applied to address acidity, dispersivity, organic carbon and nutrient deficiency constraints.

The MOP would be updated to describe the soil resource management measures that would be used during the Project life.

Land Use - Agricultural Activities and Productivity

Agricultural land resource management at the Project would include the following key components:

- minimisation of disturbance to agricultural lands, where practicable;
- continued use of adjoining Peabody Energy-owned land within the Project Development Application area for agricultural uses, where practicable;
- management of soil resources at the Project site so that they can be used for rehabilitation; and
- inclusion of agricultural lands (i.e. low impact grazing lands) in the Project rehabilitation strategy (Section 5).

Minimisation of Disturbance to Agricultural Lands

The area of agricultural land disturbed by the Project at any one time would be minimised so that beneficial agricultural uses can continue to be undertaken on available Project grazing lands. As demonstrated by WCPL at the existing Wilpinjong Coal Mine, grazing agricultural activities can be readily undertaken in conjunction with the operation of a mine (Plate 4-9).

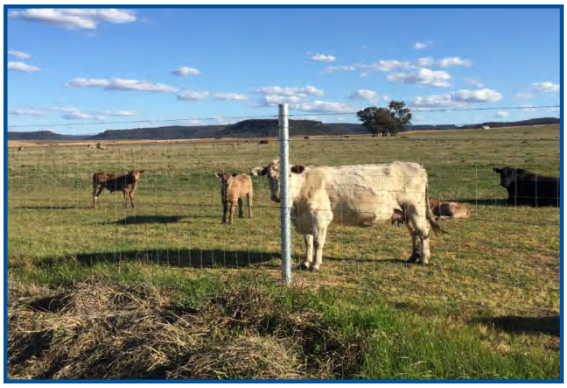


Plate 4-9: Cattle Grazing at the Wilpinjong Coal Mine

Continued Use of Existing Agricultural Areas

To minimise the potential direct impacts of the Project on agricultural production, Peabody Energy-owned agricultural lands in the Development Application area that adjoin the Project would continue to be subject to agricultural use.

Management of Soil Resources

Soil resource management measures that would be used during the life of the Project are described above.

Re-establishment of Agricultural Lands

The rehabilitation and mine closure strategy includes restoration of approximately 322 ha of agricultural land suitable for low impact grazing in the Project surface development areas. The rehabilitation of this land reduces the area of agricultural land that would otherwise be sterilised by the Project.

Land Contamination

Although Lloyd Consulting Environmental Services (2015) considered that the Historical Shale Oil Mine Complex posed a low risk to the environment and/or human health, the Historical Shale Oil Mine Complex waste material would be excavated as part of the Project and co-disposed with waste rock in the mine voids.

A number of mitigation measures that may assist to minimise the potential for land contamination are described in the following WCPL management documents and systems:

- Blast Management Plan;
- Water Management Plan, including:
  - Site Water Balance;
  - Erosion and Sediment Control Plan;
  - Surface Water Management and Monitoring Plan;
  - Groundwater Monitoring Program; and
  - Surface and Groundwater Response Plan;
- Rehabilitation Management Plan (contained in the MOP);
- Spontaneous Combustion Management Plan;
- Pollution Incident Response Management Plan;
- Air Quality Management Plan;
- Bushfire Management Plan;
- Life of Mine Tailings Management Strategy; and
- Waste Management Plan.

These documents and systems would be reviewed and revised to incorporate the Project, subject to the conditions of any Development Consent for the Project.

General measures to reduce the potential for contamination of land would include the following:

- Contractors transporting dangerous goods loads would be appropriately licensed in accordance with the provisions of the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2007).
- On-site consumable storage areas would be designed with appropriate bunding and would be operated, where applicable, in compliance with the requirements of AS 1940-2004 *The Storage and Handling of Flammable and Combustible Liquids* and AS 2187.1 *Explosives – Storage, Transport and Use – Storage*.
- Continued use of the onsite bioremediation area to process soils contaminated with organic pollutants such as hydrocarbon products and solvents (Section 2.15).
- Fuel and explosive storage areas would be regularly inspected and maintained.

In addition, during construction and exploration activities fuels, oils and other hydrocarbons would be managed to minimise the risk of spills which could cause soil contamination.

Bushfire Hazard

WCPL would continue to implement the existing bushfire management measures in the Bushfire Management Plan and consult with the Cudgegong Bush Fire Management Committee and the RFS, and provide assistance to these organisations as required. Further bushfire preventative measures are outlined in Section 4.9.

4.13 ROAD TRANSPORT

A Road Transport Assessment for the Project was undertaken by GTA Consultants (2015) and is presented as Appendix J.

The assessment was prepared in accordance with the *Guide to Traffic Generating Developments* (NSW Roads and Traffic Authority [RTA], 2002), and where relevant, makes reference to the Austroads standards.

Section 4.13.1 provides a description of the existing road network and traffic volumes. Section 4.13.2 provides an assessment of the potential impacts of the Project on the road network in the vicinity of the Project, including cumulative impacts.
Section 4.13.3 provides relevant mitigation and management measures for road transport.

4.13.1 Existing Environment

Road Hierarchy and Conditions

The following key roads are of relevance to the Wilpinjong Coal Mine (Figure 4-22):

- Main Road 208 (MR208) – extends between Mudgee and Sandy Hollow through Budgee Budgee, Wollar and Bylong and passes to the south of the Wilpinjong Coal Mine. MR208 is known as Ulan Road (between Mudgee and Budgee Budgee) and Wollar Road (thereafter).
- Main Road 214 (MR214) – extends north from Budgee Budgee to Cassilis. MR214 is known as Ulan Road.
- Main Road 598 (MR598) – provides an east-west link between Gulgong and Ulan. MR598 is known as Cope Road.
- Ulan-Wollar Road (Plate 4-10) – a local rural road which provides an east-west connection between the Villages of Ulan and Wollar.

Plate 4-10: Level Crossing on Ulan-Wollar Road

WIL-12-12_WEP_EIS_Section 4_214C

LEGEND

- Mining Lease Boundary
- Mining Lease Application Boundary
- Local Government Boundary
- NSW State Forest
- National Park, Nature Reserve or State Conservation Area
- Mining Operation
- Traffic Count Location

Source: WCPL (2015); GTA Consultants (2015); NSW Land & Property Information (2015); NSW Dept of Industry (2015); Geoscience Australia (2011)

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WILPINJONG EXTENSION PROJECT

Regional Location and Traffic Survey Locations

Figure 4-22

The primary route from Mudgee to the site is via Ulan Road (MR208 and MR214) and Ulan-Wollar Road (Figure 4-22).

Primary access to the site from Ulan-Wollar Road is via an internal sealed mine access road connecting the existing mine facilities area to Ulan-Wollar Road.

WCPL has previously funded the upgrade of approximately 6 km of Ulan-Wollar Road between Ulan Road and the Wilpinjong mine access road.

MWRC recently sealed approximately 2 km of Ulan-Wollar Road immediately to the east of the Wilpinjong Coal Mine access road with funding provided by WCPL.

WCPL encourages car pooling by employees to minimise traffic movements on the public road network through the Wilpinjong Coal Mine carpool reimbursement scheme.

Ulan Road Strategy

The Ulan Road Strategy (ARRB, 2011) reviewed the condition and performance of Ulan Road and recommended upgrades and maintenance required to meet and maintain Ulan Road at the required design standards in accordance with Project Approval 05-0021.

The Ulan Road Strategy applies to Ulan Road from Short Road, Mudgee, to the Ulan Mine Complex administration entrance.

The Ulan Road Strategy upgrade and maintenance requirements that WCPL is co-funding with UCML, Moolarben Coal and MWRC include (Department of Planning and Infrastructure [DP&I], 2013):

- Upgrade of approximately 20.6 km of Ulan Road to meet design standards.
- Upgrade of 23 intersections, including the intersection of Cope Road (MR598) and Ulan Road (MR214).
- Road safety upgrades, including the installation of wire rope barriers on some sections of the road and enhanced delineation.
- Heavy rehabilitation of some 7.8 km, and light rehabilitation of some 13.6 km of Ulan Road.
- Reseals to some 61.7 km of Ulan Road.
- General maintenance of Ulan Road over a period of 20 years.

Upgrading of Ulan Road has commenced and is ongoing, in accordance with the Ulan Road Strategy.

Existing Traffic Volumes

A program of traffic surveys was conducted during December 2012 as part of the assessment of the Modification 5 (GTA Consultants, 2013). That survey program included automatic tube counts, peak period turning movement surveys and an Origin-Destination survey.

In order to quantify changes to the traffic conditions since December 2012, an updated program of automatic tube count surveys was conducted in February 2015. Results from the sites where data were collected in both the 2012 and 2015 surveys are provided in Table 4-37 to allow comparison of the data in these years. Further road survey data are provided in Appendix J.

Comparison between the 2012 and 2015 survey results demonstrates that the daily and peak hourly traffic volumes decreased from December 2012 to March 2015 at all surveyed locations (Appendix J).

Review of the data indicates that while the peak hourly and daily number of light vehicles decreased at all locations, at some locations, the number of heavy vehicles has increased to varying degrees (Appendix J):

- Ulan Road south of Wollar Road – increased by 345 heavy vehicles per day;
- Cope Road west of Ulan Road – increased by 30 heavy vehicles per day;
- Ulan-Wollar Road west of the Wilpinjong Coal Mine – increased by 8 heavy vehicles per day; and
- Wilpinjong Coal Mine Access Road – increased by 33 heavy vehicles per day.

During the period of the traffic surveys, road works were being undertaken at the intersection of Ulan Road and Wollar Road, to upgrade the intersection. The increase in heavy vehicles recorded south of Wollar Road would be partly attributable to those road works, noting that a decrease in heavy vehicles was recorded at the next survey location farther north, south of Cope Road (Appendix J).

Table 4-37
Surveyed Average Weekday Traffic 2012 and 2015

Site[1]	Survey Location	AM Peak Hour (vehicles per hour)		PM Peak Hour (vehicles per hour)		Daily (vehicles per day)	
		2012	2015	2012	2015	2012	2015
2	Ulan Road south of Wollar Road	333	300	348	307	3,856	3,605
3	Ulan Road south of Cope Road	428	289	242	188	2,736	2,376
5	Ulan Road north of Ulan-Wollar Road	307	189	194	177	2,633	2,448
6	Cope Road west of Ulan Road	156	113	129	91	1,570	1,162
8/8A	Ulan-Wollar Road at western Wilpinjong Coal Mine boundary	121	108	72	58	693	618
10	Ulan-Wollar Road east of Slate Gully Road	16	10	14	9	142	102
11	Wilpinjong Coal Mine Access Road south of Ulan-Wollar Road	133	121	86	62	729	651

Source: After Appendix J.

[1] Refer to Figure 4-22 for locations.

Roadway Capacity

Austroads (2013) defines a Level of Service as a qualitative measure describing operational conditions within a traffic stream (in terms of speed, travel time, freedom to manoeuvre, safety and convenience) and their perception by motorists and/or passengers. Level of Service A provides the best traffic conditions, with no restriction on desired travel speed or overtaking. Level of Service B to D describes progressively worse traffic conditions. Level of Service E occurs when traffic conditions are at or close to capacity.

The existing Level of Service at each of the survey locations in Table 4-37 is A, with the exception of Ulan Road, which currently has a level of service of a combination of A, B and C (C experienced at one location at Site 4 – Ulan Road South of Ulan-Wollar Road northbound direction in the morning) (Appendix J).

Road Safety

A review of RMS accident data in the vicinity of the Project was undertaken by GTA Consultants (Appendix J). This review indicated that accident rates on Ulan Road and Ulan-Wollar Road are below accident rates described as being typical by the RTA for rural roads (RTA, 2004).

Accident rates on Wollar Road were found to be higher than typical rates, with most of these accidents being single vehicles deviating off-path on a curve (Appendix J).

School Bus Interaction

Ulan Road is currently used by school buses between 7.30 am and 8.35 am (southbound) and 3.35 pm and 4.35 pm (northbound). The school buses therefore operate on Ulan Road over a period of approximately 1 hour each morning and afternoon (Appendix J).

Existing shift times generally avoid periods where Wilpinjong Coal Mine traffic generation may coincide with school buses. However, WCPL has recently been provided approval for an earlier dayshift finish (5.00 pm), which has a greater potential for interaction with school buses. This approval is subject to conditions, including workforce education regarding school bus awareness, quarterly consultation with school bus operators and incident reporting (Appendix J).

4.13.2 Potential Impacts

Potential traffic impacts of the Project on traffic generation, roadway capacity and safety are assessed in Appendix J and summarised below.

Project Traffic Generation

Table 4-38 summarises the estimated existing and predicted Project daily vehicle movements (traffic in both directions).

Table 4-38
Existing Wilpinjong Coal Mine and Predicted Project Two-way Weekday Traffic

Scenario/Project Year	Daily (vehicles per day)	
	Light	Heavy
Existing – 2015	558	94
Project – Year 1	878	200
Project – Year 8	843	164

Source: After Appendix J.

Project traffic generation is expected to peak in conjunction with construction activities in Year 1, before a second, smaller peak occurs in Year 8, which is coincident with the forecast peak in the operational workforce.

Cumulative Traffic Increases

In order to conservatively consider the potential impacts of the Project in the context of potential background traffic growth and traffic growth associated with other approved and proposed projects, an annual baseline growth rate and the expected traffic generation from key projects has been considered.

Based on the Ulan Road Strategy (ARRB, 2011), a 1.8% per annum baseline traffic growth rate was applied to the existing traffic volumes (Appendix J). In addition, the expected traffic movements generated from the Ulan Mine Complex and Moolarben Coal Complex were incorporated specifically.

Table 4-39 presents the predicted traffic flows on key roads including additional Project traffic flows, traffic flows from these other projects and estimated background traffic growth.

The Project and other cumulative traffic generation sources would alter the level of service experienced on the public roads as follows (Appendix J):

- Year 1
  - Ulan Road south of Wollar Road from Level of Service B to C northbound.
  - Cope Road from Level of Service A to B eastbound.
  - Ulan-Wollar Road west of the Wilpinjong Coal Mine from Level of Service A to B eastbound.
- Year 8
  - Ulan-Wollar Road west of the Wilpinjong Coal Mine from Level of Service A to B eastbound.

The results demonstrate that acceptable operation can be expected in the future with the combined influences of the Project and other expected changes to traffic volumes (Appendix J).

Intersection Performance

GTA Consultants (2015) undertook a peak hour intersection analysis for the following key intersections:

- Ulan Road and Cope Road.
- Ulan Road and Ulan-Wollar Road.
- Ulan-Wollar Road and Wilpinjong Coal Mine Access Road.

The intersection performance analysis indicated that the key intersections are expected to operate at good levels of service, with spare capacity and short delays. No additional capacity is required at these intersections to accommodate the Project traffic (Appendix J).

Proposed Road Realignments

The approved Wilpinjong Coal Mine includes the relocation of Ulan-Wollar Road to the east and west of the mine and the relocation of two associated road/rail level crossings.

Table 4-39
Predicted Cumulative Two-way Weekday Traffic

Site[1]	Location	Daily (vehicles/day)		
		2015	2017 (Year 1)	2024 (Year 8)
1	Ulan Road (north of Hollyoak Bridge)	9,476	10,535	10,814
2	Ulan Road (south of Wollar Road)	3,605	4,452	3,991
3	Ulan Road (south of Cope Road)	2,376	3,326	2,498
4	Ulan Road (south of Ulan-Wollar Road)	2,985	4,091	2,929
5	Ulan Road (north of Ulan-Wollar Road)	2,448	2,301	1,465
6	Cope Road (west of Ulan Road)	1,162	1,343	1,110
7	Ulan-Wollar Road (west of Wilpinjong Coal Mine Access Road)	618	1,015	950
8A	Ulan-Wollar Road (at western Wilpinjong Coal Mine boundary)	618	1,015	950
9	Ulan-Wollar Road (east of Wilpinjong Coal Mine Access Road)	142	174	182
10	Ulan-Wollar Road (east of Slate Gully Road)	142	174	182
11	Wilpinjong Coal Mine Access Roads[B] (south of Ulan-Wollar Road)	652	1,078	1,007
12	Wollar-Bylong Road (east of Wollar Road)	141	155	169

Source: After Appendix J.

[1] Refer to Figure 4-22 for locations.

As the Project would further extend the open cuts including the development of Pit 8 in the east and the extension of Pit 6 in the west, additional local road relocations would be required (Figure 1-4).

The eastern relocation would include the relocation of the existing road/rail level crossing. Signage and road marking requirements associated with the railway level crossing would be undertaken in accordance with AS 1742.7:2007 *Manual of Uniform Traffic Control Devices*.

As part of the Moolarben Coal Complex, Moolarben Coal has approval to realign Ulan-Wollar Road north of the Open Cut 4 mining area. WCPL has consulted with Moolarben Coal regarding the road realignment and has discussed the potential coordination of the planning and design of the road realignments.

Road Safety Review

The increase in traffic expected to occur on the road network as a result of changes directly associated with the Project and unrelated to the Project would typically result in an increase in the potential for exposure to crashes, with a corresponding increase in the potential number of crashes.

The ongoing program of works on Ulan Road (Section 4.13.1) is however expected to improve road safety along those routes by upgrading the road cross section where possible, and upgrading intersections to meet current design guidelines (Appendix J). Peabody Energy has contributed towards the cost of upgrading Ulan Road to improve safety.

School Bus Interaction

For the Project, the later operational dayshift completion (6.30 pm) (Section 2.17) relative to current operations (5.00 pm) may assist to minimise use of Ulan Road at the same time as the school buses are operating.

Rail Level Crossings Delays

Road/rail level crossings are prevalent in the district and are an occasional source of delay to motorists. The impact of changes to rail traffic on the delays experienced by motorists at level crossings in the region has been reviewed by GTA Consultants (2015).

The results of the review demonstrate that the probability of vehicles being delayed at the level crossings would remain low, even when conservatively considering the scenario where the forecast peak Project traffic volume coincides with the peak hourly number of train movements (Appendix J).

4.13.3 Mitigation Measures, Management and Monitoring

No specific management or mitigation measures are considered to be warranted by GTA Consultants (2015) for the Project, noting that upgrading of Ulan Road is underway irrespective of the Project (including contributions from Peabody Energy for Ulan Road works through the Ulan Road Strategy, which would continue for the Project). The new intersections on Ulan-Wollar Road would be designed in accordance with Austroads guidelines, with basic auxiliary right treatments on Ulan-Wollar Road.

Notwithstanding, staff and drivers would continue to be made aware of safe driving behaviour through site-specific inductions and staff education programs, and would continue to be encouraged to participate in the Wilpinjong Coal Mine carpool reimbursement scheme.

4.14 TRANSPORT NOISE

A Noise and Blasting Assessment for the Project was undertaken by SLR Consulting (2015) and is presented in Appendix A.

The transport noise assessment was conducted in accordance with the:

- NSW *Road Noise Policy* (DECCW, 2011); and
- NSW *Rail Infrastructure Noise Guideline* (EPA, 2013).

The Noise and Blasting Assessment was peer reviewed by Mr Richard Heggie (Director, SLR Consulting), who concluded that the report is comprehensive, conforms to the relevant guidelines and has been undertaken in a professional manner. The peer review report is presented in Attachment 4.

Section 4.14.1 provides a description of the existing transport noise environment, including a description of the existing Wilpinjong Coal Mine transport noise management and monitoring regime. Section 4.14.2 describes the potential transportation noise impacts of the Project, including cumulative impacts. Section 4.14.3 outlines mitigation measures, management and monitoring for the Project.

4.14.1 Existing Environment

Transport Noise Management Regime

Transport noise management at the Wilpinjong Coal Mine is currently undertaken in accordance with the Noise Management Plan.

The Noise Management Plan describes general transport noise management and mitigation measures including coordinating shift changes on-site with the shift changes of the Moolarben Coal Complex and Ulan Mine Complex to minimise the cumulative traffic impacts of the three mines.

In addition, WCPL operates a carpool reimbursement scheme, which reimburses participating employees for each vehicle removed from the road. The scheme encourages employees to travel together in order to reduce employee-related traffic on local roads and associated road noise.

WCPL also contributes to the Ulan Road Strategy (ARRB, 2011), which includes upgrades to Ulan Road and voluntary at-receiver noise mitigation for some proximal privately-owned residences on Ulan Road.

In accordance with Project Approval 05-0021, WCPL requires the provision of product train locomotives that are approved to operate on the NSW rail network in accordance with the ARTC EPL 3142.

4.14.2 Potential Impacts

The transport noise component of the Noise and Blasting Assessment (Appendix A) included assessment of the following potential impacts:

- off-site road traffic noise; and
- off-site rail noise.

These aspects are described further below and in Appendix A.

Road Traffic Noise

Road Noise Assessment Study Area

The road noise assessment focuses on Ulan Road (MR214) as no privately-owned dwellings remain on Ulan-Wollar Road between the Project and Ulan Road. In particular, the section of Ulan Road south of Cope Road and north of Wollar Road was adopted as the study area, as the Project traffic as a proportion of total traffic is highest in this section of Ulan Road (Appendix A).

Road Noise Criteria

Road traffic noise along public roads was assessed by SLR Consulting (2015) in accordance with the *Road Noise Policy*, which establishes criteria for the assessment of road noise in NSW (Appendix A). The total traffic noise and relative increase criteria are provided in Table 4-40.

In relation to situations where exceedances of the road traffic noise assessment criteria are predicted, the *Road Noise Policy* states that an increase of up to 2 dB is considered to be barely perceptible (DECCW, 2011).

Predicted Road Noise Emissions

The methodology for the assessment of road noise was to:

- calculate existing traffic noise levels;
- calculate road noise levels in Project Years 1 and 8 corresponding to Project and cumulative traffic movements; and
- compare these noise levels with the relevant *Road Noise Policy* criteria.

Project Years 1 and 8 were selected for the assessment as they correspond to peaks in the Project construction and operational workforce, respectively (Appendix A).

On Ulan Road, the daytime cumulative traffic in Years 1 and 8 is predicted to result in negligible increases of 0.3 dBA and 0.8 dBA respectively to the existing daytime $L_{Aeq(15\ hour)}$ traffic noise levels (Appendix A).

The night-time cumulative traffic on Ulan Road in Years 1 and 8 is predicted to result in negligible increases of 0.2 dBA and 1 dBA respectively to the existing night-time $L_{Aeq(9\ hour)}$ traffic noise levels (Appendix A).

The relative increases in traffic noise arising from the Project in Years 1 and 8 are predicted to be less than 2 dBA which, in accordance with the *Road Noise Policy*, represents a minor impact that is considered barely perceptible (Appendix A).

The road noise assessment indicates that two of the closest receivers to this section of Ulan Road currently receive night-time $L_{Aeq(9hour)}$ traffic noise levels above the traffic noise criteria of 55 dBA (Appendix A).

Based on the cumulative traffic projections in Years 1 and 8 excluding the Project, three residential dwellings would likely receive night-time $L_{Aeq(9hour)}$ traffic noise levels above the traffic noise criteria of 55 dBA and two residential dwellings would likely receive daytime $L_{Aeq(15hour)}$ traffic noise levels above the traffic noise criteria of 60 dBA (Appendix A).

No additional dwellings are predicted to exceed the daytime or night-time total road traffic noise criteria due to the Project traffic in Years 1 and 8 (Appendix A).

Table 4-40
Road Noise Policy Criteria for Residential Land Uses

Road	Type of Project and Land Use	Total Traffic Noise Criteria	Relative Increase Criteria
Ulan Road	Land use developments generating additional traffic on existing sub-arterial roads	Daytime 60 dBA $L_{Aeq(15hour)}$	Existing $L_{Aeq(15hour)}$ plus 12 dBA
		Night-time 55 dBA $L_{Aeq(9hour)}$	Existing $L_{Aeq(9hour)}$ plus 12 dBA

Source: Appendix A.

Note: Daytime 7.00 am to 10.00 pm, Night-time 10.00 pm to 7.00 am.

Rail Noise

The existing/approved average product coal rail movements of 6 trains leaving the site per day and maximum of 10 trains leaving the site per day would be unchanged for the Project (Section 2.9).

Project product coal would be transported via rail from the Wilpinjong Coal Mine rail loop to domestic customers or the Port of Newcastle (Section 2.9). Consequently, a rail noise assessment was undertaken for the Sandy Hollow Gulgong Railway (Appendix A).

Rail Noise Criteria

The EPA's *Rail Infrastructure Noise Guideline* (EPA, 2013) assessment trigger levels are presented in Table 4-41. An assessment of rail noise impacts against the *Rail Infrastructure Noise Guideline* is presented in Appendix A.

Table 4-41
Rail Infrastructure Noise Guideline Rail Noise Assessment Trigger Levels

Descriptor	Rail Noise Assessment Trigger Levels
Daytime/evening [$L_{Aeq(15hour)}$]	65 dBA
Night-time [$L_{Aeq(9hour)}$]	60 dBA
Maximum Pass-by [$L_{Amax\ (95th\ percentile)}$]	85 dBA

Source: After Appendix A.

Predicted Rail Noise Emissions

As noted above and described in Section 2.9, the Project does not involve any change to currently approved maximum daily rail movements or rail loading hours at the Wilpinjong Coal Mine. Therefore there are no rail-related noise level increases at the nearest privately-owned receivers in the vicinity of the Project (Appendix A).

Furthermore, the nearest privately-owned receivers (minimum 500 m from the railway) are well outside any potential cumulative rail noise affected areas proximal to the railway for daytime and night-time rail movements on an average, peak and maximum pass-by basis (Appendix A).

4.14.3 Mitigation Measures, Management and Monitoring

Noise mitigation and management measures for the existing Wilpinjong Coal Mine are described in the Noise Management Plan (Section 4.6.1). This plan would be reviewed and updated to address the Project, subject to the conditions of any Development Consent for the Project.

Consistent with the Voluntary Land Acquisition and Mitigation Policy, mitigation of road noise on the public road network is considered only in the context of reducing noise from the source rather than consideration of noise treatment of the relevant affected properties.

For the Project, staff and drivers would be made aware of the potential for road noise impacts through site-specific inductions and staff education programs to reinforce quiet driving styles/attitudes, as well as the continued carpool reimbursement scheme.

WCPL would continue to contribute to the Ulan Road Strategy (ARRB, 2011), which provides some residents who live in close proximity to Ulan Road an opportunity to request at-receiver noise mitigation such as glazing or air conditioning.

4.15 VISUAL CHARACTER

A Visual Assessment for the Project was undertaken by Marc & Co and Resource Strategies (2015) and is presented in Appendix O.

A description of the existing visual setting of the Project is provided in Section 4.15.1. Section 4.15.2 describes the potential visual impacts of the Project, including cumulative impacts and Section 4.15.3 outlines visual impact mitigation and management measures.

4.15.1 Existing Environment

The Project open cut extension and infrastructure areas comprise a number of distinct land use types and landscape units including the existing Wilpinjong Coal Mine, Munghorn Gap Nature Reserve, Goulburn River National Park, agricultural lands, residential dwellings and watercourses including Cumbo Creek, Wilpinjong Creek and Wollar Creek.

Land use and key landscape features that contribute to visual character and scenic quality are described below in the context of the regional, sub-regional and local settings (Figure 4-23).

Topographic features in the vicinity of the Project are described in Section 4.2.

Regional Setting (>5 km)

The regional setting has attributes of moderate to high scenic quality due to the presence of the Goulburn River National Park to the north and the Munghorn Gap Nature Reserve to the south and south-west of the Project. The contrast between the vegetation and topography of the ranges and the cleared agricultural valleys adds to visual interest (Appendix O).

The regional setting also has attributes of lower scenic quality associated with the Moolarben Coal Complex and Ulan Mine Complex which are located immediately to the west and some 11 km to the north-west of the Project, respectively (Appendix O).

Ulan is a small village located within the Project regional setting, located approximately 8 km to the west north-west (Appendix O).

Sub-regional Setting (1 to 5 km)

The sub-regional setting is dominated by vegetated elevated areas (including the Goulburn River National Park and the Munghorn Gap Nature Reserve) and cleared agricultural valleys (Appendix O).

The sub-regional setting also has attributes of lower scenic quality associated with the Moolarben Coal Complex which is located to the west of the Project (Appendix O).

The Village of Wollar is located within the sub-regional setting, located approximately 2 km to the east. There are a limited number of privately-owned dwellings in the sub-regional setting due to the extensive land ownership of Peabody Energy and other local resource companies (Appendix O).

Other features of the sub-regional setting include power supply infrastructure associated with the existing TransGrid Wollar to Wellington 330 kV ETL, local ETLs, Wollar Road, Ulan-Wollar Road and the Sandy Hollow Gulgong Railway (Figure 4-23) (Appendix O).

Local Setting (<1km)

The visual character of the local setting is dominated by the existing Wilpinjong Coal Mine and cleared agricultural land (Appendix O).

Most natural vegetation in the local setting is restricted to patches of paddock trees on the valley floor and denser remnant vegetation on the slopes and ridges surrounding the Wilpinjong Coal Mine (including in areas of the Goulburn River National Park and the Munghorn Gap Nature Reserve) (Appendix O).

Wilpinjong Creek is located to the immediate north of the Wilpinjong Coal Mine. Cumbo Creek (a tributary of Wilpinjong Creek) runs south-north through the existing Wilpinjong Coal Mine and will be relocated and the existing alignment of the creek mined as part of the approved Wilpinjong Coal Mine operations (Section 2.1.6).

The south-eastern extent of the approved Moolarben Coal Complex surface development area will be located to the immediate west of the north-western extent of the Project (Figure 1-3) but has only recently commenced construction (Appendix O).

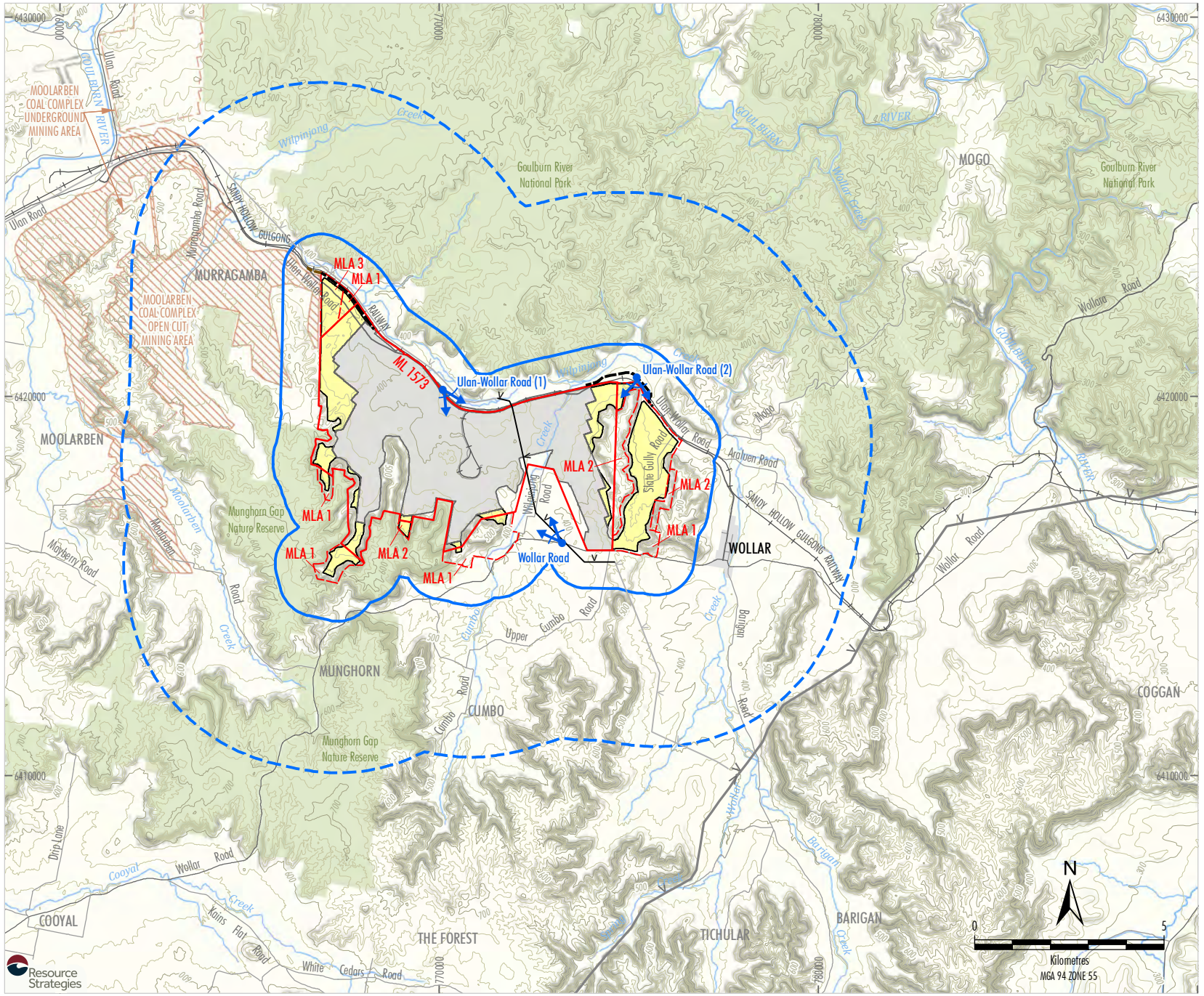
There are no small villages or towns in the local setting. There is also no privately-owned freehold land in the local setting, due to the extensive land ownership of Peabody Energy and other local resource companies (Appendix O).

Other features of the local setting include power supply infrastructure associated with the existing TransGrid Wollar to Wellington 330 kV ETL, local ETLs, Wollar Road, Ulan-Wollar Road and the Sandy Hollow Gulgong Railway (Figure 4-23) (Appendix O).

Existing Mitigation Measures

WCPL has implemented a number of measures to minimise potential visual impacts at the Wilpinjong Coal Mine (Appendix O):

- Vegetated visual bunds have been constructed along the northern boundary of Pit 5.
- Flood bunds that also act as visual bunds have been constructed around Pit 3 near Ulan-Wollar Road.



LEGEND

- Mining Lease Boundary
- Mining Application Licence Boundary
- Approved/Existing Open Cut and Contained Infrastructure Area
- Proposed Open Cut Extension Area
- Proposed Public Road Realignment
- Proposed Relocated TransGrid 330 kV ETL
- Existing TransGrid 330 kV ETL
- Existing TransGrid 500 kV ETL
- National Park or Nature Reserve
- Local Setting Boundary (1km from Project)
- Sub-regional Setting Boundary (5 km from Project)
- Viewpoint

Source: WCPL (2015); NSW Land & Property Information (2015); NSW Dept of Industry (2015)

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WILPINJONG EXTENSION PROJECT

Visual Setting

Figure 4-23

- A tree screen has been established along the east-west section of Wollar Road to the south of the Wilpinjong Coal Mine.
- Trees have been established along the mine access road.
- Mine areas are rehabilitated as soon as practicable following disturbance.
- Temporary rehabilitation of the approved elevated waste rock emplacement in Pit 2 will occur following construction (e.g. with aerial seeding).
- All external lighting is operated in accordance with Australian Standard 4282 (INT) 1995 – *Control of Obtrusive Effects of Outdoor Lighting* as required by Condition 55 of Schedule 3 of Project Approval 05-0021.

4.15.2 Potential Impacts

As no views of the Project from the Village of Wollar or any other privately-owned dwelling are anticipated due to the extensive land ownership of Peabody Energy and other local resource companies and the undulating topography and presence of remnant vegetation (Appendix O), no potential visual impacts as a result of the Project are expected at privately-owned residences.

The major aspects of the Project considered to have the potential to impact on the visual landscape include (Appendix O):

- approximately 500 ha of incremental extensions to the approved open cut pits;
- approximately 300 ha of disturbance associated with the development of Pit 8;
- an increase in the final height of the approved elevated waste rock emplacement in Pit 2 from 430 m AHD to approximately 440 m AHD;
- development of the Pit 3/8 Haul Road and associated cutting;
- ETL and road infrastructure upgrades, including:
  - extensions of Ulan-Wollar Road relocations;
  - extension to relocations of local ETLs and services; and
  - relocation of the TransGrid Wollar to Wellington 330 kV ETL;
- development of satellite mine infrastructure areas and associated ROM pads;
- additional final void associated with Pit 8; and
- lighting associated with extension to night-time mining operations.

The changes described above, while altering the layout and extent of the approved/existing mine, are effectively extensions to the existing approved mine.

Visual Assessment Methodology

The potential visual impacts were assessed by evaluating the level of visual modification of the Project in the context of the visual sensitivity of relevant surrounding land use areas.

The degree of a visual modification of a proposed development is the contrast between the development and the existing visual landscape and is generally considered to decrease with distance (Appendix O).

Visual (viewer) sensitivity is a measure of how critically a change to the existing landscape would be viewed from various use areas, where different activities are considered to have different sensitivity levels (Appendix O). Visual impacts were determined generally in accordance with the matrix presented in Table 4-42.

Table 4-42
Visual Impact Matrix

Visual Modification \ Viewer Sensitivity	H	M	L
H	H	H	M
M	H	M	L
L	M	L	L
VL	L	VL	VL

VL = Very Low
L = Low
M = Moderate
H = High

Source: Appendix O.

Visual Impact Assessment

Predicted visual impacts at potential viewpoint locations are discussed below.

Roads

Visual simulations (Figures 4-24 to 4-26) were prepared for each of the locations shown on Figure 4-23 to show the existing views as well as simulations of the Project landforms during the stage of the Project when the greatest potential visual impact would occur at the viewpoint. The post-mining simulation illustrates the conceptual landform following completion of mining and rehabilitation activities.

The moderate level of visual modification coupled with the low level of visual sensitivity at these locations means a low level of potential visual impact would be expected for users of the Ulan-Wollar Road (Table 4-43).

Given the low level of visual modification associated with the Project coupled with the low to moderate level of visual sensitivity of users of Wollar Road, a low level of potential visual impact would be expected on this road (Table 4-43).

With progressive and final rehabilitation, the level of potential visual impact associated with the Project along Wollar Road and Ulan-Wollar Road would be either very low or low (Table 4-43).

Dwellings

No views of the Project from the Village of Wollar or any other privately-owned dwelling are anticipated due to the extensive land ownership of Peabody Energy and other local resource companies and the undulating topography and presence of remnant vegetation (Appendix O).

Munghorn Gap Nature Reserve and Goulburn River National Park

A review of walking tracks published in the online visitor guides for the Munghorn Gap Nature Reserve and Goulburn River National Park (NPWS, 2014) identified no public access routes leading to areas of the Goulburn River National Park or Munghorn Gap Nature Reserve that directly overlook the Project (Appendix O).

These areas are therefore neither routinely accessed by the public, nor are they readily accessible to the public. Given the above, the Goulburn River National Park and the Munghorn Gap Nature Reserve are not considered to be relevant viewpoints and were not assessed further (Appendix O).

Sandy Hollow Gulgong Railway

As the Sandy Hollow Gulgong Railway is predominantly used by coal trains (i.e. passenger trains are not known to use the line), it is not considered to be a relevant viewpoint and was not assessed further (Appendix O).

Night Lighting

The scale and intensity of night-lighting for the Project would be similar in intensity to the existing night-lighting at the Wilpinjong Coal Mine. Night-lighting sources would however extend into the Project open cut extension areas and Pit 8. In addition, the Project would include an increase in the number of mobile equipment (Appendix O).

Table 4-43
Summary of Visual Assessment

Location	Visual Sensitivity	Visual Modification Level	Potential Impact[1]	Potential Impact After Rehabilitation
Ulan-Wollar Road (1)	L	M	L	VL
Ulan-Wollar Road (2)	L	M	L	L
Wollar Road	L – M	L	L	VL

Source: Appendix O.

[1] Methodology described in Section 4.15.2.

H – High, M – Moderate, L – Low, VL – Very Low.

Source: WCPL (2015); Marc and Co (2015)

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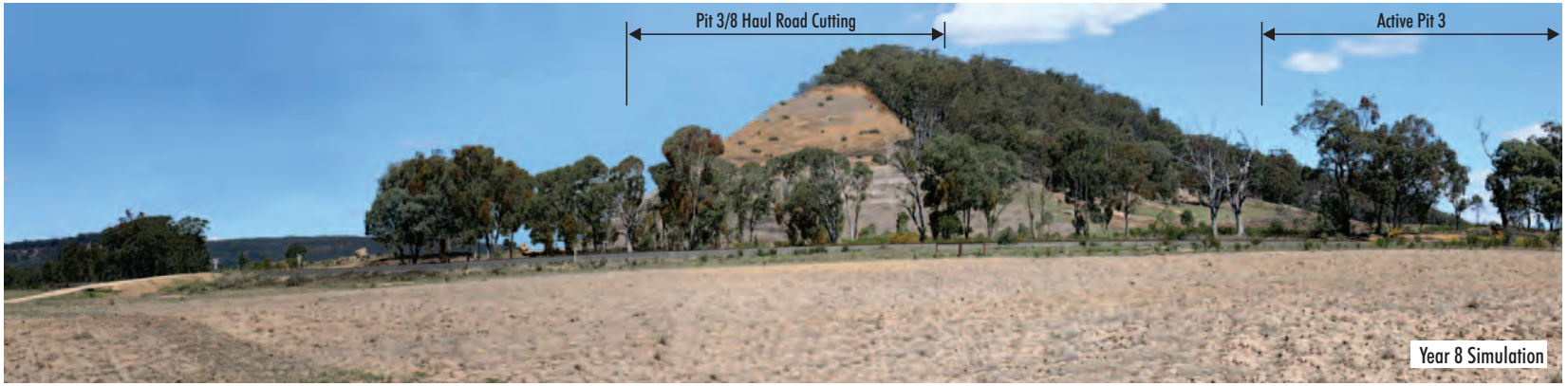
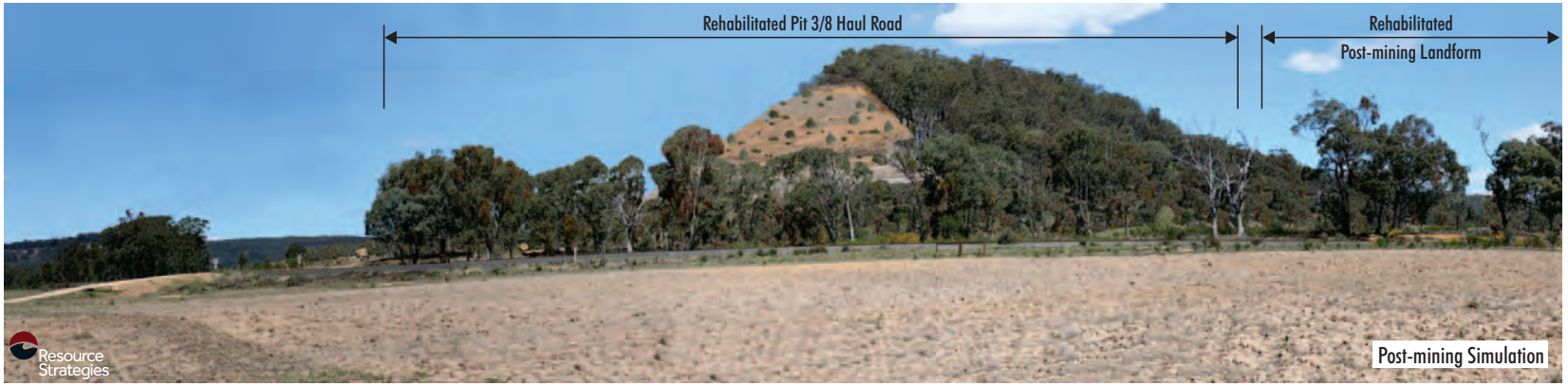
Existing View and Visual Simulations
Ulan-Wollar Road (1) Viewpoint

Figure 4-24

WIL-12-12_WEP_EIS_Section 4_002B





Source: WCPL (2015); Marc and Co (2015)

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WILPINJONG EXTENSION PROJECT

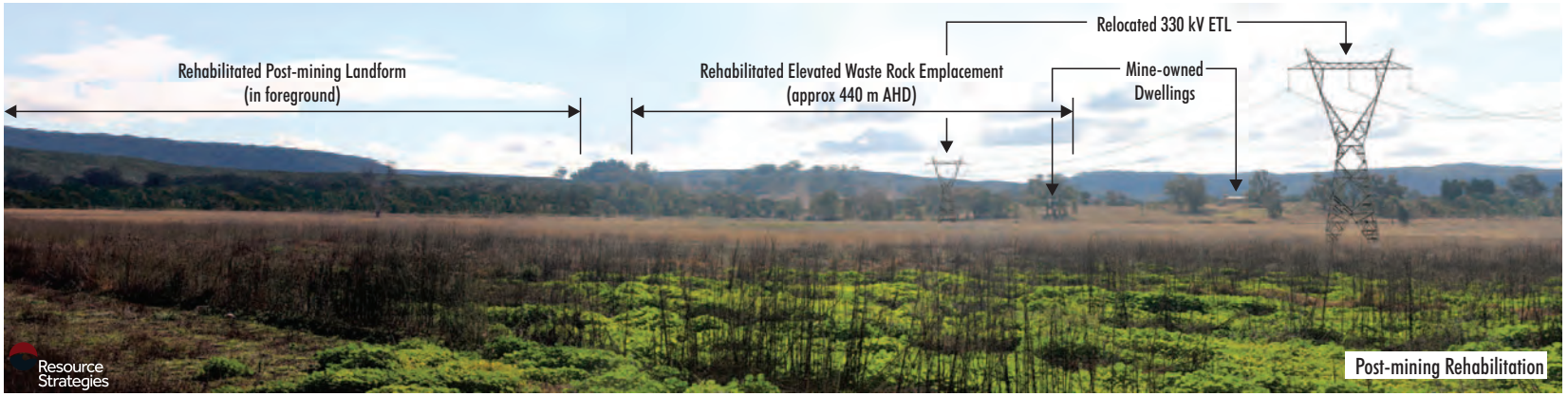
Existing View and Visual Simulations
Ulan-Wollar Road (2) Viewpoint

Figure 4-25

Resource Strategies

WIL-12-12_WEP_EIS_Section 4_004A

Source: WCPL (2015); Marc and Co (2015)



WIL-12-12_WEP_EIS_Section 4_003A

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WILPINJONG EXTENSION PROJECT

Existing View and Visual Simulations
Wollar Road Viewpoint

Figure 4-26

Consequently there would be a potential increase in night-lighting impacts associated with night-glow and mobile vehicle-mounted lights. There would be increased potential for direct views of mobile equipment lights and operational lighting to be available from additional sections of Ulan-Wollar Road and Wollar Road due to the extensions of open cut pits and the increased number of mobile equipment (Appendix O).

Notwithstanding the above, the nature of the night-lighting for the Project would be similar to the existing night-lighting at the Wilpinjong Coal Mine and the change in potential night-lighting impacts would be minor (Appendix O).

Cumulative Impacts

The assessment of potential cumulative visual impacts considered the combined effects of the Project with the effects of the adjoining Moolarben Coal Complex. Other mining projects in the area (e.g. Ulan Mine Complex) are considered to be located too far away from the Project to have any significant cumulative visual impact with the Project (Appendix O).

It is expected that views of both the Project and the Moolarben Coal Complex would generally be only available from viewpoints from the northern side of the Project along Ulan-Wollar Road. No simultaneous views of the Moolarben Coal Complex and Pit 8 would be available due to the intervening ridgeline located between the existing Wilpinjong Coal Mine and Pit 8.

Simultaneous views of both projects would be limited by intervening topography and vegetation and the exposure to the simultaneous views would be confined to a relatively short period of time and a limited number of users (Appendix O).

The potential night-lighting impacts associated with the Moolarben Coal Complex and the Project would be of a similar level to that of the currently approved Moolarben Coal Complex operations and the change in potential night-lighting impacts for the Project would be minor. The Project is therefore not expected to result in significant cumulative night-lighting impacts (Appendix O).

Given the above, it is expected that the potential cumulative visual impacts as a result of the Project and the Moolarben Coal Complex are considered to be low (Appendix O).

4.15.3 Mitigation and Management Measures

The mitigation and management measures that would be implemented for the maintenance of visual amenity at the Project are described below.

Progressive Rehabilitation

Progressive rehabilitation of Project landforms would be undertaken in order to reduce the contrast between the Project landforms and the surrounding environment. This would include progressive rehabilitation with selected tree and pasture species (endemic where practicable). The effectiveness of progressive rehabilitation in reducing visual impacts is shown on the existing view on Figure 4-26.

The Project final landform has been designed to integrate where practicable with the adjoining natural landforms.

Visual Screening

WCPL would maintain the following existing measures implemented to minimise potential visual impacts at the Wilpinjong Coal Mine for the Project:

- The use of vegetated visual bunds along select pit boundary areas.
- A tree screen that has been established along the east-west section of Wollar Road to the south of the Wilpinjong Coal Mine.
- Trees established along the mine access road.
- Mine areas are rehabilitated as soon as practicable following disturbance.
- Temporary rehabilitation of the approved elevated waste rock emplacement in Pit 2 will occur following construction (e.g. with aerial seeding).

In addition, overburden material would be placed along selected boundary areas of each Project open pit to act as a safety bund (i.e. to prevent accidental access). In some areas these bunds (once they are revegetated) would assist in reducing direct views to open cut workings from publicly accessible locations. Bunds would be constructed up to 3 m above the existing surface level and would remain as a permanent landscape feature or be integrated into the rehabilitated final landforms.

In particular, a perimeter bund would be constructed at the southern extent of Pit 8 to restrict access and reduce views of the active open pit development areas (and ultimately the final void) from Wollar Road. The bund would be up to approximately 3 m in height and would be progressively vegetated with shrubs and trees to screen views of Pit 8.

In addition, existing remnant vegetation along Ulan-Wollar Road and Wollar Road would continue to be maintained where practicable to minimise views of the Project from these roads.

Night Lighting

Whilst ensuring that operational safety is not compromised, WCPL would minimise light emissions from the Project by select placement, configuration and direction of lighting so as to reduce off-site nuisance effects where practicable.

All external lighting at the Project would be operated in accordance with AS 4282 (INT):1995 – *Control of Obtrusive Effects of Outdoor Lighting*.

4.16 ECONOMIC EFFECTS

An Economic Assessment for the Project was undertaken by Deloitte Access Economics (2015) and is presented in Appendix M.

The Economic Assessment was peer reviewed by Mr Brian Fisher (BAEconomics), who concluded that the report has been competently completed and provides an accurate estimate of the net value of the Project to NSW. The peer review report is presented in Attachment 4.

The economic impact assessment component of the Economic Assessment was conducted at two different scales to assess the potential impact of the Project on the broader region and in NSW. The broader region adopted for the economic impact assessment was the Mid-Western Regional, Muswellbrook, Singleton, Upper Hunter, Bathurst Regional and Lithgow LGAs (Appendix M).

The economic impact assessment is primarily concerned with the effect of a proposal on an economy in terms of specific indicators, such as gross product, employment and wages. The economic impact assessment is based on computable general equilibrium modelling developed by Deloitte Access Economics.

The computable general equilibrium model assesses the wider economic impacts of the Project at two levels (Appendix M):

- Direct impacts — the economic gains associated with the Project operations themselves (e.g. coal extraction and processing, and revenues generated by sale of coal exports).
- Indirect, induced and crowding out impacts — the economic gains in related upstream or downstream industries and the economic losses associated with 'crowding out' of activity in other sectors of the economy as a result of the Project.

A broader region was considered in the Economic Assessment as the computable general equilibrium model is better suited to larger economies (Appendix M).

A summary of the existing broader regional and NSW economy is provided in Section 4.16.1. The potential impacts of the Project on the broader regional and NSW economies are described in Section 4.16.2, while mitigation and management measures are provided in Section 4.16.3.

4.16.1 Existing Environment

The population of the regional economy (i.e. Mid-Western Regional, Muswellbrook, Singleton, Upper Hunter, Bathurst Regional and Lithgow LGAs) is approximately 134,000 (Appendix M).

The mining, retail trade and the agriculture, forestry and fishing sectors are the largest sectors from an employment perspective in the broader region (Appendix M).

The mining sector is of greater relative importance to the broader regional economy than to the NSW economy, while the manufacturing, professional, scientific and technical service and health care and social assistance sectors are of less relative importance than they are to the NSW economy (Appendix M).

4.16.2 Potential Impacts

The regional economic impact assessment in Appendix M included consideration of the impacts of the Project on both the broader regional (i.e. Mid-Western Regional, Muswellbrook, Singleton, Upper Hunter, Bathurst Regional and Lithgow LGAs) and NSW economies.

Gross Product

The projected impact on the broader regional and NSW economies over the Project life is presented in Figure 4-27. The impact on the broader regional and NSW economies peak at approximately $311M and $366M in 2019, respectively (Figure 4-27) (Appendix M).

Source: Appendix M.

Figure 4-27: Additional Gross Production

In net present value terms, Deloitte Access Economics estimates the Project would increase gross product in the broader regional and NSW economies by some $1.8 billion and $2.2 billion over the Project life, respectively (Appendix M).

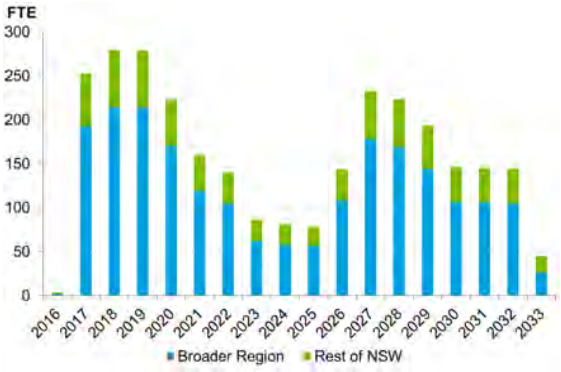
Employment and Wages

At full development, the Project operational workforce would be in the order of 625 on-site personnel. This would occur in the period between Year 2 and Year 8 and would comprise a combination of direct WCPL employees and on-site contractor's personnel (Section 2.17).

Construction and development activities would require up to approximately 100 personnel in the first 12 months of the Project. Construction activities would however be undertaken at various times over the life of the Project, with smaller peaks of up to 40 people anticipated in Year 2 and Year 8.

The Project is also projected to result in indirect employment impacts associated with related upstream or downstream industries and any 'crowding out' of activity in other sectors of the economy (Appendix M).

Considering these direct and indirect employment impacts, the incremental increase in employment in the broader regional and NSW economies over the Project life is presented in Figure 4-28.



Source: Appendix M.

Figure 4-28: Additional Employment

Additional net employment is projected to peak in 2019 with an additional 214 fulltime equivalent jobs in the region and an additional 64 fulltime equivalent jobs in the rest of NSW (Figure 4-28).

The projected growth in employment would be accompanied by an increase in real wages (Appendix M).

The Project would result in limited additional indirect employment in the Mid-Western Regional LGA (Appendix M).

End of Project Life

The establishment and operation of the Project would stimulate demand in the broader regional and NSW economy leading to increased business sales in a range of sectors and increased employment opportunities. Cessation of the mining operations would result in a contraction in broader regional economic activity (Appendix M).

The magnitude of the broader regional economic impacts of cessation of the Project would depend on a number of interrelated factors, including the movements of workers and their families, alternative development opportunities and economic structure and trends in the broader regional economy at the time (Appendix M).

New mining resource developments in the broader region would help broaden its economic base and buffer against impacts of the cessation of individual activities. The broader region is a prospective location with a range of coal resources.

4.16.3 Mitigation and Management Measures

WCPL would develop a Mine Closure Plan for the Project which would include details of the mine closure strategy (Section 5.6). The Mine Closure Plan would be developed in consultation with the MWRC, the DP&E and the local community, and would include consideration of amelioration of potential adverse socio-economic effects due to the reduction in employment at Project closure.

4.17 SOCIAL AND COMMUNITY INFRASTRUCTURE

Elliott Whiteing (2015) has considered the potential impacts of the Project on employment, population, community infrastructure demand and social values (Appendix N).

For the purposes of the Social Impact Assessment, the following areas were considered:

- Local (i.e. the Village of Wollar and surrounds).
- Regional (i.e. Mudgee and surrounds).
- Broader Regional (i.e. the Mid-Western Regional LGA and surrounding LGA's).

A summary of background demographics, employment, community infrastructure and social values is provided in Section 4.17.1. The potential impacts of the Project on employment, population, community infrastructure demand and social values are provided in Section 4.17.2. Relevant mitigation measures and management are described in Section 4.17.3.

The Social Impact Assessment has been guided by the requirements of the SEARs for the Project.

4.17.1 Existing Environment

The Social Impact Assessment has been informed by extensive consultation undertaken by WCPL since commencement of operations at the Wilpinjong Coal Mine in 2006.

A summary of community consultation undertaken for the Project is provided in Section 3.1.

As part of Social Impact Assessment a specific community survey was undertaken. The community survey was designed to enable a broad range of community members to participate in consultation, obtain information for the social baseline, and seek community members' views about the Project's potential impacts and opportunities (Appendix N).

The survey was available on-line and was advertised in the Mudgee Guardian and accompanied by an editorial article (Appendix N).

Copies of the survey were also provided to all interviewees and households in the Village of Wollar, and to people and organisations on WCPL's stakeholder register.

Consultation undertaken specific to the Project Social Impact Assessment is summarised in Table 4-44. A summary of findings from this consultation as well as additional background research is provided in Table 4-45. This includes findings that relate to local, regional and broader regional areas of potential relevance to the Project. A summary of the findings for the local area (Village of Wollar and surrounds) is provided below.

The Village of Wollar was established as a hub to support the surrounding pastoral properties. Population within the village fluctuated over time with peaks occurring during the Gulgong gold rush of the 1870s and during the construction of the Sandy Hollow Gulgong Railway during the 1930s (Appendix N).

Population began to decline in the 1960s with a resurgence in the 1980s as people sought lifestyle blocks in the area. However, these small holdings tended to fail resulting in a gradual drift away from the area. The population decline in recent decades is evidenced by Wollar Public School enrolments dropping from 32 in 1990 to eight in 2015 (Appendix N).

By 2006, the population of the Wollar 'State Suburb' (with an area of 795 km^2) was 304 people. In 2011, the State Suburb had been expanded to include adjacent areas including the Village of Ulan, with an area of 963 km^2, however, the population had declined to 260 people (Appendix N).

In early 2015, the Wollar community (Village of Wollar and surrounding areas) included approximately 23 households, with an estimated population of between 40 and 50 people. Within the Village of Wollar there are approximately seven privately-owned households (Appendix N).

Table 4-44
Summary of Social Impact Assessment Stakeholder Engagement and Consultation

Stakeholder	Initiative
Directly affected and adjacent properties	• Interviews with Village of Wollar residents, ex-residents and local stakeholders. • Community survey.
Social and cultural values in communities closest to the Project	• Consultation/engagement with Village of Wollar residents (current and former). • Community survey. • WCPL employee survey.
Social infrastructure and service providers	• Consultation with MWRC. • Meetings/consultation with social infrastructure, education, training and employment providers (Wollar Public School, Ulan Public School, Mudgee Medical Centre, Cooks Gap RFS, NSW Ambulance Service – Central West Zone and NSW Police – Mudgee Local Area Command. • Community survey. • WCPL employee survey.
Workforce participation, employment and diversity profile	• Consultation with MWRC representatives on need and capacity issues. • Community survey. • WCPL employee survey.
Regional stakeholders	• Newsletters and website updates. • Interviews with Village of Wollar residents, ex-residents and local stakeholders. • Community survey.

Source: Appendix N.

Table 4-45
Summary of Key Local and Regional Social Impact Assessment Baseline Findings

Social Aspect	Key Local and Regional Baseline Findings
Planning Considerations	• Regional and broader regional planning challenges include housing, uneven distribution of economic growth and infrastructure (including social) and land use associated with mining industry growth. • The region and broader region is characterised by diversified production combining cropping with sheep meat, wool or cattle production, and a broad range of agricultural industries.
Social and Cultural Values	• A decline in the population of the Village of Wollar area has resulted in a decline in local community networks and service levels. • Local amenity associated with the Village of Wollar (including heritage features) is valued, although the integrity of some physical structures is declining. • Connections to history and heritage and achieving balance between the natural environment and economic drivers are key regional values.
Amenity	• With the exception of open spaces and access to bush land, poor local amenity was identified (e.g. dilapidated structures, isolation and limited social infrastructure). • The region and broader region have a good level of amenity, particularly in Mudgee.

Table 4-45 (Continued)
Regional Social Impact Assessment Baseline Findings

Social Aspect	Key Local and Regional Baseline Findings
Social Infrastructure and Services	• Primary schools available in Village of Wollar, Ulan, and Gulgong although viability of Wollar Public School is currently under review by the NSW Department of Education. • High schools in Gulgong and Mudgee, with capacity issues identified for Mudgee Public High in 2012. • Despite local population decline, the local shop in the Village of Wollar has continued to operate, largely due to Peabody Energy ownership and continued funding by WCPL. • In 2012, TAFE Western Mudgee College was identified as unable to meet training demands as part of demand for mining apprenticeships. • The closest university to the Project is the Dubbo campus of Charles Sturt University (i.e. some 150 km to the west). • Interviewees indicated that there was a waiting list for access to GPs across the region. • Three public hospitals and/or health services are present within the region: Gulgong, Mudgee and Rylstone. All of which include emergency services, although they are listed with less than 50-bed capacity. Additional hospital/health services are available in the broader region (i.e. in adjoining LGAs).
Police and Emergency Services	• There are four police stations in the Mid-Western Regional LGA. Police representatives indicate there is capacity to service small increases in demand. • Three primary response Ambulance Service stations are present within the region. Each with capacity to meet increased population demand. • The local area is part of the Cudgegong Rural Fire District NSW RFS, which noted that mine employees contribute to fire-fighting capacity in the region. Local access and capacity issues were identified by Wollar stakeholders.
Housing Profile	• Almost half of the Wollar State Suburb Code's[1] housing stock in 2011 (175 dwellings) were unoccupied. These are a portion of the 1,913 unoccupied dwellings within the Mid-Western Regional LGA. • No rentals available in the Village of Wollar or Ulan at 3 November 2014, with 30 dwellings available in Gulgong and 155 in Mudgee. • No sales listings at 3 November 2014 in the Village of Wollar and one listed on the outskirts of Ulan, while Gulgong offered 48 houses and Mudgee offered in the order of 265 houses and 14 units for sale.

Source: After Appendix N.

[1] State Suburb Code is the smallest geographical area for which the ABS census data is released. The Wollar State Suburb Code includes the gazetted localities of Cumbo, Mogo, Turill, Ulan and Wollar.

Despite the decline in the local population the local shop in the Village of Wollar has continued to operate, largely due to Peabody Energy ownership and continued funding by WCPL. Should WCPL funding of the local shop discontinue, it is expected that the local shop would close.

The majority of houses in the Village of Wollar are owned by Peabody Energy, with some accommodating WCPL employees. If remaining private landowners within the Village of Wollar choose to sell to Peabody Energy, the population decline would continue (Appendix N).

4.17.2 Potential Impacts

Elliott Whiteing (2015) has determined the potential impacts of the Project on local and regional communities and centres.

The potential cumulative impacts of the Project and other proposed, approved or recently commenced resource projects within the Mid-Western Regional LGA have also been considered in Appendix N.

The potential economic impacts of the Project are described in Section 4.16.

Employment

As described in Section 2.17, the Project operational workforce (at full development) would be in the order of 625 on-site personnel, an increase of approximately 75 personnel from the workforce of the approved mine. Construction and development activities would also require up to approximately 100 personnel in the first 12 months, with smaller peaks of up to 40 people anticipated in later years.

The Project would increase availability and longevity of employment at the Wilpinjong Coal Mine. This increased employment would help maintain a stable economic base in the region (i.e. Mid-Western Regional LGA) (Appendix N).

Population Change

Regional population growth associated with the Project would be minor and would have no discernible effects on demographic characteristics such as age or cultural diversity at a regional level (Appendix N).

The isolation and limited number of habitable vacant dwellings in the Village of Wollar provides limited opportunity for significant increases in local population (Appendix N).

Housing Availability

Non-local construction workers may require temporary accommodation in the region during their shifts. Up to 50 beds (in temporary accommodation or shared rental housing) may be required in peak periods (Appendix N).

New employees who move to the region would require housing, in the approximate range of 10 dwellings by 2018 and a total of 18 dwellings by 2024 (Appendix N).

There is a good range of hotels and motels in the region, and currently a good supply of rental accommodation. Project construction is not expected to materially affect rental housing availability or affordability (Appendix N).

The Project is unlikely to have a significant adverse effect on temporary accommodation capacity, rather the increase in business is likely to be welcomed by accommodation providers (Appendix N).

In the context of the number of dwellings currently available for rent or purchase in the region and approved residential developments yet to be constructed, housing stock would have the capacity to meet incremental Project housing requirements (i.e. negative effects on access to housing for existing residents is not anticipated) (Appendix N).

Businesses

Both of the construction and operational phases would contribute to indirect employment opportunities and to continued job security within businesses in the region and broader region, through contractual arrangements with suppliers (Appendix N).

Social Infrastructure

Construction generated demand on social infrastructure (e.g. health care services, emergency services, childcare, education centres, etc.) is not expected to be discernible in the regional context (Appendix N).

While the Project represents a potential positive stimulus to the education and training sector, demand for social infrastructure from additional Project operational employment would generally be low and also indiscernible in the regional context (Appendix N).

The Project's operational phase is unlikely to generate demand for the Wollar Public School or the visiting health service. The Project represents a potential opportunity to maintain or increase local RFS capacity with additional employee membership (Appendix N).

Social Sustainability

The Project would support economic stability and community confidence in the region for a further seven years beyond the life of the current Wilpinjong Coal Mine. This includes Peabody Energy's agricultural properties contributing to the maintenance of rural uses and agricultural productivity in the region (Appendix N).

Within the Village of Wollar the general store and (potentially) the school are already operating below viable thresholds (Appendix N).

While not a direct Project impact, further Peabody Energy property purchases have the potential to accelerate the existing decline of an already small population living in the Village of Wollar. This would further reduce the community's ability to sustain social resources (e.g. neighbourly support, the local park and Community Hall) and further challenge the viability of the Wollar community (Appendix N).

Amenity

The Project would not have any regional scale amenity impacts (Appendix N).

Although the current Wilpinjong Coal Mine operates in accordance with Project Approval 05-0021 and its various subsidiary approvals, licences and leases, some local residents report that they experience anxiety and sleep disturbance due to the Wilpinjong Coal Mine (Appendix N). The Project would result in a seven year extension to the mine and therefore extends the period of potential for these reported impacts.

Potential impacts relating to noise (i.e. potential sleep disturbance) and dust impacts are described in Sections 4.3 and 4.4.

Quality of Life/Wellbeing and Sense of Place

Regionally, continuation of employment would contribute to individual and household well-being for employees and their families, and contribute to economic development.

On a regional scale, the Project represents a potential positive change to quality of life and community wellbeing (Appendix N).

Impacts on sense of place are not likely at a regional level, except in relation to residents in the region who feel connected to the Village of Wollar (e.g. former Wollar residents) (Appendix N).

The Project would extend the life of the Wilpinjong Coal Mine and, therefore, any associated impacts on wellbeing and quality of life that are perceived in the local community.

Village of Wollar residents and ex-residents report as having a relationship with the village's history, built features, and community. General deterioration of the village and declining community resources to contribute towards its upkeep are affecting social character (Appendix N).

The existing isolation and declining population of the Village of Wollar may be accelerated by the Project if the closer proximity of the mine (to the village) results in additional residents electing to move away (Appendix N).

Cumulative Impacts

The potential cumulative impacts of the Project and other approved or recently commenced resource projects within the Mid-Western Regional LGA have been considered in Appendix N.

Key findings of the cumulative assessment include (Appendix N):

- It is unlikely that all of the approved or recently commenced projects would be in a construction phase simultaneously.
- Cumulative demands for construction labour would have minimal impact on the availability of labour for other industries in the region.
- Large numbers of construction workers can impact the local values of regional centres by 'crowding-out' locals. Mid-Western Regional LGA communities have recent experience managing increases in the temporary population (and associated demand on local services such as hotels and temporary accommodation) from a period of high mining activity in 2012-2013.
- Opportunities for local and regional businesses would exist during any period of increased demand for goods and services due to the cumulative impacts of multiple resource projects, which is expected to be welcomed.

The Project is, therefore, unlikely to materially add to a regionally significant cumulative impact.

4.17.3 Mitigation and Management Measures

WCPL has developed key strategies to mitigate the Project's social impacts and to maximise Project benefits for the region.

These strategies and the specific actions to be undertaken by WCPL or jointly with other stakeholders are described in Appendix N and summarised below:

- continue consultation and information dissemination including via the Wollar Progress Association, Project CCC, blast notifications, Project updates, Project community hotline, consultation regarding complaints and periodic advice regarding opportunities through the community investment program;
- investigate options for supporting an alternative postal service for the local community in the event that WCPL funding for the local shop is discontinued;
- maintain local advertisement of employment opportunities;
- continue consultation with the MWRC and relevant State agencies to confirm changes in social conditions (e.g. population estimates and housing availability) and to identify any other issues that would inform social strategies;
- continue consultation with the MWRC and regional service providers regarding the Project; and
- continue support of selected community and cultural events, both in the local area and in support of regional community values (in consultation with local stakeholders and MWRC).

In addition to the strategies summarised above (and as described in Section 6.2.8), it is expected that a voluntary planning agreement would either be negotiated prior to determination of the development application for the Project, or would be required by the conditions of the Development Consent for the Project.

4.18 GREENHOUSE GAS EMISSIONS

4.18.1 Quantitative Assessment of Potential Greenhouse Gas Emissions

A quantitative assessment of Project greenhouse gas emissions was undertaken by Todoroski Air Sciences (2015) and is provided in Appendix B. A summary of the assessment is provided below.

Greenhouse Gas Protocol Emission Scopes

The Greenhouse Gas Protocol (GHG Protocol) (World Business Council for Sustainable Development [WBCSD] and World Resources Institute [WRI], 2004) defines three 'scopes' of emissions (Scopes 1, 2 and 3). Scopes 1 and 2 have been defined such that two or more entities would not account for the same emissions in the same scope.

Scope 1: Direct Greenhouse Gas Emissions

Direct greenhouse gas emissions are defined as those emissions that occur from sources that are owned or controlled by the entity (WBCSD and WRI, 2004). Direct greenhouse gas emissions are those emissions that are principally the result of the types of activities undertaken by an entity that are listed below:

- Generation of electricity, heat or steam. These emissions result from combustion of fuels in stationary sources (e.g. boilers, furnaces and turbines).
- Transportation of materials, products, waste, and employees. These emissions result from the combustion of fuels in entity owned/controlled mobile combustion sources (e.g. trucks, trains, ships, aeroplanes, buses and cars).
- Fugitive emissions. These emissions result from intentional or unintentional releases (e.g. equipment leaks from joints, seals, packing, and gaskets; methane emissions from coal mines and venting; hydroflurocarbon emissions during the use of refrigeration and air conditioning equipment; and methane leakages from gas transport) (WBCSD and WRI, 2004).

Scope 2: Electricity Indirect Greenhouse Gas Emissions

Scope 2 emissions are a category of indirect emissions that account for greenhouse gas emissions from the generation of purchased electricity consumed by the entity.

Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the entity (WBCSD and WRI, 2004). Scope 2 emissions physically occur at the facility where electricity is generated (WBCSD and WRI, 2004). Entities report the emissions from the generation of purchased electricity that is consumed in its owned or controlled equipment or operations as Scope 2.

Scope 3: Other Indirect Greenhouse Gas Emissions

Under the GHG Protocol, Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions.

Scope 3 emissions are defined as those emissions that are a consequence of the activities of an entity, but which arise from sources not owned or controlled by that entity. Some examples of Scope 3 activities provided in the GHG Protocol are extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services (WBCSD and WRI, 2004).

The GHG Protocol provides that reporting of Scope 3 emissions is optional (WBCSD and WRI, 2004). If an organisation believes that Scope 3 emissions are a significant component of the total emissions inventory, these can be reported along with Scope 1 and 2. However, the GHG Protocol also notes that reporting Scope 3 emissions can result in double counting of emissions and can also make comparisons between organisations and/or projects difficult because reporting is voluntary.

Greenhouse Gas Emissions Estimation Methodology

Project direct and indirect greenhouse gas emissions have been estimated by Todoroski Air Sciences (2015) (Appendix B) using published emission factors from the *National Greenhouse Accounts Factors July 2014* (NGA Factors) (DotE, 2014), where possible.

Where NGA Factors were not available (e.g. for rail transport of product coal), greenhouse gas emissions have been estimated based on emission projections for the same activities for similar projects. Fugitive emissions have been calculated using site-specific emission data.

The NGA Factors provide greenhouse gas emission factors for carbon dioxide, methane and nitrous oxide. Emission factors are standardised for each of these greenhouse gases by being expressed as a carbon dioxide equivalent (CO_2-e) based on their Global Warming Potential. This is determined by the differing periods that greenhouse gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation (e.g. methane has a Global Warming Potential 21 times that of carbon dioxide) (DotE, 2014).

Project Greenhouse Gas Emissions

A summary of potential Project greenhouse gas emission sources and their respective scopes is provided in Table 4-46.

The total direct (i.e. Scope 1) emissions over the life of the Project are estimated to be approximately 2 million tonnes of carbon dioxide equivalent (Mt CO_2-e), which is an average of approximately 0.12 Mt CO_2-e per annum over the life of the Project (Appendix B).

The total indirect emissions (i.e. Scopes 2 and 3) over the life of the Project are estimated to be approximately 347 Mt CO_2-e, which is an average of approximately 20.4 Mt CO_2-e per annum. Approximately 97% (337 Mt) of these emissions would be associated with the Scope 3 combustion of product coal by third parties (Appendix B).

It should be noted that the above greenhouse gas emission estimates are inclusive of the approved Wilpinjong Coal Mine operations for the remainder of the approved mine life.

Project Greenhouse Gas Emissions Intensity

The estimated greenhouse gas emissions intensity of the Project (including the approved Wilpinjong Coal Mine) is approximately 0.01 tonnes of carbon dioxide equivalent per tonne (t CO_2-e/t) of ROM coal (this includes all Scope 1 and 2 emissions). This makes the Wilpinjong Coal Mine one of the most efficient mining operations in NSW in terms of greenhouse gas emissions intensity (Appendix B).

Table 4-46
Summary of Potential Project Greenhouse Gas Emissions

Component	Direct Emissions	Indirect Emissions	
	Scope 1	Scope 2	Scope 3
Electricity Consumption for the Processing of Project ROM Coal	N/A	Emissions from the generation of purchased electricity used at the Project.	Emissions from the extraction, production and transport of fuel burned for the generation of electricity consumed, and the electricity lost in delivery in the transmission and distribution network.
Diesel Consumption	Emissions from the combustion of diesel at the Project.	N/A	Emissions attributable to the extraction, production and transport of diesel consumed at the Project.
Explosives	Emissions from the use of explosives.	N/A	N/A
Fugitive	Fugitive emissions that result from the extraction of coal.	N/A	N/A
Grease and Oils	Emissions from the combustion of petroleum based grease and oil at the Project.	N/A	Emissions attributable to the extraction, production and transport of grease and oil consumed at the Project.
Product Coal Transport	N/A	N/A	Emissions from the combustion of diesel used by the rail haulage and shipping contractors.
Combustion of Coal	N/A	N/A	Third party emissions from the combustion of product coal from the Project.

Source: Appendix B.

Potential Impacts of Greenhouse Gas Emissions on the Environment

The Project's contribution to projected climate change, and the associated environmental impacts, would be in proportion with its contribution to global greenhouse gas emissions (Appendix B).

The Project's contribution to Australian emissions would be relatively small, as estimated annual average Scope 1 and 2 emissions from the Project (0.13 Mt CO_2-e) represent approximately 0.02% of Australia's annual greenhouse gas emission from 2013/2014 (543 Mt CO_2-e) (Appendix B).

Increased global greenhouse gas levels have the potential to alter climate variables such as temperature, rainfall and evaporation. Projected changes to climate variables would have associated impacts, including to land, settlements and ecosystems, as described in Section 6.

4.18.2 Australian Greenhouse Gas Emissions Reduction Targets

The potential impacts of greenhouse gas emissions from all Australian sources will be collectively managed at a national level, through initiatives implemented by the Commonwealth Government.

The Commonwealth Government has committed to reduce greenhouse gas emissions by 5% below 2000 levels by 2020, consistent with Australia's commitments under the Kyoto Protocol (Commonwealth of Australia, 2014).

The Emissions Reduction Fund is the centrepiece of a suite of Commonwealth Government policies designed to incentivise business and other entities to adopt better technologies and practices to reduce greenhouse gas emissions (Commonwealth of Australia, 2014).

WCPL would also implement Project-specific greenhouse gas mitigation measures, as described below.

4.18.3 Project Greenhouse Gas Mitigation Measures, Management and Monitoring

Air Quality management at the Wilpinjong Coal Mine is currently undertaken in accordance with the Air Quality Management Plan.

In relation to greenhouse gas emissions, the plan describes that emissions are minimised through the efficient use of diesel by mobile equipment. Diesel use is minimised by:

- optimising the design of haul roads to minimise the distance travelled between the pit and the CHPP;
- minimising the rehandling of material (i.e. coal, overburden and topsoil); and
- maintaining mobile equipment in good operating order.

The plan also describes a number of greenhouse gas abatement measures and mining efficiency improvement projects, including:

- optimisation of dozer pushing (i.e. increasing the amount of material moved by dozers);
- increasing the bucket size on excavators to move more material with each bucket load;
- introduction of new, more efficient equipment to site (e.g. mobile equipment upgrade);
- operational practices (e.g. unattended plant is not left idling and is switched off as soon as practicable after use);
- encouragement of staff car pooling; and
- use of solar power for monitoring equipment and investigations into its use for other operations.

In addition to those described above, the following measures would be undertaken as part of the Project:

- monitor the total site electricity consumption and investigate avenues to minimise the requirement;
- provide energy awareness programs for staff and contractors; and
- minimise the production of waste generated on-site.

The existing Air Quality Management Plan would be reviewed and updated to address the Project, subject to the conditions of any Development Consent for the Project.

WCPL would continue to assess and implement energy and greenhouse gas management initiatives during the Project. Peabody Energy would also report greenhouse gas emissions in accordance with the NGER Act.

4.19 HAZARD AND RISK

A Preliminary Hazard Analysis to evaluate the potential hazards associated with the Project was conducted by a multi-disciplinary team, including technical advisors from WCPL. The Preliminary Hazard Analysis was conducted in accordance with the general principles of risk evaluation and assessment outlined in the DP&I *Multi-Level Risk Assessment* (DP&I, 2011).

The Preliminary Hazard Analysis also addresses the requirements of *State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)* (SEPP 33) and has been assessed in general accordance with *Hazardous Industry Planning Advisory Paper No. 6: Hazard Analysis* (NSW Department of Planning [DoP], 2011).

Potential incidents and hazards identified for the Project are described in Section 4.19.1. Proposed preventative and control measures to address potential hazards are described in Section 4.19.2.

4.19.1 Hazard Identification and Risk Assessment

Potentially hazardous materials handled at the Project include hydrocarbons (petrol, diesel, oils, greases, degreasers and kerosene), explosives, chemicals and Liquid and Non-Liquid Wastes (Appendix Q).

In accordance with DP&I (2011), the Preliminary Hazard Analysis specifically covers the risks from fixed installations. As such, the main focus of the assessment was the on-site storage of potentially hazardous materials (Appendix Q).

Notwithstanding, because Project mining operations would, in some cases, be located in proximity to public roads, some additional risks relating to mining operations (e.g. blasting, open pit slumping and uncontrolled mobile equipment excursions off-site) were included in the Preliminary Hazard Analysis (Appendix Q).

The following generic classes of incidents were identified:

- leak/spill;
- fire;
- explosion;
- theft;
- uncontrolled/unauthorised movement;
- excessive vibration or overpressure;
- loss of structural integrity;
- equipment malfunction;
- flyrock; and
- pit slope failure.

These incident classes were applied to the Project component areas to identify scenarios for which treatment measures were developed.

Following identification of the potential hazards associated with the Project, a qualitative assessment of the risks to the public, property and the environment associated with the Project was undertaken (Appendix Q).

An assessment of the combination of the consequence and probability rankings concluded that the overall risk rankings for the identified hazards would be low, and therefore tolerable (Appendix Q).

4.19.2 Hazard Prevention and Mitigation Measures

A number of hazard control and mitigation measures are described in existing management plans which would be revised or proposed for the Project. The relevant management plans include:

- Blast Management Plan;
- Water Management Plan, including:
  - Cumbo Creek Relocation Plan;
  - Site Water Balance;
  - Erosion and Sediment Control Plan;
  - Surface Water Management and Monitoring Plan;
  - Groundwater Monitoring Program; and
  - Surface and Groundwater Response Plan.
- Rehabilitation Management Plan (contained in the MOP);
- Spontaneous Combustion Management Plan;
- Pollution Incident Response Management Plan;
- Air Quality Management Plan;
- Bushfire Management Plan; and
- Waste Management Plan (including a Life of Mine Tailings Strategy).

In addition, the following hazard control and mitigation measures would be adopted for the Project:

- **Maintenance** – Ongoing and timely maintenance of all mobile and fixed plant and equipment in accordance with the recommended maintenance schedule, and consistent with the maintenance schemes required by legislation.
- **Staff Training** – Operators and drivers would be trained and (where appropriate) licensed for their positions. Only those personnel licensed to undertake skilled and potentially hazardous work would be permitted to do so.
- **Engineering Structures** – Mining and civil engineering structures would be constructed in accordance with applicable codes, guidelines and Australian Standards. Where applicable, Peabody Energy would obtain the necessary licences and permits for engineering structures.
- **Contractor Management** – All contractors employed by Peabody Energy would be required to operate in accordance with the relevant Australian Standards and NSW legislation.
- **Water Management** – As reported in Appendix D, water management structures would be constructed to generally separate runoff from undisturbed areas and disturbed areas.

- **Coal Stockpile Management** – Coal stockpiles would be managed to reduce the potential for spontaneous combustion.
- **Storage Facilities** – Storage and usage procedures for potentially hazardous materials (i.e. fuels, lubricants and chemicals) would be developed in accordance with Australian Standards and relevant legislation. A register of chemicals and dangerous goods stored on-site would be kept up-to-date via a tracking, storage and chemical information management system.
- **Waste Management System** – Waste would be managed according to a hierarchy of waste control (avoidance, resource recovery and disposal). Waste disposal measures and a monitoring program are described in the Waste Management Plan.
- **Emergency Response** – Emergency response procedures, manuals and systems would continue to be implemented.