

Narrabri Mine Modification 5

Environmental Assessment

MAIN REPORT

APPENDICES

EXECUTIVE SUMMARY

Background

This document is an Environmental Assessment for a proposed modification to the Narrabri Mine (NM), which is an underground coal mining operation that is operated in accordance with Project Approval 08_0144.

The NM is operated by Narrabri Coal Operations Pty Ltd (NCOPL) on behalf of the Narrabri Joint Venture, which consists of Whitehaven Coal Limited's (Whitehaven) subsidiary Narrabri Coal Pty Ltd (70 percent [%]), Upper Horn Investments (Australia) Pty Ltd (7.5%), J-Power Australia Pty Limited (7.5%), EDF Trading Australia Pty Limited (7.5%), and Daewoo International Narrabri Investment Pty Limited and Kores Narrabri Pty Limited (7.5%).

Stage 1 of the NM was approved in 2007 under Part 3A of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act) and involved initial site establishment activities and continuous miner mining operations.

Project Approval 08_0144 for Stage 2 of the NM was issued under Part 3A of the EP&A Act in 2010 and allowed the mine to convert to a longwall mining operation.

Project Approval 08_0144 has been modified on three occasions since it was issued (Modifications 1, 2 and 4). A separate modification application regarding emergency road transportation of product coal (Modification 3) was lodged in December 2012 however was later withdrawn.

Project Approval 08_0144 allows for the production and processing of up to 8 million tonnes per annum (Mtpa) of ROM coal for a period of 21 years. ROM coal is processed at the NM to produce thermal and Pulverised Coal Injection product coal. Product coal is transported from the NM by rail to Newcastle.

Description of the Modification

NCOPL has conducted a review of the existing/approved NM operations to identify options to improve operational efficiency so that existing/approved NM infrastructure and equipment could be used to increase the ROM coal production beyond 8 Mtpa.

The review identified that the approved underground mine geometry could be changed (i.e. an increase in longwall (LW) panel widths for LW107 to LW120 from 295 metres [m] to 400 m) to allow for an increase in the ROM coal production rate up to approximately 11 Mtpa.

The proposed changes to the approved underground mine geometry would increase the period between longwall machine 'change-outs' (i.e. the process where a machine is removed from a complete longwall panel and reinstalled in the next panel) which currently suspends longwall mining operations by approximately 6 to 8 weeks each year. The period between longwall machine 'change-outs' would increase beyond 12 months and therefore longwall mining operations would be able to continue uninterrupted for periods of greater than 12 months. This, coupled with minor operational efficiency gains associated with the wider longwall panels, would allow the annual ROM coal production rate to increase up to approximately 11 Mtpa.

The Modification is sought under section 75W of the EP&A Act.

The Modification would not include any other significant changes to the existing/approved NM.

Table ES-1 provides a comparative summary of the existing/approved and proposed modified NM.

Environmental Review

The key potential impacts of the Modification are related to the incremental changes in subsidence associated with the modified underground mine layout. In addition, potential amenity impacts associated with the processing and handling of the additional ROM coal associated with the Modification (i.e. increase from 8 Mtpa up to 11 Mtpa) have been considered.

Table ES-1
Comparison of the Existing/Approved and Modified NM

Project Component	Existing/Approved ¹	Modified
Project Life	<ul style="list-style-type: none"> Mining operations approved until July 2031. 	<ul style="list-style-type: none"> Unchanged.
Tenement	<ul style="list-style-type: none"> Mining operations conducted within Mining Lease 1609. 	<ul style="list-style-type: none"> Unchanged.
Mining Method	<ul style="list-style-type: none"> Longwall mining of the Hoskissons Seam. 	<ul style="list-style-type: none"> Unchanged.
Underground Mine Geometry	<ul style="list-style-type: none"> Twenty-six longwall panels (LW101 to LW126). 295 m wide longwall panels. 	<ul style="list-style-type: none"> A reduction in the number of longwall panels from 26 to 20. An increase in longwall panel widths for LW107 to LW120 from 295 m to 400 m (LW101 to LW106 unchanged). Western extension of the underground mine footprint relative to the existing/approved underground longwall mine footprint of approximately 60 m.
ROM Coal Production	<ul style="list-style-type: none"> Total ROM coal production of approximately 170 million tonnes (Mt). ROM coal production of up to 8 Mtpa. 	<ul style="list-style-type: none"> Unchanged. An increase in ROM coal production from 8 Mtpa up to approximately 11 Mtpa.
Subsidence Commitments and Management	<ul style="list-style-type: none"> The subsidence impact performance measures listed in Conditions 2 and 3, Schedule 3 of Project Approval 08_0144. 	<ul style="list-style-type: none"> Unchanged.
Underground Mine Surface Infrastructure	<ul style="list-style-type: none"> Ventilation shafts, pre-drainage and goaf gas drainage sites, mine safety pre-conditioning sites (LW101 to LW105), access roads and electricity transmission lines. 	<ul style="list-style-type: none"> Unchanged. Mine safety pre-conditioning sites would be developed in LW106 to LW120.
Coal Washing	<ul style="list-style-type: none"> Coal Handling and Preparation Plant (CHPP) and secondary crusher/screen capable of processing approximately 2,000 tonnes (t) per hour. 	<ul style="list-style-type: none"> Unchanged.
Coal Handling and Stockpiling	<ul style="list-style-type: none"> ROM coal stockpile capacity of 700,000 t. Product coal stockpile capacity of 500,000 t. 	<ul style="list-style-type: none"> Unchanged.
Coal Reject Management	<ul style="list-style-type: none"> CHPP rejects emplaced in Rejects Emplacement Area. 	<ul style="list-style-type: none"> Unchanged.
Product Coal Transport	<ul style="list-style-type: none"> Product coal transported to Newcastle by rail. Peak of 8 trains per day (trains/day). Average of 3 trains/day. 	<ul style="list-style-type: none"> Increase in the average number of trains from 3 trains/day to 4 trains/day. Peak number of trains per day unchanged.
Water Management	<ul style="list-style-type: none"> Conducted in accordance with the Water Management Plan (URS Australia, 2013). 	<ul style="list-style-type: none"> Minor amendments to the site water management system.
Water Supply	<ul style="list-style-type: none"> Make-up water demand to be met from mine dewatering, runoff recovered from operational areas, and licensed extraction from Namoi River and Namoi River Alluvium. 	<ul style="list-style-type: none"> Unchanged.
Hours of Operation	<ul style="list-style-type: none"> 24 hours per day, seven days per week. 	<ul style="list-style-type: none"> Unchanged.
Employment	<ul style="list-style-type: none"> Operational workforce (employees and contractors) of approximately 370 employees. 	<ul style="list-style-type: none"> Unchanged.
Surface Development Footprint	<ul style="list-style-type: none"> Approximately 750 hectares (ha). 	<ul style="list-style-type: none"> The size of the surface development footprint would be unchanged. The location of underground mine surface infrastructure may change (i.e. to reflect changes in mine geometry).
Rehabilitation Strategy	<ul style="list-style-type: none"> Conducted in accordance with the Landscape Management Plan. 	<ul style="list-style-type: none"> Unchanged.

¹ Project Approval 08_0144 (as modified).

In order to assess the potential environmental impacts of the Modification, environmental reviews have been completed for issues related to the potential incremental changes in subsidence effects and potential amenity impacts. A summary of the key findings of these environmental reviews is provided below:

- Potential incremental changes in subsidence effects due to the modified underground mine layout would result in some changes to the maximum subsidence levels and strains and tilts, however the proposal would not change the approved level of subsidence impact associated with the existing/approved underground mine layout.
- Incremental subsidence effects due to the Modification, including changes to potential cracking and ponding/stream alignment would be limited (i.e. the level of impact would not change relative to the approved NM). Therefore, changes to impacts on land resources are not anticipated to be material. Notwithstanding, existing subsidence mitigation and management measures would continue to be implemented for the Modification and would be described in the relevant Extraction Plan.
- Potential groundwater impacts associated with incremental changes in subsurface behaviour above the approved underground mine footprint were assessed via quantitative modelling. The modelling showed that groundwater inflows would be similar to predictions for the existing/approved underground mine layout and previous predictions, albeit the peak inflows would occur earlier in the mine life. Overall changes to impacts on groundwater resources were minimal and within the Minimal Impact Considerations of the NSW Aquifer Interference Policy for highly productive groundwater. Groundwater resources would continue to be monitored and managed in accordance with the Water Management Plan.
- The effects of the proposed increased ROM coal processing and handling rates and groundwater inflows were assessed as part of a revised site water balance. This assessment indicated that the site water management system would continue to perform within its key objectives for the Modification.
- The modified underground mine layout involves a marginal (60 m) westerly extension relative to the existing/approved layout. Therefore, additional potential impacts on Aboriginal cultural heritage have been assessed, including a survey of this area and consideration of incremental changes to subsidence effects elsewhere as a result of the modified underground mine layout. This assessment did not identify any new Aboriginal cultural heritage sites in the extension area, and did not identify any additional impacts due to subsidence effects.
- Potential biodiversity impacts were assessed as part of the environmental review. Previous observations and studies on-site have identified the potential for impacts to large trees at low depths of cover (associated with the eastern portion of the NM) with less impacts at higher depths of cover (associated with the western portion of the NM). The assessment found that the Modification would not result in additional material changes to the subsidence impacts (e.g. cracking, land instability, reduction in soil moisture, soil erosion, deviation of surface flows and ponding), therefore, no material alteration to the existing/approved impacts of the NM on flora or fauna are anticipated.
- The Modification would not require any significant changes to the existing/approved coal handling and preparation infrastructure. The increased ROM coal processing rate would be achieved using the existing peak capacity of the existing/approved coal handling and preparation infrastructure more often. Therefore, the Modification would not result in any significant change to amenity impacts such as air quality and noise. Air quality and noise impacts would continue to be monitored at the NM.

Justification for the Modification

Operational longwall mining experience to date at the NM indicates that the longwall panel width could be increased to 400 m, and this change would reduce the amount of underground mine development that is required. This change would improve the efficiency of extraction of the NM coal resource (i.e. the Hoskissons Seam).

The Modification would not change the:

- overall life of mine;
- overall surface disturbance areas; and
- major surface infrastructure such as the CHPP, coal stockpiles and train loading.

The Modification is consistent with the subsidence impact performance measures in Project Approval 08_0144 and existing subsidence management measures. The modified underground mine layout is only predicted to result in minor incremental changes to subsidence effects and associated impacts.

Similarly, the increase in processing rate up to 11 Mtpa would increase the use of existing surface infrastructure, without the need of additional infrastructure. Therefore amenity impacts are anticipated to be minor.

The Modification would allow for the continued employment of the existing workforce at the NM.

It is therefore considered that the Modification is justified on environmental, economic and social grounds and that a section 75W modification is appropriate.

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1 INTRODUCTION

This document is an Environmental Assessment (EA) for a proposed modification to the Narrabri Mine (NM), which is an underground coal mining operation that is operated in accordance with Project Approval 08_0144.

The NM is operated by Narrabri Coal Operations Pty Ltd (NCOPL) on behalf of the Narrabri Joint Venture, which consists of Whitehaven Coal Limited's (Whitehaven) subsidiary Narrabri Coal Pty Ltd (70 percent [%]), Upper Horn Investments (Australia) Pty Ltd (7.5%), J-Power Australia Pty Limited (7.5%), EDF Trading Australia Pty Limited (7.5%), and Daewoo International Narrabri Investment Pty Limited and Kores Narrabri Pty Limited (7.5%).

Modification 5 (the Modification) is sought under section 75W of the New South Wales (NSW) *Environmental Planning and Assessment Act, 1979* (EP&A Act).

1.1 OVERVIEW OF THE EXISTING/APPROVED NARRABRI MINE

The NM is located approximately 28 kilometres (km) south-east of Narrabri and approximately 65 km north-west of Gunnedah in the Gunnedah Basin, NSW (Figure 1).

Stage 1 of the NM was approved under Part 3A of the EP&A Act in 2007 and involved initial site establishment activities and continuous miner mining operations.

Project Approval 08_0144 for Stage 2 of the NM was issued under Part 3A of the EP&A Act in 2010 and allowed the mine to convert to a longwall mining operation.

Project Approval 08_0144 has been modified on three occasions since it was issued:

- March 2011 – to update subsidence management conditions in Project Approval 08_0144;
- December 2011 – to allow for one-off road transport of coal to the Tarrawonga Coal Mine; and
- September 2015 – to allow for the extension of the run-of-mine (ROM) and product coal stockpiles.

A separate modification application regarding emergency road transportation of product coal (Modification 3) was lodged in December 2012 however was later withdrawn.

Project Approval 08_0144 allows for the production and processing of up to 8 million tonnes per annum (Mtpa) of ROM coal for a period of 21 years. ROM coal is processed at the NM to produce thermal and Pulverised Coal Injection (PCI) product coal. Product coal is transported from the NM by rail to Newcastle.

The existing/approved NM general arrangement is shown on Figure 2.

1.2 OVERVIEW AND JUSTIFICATION FOR THE MODIFICATION

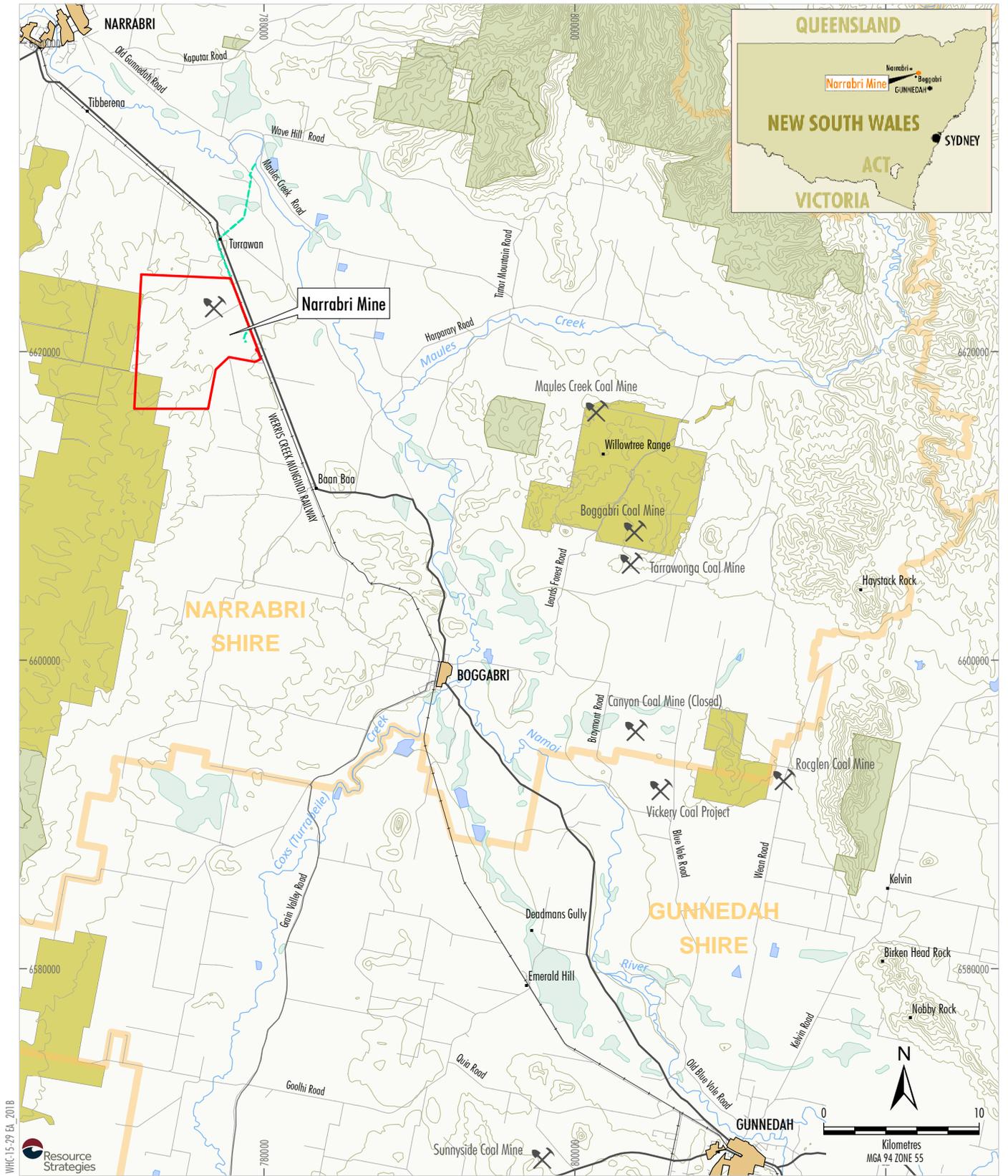
NCOPL has conducted a review of the existing/approved NM operations to identify options to improve operational efficiency so that existing/approved NM infrastructure and equipment could be used to increase the ROM coal production beyond 8 Mtpa.

The review identified that the approved underground mine geometry could be changed to allow for an increase in the ROM coal production rate up to approximately 11 Mtpa.

The proposed changes to the approved underground mine geometry would increase the period between longwall machine 'change-outs' (i.e. the process where a machine is removed from a complete longwall panel and reinstalled in the next panel) which currently suspends longwall mining operations by approximately 6 to 8 weeks each year. The period between longwall machine 'change-outs' would increase beyond 12 months and therefore longwall mining operations would be able to continue uninterrupted for periods of greater than 12 months. This, coupled with minor operational efficiency gains associated with the wider longwall panels, would allow the annual ROM coal production rate to increase up to approximately 11 Mtpa.

The Modification would not include any other significant changes to the existing/approved NM.

Table 1 provides a comparative summary of the existing/approved and proposed modified NM.



WHC-15-29 EA, 2018



LEGEND

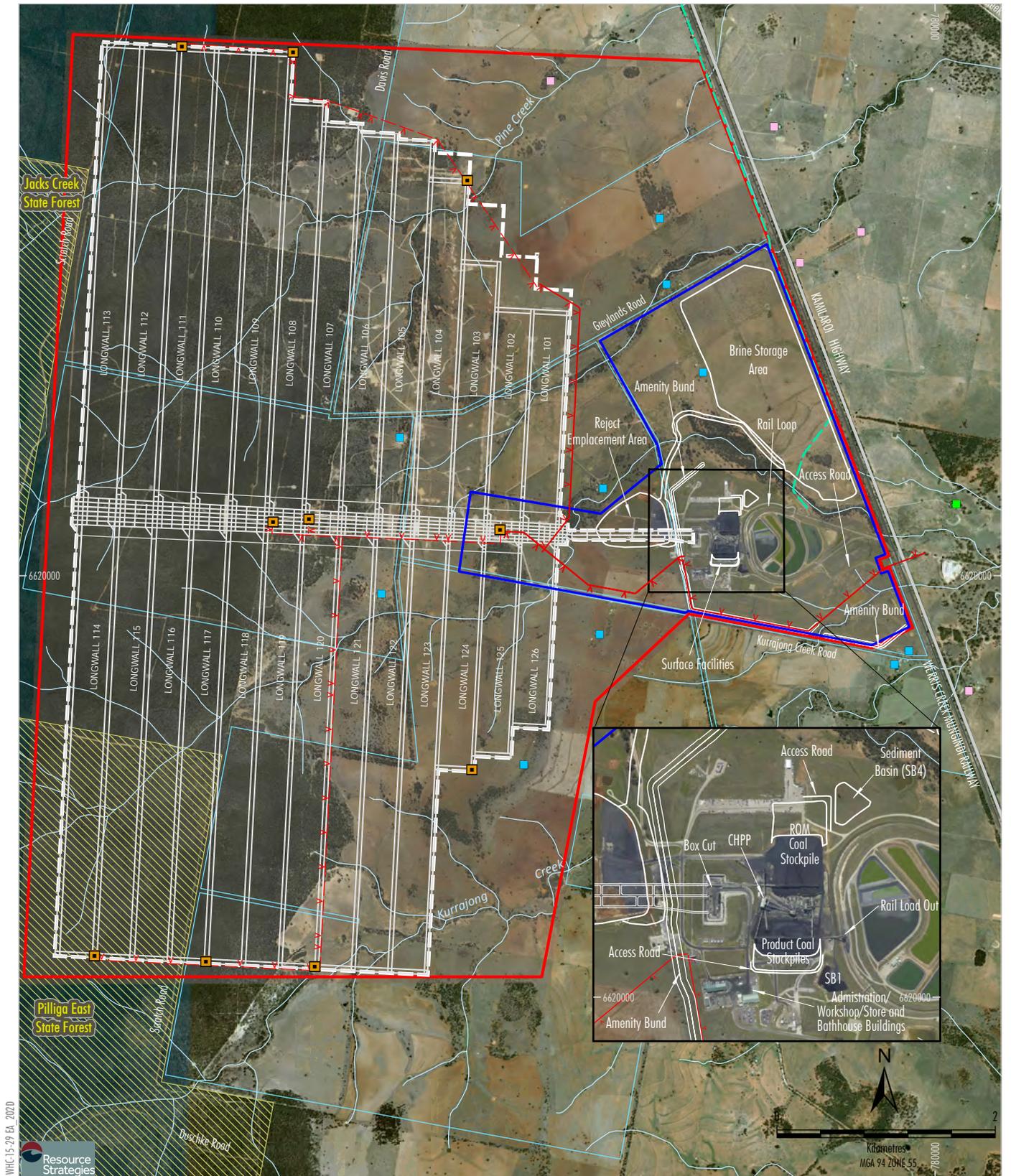
-  Local Government Boundary
-  NSW State Forest
-  National Park, Nature Reserve or State Conservation Area
-  Mine Lease Boundary (ML 1609)
-  Namoi River Water Pipeline
-  Mining Operation

Source: Geoscience Australia, 2006 and NSW Trade & Investment, 2013



NARRABRI MINE
Regional Location

Figure 1



Source: Orthophotos - Whitehaven Coal (March 2015) and Google Earth (Feb 2015); R.W. Corkery & Co Pty Ltd (2009), NSW Trade & Investment (2015) and NCOPL (2015)

WHITEHAVEN COAL

NARRABRI MINE

**Existing/Approved Narrabri Mine
Indicative General Arrangement**

Figure 2

**Table 1
Comparison of the Existing/Approved and Modified NM**

Project Component	Existing/Approved¹	Modified
Project Life	<ul style="list-style-type: none"> Mining operations approved until July 2031. 	<ul style="list-style-type: none"> Unchanged.
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Mining Method	<ul style="list-style-type: none"> Longwall mining of the Hoskissons Seam. 	<ul style="list-style-type: none"> Unchanged.
Underground Mine Geometry	<ul style="list-style-type: none"> Twenty-six longwall panels (LW101 to LW126). 295 metres (m) wide longwall panels. 	<ul style="list-style-type: none"> A reduction in the number of longwall panels from 26 to 20. An increase in longwall panel widths for LW107 to LW120 from 295 m to 400 m (LW101 to LW106 unchanged). Western extension of the underground mine footprint relative to the existing/approved underground longwall mine footprint of approximately 60 m.
ROM Coal Production	<ul style="list-style-type: none"> Total ROM coal production of approximately 170 million tonnes (Mt). ROM coal production of up to 8 Mtpa. 	<ul style="list-style-type: none"> Unchanged. An increase in ROM coal production from 8 Mtpa up to approximately 11 Mtpa.
Subsidence Commitments and Management	<ul style="list-style-type: none"> The subsidence impact performance measures listed in Conditions 2 and 3, Schedule 3 of Project Approval 08-0144. 	<ul style="list-style-type: none"> Unchanged.
Underground Mine Surface Infrastructure	<ul style="list-style-type: none"> Ventilation shafts, pre-drainage and goaf gas drainage sites, mine safety pre-conditioning sites (LW101 to LW105), access roads and electricity transmission lines. 	<ul style="list-style-type: none"> Unchanged. Mine safety pre-conditioning sites would be developed in LW106 to LW120.
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Water Supply	<ul style="list-style-type: none"> Make-up water demand to be met from mine dewatering, runoff recovered from operational areas, and licensed extraction from Namoi River and Namoi River Alluvium. 	<ul style="list-style-type: none"> Unchanged.
Hours of Operation	<ul style="list-style-type: none"> 24 hours per day, seven days per week. 	<ul style="list-style-type: none"> Unchanged.
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Surface Development Footprint	<ul style="list-style-type: none"> Approximately 750 hectares (ha). 	<ul style="list-style-type: none"> The size of the surface development footprint would be unchanged. The location of underground mine surface infrastructure may change (i.e. to reflect changes in mine geometry).
Rehabilitation Strategy	<ul style="list-style-type: none"> Conducted in accordance with the Landscape Management Plan. 	<ul style="list-style-type: none"> Unchanged.

¹ Project Approval 08_0144 (as modified).

1.3 CONSULTATION

Consultation has been conducted with the local community and key local and state government agencies during the preparation of this EA.

A summary of this consultation is provided below.

It is anticipated that consultation with the local community, key NSW Government agencies and relevant local governments will continue during the public exhibition of this EA and the assessment of the proposal by the NSW Government.

NSW Government Agencies

NCOPL continues to consult with relevant NSW Government agencies on a regular basis in relation to the current NM operations.

Department of Planning and Environment

NCOPL met with the Department of Planning and Environment (DP&E) in Sydney on 27 May 2015. An overview of the Modification was provided and key assessment requirements and the proposed timing for EA lodgement were discussed.

A follow-up meeting was also held with the DP&E in Armidale on 21 July 2015 to describe preliminary environmental assessment outcomes and to provide an update on the proposed timing for EA lodgement.

Division of Resources and Energy

In July 2015, NCOPL provided a briefing package to NSW Division of Resources and Energy (DRE) within the Department of Industry, Skills and Regional Development that included an overview of the Modification, key assessment requirements and the proposed timing for EA lodgement.

A follow-up meeting with the DRE was held in Maitland on 19 August 2015. A description of preliminary environmental assessment outcomes, resource recovery outcomes, and an update on the proposed timing for EA lodgement was provided. It was noted at the meeting that the existing mining tenement would be sufficient to cater for the Project.

Office of Water

In July 2015, NCOPL provided a briefing package to NSW Office of Water (NOW) that included an overview of the Modification, key assessment requirements and the proposed timing for EA lodgement.

A follow-up briefing package was provided to NOW in August 2015 that included a summary of surface and groundwater assessment outcomes and water licensing.

Environment Protection Authority

NCOPL met with the Environment Protection Authority (EPA) in Armidale on 21 July 2015. An overview of the Modification, preliminary noise, air quality and water quality assessment outcomes were provided. Environment Protection Licence (EPL) 12798 variation requirements were also discussed.

Items discussed included recent noise monitoring outcomes and noise movement responses by NCOPL.

Roads and Maritime Service

In July 2015, NCOPL provided a briefing package to Roads and Maritime Service (RMS) that included an overview of the Modification and potential road transport impacts, and outlined the proposed timing for EA lodgement.

Office of Environment and Heritage

NCOPL met with the Office of Environment and Heritage (OEH) in Dubbo on 26 August 2015. An overview of the Modification and a summary of preliminary Aboriginal cultural heritage and biodiversity impacts were provided.

Local Land Service

In July 2015, NCOPL provided a briefing package to Local Land Service that included an overview of the Modification and key assessment requirements and outlined the proposed timing for EA lodgement.

Forestry Corporation of NSW

NCOPL provided Forestry Corporation of NSW with a briefing package in August 2015 regarding the Modification. This package included a description of the small changes to the modified underground mine layout proposed in respect of Corporation of NSW.

Local Government

Narrabri Shire Council

The NM is located within the Narrabri Shire local government area (LGA).

The Narrabri Shire Council (NSC) has been updated on the Modification through its involvement in the Community Consultative Committee (CCC) (see below). Further information on the Modification was provided to the NSC during a meeting on 27 July 2015.

Gunnedah Shire Council

Although the NM is not located within the Gunnedah Shire LGA (Figure 1), members of the existing NM workforce reside in the Gunnedah Shire LGA and NM product coal is transported by train through the Gunnedah Shire LGA.

NCOPL met with the Gunnedah Shire Council (GSC) in Gunnedah on 31 July 2015. An overview of the Modification and the key environmental assessment issues related to the GSC were discussed during the meeting.

Local Community

A CCC for the NM is in place and provides a mechanism for ongoing communication between NCOPL and the local community.

NCOPL provided an overview of the Modification at the CCC meeting held on 10 June 2015.

Landholders in the vicinity of the NM were also provided information on the Modification in the NM Community Newsletter in August 2015.

Registered Aboriginal Parties (RAPs) were invited to participate in site surveys in July 2015. Details of site surveys are provided in Section 4.9.

Rail and Port Operators

NCOPL has consulted with the Australian Rail Track Corporation regarding an increase in rail movements dispatched from the NM as a result of the Modification.

Whitehaven's existing port allocations are sufficient for the increased rate of coal production associated with the Modification.

1.4 STRUCTURE OF THIS DOCUMENT

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

Section 1	Provides an overview and justification for the Modification, describes the structure of this EA and a summary of the consultation undertaken in relation to the Modification.
Section 2	Describes the existing/approved NM.
Section 3	Provides a description of the Modification.
Section 4	Provides an environmental assessment of the Modification and describes the existing environmental management systems and measures available to manage and monitor any potential impacts.
Section 5	Describes the general statutory context of the proposed Modification.
Section 6	Concludes the document.
Section 7	Lists documents and reports cited in this EA.

Appendices A to F provide supporting information as follows:

Appendix A	Subsidence Assessment
Appendix B	Groundwater Assessment
Appendix C	Surface Water Assessment
Appendix D	Noise Assessment
Appendix E	Air Quality and Greenhouse Gas Assessment
Appendix F	Aboriginal Cultural Heritage Assessment

2 OVERVIEW OF THE EXISTING/APPROVED NARRABRI MINE

2.1 UNDERGROUND MINING OPERATIONS

Development of the NM commenced in 2008 and production using continuous miner mining methods commenced in 2010.

Following the issue of Project Approval 08_0144 for Stage 2 of the NM, longwall mining operations commenced in 2012.

2.1.1 Indicative Mine Schedule

The NM is approved to produce up to 8 Mtpa of ROM coal until July 2031¹.

Mining operations are undertaken 24 hours per day, seven days per week.

During the 2014/2015 Annual Review period, approximately 6.7 Mt of ROM coal was mined at the NM (NCOPL, 2015a).

2.1.2 Layout of Underground Mining Area

The approved underground mining area consists of 26 longwall panels. The longwall panels are approximately 295 m wide and range from approximately 1.8 km to 4 km long (Figure 2).

Longwall mining is currently being undertaken in LW104 (Figure 2).

2.1.3 Underground Mine Access

Access to the underground mining area is via three drifts from the box cut located in the pit top area (Figure 2).

A conveyor to transfer ROM coal to the surface is located in one of the drifts.

The other drifts allow for employee, machine and material access and services (i.e. ventilation, water and electricity).

2.1.4 Subsidence Impact Performance Measures

Longwall mining at the NM is conducted to meet the subsidence impact performance measures outlined in Conditions 1 and 2, Schedule 3 of Project Approval 08_0144.

2.1.5 Major Underground Equipment and Mobile Fleet

The existing major underground equipment and mobile fleet currently used comprises (NCOPL, 2015a):

- longwall mining unit;
- continuous miners;
- personnel transport units;
- underground loaders;
- shuttle cars;
- feeder breakers; and
- underground drill rigs.

2.1.6 Mine Safety Pre-conditioning

Mine safety pre-conditioning of the Digby Conglomerate is undertaken in LW101 to LW106 to manage the effects of weighting on the longwall face and to reduce the risk of a windblast event occurring if the Digby Formation Conglomerate does not fracture and cave properly.

A series of boreholes are developed at both ends of each longwall panel to allow for mine safety pre-conditioning to occur.

These activities are conducted as per an approval issued under clause 88(1) of the *Coal Mine Health and Safety Regulation, 2006* (this has recently been repealed and replaced by clause 33 [High Risk Activity] of the *Work Health and Safety [Mines] Regulation 2014*), and are considered to be 'exempt development' under clauses 10(3)(g) and 10(4)(c) of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries), 2007* (the Mining SEPP), on the basis that the planned activities would have not greater than minimal environmental impact.

¹ The Narrabri Coal Mine Stage 2 Longwall Project Environmental Assessment (R.W. Corkery & Co, 2009) described a 28 year mine life (i.e. until 2037) however Condition 5, Schedule 2 of Project Approval 08_0144 restricts mining operations to July 2031.

2.1.7 Ventilation System

The ventilation system is progressively established to maintain a safe underground working environment. Three ventilation shafts will be established in the mains and an additional seven ventilation shafts will be established at the rear of the longwall panels (Figure 2).

2.1.8 Coal Seam Gas Management

Pre-Drainage

Pre-drainage of the coal seam is progressively conducted ahead of longwall mining operations through a combination of surface to in-seam borehole and conventional underground in-seam drainage methods.

Surface to in-seam boreholes extract gas from the coal seam to the surface where it is vented to the atmosphere. The number of pre-drainage sites required for each longwall panel depends on the gas quantity and content.

Groundwater extracted with the gas is transferred to the site water management system (Section 2.6).

Conventional in-seam drainage is undertaken by drilling into the seam from gate roads. The gas is extracted from the seam and then transferred to the surface where it is vented to the atmosphere.

The location of gas drainage infrastructure is determined based on operational and environmental factors at the time of construction.

Goaf Drainage

Goaf gas drainage is conducted behind the progressing longwall mining operations. Goaf drainage boreholes are used to drain the goaf gas.

Goaf drainage boreholes are established at regular intervals along each longwall panel depending on gas quantity and content. Unsealed access tracks will be constructed along the length of each longwall panel to allow for the construction and operation of the goaf drainage boreholes.

The location of gas drainage infrastructure is determined based on operational and environmental factors at the time of construction.

2.1.9 Mine Dewatering

Groundwater inflows to the underground workings are pumped to a sump in the box cut before being transferred to the site water management system (Section 2.6).

Groundwater inflows are estimated to peak at 3.89 million litres per day (ML/day) (Aquaterra, 2009).

Water extracted from the underground workings during the 2014/2015 Annual Review period averaged approximately 1.22 ML/day (NCOPL, 2015a).

2.1.10 Underground Mine Surface Infrastructure

Existing/approved underground mine surface infrastructure includes:

- mine safety pre-conditioning sites (LW101 to LW106);
- ventilation shafts (Figure 2);
- pre-drainage and goaf gas drainage sites;
- access roads; and
- electricity transmission lines (Figure 2).

2.2 PIT TOP AREA

The pit top area incorporates the majority of the NM surface infrastructure (Figure 2).

The following surface infrastructure is located in the pit top area:

- box cut (Section 2.1.3);
- CHPP (Section 2.3);
- ROM and product coal stockpiles and associated coal handling infrastructure (Section 2.3);
- reject emplacement area (Section 2.5);
- rail loop and product coal load-out infrastructure (Section 2.4);
- site water management infrastructure (water treatment plants; water storages, brine storage area, environmental storages and associated pumps and pipelines) (Section 2.6);
- administration, workshop, store and bathhouse buildings;
- range of service facilities (i.e. potable water, sewerage, electricity, waste management) (Section 2.7);

- longwall unit assembly area;
- access roads;
- car parking; and
- amenity bunds.

The existing major mobile fleet currently used on the surface includes (NCOPL, 2015a):

- dozers;
- trucks;
- water carts;
- excavators;
- grader; and
- drill rigs.

2.3 COAL HANDLING AND PREPARATION

ROM coal is primary sized (nominally less than 200 millimetres [mm]) underground before it is transferred to the ROM coal stockpile on the surface via the drift conveyor. A reversible tripper stacks the ROM coal on the ROM coal stockpile in conjunction with dozers.

The ROM coal is then either fed via reclaim valves to a rotary breaker or by dozer push to a chain feeder which feeds a secondary bypass crusher.

The rotary breaker reduces the size of the ROM coal to less than 125 mm before it is transferred to the CHPP. Waste generated from the rotary breaker is transferred to the reject emplacement area.

The CHPP produces a combined (part washed) (thermal) and washed (PCI) coal products. Coal fines from the CHPP are blended with the unwashed (thermal) product coal. Coal (coarse) reject generated at the CHPP is disposed in the reject emplacement area (Section 2.5).

Product coal from the CHPP is transferred to the product coal stockpile via conveyor in conjunction with dozers.

The product coal from the secondary bypass crusher is blended with the unwashed (thermal) product coal from the CHPP on the product coal stockpile or during train loading. No waste is generated from the secondary bypass crusher except for minor amounts of tramp material (e.g. poly-pipe).

2.4 PRODUCT COAL TRANSPORT

Condition 7, Schedule 2 of Project Approval 08_0144 requires product coal to be transported from the NM by rail.

Product coal is loaded onto trains 24 hours per day, seven days per week. An average of three trains are loaded each day and a maximum of 8 trains/day are loaded during peak coal transport periods.

Product coal from the NM is transported via the Werris Creek Mungindi Railway to the Port of Newcastle for export.

2.5 COAL REJECT MANAGEMENT

Coal reject generated during coal preparation at the NM (Section 2.3) includes coarse reject and fine reject. Only coarse reject waste is currently generated at the NM as fine reject from the CHPP is blended with the unwashed (thermal) product coal.

In accordance with Condition 8, Schedule 2 of Project Approval 08_0144, coal reject is not transported from the NM for disposal. The coal rejects are disposed in the reject emplacement area (Figure 2).

The reject emplacement area has been constructed with a compacted floor with a permeability of less than 1×10^{-9} metres per second (m/s) and a surface water runoff management system (NCOPL, 2015a).

Up to approximately 8 Mt of coal rejects will be disposed in the reject emplacement area over the life of the NM.

No waste is generated from the secondary bypass crusher except for minor amounts of tramp material (e.g. poly-pipe).

2.6 SITE WATER MANAGEMENT

2.6.1 Site Water Management System

The site water management strategy for the NM is based on the containment and re-use of mine water while diverting upstream water around the NM. The water management system includes:

- up-catchment diversion structures;
- raw water storage dams;
- saline water storage dams;
- filtered water storage dams;
- brine storage dams;
- sediment dams;

- reverse osmosis (RO) plant;
- Namoi River water pipeline; and
- other water transfer infrastructure (i.e. tanks, pumps and pipelines).

The water management system is progressively developed subject to its ongoing performance, prevailing climatic conditions and actual underground mine inflows.

The water management system is managed in accordance with the Water Management Plan (URS Australia, 2013).

A detailed description of the existing/approved site water management system is provided in Appendix C.

2.6.2 Water Demand and Supply

Water is required for mining operations, CHPP operations, washdown requirements, dust suppression, drilling and potable water supply.

The main water sources for the NM are:

- groundwater (saline) inflows into the underground workings;
- captured runoff from mine areas;
- raw water imported to site (e.g. Namoi River and Namoi River alluvium extraction); and
- potable water trucked to site.

The RO plant treats groundwater inflows and mine area runoff to produce filtered water and a brine waste product. The filtered water is used in mining operations.

Brine (generated from the RO plant) and groundwater inflows are used for dust suppression.

Mine area runoff and groundwater inflows are used in CHPP operations.

Raw water is used to supplement longwall mining and CHPP operations demand and to supply a separate water treatment plant used to produce potable water. Potable water is also transported to the NM to supplement the potable water supply from the water treatment plant.

NCOPL currently holds four Water Access Licences that allow for the extraction of 678 million litres (ML) from the Namoi River (Appendix C).

The water balance of the system fluctuates with the magnitude of groundwater inflows and climatic conditions over time.

2.6.3 Controlled Releases

In accordance with EPL 12789, NCOPL is permitted to discharge water collected in selected water storages, providing the discharge meets certain water quality criteria.

Filtered water from the RO plant that is not required for use at the NM will be piped to the Namoi River (Figure 1) for release in accordance with Condition 11, Schedule 4 of Project Approval 08_0144.

2.7 OTHER INFRASTRUCTURE AND SUPPORTING SYSTEMS

2.7.1 Site Access

Primary access to the NM site from the Kamilaroi Highway is via Kurrajong Creek Road and an internal sealed mine access road connecting the pit top area.

For environmental monitoring, general land management, exploration activities and other ancillary activities, alternative access points to the NM area are also used as required.

Unsealed access tracks will be constructed across the underground mining area and pit top area.

2.7.2 Electricity Supply and Distribution

The NM receives electricity via a spur line from a 66 kilovolt (kV) supply system adjacent the Kamilaroi Highway (Figure 2). Transformers in the pit top area step down the 66 kV supply to 11 kV for distribution by overhead cable or underground cable where necessary.

The 66 kV electricity transmission line will be progressively extended as ventilation shafts are developed (Figure 2).

2.7.3 Potable Water

As described in Section 2.6.2, potable water is supplied via an on-site water treatment plant and water transported to the NM.

A potable water supply reticulation system services the main pit top area facilities (e.g. office buildings and maintenance areas).

2.7.4 Dangerous Goods and Waste Management

Hydrocarbon Storages

Hydrocarbons used on-site include fuels (i.e. diesel and petrol), oils, greases, degreaser and kerosene.

Hydrocarbon storage facilities are constructed and operated in accordance with Australian Standard (AS) 1940:2004 *The Storage and Handling of Flammable and Combustible Liquids* and the NSW *Work Health and Safety Regulation, 2011*.

Liquid and Non-Liquid Wastes

Waste management at the NM is conducted in accordance with the Waste Management Plan (NCOPL, 2015b).

Solid and hazardous waste generated by the mine is removed from the site and disposed of by a licensed contractor.

Waste materials are collected and sorted for recycling of paper, cardboard, metals, glass, air filters and oil filters.

Sewage is treated in an on-site sewage treatment plant which is serviced by a licensed contractor.

2.8 CONSTRUCTION ACTIVITIES

Construction activities at the NM (when required) are restricted to 7.00 am to 10.00 pm up to seven days a week.

2.9 WORKFORCE

The existing operational workforce (employees and contractors) is approximately 370 personnel.

2.10 REHABILITATION

Rehabilitation at the NM is managed in accordance with the Landscape Management Plan (EcoLogical Australia Pty Ltd [EcoLogical], 2012a) which incorporates the following:

- Rehabilitation Management Plan (EcoLogical, 2012b); and
- Mine Closure Plan (GSS Environmental, 2011).

In accordance with Condition 2, Schedule 5 of Project Approval 08_0144, rehabilitation at the NM is undertaken progressively as areas/landforms become available. Approximately 97 ha of rehabilitation has been undertaken at the NM (NCOPL, 2015a).

A summary of the key elements of the rehabilitation program at the NM is provided below.

2.10.1 Rehabilitation Objectives

The rehabilitation objectives at the NM include (EcoLogical, 2012b):

Short-Term

- Minimise clearing/vegetation disturbance consistent with operational requirements.
- Rehabilitate areas of disturbance no longer required for mining related operations in accordance with the Rehabilitation Management Plan (EcoLogical, 2012b).
- Apply soil to the final landform based on material availability and post-mining land use.
- Stabilise all earthworks, drainage lines and disturbed areas required for mine-related activities to minimise erosion and sedimentation.
- Control vermin, feral animals and noxious weeds.
- Reduce the visibility of the activities from adjacent properties and the local road network.

Long-Term

- Control vermin, feral animals and noxious weeds. Continuation and/or restoration of biodiversity and ecological integrity of areas affected by mining or agriculture within ML 1609.
- Establish a low maintenance, geotechnically stable, safe and vegetated landform which blends in with the surrounding natural landscape.
- Backfill the box cut and blend the final landform with the surrounding topography such that the visual impact of the post-mining landform is minimised.
- Provide habitat for fauna and corridors for fauna movement within the final landform.
- Monitor rehabilitation success in terms of physical and biological parameters.

- Decommission and remove all project-related infrastructure not required for the future use of the site.
- Remediate any land contaminated by accumulated salts or hydrocarbon spills/leaks.
- The re-establishment of agricultural land of comparable land capability to that of the pre-disturbance environment (i.e. Rural Land Capability Class III).

2.10.2 Final Landform and Land Use Concepts

The final landform levels and topography of the rehabilitated NM site will generally approximate the pre-mining topography with the exception of the reject emplacement area and rail loop (if the rail loop is retained).

The final land use of the NM site is expected to include a combination of agriculture and remnant vegetation (EcoLogical, 2012a).

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

2.10.3 Revegetation Strategy

The revegetation strategy at the NM will include (EcoLogical, 2012b):

- Long lived perennial pasture grasses will be seeded to produce a vegetation regime compatible with the final land use (i.e. agriculture).
- Native tree species endemic to the area will be planted as paddock trees at low densities.
- Native woodland species, including overstorey, midstorey and understorey species, which are endemic to the area will be planted within the disturbed areas of remnant vegetation.

Native woodland species, including overstorey, midstorey and understorey species, which are endemic to the area have been planted at the base of the amenity bund to minimise visual impacts of the NM.

2.11 BIODIVERSITY OFFSETS

The Biodiversity Offset Strategy (EcoLogical, 2014a) outlines the biodiversity offsets for the NM. The Biodiversity Offset Strategy was approved by the DP&E on 11 August 2014.

NCOPL has commenced the implementation of the biodiversity offset areas and is currently investigating mechanisms for securing the offsets based on comments received by DP&E (NCOPL, 2015a).

2.12 ENVIRONMENTAL MONITORING AND MANAGEMENT

The NM environmental management system includes various environmental management plans and programs that have been developed and implemented since operations commenced, including:

- Environmental Management Strategy (NCOPL, 2015c).
- Noise Management Plan (NCOPL, 2015d).
- Air Quality Monitoring Program (NCOPL, 2015e).
- Water Management Plan (URS Australia, 2013) incorporating the following:
 - Site Water Balance;
 - Erosion and Sediment Control Plan;
 - Surface Water Monitoring Plan;
 - Groundwater Monitoring Program; and
 - Surface and Groundwater Response Plan.
- Aboriginal Cultural Heritage Management Plan (NCOPL, 2011).
- Energy Savings Action Plan (Advitech, 2014).
- Greenhouse Gas Minimisation Plan (SLR Consulting, 2012).
- Waste Management Plan (NCOPL, 2015b).
- Landscape Management Plan (Ecological, 2012a) incorporating the following:
 - Rehabilitation Management Plan (EcoLogical, 2012b); and
 - Mine Closure Plan (GSS Environmental, 2011).
- Biodiversity Offset Strategy (EcoLogical, 2014a).
- Extraction Plan (AECOM, 2011).

Further details of the existing content and/or revision of these plans and programs for the Modification is provided under the relevant environmental aspect headings in Section 4.

2.13 COMMUNITY CONTRIBUTIONS

NCOPL has or will make the following contributions in accordance with Condition 9, Schedule 2 of Project Approval 08_0144:

- upgrade and seal of 7 km length of the Kurrajong Creek Road for the NSC;
- a \$7,000 contribution to the NSC for provision of bush fire services;
- a total contribution of \$93,000 to the NSC for community infrastructure;
- a total contribution of \$100,000 to the GSC for the Gunnedah Urban Riverine Scheme;
- a total contribution of \$1,500,000 to the NSC for the Narrabri Swimming Complex; and
- a total contribution of \$100,000 to the GSC for community enhancement.

NCOPL also makes financial and in-kind contributions to a number of non-government and community organisations in the region. NCOPL's financial contributions (in the form of sponsorships and donations) in the region in the 2014/2015 Annual Review period totalled \$15,000 (NCOPL, 2015a).

During the 2014 financial year, Whitehaven's total financial contributions in the region were in excess of \$160,000 (NCOPL, 2015a).

2.14 COMPLAINTS

In accordance with the requirements of the Environmental Management Strategy (NCOPL, 2015c) and Project Approval 08_0144, NCOPL records and responds to all complaints and provides a complaints register summary in the Annual Review each year.

From April 2014 to March 2015, a total of 41 complaints were received (NCOPL, 2015a). The complaints received were related to air quality (30) and noise (11). A discussion on noise and air quality monitoring conducted at the NM is provided in Sections 4.6 and 4.7, respectively.

Mine-related complaints are managed in accordance with the Complaints Management Protocol as outlined in the Environmental Management Strategy (NCOPL, 2015c).

3 MODIFICATION OVERVIEW

A description of the Modification is provided below, including a comparison of the modified NM with the existing/approved NM (Table 1).

3.1 UNDERGROUND MINING OPERATIONS

3.1.1 Indicative Mine Schedule

The indicative modified ROM coal production schedule from 2015 onwards is provided in Table 2. The mine schedule would continue to be subject to periodic revision over the life of the mine and updated if required in the Mining Operations Plan.

Table 2
Indicative Modified ROM Coal Production Schedule (2015 to 2031)

Project Year	Calendar Year	ROM Coal Production (Mt)
5	2015	6.4
6	2016	8.0
7	2017	9.6
8	2018	10.0
9	2019	10.5
10	2020	9.5
11	2021	10.4
12	2022	10.1
13	2023	10.2
14	2024	10.2
15	2025	10.1
16	2026	10.1
17	2027	10.2
18	2028	9.8
19	2029	10.0
20	2030	10.0
21	2031	2.0

There would be an increase in the peak rate of ROM coal production from 8 Mtpa up to approximately 11 Mtpa.

The increased ROM coal production rate would not require changes to the existing/approved longwall mining operations. The increased ROM coal production rate would be achieved via operational efficiencies borne from the proposed changes to the underground mine geometry (Section 3.1.2).

The Modification does not include any extension to the approved 21 year mine life of the NM.

3.1.2 Layout of Underground Mining Area

The Modification would include the following changes to the approved underground mine geometry (Figure 3):

- a reduction in the number of longwall panels from 26 to 20;
- an increase in longwall panel widths for LW107 to LW120 from 295 m to 400 m (LW101 to LW106 unchanged); and
- a western extension of the underground mine footprint relative to the existing/approved underground longwall mine footprint of approximately 60 m (Figure 4).

The proposed changes to the underground mine geometry would improve the efficiency of longwall mining operations. The wider longwall panels would increase the period between longwall machine 'change-outs' which typically delay longwall mining operations by approximately 6 to 8 weeks. The period between longwall machine 'change-outs' would increase beyond 12 months and therefore longwall mining operations would be able to continue uninterrupted for periods of greater than 12 months. This, coupled with minor operational efficiency gains associated with the wider longwall panels, would allow the annual ROM coal production rate to increase up to approximately 11 Mtpa.

3.1.3 Underground Mine Access

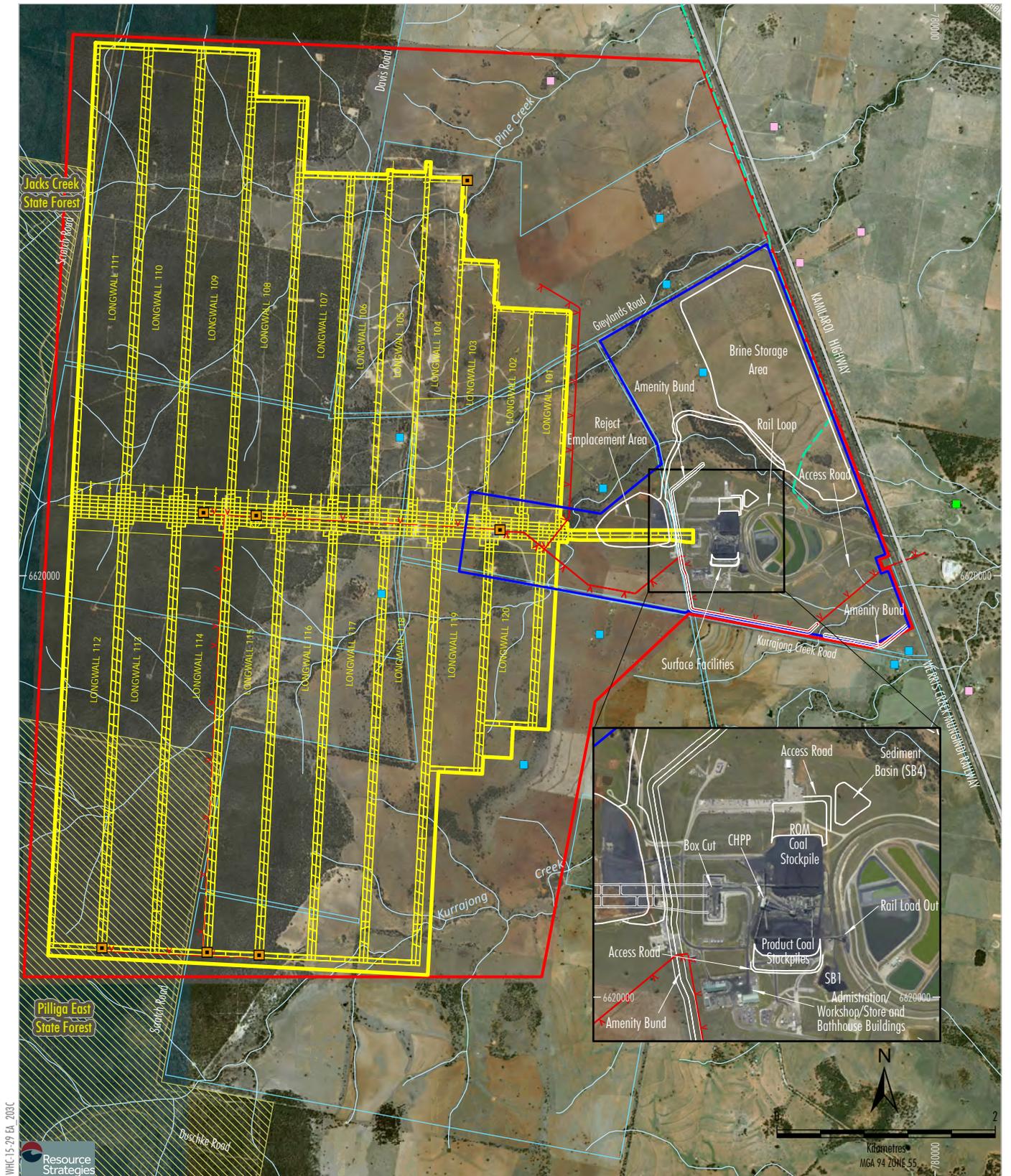
The existing underground mine access (Section 2.1.3) would remain unchanged for the Modification (Figure 3).

3.1.4 Subsidence Impact Performance Measures

Longwall mining at the modified NM would continue to be conducted to meet the subsidence impact performance measures outlined in Conditions 1 and 2, Schedule 3 of Project Approval 08_0144.

3.1.5 Major Underground Equipment and Mobile Fleet

The existing underground equipment and mobile fleet (Section 2.1.5) would remain unchanged for the Modification, with the exception of additional longwall miner modules which would be added to facilitate miners of the wider panels.



WHC-15-29 EA_203.C
Resource Strategies

- LEGEND**
- State Forest
 - Mining Lease Boundary (ML 1609)
 - Pit Top Area
 - Modified Underground Mine Footprint
 - Approved Surface Development (Not Constructed)
 - Modified Underground Mine Development
 - Electricity Transmission Line (Constructed)
 - Electricity Transmission Line (Not Constructed)
 - Namoi River Water Pipeline
 - Ventilation Shaft Location

- Mine-owned Dwelling
- Private Dwelling
- Private Dwelling - NCOPL Agreement
- Mine Owned Land

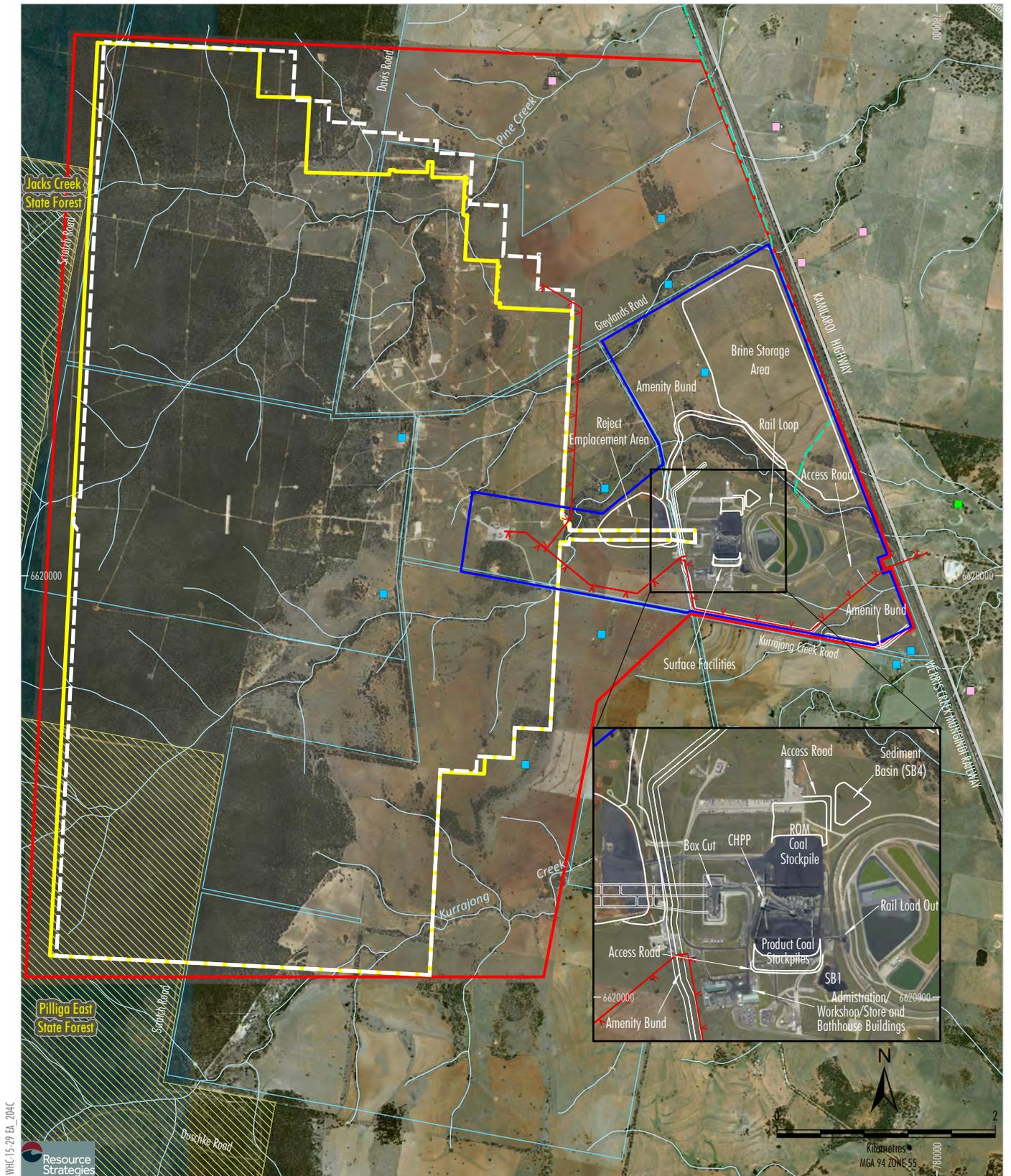
Source: Orthophotos - Whitehaven Coal (March 2015) and Google Earth (Feb 2015); R.W. Cokerly & Co Pty Ltd (2009), NSW Trade & Investment (2015) and NCOPL (2015)

NARRABRI MINE

Modified Narrabri Mine

Indicative General Arrangement

Figure 3



WHC-15-29 EA_204-C
Resource Strategies

- | | | | |
|---|--|---|------------------------------------|
|  | State Forest |  | Mine-owned Dwelling |
|  | Mining Lease Boundary (ML 1609) |  | Private Dwelling |
|  | Pit Top Area |  | Private Dwelling - NCOPL Agreement |
|  | Approved Underground Mine Footprint | | |
|  | Approved Surface Development (Not Constructed) | | |
|  | Modified Underground Mine Footprint | | |
|  | Electricity Transmission Line (Constructed) | | |
|  | Namoi River Water Pipeline | | |

Source: Orthophotos - Whitehaven Coal (March 2015) and Google Earth (Feb 2015); R.W. Cokerly & Co Pty Ltd (2009), NSW Trade & Investment (2015) and NCOPL (2015)


NARRABRI MINE
 Approved and Modified
 Indicative Underground Mine Footprint

Figure 4

3.1.6 Mine Safety Pre-conditioning

The Modification would include the continuation of mine safety pre-conditioning of the Digby Conglomerate for the remaining underground mine area (i.e. LW107 to LW120).

As described in Section 2.1.6, mine safety pre-conditioning is proposed to manage the effects of weighting on the longwall face and to reduce the risk of a windblast event occurring if the Digby Conglomerate does not fracture and cave properly.

A series of boreholes would be developed at both ends of each longwall panel for pre-conditioning to occur (Figure 5).

3.1.7 Ventilation System

The ventilation system would continue to be progressively established to maintain a safe working environment.

The existing ventilation shaft in the mains would remain unchanged. The location of the two mains ventilation shafts not yet constructed would change slightly due to proposed change to the longwall panel geometry (Figure 5).

Only three of the four approved ventilation shafts at the rear of the southern longwall panels would be required for the Modification. The location of these remaining three ventilation shafts would also change slightly due to the proposed change to the longwall panel geometry (Figure 5).

The additional ventilation shafts at the rear of the northern longwall panels not yet constructed would not be required for the Modification (Figure 5).

3.1.8 Coal Seam Gas Management

Pre-Drainage

Pre-drainage of the coal seam would continue to be progressively conducted as per existing/approved methods (Section 2.1.8).

Goaf Drainage

Goaf coal seam gas drainage would continue to be conducted behind the progressing longwall mining operations (Section 2.1.8).

3.1.9 Mine Dewatering

Groundwater inflows for the modified NM are estimated to peak at 3.77 ML/day (Appendix B).

3.1.10 Underground Mine Surface Infrastructure

The same type of underground mine surface infrastructure as for the existing/approved NM would be required for the Modification (Figure 5):

- mine safety pre-conditioning sites;
- ventilation shafts;
- pre-drainage and goaf gas drainage sites;
- access roads; and
- electricity transmission lines.

Mine safety pre-conditioning sites would continue to be undertaken for the remaining underground mine area (i.e. LW107 to LW120).

The number of ventilation shafts would reduce from a total of 10 to 7 for the Modification (Section 3.1.7). Any further extension to the northern electricity transmission line associated with the northern ventilations shafts (Figure 2) would not be required.

The number of pre-drainage and goaf gas drainage sites and associated access tracks would reduce as a result of the reduced number of longwall panels.

An indicative layout of the modified underground mine surface infrastructure is provided on Figure 5. Consistent with the approved NM, the exact location of this underground mine surface infrastructure would be determined based on both operational and environmental factors at the time of construction.

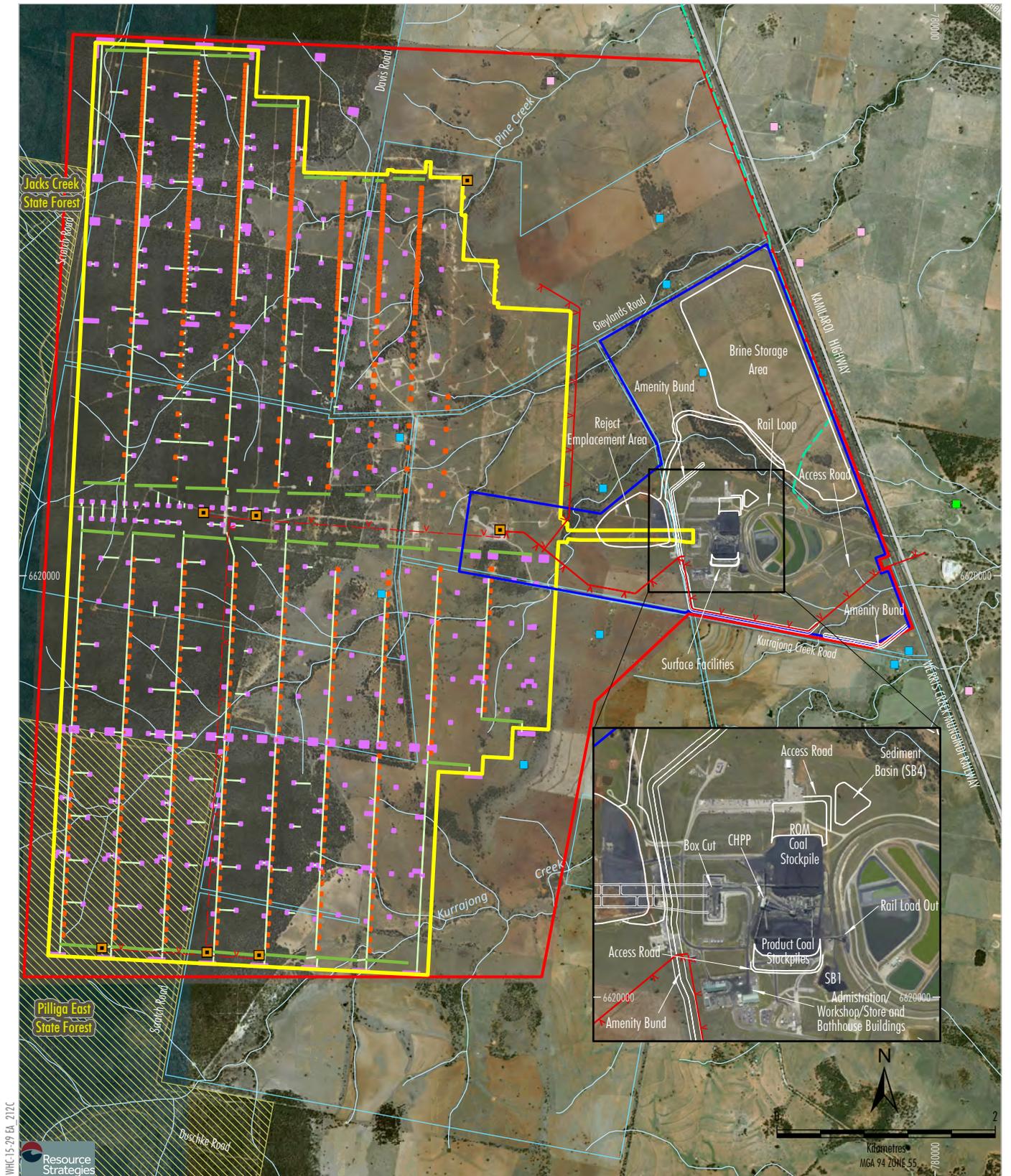
Overall, the size of the surface development footprint at the NM would remain unchanged.

3.2 PIT TOP AREA

The Modification would not require any significant changes to the existing/approved pit top area.

No additional surface development area would be required in the pit top area for the Modification.

No additional mobile fleet in the pit top area would be required for the Modification.



WHC-15-29 Bl. 212C
Resource Strategies

Source: Orthophotos - Whitehaven Coal (March 2015) and Google Earth (Feb 2015); R.W. Cokerly & Co Pty Ltd (2009), NSW Trade & Investment (2015) and NCOPL (2015)

- | | | | |
|---|---|---|------------------------------------|
|  | State Forest |  | Ventilation Shaft |
|  | Mining Lease Boundary (ML 1609) |  | Goaf Drainage Borehole |
|  | Pit Top Area |  | Pre-Drainage Borehole |
|  | Approved Surface Development (Not Constructed) |  | Pre-conditioning Borehole |
|  | Modified Underground Mine Footprint |  | Unsealed Access Track |
|  | Electricity Transmission Line (Constructed) |  | Mine-owned Dwelling |
|  | Electricity Transmission Line (Not Constructed) |  | Private Dwelling |
|  | Namoi River Water Pipeline |  | Private Dwelling - NCOPL Agreement |


NARRABRI MINE
Modified Indicative Underground Mine
Surface Infrastructure

Figure 5

3.3 COAL HANDLING AND PREPARATION

The maximum ROM coal processing rate would increase from 8 Mtpa up to approximately 11 Mtpa.

The Modification would not require any significant changes to the existing/approved coal handling and preparation infrastructure.

The increased ROM coal processing rate would be achieved using the existing peak capacity of the existing/approved coal handling and preparation infrastructure more often.

3.4 PRODUCT COAL TRANSPORT

Product coal from the modified NM would continue to be transported from the NM by rail in accordance with Condition 7, Schedule 2 of Project Approval 08_0144.

The maximum number of trains per day (i.e. 8 trains/day) would remain unchanged as a result of the Modification. The increased ROM coal production rate proposed as part of the Modification would however result in an increase in the average number of trains loaded each day from three to four trains.

3.5 COAL REJECT MANAGEMENT

The Modification would not require any significant changes to the existing/approved coal reject management at the NM.

3.6 WATER MANAGEMENT

3.6.1 Site Water Management System

The water management system would continue to be progressively developed subject to its ongoing performance, prevailing climatic conditions and actual underground mine inflows.

The Modification would include the following minor amendments to the site water management system:

- removal of a sediment dam (SD5); and
- installation of evaporator spray systems on water storage dams (A1, A2, A3, B2 and C).

SD5 is proposed to be removed from the site water management system as it currently collects water from undisturbed catchments not associated with the NM (Appendix C).

Evaporator spray systems would be installed on water storage dams to increase evaporation of mine water and brine to minimise RO treatment requirements. The evaporators would be operated during the daytime only.

No other significant changes to the site water management system (Section 2.6) would be required.

NCOPL would continue to progressively develop the site water management system (as required) in accordance with the Water Management Plan.

3.6.2 Site Water Balance

A review of the water balance for the modified NM was conducted by WRM (2015) (Appendix C).

The water balance model simulates future changes in stored volumes of water on-site in response to inflows (e.g. groundwater inflows, rainfall-runoff), outflows (evaporation, underground mining demand, CHPP demand, dust suppression usage, licensed discharge) and pumped transfers.

The water balance review indicates that there would continue to be an excess of water produced at the modified NM. The on-site water demand would therefore be likely to be satisfied by water captured in the site water management system (Appendix C).

The water balance model indicates that the risk of an uncontrolled release from the modified NM is very low and that there would be no uncontrolled releases of brine (Appendix C).

NCOPL would continue to undertake regular reviews of the site water balance, which is inherently highly influenced by groundwater inflows.

Depending on stored water volumes, NCOPL can source raw water from existing licensed water supply sources (e.g. Namoi River extraction) to maintain a storage reserve or release excess filtered water to the Namoi River (Figure 1) in accordance with Condition 11, Schedule 4 of Project Approval 08_0144 to reduce storage reserves.

3.7 OTHER INFRASTRUCTURE AND SUPPORTING SYSTEMS

The Modification would not result in any significant changes to other existing/approved infrastructure and supporting systems.

The Modification would include a minor increase in heavy vehicle deliveries to the NM due to increased demand for consumables (e.g. diesel) associated with the increased ROM coal production rate.

3.8 CONSTRUCTION ACTIVITIES

The Modification would not require the construction of any additional infrastructure at the NM.

3.9 WORKFORCE

The existing operational workforce (employees and contractors) of approximately 370 personnel (Section 2.9) would remain unchanged as a result of the Modification.

3.10 REHABILITATION

The existing rehabilitation strategy for the NM (Section 2.10) would be extended for the modified NM.

3.11 BIODIVERSITY OFFSETS

No change is proposed to the existing NM offsite biodiversity offset areas described in the Biodiversity Offset Strategy (Section 2.11). Potential incremental increases in subsidence on existing biodiversity offset areas is addressed in Section 4.11.

4 ENVIRONMENTAL REVIEW

4.1 IDENTIFICATION OF KEY ISSUES

The key potential impacts of the Modification are related to the change to the approved underground mine geometry and the associated potential subsidence impacts and consequences.

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

- built features;
- land resources;
- groundwater;
- surface water;
- Aboriginal cultural heritage;
- historic heritage; and
- biodiversity.

In addition, because of the increase in the ROM coal production rate, this EA considers potential changes to noise, air quality, greenhouse gas, groundwater and surface water impacts.

The minor increase in heavy vehicle movements associated with increased deliveries would result in potential changes to road transport impacts. A discussion of these potential impacts is provided in this section of the EA.

As no change to the approved NM workforce or mine life is proposed for the Modification, there would be no material alteration to the approved community infrastructure impacts.

4.2 SUBSIDENCE

4.2.1 Background

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

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

Previous Assessment

An assessment of potential subsidence impacts associated with Stage 2 of the NM was conducted by Ditton Geotechnical Services (2009).

Extraction Plan

Condition 4, Schedule 3 of Project Approval 08_0144 requires NCOPL to prepare an Extraction Plan for second workings prior to extraction. The Extraction Plan is also prepared to meet the requirements of a Subsidence Management Plan.

The Extraction Plan (AECOM, 2011) for LW101 to LW105 at the NM was approved in April 2012 (Approval 10/9000).

End of Panel Reports

Condition 18 of the Subsidence Management Plan Approval (issued under delegation by the Director-General of the Department of Industry, Skills and Regional Development) requires an End of Panel Report to be completed within four months of the completion of each longwall panel.

A summary of the predicted impacts from the Extraction Plan and observed impacts recorded from the completed longwall panels and provided in the End of Panel Reports for LW101 to LW103 is provided below.

End of Panel Report (LW101)

Impacts to the following features as a result of mining of LW101 are generally consistent with predictions made in the Extraction Plan:

- natural features;
- public utilities;
- farm land and facilities;
- industrial, commercial and business establishments; and
- other significant features.

An impact on natural features was the stress and mortality of large trees along Greylands Road and the adjacent ephemeral watercourse (i.e. tributary of Pine Creek). In accordance with the Extraction Plan, a site investigation was undertaken to determine the cause of tree stress and mortality (NCOPL, 2013).

The following subsidence monitoring results, outlined in the LW101 End of Panel Report (NCOPL, 2013), were generally consistent with the predictions made in the Extraction Plan:

- The maximum subsidence results were within $\pm 10\%$ of the predicted value of 2.44 m.
- The maximum tilt measurements were within 15% of the predicted value of 47 millimetres per metre (mm/m).
- The maximum tensile strain measurements were within the predicted range of the values of 11 mm/m (smooth profile) and 22 mm/m (discontinuous or crack affected profiles).
- The maximum compressive strain measurements were within the range of the predicted values of 14 mm/m (smooth profile) and 28 mm/m (discontinuous or crack affected profiles).

End of Panel Report (LW102)

The Extraction Plan predicted minor impacts to the surface features as a result of mining of LW102 (NCOPL, 2014). Impacts to the following features as a result of mining LW102 are generally consistent with predictions made in the Extraction Plan:

- natural features;
- public utilities;
- farm land and facilities;
- industrial, commercial and business establishments; and
- other significant features.

As with LW101, impacts to trees occurred (although to a lesser extent). The investigation undertaken at the time did not provide any conclusive explanation for the mortality of the larger trees.

The following subsidence monitoring results, outlined in the LW102 End of Panel Report (NCOPL, 2014), were generally consistent with the predictions made in the Extraction Plan:

- The maximum subsidence measurements were within 10% of the predicted value of 2.44 m.
- The maximum tilt measurements were within 10% of the predicted value of 41 mm/m.

- The maximum tensile strain measurements were within 10% of the predicted range of the values of 10 mm/m (smooth profile) and 20 mm/m (discontinuous or crack affected profiles).
- The maximum compressive strain measurements exceeded the range of the predicted values of 12 mm/m (smooth profile) and 24 mm/m (discontinuous or crack affected profiles). However, 98% of the recorded values were within the predicted range.

End of Panel Report (LW103)

The Extraction Plan predicted minor impacts to the surface features as a result of mining LW103 (NCOPL, 2015f).

Impacts to the following features as a result of mining LW103 are generally consistent with predictions made in the Extraction Plan:

- natural features;
- public utilities;
- farm land and facilities;
- industrial, commercial and business establishments; and
- other significant features.

Trees along Greylands Road and the ephemeral creek were not materially impacted. However, an ongoing investigation into the mortality of larger trees along Greylands Road and the ephemeral creek was completed and concluded the following (NCOPL, 2015f):

- Lateral movement of overburden in the top 20 to 30 m of the ground occurred, resulting in surface cracks approximately 8 m apart.
- Visible root shearing was observed and was likely to be a cause of the declining tree condition.
- Root shearing was exacerbated by dry conditions, heavy soil texture and shallow depth of cover with increased surface impacts including cracking and surface deformation.

As longwall mining progresses to the west, the depth of cover increases and the soil texture becomes lighter. As a result, further impacts on trees are expected to be minimal (NCOPL, 2015f).

The following subsidence monitoring results, outlined in the LW103 End of Panel Report (NCOPL, 2015f), were generally consistent with the predictions made in the Extraction Plan:

- The maximum subsidence measurements were within 10% of the predicted value of 2.44 m.
- The maximum tilt measurements exceeded the maximum predicted value of 35 mm/m. However, the exceedances were within 15% of the maximum predicted value and all values were within the predicted range.
- The maximum tensile strain measurements exceeded the range of predicted values of 8 mm/m (smooth profile) and 16 mm/m (discontinuous or crack affected profiles). However, the exceedances were within 18% of the maximum predicted value and 97% of the recorded values were within the predicted range.
- The maximum compressive strain measurements exceeded the range of the predicted values of 10 mm/m (smooth profile) and 20 mm/m (discontinuous or crack affected profiles). However, the exceedances were within 17% of the maximum predicted value and 95% of the recorded values were within the predicted range.

Monitoring results from the End of Panel Reports indicate that impacts associated with mining at the NM are generally consistent with the predictions made in the Extraction Plan (NCOPL 2013, 2014, 2015f). The DRE has reviewed these monitoring results as part of the End of Panel Report process.

4.2.2 Environmental Review

An assessment of potential mine subsidence associated with the Modification was undertaken by Ditton Geotechnical Services (2015) and is provided in Appendix A.

Prediction Methodology

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

The Ditton Geotechnical Services (2009) subsidence prediction model was calibrated against subsidence monitoring data measured to date at the NM.

Predicted Subsidence Levels

The results presented in Appendix A generally indicate changes in subsidence level predictions, due to the proposed changes in mine geometry and improvements in the subsidence prediction model resulting from the calibration described above, between the approved and modified underground mine layout of approximately 20% (i.e. some increase some decreases). The predicted increases are unlikely to result in significantly higher impacts or environmental consequences, based on impacts observed to date (Appendix A).

The Subsidence Assessment (Appendix A) concluded that the Modification would not change the level of impact assessed for the approved underground mine layout or the current Extraction Plan. Table 3 presents a comparison of the predicted subsidence effects from the approved NM and the Modification.

**Table 3
Comparison of Predicted Subsidence Levels of the Approved and Modified Mining Layout**

Parameter	Approved		Modification
	LW101–126 (2009 Predictions)	LW101–106 (Current Predictions)	LW107–120
Final Maximum Subsidence (m)	2.44	2.56 – 2.75	2.75
Maximum Tilt (mm/m)*	30 (45) - 45 (68)	25 (37) - 45 (68)	17 (25) - 41 (62)
Maximum Tensile Strain (mm/m)*	4 (8) - 11 (22)	6 (11) - 13 (25)	3 (6) - 11 (21)
Maximum Compressive Strain (mm/m)*	8 (16) - 14 (28)	7 (14) - 16 (32)	4 (8) - 14 (27)
Final Goaf Edge Subsidence (m)	0.22 – 0.59	0.13 – 0.32	0.09 – 0.36
Final Angle of Draw (°)	26.5 – 31	25.3 – 32.2	22.7 - 33.2

Source: Appendix A.

* Predicted tilts and strains for 'smooth' subsidence profiles. Cracking or discontinuous displacements may cause the 'smooth' profile tilt and strain values to increase by 1.5 to 2 times respectively (bracketed values).

The results of the comparison indicate the following changes to subsidence effect predictions due to the Modification compared to the values provided in Ditton Geotechnical Services (2009) for the approved NM (Appendix A):

- Maximum subsidence would increase by approximately 13%.
- Maximum tilt and strain would change by approximately 15% due to model changes based on measured results and mining geometry changes.
- Maximum goaf edge and angle of draw predictions would change by approximately 20% due to model changes based on measured results and mining geometry changes.

These changes would not change the approved level of impact described in Ditton Geotechnical Services (2009) (Appendix A).

Subsidence Impacts

The following sub-sections describe the predicted subsidence impacts.

Potential Environmental Consequences on Key Natural and Built Features

Streams

Direct hydraulic connection to the surface, due to sub-surface fracturing above the modified underground mine layout, is considered unlikely to occur where cover depths are greater than 160 m (Appendix A).

Alluvial Aquifers

Potential impacts on alluvial aquifers as a result of subsidence are described in Section 4.4.

Surface Gradient, Slopes and Valley Closure

Surface gradients are likely to increase or decrease by up to 3.5% along creeks, with occasional increases of up to 5% (Appendix A).

General and localised slope instability along low-level hills is considered very unlikely due to the predicted cracking and tilting above the modified underground mine layout (Appendix A).

The development of valley closure and associated uplift in valley floors and along creek beds is unlikely to exceed 200 mm (Appendix A).

Ponding

Ditton Geotechnical Services (2009) predicted that ponding would occur in some areas with depths in the order of 0.5 m to 1.5 m. For the Modification, potential ponding depths of 0.1 to 2.6 m may develop above several of the longwalls along creeks in the flatter areas of the NM, based on post-mining contour predictions (Appendix A).

Surface Cracking and Shearing

Consistent with previous studies, the Subsidence Assessment (Appendix A) indicates that the surface deformations due to the Modification are likely to cause the following impacts:

- Surface cracking within tensile strain zones is predicted to range in width from 20 mm to 250 mm at cover depths ranging from 360 m to 160 m, respectively.
- Surface shearing and uplift within compressive strain zones is predicted to range in widths from 30 mm to 330 mm at cover depths ranging from 360 m to 160 m, respectively.

Biodiversity

Potential impacts on biodiversity as a result of subsidence are described in Section 4.11.

Land Use and Land Resources

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

Aboriginal Cultural Heritage

A number of Aboriginal cultural heritage items have been identified at the NM. Potential consequences on Aboriginal cultural heritage items as a result of subsidence impacts are described in Section 4.9 and Appendix F.

Infrastructure and Improvements

Vacant NCOPL-owned residential dwellings and farm machinery sheds are likely to be significantly impacted during mining (i.e. moderate to severe impact rating in accordance with AS 2870:2011) (Appendix A).

Impacts to fences and two disused orchards may include the loss of function due to structural failure of wire strands and fence posts and /or the disruption of the orchard's water and drainage system (Appendix A).

The powerlines and poles to the various residences and orchards within ML 1609 would be subsided by LW101 to LW105 by up to 2.72 m (Appendix A). The differential subsidence between subsided and non-subsided poles with chain pillars in between them may have conductor clearances decreased by up to 1.96 m or increased by up to 0.16 m. The poles would be affected by transient and final tilts towards the centre of the goaf of up to 41 mm/m. The ground strains at the poles are likely to range up to 12 mm/m. The predicted tilts and strains have the potential to damage the poles and ceramic conductor isolators (Appendix A).

Stock watering dams are likely to be damaged by mine induced cracking and/or shearing, resulting in dam wall breach or storage losses through the floor of the dam storage areas. Windmills and fences around the dams could also be damaged and require repairs after mining (Appendix A).

Management Measures and Monitoring

Mining at the NM is conducted in accordance with the approved Extraction Plan (AECOM, 2011). The Extraction Plan is being updated to include LW106, the last of the proposed longwall panels using the currently approved width.

Infrastructure and Improvements

The key NM surface infrastructure is located greater than 800 m to the east of the subsidence and strain zone, therefore no damage or impacts are expected (Appendix A).

Powerlines would continue to be managed in accordance with the NM Public Safety Management Plan (AECOM, 2012a). Flexible/roller conductor sheathing on the poles to control the conductor tension during/after mining impacts have already been implemented and this practice would continue. NCOPL is also assessing options for removing the affected powerlines on land owned by the mine.

The Werris Creek Mungindi Railway and Kamilaroi Highway are both located greater than 1.9 km to the east of the subsidence and strain zone and are therefore extremely unlikely to be affected by horizontal or vertical movements due to mine subsidence (Appendix A).

Public roads would continue to be managed in accordance with the NM Public Safety Management Plan (AECOM, 2012a) to provide signage and traffic control measures and maintain safety for road users during active subsidence periods. Some sections of road may also require re-grading or drainage remediation works after subsidence development (Appendix A).

Unsealed roads and tracks around the site are likely to be subject to cracking and shearing during mine subsidence development. The roads are likely to require maintenance and repair works after undermining occurs (Appendix A).

It is noted that the dwellings are NCOPL-owned and would be vacated prior to subsidence occurring. Machinery sheds would similarly be vacated before subsidence develops.

An inspection of mine subsidence damaged structures would be made by qualified building consultants and any repair works to internal/external cracking or re-levelling of damaged structures would be implemented before allowing residents to move back into the dwellings or recommencement of use of machinery sheds. The actual measures to be implemented would be documented in the relevant Extraction Plan.

Where impacts on stock watering dams are predicted, repairs to the dams and provision of temporary supplies of water may be required. In addition, repairs to fencing and/or temporary fencing would also be undertaken in consultation with the landowner or manager.

Impacts on other infrastructure and improvements (including the disused orchards) would continue to be managed in accordance with the relevant Extraction Plan.

Public Safety

The Extraction Plan for the Modification would include an updated Public Safety Management Plan as required under Condition 4(g), Schedule 3 of Project Approval 08_0144. The approved Public Safety Management Plan includes measures to maintain public safety (e.g. regular monitoring and remediation of surface cracking).

4.3 LAND RESOURCES

4.3.1 Background

Landforms and Topography

The NM is located in the north-west slopes region of NSW, which includes the Namoi River valley and associated agricultural land uses and elevated, vegetated country managed as State Forests and National Parks.

Topography in the vicinity of the NM is characterised by vegetated hilly country of Jacks Creek State Forest and Pilliga East State Forest to the west, grading down to the alluvial plains associated with the Namoi River to the east.

At the NM site, topography ranges from approximately 370 m Australian Height Datum (AHD) in the south-west to approximately 240 m AHD in the east (Figure 6).

Land Use

Land use at the NM (apart from coal mining) varies east to west, reflecting topography and increasing vegetation cover. The eastern portion of the NM is predominantly cleared (except for some remnant riparian vegetation in some places) with land uses including grazing of cattle, sheep and horses and some limited cereal cropping and horticulture (R. W. Corkery & Co. Pty Ltd, 2009).

To the west, vegetation cover increases with topography to the Pilliga East State Forest and Jacks Creek State Forest, which are managed by Forestry Corporation of NSW.

Soil Resources

Soil resources at the NM were reviewed by Geoff Cunningham Natural Resource Consultants (2009). This report describes that the NM is on the boundary of two broad soil types, red brown earth soils and Pilliga scrub soils:

Red Brown Earth soils are generally associated with gently undulating slopes. The soils are typically hardsetting with a sandy loam to sandy clay loam A horizon overlying a sandy clay loam to light clay B horizon. The soils are predominantly red brown in colour and have a weak to moderate degree of structure.

The Pilliga Scrub soils are mainly sandy solodised soils and sandy solodic soils. The soils possess a surface horizon of light texture that is sharply differentiated from the subsoil, which has a well developed columnar structure with a sandy texture. There is usually a strongly bleached zone above the subsoil. Other soils within this complex include sandy solodised and solodic soils, deep siliceous sands, earthy sands, lithosols and red and yellow earths.

Rural Land Capability and Agricultural Suitability

Geoff Cunningham Natural Resource Consultants (2009) states that the NM is characterised by Rural Land Capability Classes III, IV, VI and VII, which are described as follows:

Class III land is sloping land suitable for cropping on a rotational basis. Structural soil conservation works such as graded banks, waterways and diversion banks, together with soil conservation practices such as conservation tillage and adequate crop rotations are required.

Class IV land is land not capable of being regularly cultivated but suitable for grazing with occasional cultivation and requiring soil conservation practices such as pasture improvement, application of fertiliser and minimal cultivation for the establishment or re-establishment of permanent pasture.

Class VI land is land suitable for grazing with no cultivation. Soil conservation practices including limitation of stock, broadcasting of seed and fertiliser, prevention of fire and destruction of vermin are required along with some isolated structural works.

Class VII land is land best suited to green timber and generally comprises areas of steep slopes, shallow soils and/or rock outcrop. Adequate ground protection must be maintained by limiting grazing and minimising damage by fire.

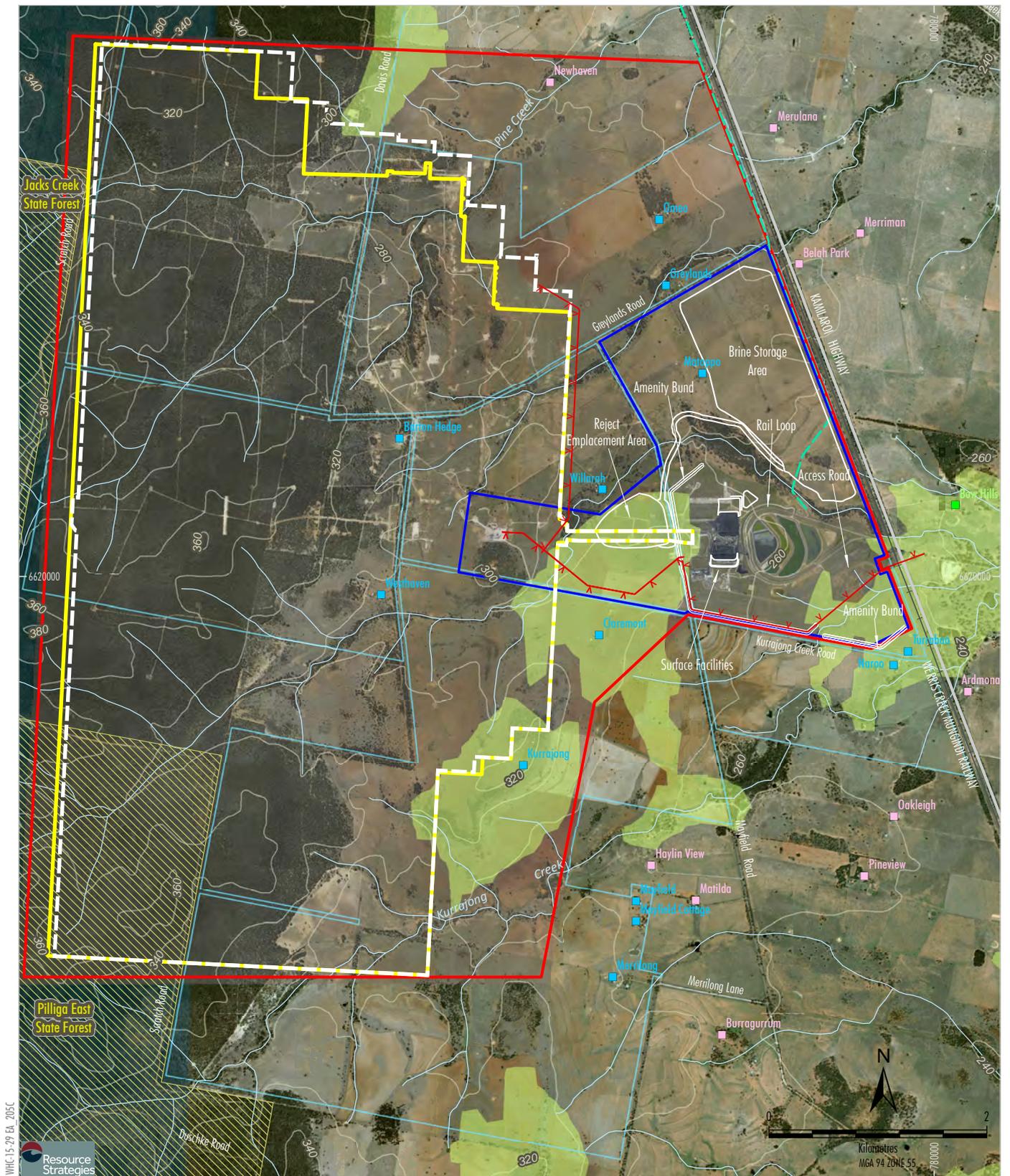
Similarly, Geoff Cunningham Natural Resource Consultants (2009) also reviewed Agricultural Suitability of the NM and concluded that the area is characterised by Classes 2, 3 and 4, which are described as:

Class 2 land is arable land suitable for regular cultivation for crops but not suited to continuous cultivation. It has a moderate to high suitability for agriculture but edaphic [soil factors] or environmental constraints reduce the overall level of production and may limit the cropping phase to a rotation with sown pastures.

Class 3 land is grazing land that is well suited to pasture improvement. It may be cultivated or cropped in rotation with pasture. The overall level of production is moderate as a result of edaphic [soil related] or environmental constraints. Erosion hazard or soil structural breakdown limit the frequency of ground disturbance, and conservation or drainage works may be required.

Class 4 land is land suitable for grazing but not for cultivation. Agriculture is based on native pastures established using minimum tillage techniques. Production may be high seasonally but the overall level of production is low as a result of a number of major constraints, both environmental and edaphic [soil related].

The pattern of land capability and agricultural suitability follows a general east-west trend; with poorer agricultural land in the western portion of the NM grading to better land in the east.



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Resource Strategies

Source: Orthophotos - Whitehaven Coal (March 2015) and Google Earth (Feb 2015); R.W. Corkery & Co Pty Ltd (2009), NSW Trade & Investment (2015) and NCOPL (2015)

- | | | | |
|---|--|---|---|
|  | State Forest |  | Mine-owned Dwelling |
|  | Mining Lease Boundary (ML 1609) |  | Private Dwelling |
|  | Pit Top Area |  | Private Dwelling - NCOPL Agreement |
|  | Approved Underground Mine Footprint |  | Mine Owned Land |
|  | Approved Surface Development (Not Constructed) |  | Biophysical Strategic Agricultural Land |
|  | Modified Underground Mine Footprint | | |
|  | Electricity Transmission Line (Constructed) | | |
|  | Namoi River Water Pipeline | | |


NARRABRI MINE
 Biophysical Strategic Agricultural Land
 Mapping

Figure 6

Agricultural Activities and Productivity

As described above, agricultural land use at the NM comprises grazing and some limited cereal cropping and horticulture.

Consistent with the Rural Land Capability Class III description, rotational cropping (particularly wheat) is undertaken in some portions of the NM. Geoff Cunningham Natural Resource Consultants (2009) reported that there is no soil nutrient limitation in regard to this land use.

Strategic Agricultural Lands

The Mining SEPP includes mapping of lands identified as Biophysical Strategic Agricultural Land (BSAL). The closest regionally mapped BSAL in the Mining SEPP is on the eastern margin of the NM, however no regionally mapped BSAL is within the western extension of the underground mine footprint (Figure 6).

4.3.2 Environmental Review

Potential Impacts

Potential land resource impacts as a result of the Modification would be limited to impacts associated with mine subsidence as the size of the surface development footprint would remain unchanged.

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

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

As described in Section 4.2, incremental subsidence effects due to the Modification, including changes to potential cracking and ponding/stream alignment would be limited (i.e. the level of impact would not change relative to the approved NM). Therefore, changes to impacts on land resources (including regionally mapped BSAL) are not anticipated to be material.

Mitigation Measures, Management and Monitoring

Mitigation measures in respect of potential impacts on land resources would include (EcoLogical, 2012c):

- Stabilisation of damaged or eroded creek/stream banks.

- Re-establishment of natural flow patterns in consultation with a specialist geomorphologist, with the aim to provide long-term stability of creek channel and banks.
- Treatment of surface cracking, including:
 - ripping or grouting of surface cracks within agricultural areas; and
 - filling of cracks with suitable sub-soil material (particularly in vegetated areas).

The Extraction Plan Land Management Plan (EcoLogical, 2012c) describes monitoring of potential subsidence impacts on land resources; the key elements of which are:

- Visual inspections – particularly noting any cracking and erosion areas.
- Remote sensing – including LiDAR to assist in determine topographical changes.
- Agricultural survey – including measurement of pasture and soil nutrient changes.
- Creek line survey – to assist in detecting any geomorphic changes to creek lines.

This monitoring regime would continue to be implemented for the Modification.

4.4 GROUNDWATER

4.4.1 Background

Geology and Hydrogeological Regime

Regionally, the NM is located near the northern and western boundaries of the Gunnedah Basin and the eastern margin of the Surat Basin, a sub-basin of the Great Artesian Basin.

In summary, the stratigraphy of the NM is characterised by two main geological basins:

- Surat Basin Units of Jurassic age which include Pilliga Sandstone, Purlawaugh Formation and Garrawilla Volcanics; and
- Gunnedah Basin Units:
 - Napperby and Digby Formations of Triassic age; and
 - Permian coal measures within the Black Jack Group which includes Hoskissons Seam, and Arkarula and Pamboola Formations. Locally, these coal measures are characterised by an east (shallowest) to west (deepest) gradient (or dip).

To the east of the NM are alluvial sediments of Quaternary age (Narrabri Formation and Gunnedah Formation) associated within the upper Namoi Valley.

Review of the NOW Pineena groundwater database conducted by HydroSimulations (2015) (Appendix B) indicates that the majority of registered groundwater bores in the vicinity of the NM have been established in the alluvial sediments (or regolith) and the Pilliga Sandstone.

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

- a porous hard rock groundwater system that occurs throughout the stratigraphic sequence of Jurassic and Triassic formations and Permian coal measures; and
- aquifers associated with the unconsolidated alluvial sediments of the Namoi River floodplain (i.e. the Upper Namoi Alluvial aquifer).

Water Management Plan

The Water Management Plan (URS Australia, 2013) details the groundwater monitoring program, sampling and water quality analysis regime, groundwater impacts assessment criteria and reporting procedures. The groundwater monitoring sites are shown on Figure 7.

Generally, water levels are measured at quarterly intervals, with groundwater sampled for water quality annually and the results reported in the Annual Environmental Management Report (AEMR)/Annual Review.

The Water Management Plan (URS Australia, 2013) includes a Surface and Groundwater Response Plan which identifies triggers and contingency actions/mitigation measures to be invoked.

4.4.2 Environmental Review

A groundwater assessment has been conducted by HydroSimulations (2015) for the Modification and is provided in Appendix B.

Modelling Approach and Calibration

A numerical groundwater model was established by HydroSimulations (2015) using the MODFLOW-SURFACT modelling package. The model was calibrated against regional groundwater levels earlier in 2015 and validated against the most recently available water levels as part of the Modification.

The aim of the validation exercise was to confirm the validity of the model for use in the EA by considering:

- The existence of observation data extending beyond the period on which model calibration was based.
- The introduction into the model of the modified approaches to estimating the height of mining-induced fracturing and the vertical conductivity of the fractured zone (in accordance with Ditton Geotechnical Services [2015]).

HydroSimulations (2015) concluded that the validation exercise indicates that the model is fit for purpose.

Potential Impacts

The main potential impacts on the groundwater regime would be:

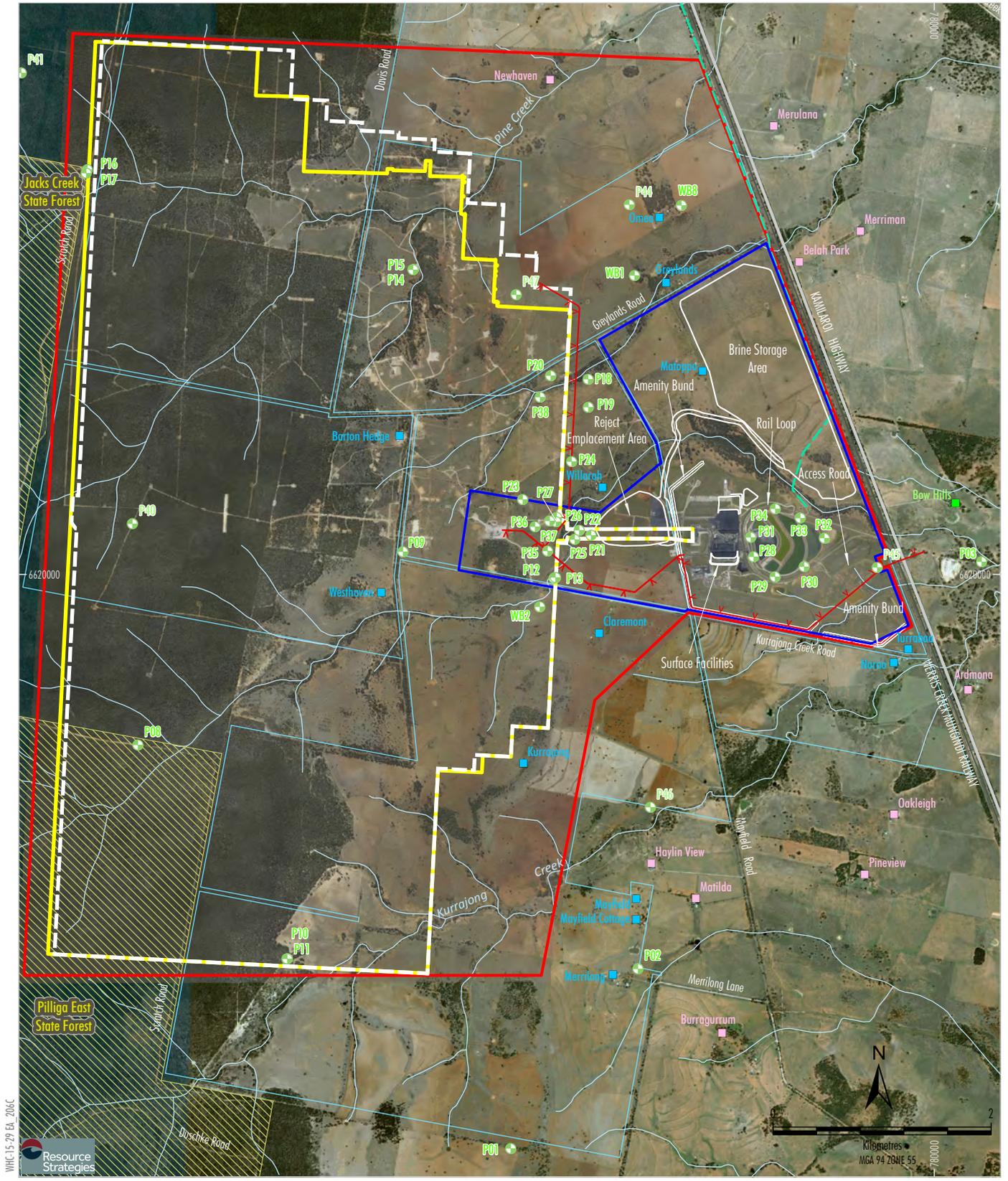
- incremental changes in subsurface fracturing and shearing of sub-surface strata above the modified underground mine footprint, with marginal lateral extension of the area of strata subject to this impact (i.e. the 60 m westerly extension); and
- incremental changes in dewatering of groundwater that enters the underground mine as a result of the above.

The potential impacts of the Modification on the groundwater regime are considered below.

Groundwater Inflows

In order to consider the incremental changes in groundwater impacts associated with the Modification, the groundwater model was run for the existing/approved underground mine plan, to allow direct comparison with the Modification mine plan.

From the start of mining, predicted rates of mine inflow increase progressively for both layouts, to peak values of 3.52 ML/day (approximately 1,290 ML for the year) and 3.77 ML/day (approximately 1,380 ML for the year) for the currently approved and modified layouts, respectively (Appendix B). This results in a minor 0.25 ML/day incremental increase in groundwater inflows (or approximately 90 million litres per year [ML/year]). The earlier peak for the modified layout was anticipated by HydroSimulations given the shorter mining duration.



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Resource Strategies

- LEGEND**
- State Forest
 - Mining Lease Boundary (ML 1609)
 - Pit Top Area
 - Approved Underground Mine Footprint
 - Approved Surface Development (Not Constructed)
 - Modified Underground Mine Footprint
 - Electricity Transmission Line (Constructed)
 - Namoi River Water Pipeline

- Mine-owned Dwelling
 - Private Dwelling
 - Private Dwelling - NCOPL Agreement
 - Mine Owned Land
- Monitoring Site**
- Groundwater Monitoring Site

Source: Orthophotos - Whitehaven Coal (March 2015) and Google Earth (Feb 2015); R.W. Corkery & Co Pty Ltd (2009), NSW Trade & Investment (2015) and NCOPL (2015)

NARRABRI MINE
Groundwater Monitoring Locations

Figure 7

For each of the layouts, inflows decrease progressively towards the scheduled end of mining due to cessation of dewatering in the western (downdip) portion of the mine plan. Figure 8 shows the predicted inflows for the approved and modified NM.

Impacts to Porous Hard Rock Groundwater System

For the Hoskissons Coal Seam, lateral flow direction in areas distant from the mine site will be largely unaffected by the Modification (Appendix B). Locally, areas close to the mine site would result in incremental changes in potentiometric pressure (particularly in the area of the westerly extension of the mine plan).

For the Pilliga Sandstone, changes in potentiometric pressure would be localised in the vicinity of the NM (Appendix B).

Impacts to Alluvial Aquifers

For the shallow layers (regolith/alluvium), changes in potentiometric pressure would be restricted to the close environs of the mine site (Appendix B).

Stream Baseflows

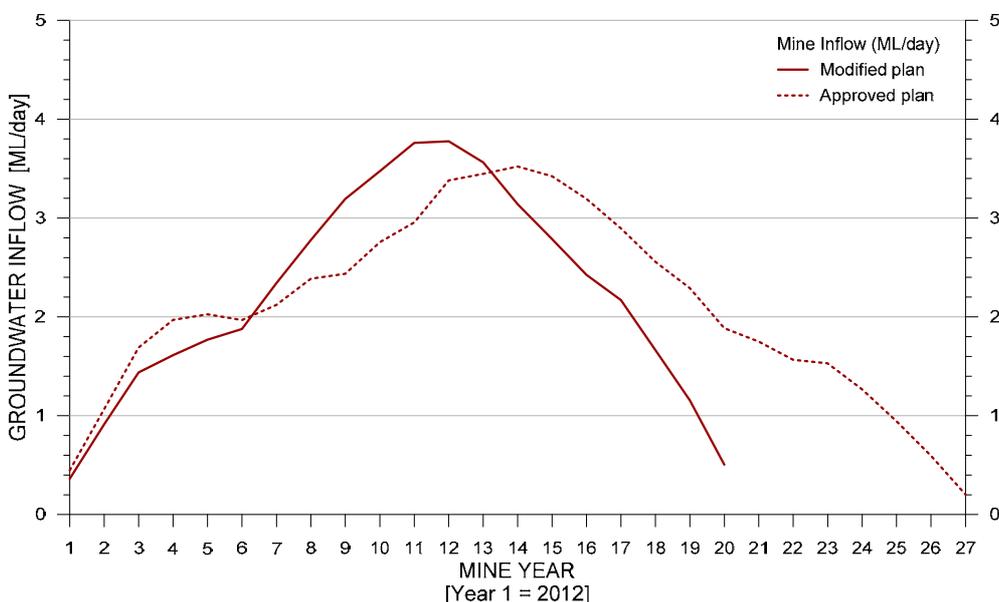
The difference between predicted baseflow to the Namoi River for the approved and modified NM is negligible.

Groundwater Users

HydroSimulations (Appendix B) predicts that one privately owned registered bore in less productive groundwater would be affected by drawdown associated with the Modification. No impacts to bores in highly productive groundwater are anticipated.

Aquifer Interference Policy

An assessment of the Modification against the minimal impact considerations in the NSW Aquifer Interference Policy (the AIP) (NSW Government, 2012a) was conducted as part of the Groundwater Assessment (Appendix B). The Groundwater Assessment concluded that the Modification is within the 'Level 1' minimal impact considerations outlined in the AIP for highly productive groundwater. Further discussion on the AIP is provided in Section 5.3.2 and Appendix B.



Source: Appendix B.

Figure 8 Predicted Groundwater Inflows for the Approved and Modified NM.

Mitigation Measures, Management and Monitoring

Groundwater level and quality monitoring would continue to be conducted in accordance with the Water Management Plan (URS Australia, 2013). Consistent with the Surface and Groundwater Response Plan (a component of the Water Management Plan), an investigation would be conducted in the event that monitoring identifies a groundwater level or quality trigger level exceedance specified in the Water Management Plan (URS Australia, 2013).

Similarly, NCOPL would implement the Surface and Groundwater Response Plan (a component of the Water Management Plan [URS Australia, 2013]) in the event a complaint is received in relation to loss of groundwater supply.

4.5 SURFACE WATER

4.5.1 Background

Hydrology

Pine Creek and its tributaries traverse the northern portion of the NM, before joining the Namoi River to the north-east of the NM. The total catchment area of Pine Creek is 76 square kilometres (km²) (Appendix C).

Kurrajong Creek and its tributaries traverse the south-eastern portion of the NM before joining Tulla Mullen Creek which flows into the Namoi River. The total catchment area of Kurrajong Creek and its tributaries is 62 km² (Appendix C).

The Namoi River stretches for over 350 km and flows in a north-westerly direction approximately 3 to 5 km to the east of the NM. The Namoi River catchment extends from the Great Dividing Range in the east to Walgett in the west where the Namoi River discharges into the Barwon River. The Namoi River has a total catchment area of approximately 42,000 km² to Walgett (Appendix C).

Water Quality

Surface water quality monitoring has been undertaken along Pine Creek and Kurrajong Creek and their tributaries upstream and downstream of the NM (Figure 9) since July 2007 (Appendix C).

Samples are taken during or immediately following flow events and analysed for electrical conductivity, pH, total suspended solids, oil and grease and total organic carbon (Appendix C).

No significant difference in water quality has been observed between monitoring sites upstream and downstream of the NM (Appendix C).

Surface Water Management and Monitoring

Surface water management at the NM is conducted in accordance with the Water Management Plan (URS Australia, 2013) which includes:

- a description of the site water management system;
- surface water management measures;
- erosion and sediment control measures;
- a site water balance;
- a surface water monitoring program; and
- a surface water and groundwater response plan.

In addition, an Extraction Plan Water Management Plan (URS Australia, 2012) has been prepared to manage potential subsidence impacts and/or environmental consequences on surface water resources and flooding at the NM.

Licensing

NCOPL holds four Water Access Licences that allow extraction from the Namoi River. The Water Access Licences allow for a total combined extraction of 678 ML from the Namoi River (Appendix C).

4.5.2 Environmental Review

A surface water assessment has been conducted by WRM (2015) for the Modification and is provided in Appendix C.

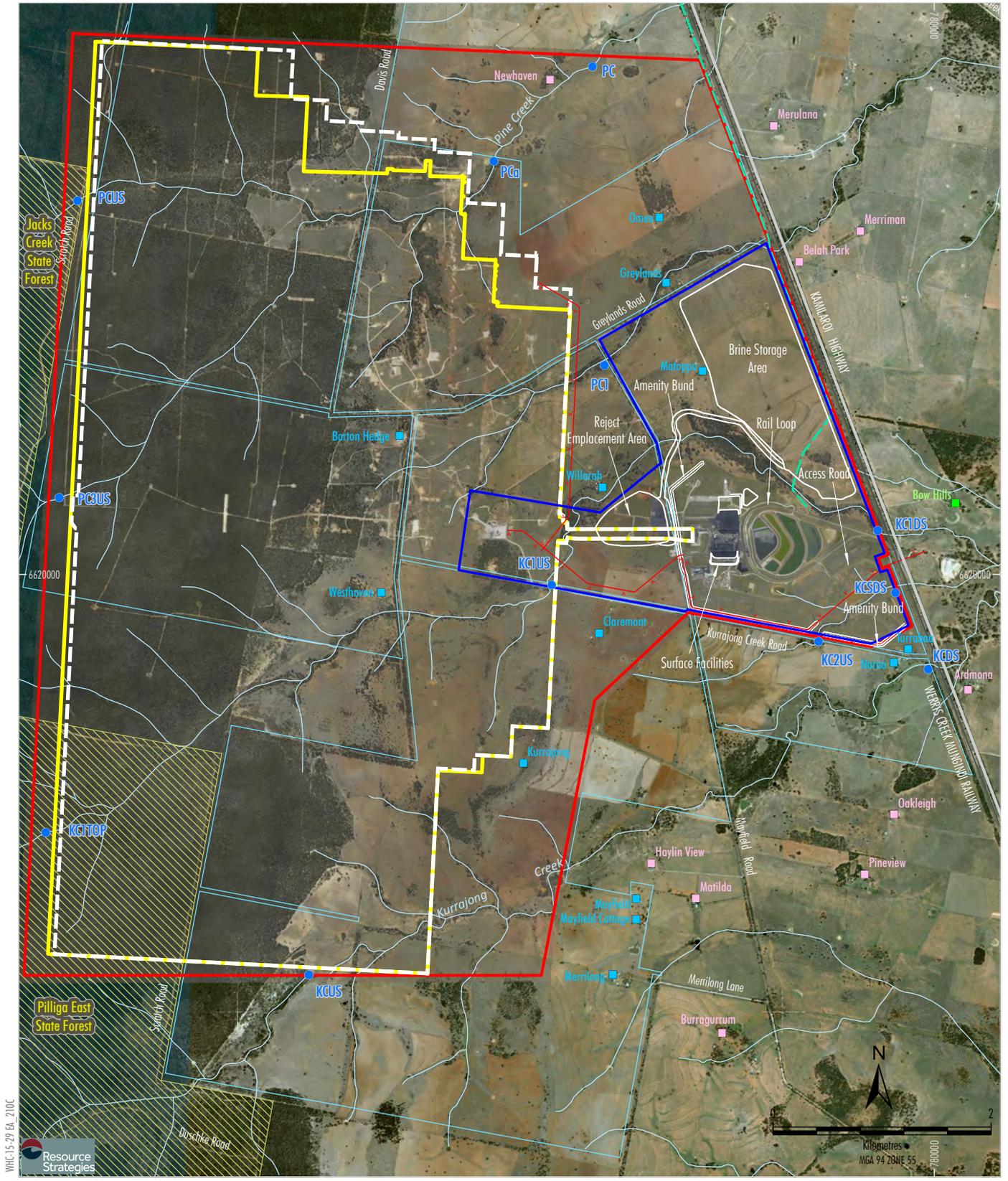
Potential Impacts

Site Water Management System Performance

The water management system would continue to be progressively developed subject to its ongoing performance, prevailing climatic conditions and actual underground mine inflows.

The Modification would include the following minor amendments to the site water management system:

- removal of a sediment dam (SD5); and
- installation of evaporator spray systems on water storage dams (A1, A2, A3, B2 and C).



WHC-15-29 Bl. 210C
Resource Strategies

Source: Orthophotos - Whitehaven Coal (March 2015) and Google Earth (Feb 2015); R.W. Corkery & Co Pty Ltd (2009), NSW Trade & Investment (2015) and NCOPL (2015)

- LEGEND**
- State Forest
 - Mining Lease Boundary (ML 1609)
 - Pit Top Area
 - Approved Underground Mine Footprint
 - Approved Surface Development (Not Constructed)
 - Modified Underground Mine Footprint
 - Electricity Transmission Line (Constructed)
 - Namoi River Water Pipeline
 - Mine-owned Dwelling
 - Private Dwelling
 - Private Dwelling - NCOPL Agreement
 - Mine Owned Land
 - Monitoring Site**
 - Surface Water Monitoring Location

NARRABRI MINE
Surface Water Quality Monitoring Locations

Figure 9

A review of the water balance of the modified NM was conducted by WRM Water and Environment (2015) (Appendix C).

The water balance model simulates future changes in stored volumes of water on-site in response to inflows (e.g. groundwater inflows, rainfall-runoff), outflows (evaporation, underground mining demand, CHPP demand, dust suppression usage, licensed discharge) and pumped transfers. The modelling is completed over a large number of different daily climate “realisations” compiled from the available rainfall record and includes historical climate events in the water balance model, including high, low and median rainfall periods.

The water balance review indicates that there would continue to be an excess of water produced at the modified NM. The on-site water demand would therefore be likely to be satisfied by water captured in the site water management system (Appendix C), with excess water treated on-site.

The water balance model indicates that the risk of an uncontrolled release from the modified NM is very low and that there would be no uncontrolled releases of brine (i.e. a by-product of water treatment on-site) (Appendix C).

NCOPL would continue to undertake regular reviews of the site water balance, which is inherently highly influenced by groundwater inflows. The timing of implementation of augmentations to the site water management system would be dependent on actual water storage levels and inflows, and the outcomes of these reviews.

Depending on stored water volumes, NCOPL can source raw water from existing licensed water supply sources (e.g. Namoi River extraction) to maintain a storage reserve or release excess filtered water to the Namoi River (Figure 1) in accordance with Condition 11, Schedule 4 of Project Approval 08_0144 to reduce storage reserves.

Pine and Kurrajong Creeks

WRM Water and Environment (Appendix C) concluded that potential impacts on Pine and Kurrajong Creeks (and their tributaries) due to subsidence associated with the Modification would be generally consistent with the currently approved impacts.

No major changes in the channel morphology of Pine and Kurrajong Creeks (and their tributaries) are expected (Appendix C).

As described in Section 3.6.1, SD5 is proposed to be removed from the site water management system as it currently collects water from undisturbed catchments not associated with the NM.

An additional 10 ha of undisturbed catchment would therefore report back to Kurrajong Creek (Appendix C).

The Modification would not change the size of the catchment reporting to Pine Creek (Appendix C).

Water Quality

As described above, the water balance model indicates that the risk of an uncontrolled release from the modified NM would be very low and that there would be no uncontrolled releases of brine. Uncontrolled releases from the modified NM are, therefore, unlikely to result in adverse water quality impacts (Appendix C).

Water released to the Namoi River would be treated, and would comply with the criteria outlined in Condition 20, Schedule 4 of Project Approval 08_0144 and would therefore not result in adverse water quality impacts in the Namoi River (Appendix C).

The evaporators would be located in water storage dams (i.e. A1, A2, A3, B2 and C) so that water that is not evaporated reports back to the water storage dam (i.e. maintained in site water management systems).

Management Measures, Monitoring and Licensing

Management Measures and Monitoring

NCOPL would continue to implement the existing surface water management measures detailed in the Water Management Plan (URS Australia, 2013).

Although the controlled release of treated water to the Namoi River is not expected to result in adverse water quality impacts, NCOPL would implement the salinity offset works proposed for the Stage 2 NM in consultation with the NOW.

An operational protocol for the evaporators to minimise potential for impacts associated with the operation of the evaporators (e.g. cessation of evaporator operation during strong winds to minimise spray drift) would be incorporated in a revised Water Management Plan.

The management and remediation of subsidence impacts on Pine Creek and Kurrajong Creek would continue to be undertaken in accordance with the Extraction Plan Water Management Plan (URS Australia, 2012).

Monitoring

NCOPL would continue to implement the existing surface water monitoring program detailed in the Water Management Plan (URS Australia, 2013).

Prior to the controlled release of treated water to the Namoi River, NCOPL would prepare and implement a Raffinate Discharge Control and Monitoring Plan in accordance with Condition 17, Schedule 4 of Project Approval 08_0144 to monitor potential Namoi River water quality impacts associated with the controlled release of the treated water.

Licensing

NCOPL will maintain existing Water Access Licences for the extraction of water from the Namoi River.

4.6 NOISE

4.6.1 Background

NM Noise Limits

Condition 1, Schedule 4 of Project Approval 08_0144 and Condition L3 of EPL 12789 specify the noise limits for the NM. Noise at the NM must not exceed 35 A-weighted decibels equivalent continuous noise level criteria (dBA $L_{Aeq[15\text{minute}]}$) at a privately owned residence or at 25% of a private landholders land during the day, evening or night.

Previous Assessments

An assessment of potential noise impacts associated with Stage 2 of the NM was conducted by Spectrum Acoustics (2009) which indicated that, with the implementation of mitigation measures, four privately owned residences would experience noise levels above 35 dBA $L_{Aeq[15\text{minute}]}$. These four residences have either since been purchased by NCOPL or the landholder has entered into a private agreement with NCOPL.

An assessment of the potential noise impacts associated with Modification 4 was undertaken by Spectrum Acoustics (2015).

The maximum predicted operational noise levels at privately owned residences under the relevant assessable meteorological conditions (i.e. 4 degrees Celsius [$^{\circ}\text{C}$]/100 m inversion conditions) are presented in Table 4.

**Table 4
Maximum Predicted Noise Levels
for the Approved NM
(at Privately-owned Residences)**

Residence	Predicted Noise Level dBA $L_{Aeq[15\text{minute}]}$
“Bow Hills” ¹	39
“Ardmona”	35
“Oakleigh”	31
“Pineview”	<30
“Matilda”	32
“Haylin View”	35
“Newhaven”	<30
“Belah Park”	36
“Merriman”	33
“Merulana”	<30

Source: Spectrum Acoustics (2015).

¹ NCOPL has entered into an agreement with the landholder which includes the implementation of additional mitigation measures.

Noise contours from Spectrum Acoustics (2015) are shown on Figure 10.

In summary, it was predicted that (Table 4):

- No privately-owned residences² would be in the noise affectation zone.
- One privately-owned residence² would be in the noise management zone (“Belah Park” – Figure 10).

NCOPL is currently negotiating the acquisition of “Belah Park”.

Noise Management and Monitoring

The existing Noise Management Plan (NCOPL, 2015d) describes the noise management and monitoring measures at the NM.

The Noise Management Plan describes (NCOPL, 2015d):

- Project Approval 08_0144 and EPL 12789 noise criteria;
- noise management measures;

² Privately-owned residences not subject to an existing private agreement with NCOPL.

- attended and real-time noise monitoring program; and
- complaints handling procedures.

Attended Noise Monitoring

The NM noise monitoring program includes attended noise monitoring at locations surrounding the NM (Figure 10).

Based on the results of attended monitoring, operational noise from the NM has complied with the noise limits specified in Project Approval 08_0144 and EPL 12789 at privately owned residences not subject to an existing private agreement with NCOPL during 2012 to July 2015 except on six occasions (Appendix D).

Real-time Monitoring

Real time (unattended) noise monitoring is conducted at the NM to assist in the management of noise impacts (Appendix D).

4.6.2 Environmental Review

Wilkinson Murray (2015) conducted an assessment of potential noise impacts associated with the Modification (Appendix D).

Potential Impacts

The Modification would not include any significant change to night-time noise sources at the NM (e.g. mine fleet, CHPP and surface infrastructure) (Sections 3.1.10 and 3.2) that were modelled by Spectrum Acoustics (2015).

The site water balance review indicated that evaporators may be adopted at the modified NM. The evaporators would operate during the daytime only and would be selected and located to minimise potential noise impacts.

Wilkinson Murray (2015) considered the Spectrum Acoustics (2015) noise model to be fit for purpose to determine the potential noise impacts associated with the Modification (Appendix D).

Given the above, Wilkinson Murray (2015) concluded that the modified NM operational intrusive noise levels would not change from those predicted in Spectrum Acoustics (2015) (Appendix D).

Management Measures and Monitoring

NCOPL would continue to implement the noise management and monitoring measures detailed in the Noise Management Plan (NCOPL, 2015d).

4.7 AIR QUALITY

4.7.1 Background

Previous Assessment

An assessment of potential air quality impacts associated with Stage 2 of the NM was undertaken by Heggies (2009a).

An assessment of the potential air quality impacts associated with Modification 4 was undertaken by Environ Australia (2015).

The Environ Australia (2015) assessment predicted there would be no exceedances of the Project Approval 08_0144 24-hour average particulate matter with diameter less than 10 microns (PM₁₀) criterion, annual average total suspended solids (TSP), PM₁₀ or dust deposition criteria at any privately-owned residence due to emissions from the project only.

When considering project only dust emissions cumulatively with other dust sources, no exceedances of annual average PM₁₀, TSP or dust deposition criteria were predicted (Environ Australia, 2015).

Environ Australia (2015) predicted that the risk of additional exceedances (less than 0.2%) of the 24-hour PM₁₀ criterion at privately owned residences, due to Modification 4 is minimal.

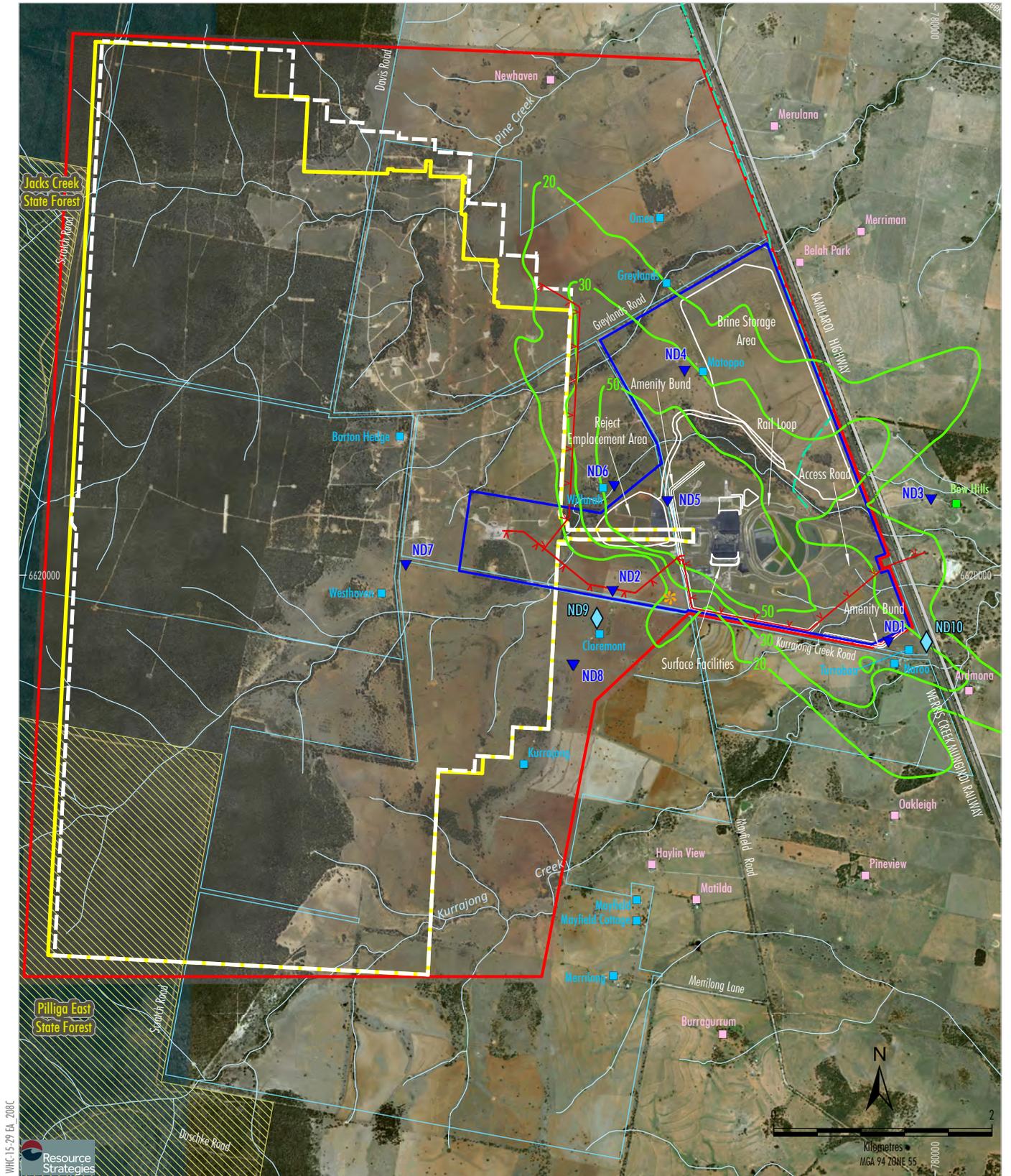
The results of Environ Australia (2015) are generally consistent with Heggies (2009a).

Air Quality Management and Monitoring

The Air Quality Monitoring Program (NCOPL, 2015e) describes the air quality management and monitoring regime at the NM.

The Air Quality Monitoring Program (NCOPL, 2015e) describes:

- Project Approval 08_0144 air quality criteria;
- air quality controls and management procedures;
- air quality monitoring locations and frequency, comprising (Figure 11):
 - two High Volume Air Samplers (HVAS) measuring PM₁₀ on a one day in six cycle; and
 - eight dust deposition gauges.



Source: Orthophotos - Whitehaven Coal (March 2015) and Google Earth (Feb 2015); R.W. Corkery & Co Pty Ltd (2009), NSW Trade & Investment (2015) and NCOPL (2015)

- LEGEND**
- State Forest
 - Mining Lease Boundary (ML 1609)
 - Pit Top Area
 - Approved Underground Mine Footprint
 - Approved Surface Development (Not Constructed)
 - Modified Underground Mine Footprint
 - Electricity Transmission Line (Constructed)
 - Namoi River Water Pipeline

- Mine-owned Dwelling
 - Private Dwelling
 - Private Dwelling - NCOPL Agreement
 - Mine Owned Land
- Monitoring Site**
- Deposited Dust Monitoring Location
 - PM₁₀ Monitoring Location
 - Meteorological Station
 - PM₁₀ Contour

WHITEHAVEN COAL

NARRABRI MINE

Air Quality and Meteorological Monitoring Locations and 24-hour PM₁₀ Contours (Project Only)

Figure 11

- response protocol to any exceedances of Project Approval 08_0144 air quality criteria; and
- complaints management protocol.

Existing Air Quality

Air quality monitoring conducted since 2007 in accordance with the Air Quality Monitoring Program (NCOPL, 2015e) shows cumulative 24-hour PM₁₀ levels have been below the Project Approval 08_0144 criterion with the exception of a one-off exceedance in 2008 associated with localised short-term construction activities and exceedances in late 2009 associated with a regional dust storm event (Appendix E).

No exceedances of the Project Approval 08_0144 annual average PM₁₀ criterion have been recorded (Appendix E).

No exceedances of the Project Approval 08_0144 cumulative annual average dust deposition criterion have been recorded at the dust deposition gauge that is located on privately-owned property with the exception of 2008 and 2009 exceedances as discussed above (Appendix E).

4.7.2 Environmental Review

Potential Impacts

Modelling Methodology

Air quality dispersion modelling has been conducted by Ramboll Environ (formerly Environ Australia) (2015) to assess potential impacts of the Modification (Appendix E).

The air quality modelling scenario selected was the existing NM with the increased ROM coal production rate.

Emissions of TSP (i.e. dust) were estimated by Ramboll Environ (2015) using contemporary emission estimation methodologies.

Predicted Impacts – Project Only

Concentrations of TSP, PM₁₀ and particulate matter with diameter less than 2.5 microns (PM_{2.5}) as well as dust deposition levels were predicted at privately owned residences.

There were no predicted exceedances of the Project Approval 08_0144 24-hour average PM₁₀ criterion, or annual average TSP, PM₁₀ or dust deposition criteria, at any privately-owned residence due to emissions from the Project only (i.e. the NM incorporating the Modification) (Appendix E).

Contours showing predicted project only 24-hour PM₁₀ concentrations are provided on Figure 11.

Predicted Impacts – Cumulative

Ramboll Environ has analysed monitoring data to estimate the contribution of other (i.e. non-NM) sources to dust concentrations and dust deposition levels. When considering project only dust emissions cumulatively with other dust sources, no exceedances of annual average PM₁₀, TSP or dust deposition criteria are predicted (Appendix E).

Statistical analysis, where all available 24-hour PM₁₀ monitoring data is added to 365 days of predicted project only 24-hour PM₁₀ concentrations was undertaken for the Modification.

The analysis found that the risk of an additional exceedance of the 24-hour average PM₁₀ criterion at privately owned residences due to the Modification is minimal (less than 0.1%) (Appendix E).

Management Measures and Monitoring

NCOPL would continue to implement the existing air quality management and monitoring measures detailed in the Air Quality Monitoring Program (NCOPL, 2015e) for the Modification.

4.8 GREENHOUSE GAS EMISSIONS

4.8.1 Background

Previous Assessment

Estimates of potential greenhouse gas emissions associated with the NM were provided by Heggies (2009b).

Estimates were presented for direct (Scope 1) emissions, indirect (Scope 2) and significant indirect upstream/downstream (Scope 3) emissions.

Annual Scope 1 (direct) emissions were estimated to be 0.4 million tonnes of carbon dioxide equivalents (Mt CO₂-e) per annum. Heggies (2009b) estimated that annual total (Scopes 1 to 3) emissions for the NM to be 19.5 Mt CO₂-e.

Greenhouse Gas Management

NCOPL implements all reasonable and feasible measures to minimise greenhouse gas emissions at the NM in accordance with Condition 31, Schedule 4 of Project Approval 08_0144.

Greenhouse gas management at the NM is conducted in accordance with the Greenhouse Gas Minimisation Plan (SLR, 2012). The Greenhouse Gas Minimisation Plan includes:

- identification of greenhouse gas emission sources at the NM;
- options for minimising greenhouse gas emissions;
- cost and benefits of coal seam methane abatement and use; and
- research programs.

In addition, an Energy Savings Action Plan (Advitech, 2014) has been implemented at the NM to minimise greenhouse gas emissions.

4.8.2 Environmental Review

Potential Impacts

Greenhouse gas emissions associated with the modified NM have been assessed by Ramboll Environ (2015) in accordance with relevant *National Greenhouse Accounts Factors* (Department of the Environment [DoE], 2014a) and *Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia, National Greenhouse and Energy Reporting (Measurement) Determination* (DoE, 2014b).

The greenhouse gas emissions associated with the modified NM have been assessed in terms of direct (Scope 1) emission potential, indirect (Scope 2) emission potential and significant upstream/downstream (Scope 3) emission potential (Appendix E).

Direct emissions include diesel usage and the liberation of methane associated with mining of the coal, whilst indirect emissions are associated with generation of electricity consumed at the modified NM and transportation and end-use of coal.

The average annual direct (Scope 1) emissions from the modified NM are estimated to be approximately 0.15 Mt CO₂-e per annum.

The average annual indirect (Scope 2) and upstream/downstream (Scope 3) emissions are estimated to be approximately 0.08 Mt CO₂-e per annum and 22.1 Mt CO₂-e per annum, respectively (Appendix E).

Average annual Scope 1 emissions from the modified NM (0.15 Mt CO₂-e) would represent 0.03% of Australia's Kyoto commitment (591.5 Mt CO₂-e) (Appendix E).

Management Measures

Opportunities to minimise energy consumption and greenhouse gas emissions have been a central consideration to the design and engineering of the NM development and where practicable, energy efficiency measures have been implemented into the NM infrastructure and operations philosophy (Advitech, 2014).

NCOPL would continue to minimise greenhouse gas emissions in accordance with the Greenhouse Gas Minimisation Plan (SLR, 2012) and the Energy Savings Action Plan (Advitech, 2014).

4.9 ABORIGINAL CULTURAL HERITAGE

4.9.1 Background

An Aboriginal Cultural Heritage Assessment (ACHA) has been prepared for the Modification by Niche Environment and Heritage (2015) and is presented in Appendix F.

The ACHA for the Modification has been undertaken in consideration of the following codes and guidelines (Appendix F):

- *Aboriginal cultural heritage consultation requirements for proponents 2010* (NSW Department of Environment, Climate Change and Water [DECCW], 2010a).
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b).
- *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011).

Previous Archaeological Investigations

A number of Aboriginal cultural heritage surveys, assessments and salvage programmes have been undertaken within the NM and surrounds.

Key Aboriginal cultural heritage surveys and assessments were undertaken for the NM in 2007, 2009 and 2013 (Archaeological Surveys & Reports, 2009a; Australian Archaeological Survey Consultants, 2007; Advitech Environmental, 2013). Various other minor surveys and assessments have also been undertaken.

A detailed description of previous archaeological assessments and surveys undertaken at the NM and surrounds is provided in Appendix F.

A total of 142 Aboriginal sites have been previously identified at the NM and surrounds, including artefact scatters, isolated finds, grinding grooves (including axe grinding grooves), scarred trees, an open camp site and a resource site (Appendix F).

Aboriginal Cultural Heritage Management

The management of Aboriginal heritage at the NM is currently conducted in accordance with the measures outlined in the Aboriginal Cultural Heritage Management Plan (NCOPL, 2011).

The Extraction Plan (AECOM, 2011) for LW101 to LW105 includes a Heritage Management Plan (AECOM, 2012b) and Land Management Plan (EcoLogical, 2012c) which include additional Aboriginal heritage management measures.

4.9.2 Environmental Review

Consultation

The ACHA prepared for the Modification included consultation with two RAPs, namely the Gomeroi Narrabri Aboriginal Corporation and the Narrabri Local Aboriginal Land Council (Appendix F).

Consultation with RAPs regarding the existing NM has been extensive and involved various methods of communication including public notices, meetings, written and verbal correspondence and archaeological survey attendance.

A detailed description of the consultation undertaken for the Modification is provided in Appendix F.

Desktop Review

A search of the OEH Aboriginal Heritage Information Management System (AHIMS) database was undertaken in July 2015 (Appendix F) for the NM and wider surrounds. This search identified a total of 141 Aboriginal sites³ at the NM and surrounds, however did not identify any Aboriginal heritage sites within the area associated with the western extension of the underground mine footprint (Section 3.1.2) (i.e. the area subject to survey).

Archaeological Survey Design

Archaeological surveys of the area associated with the western extension of the underground mine footprint were undertaken in consultation with the RAPs on 15 and 21 July 2015.

Surveys were undertaken consistent with the approach described in the Proposed Methodology (issued to all RAPs for their review and comment in June 2015) and consistent with the approach undertaken for the Narrabri Coal Mine Stage 2 Longwall Project Aboriginal Heritage Assessment (Archaeological Surveys & Reports, 2009a).

The surveys targeted sensitive locations and/or environments within the area of the western extension associated with the modified underground mine footprint, which had the highest potential to contain evidence of Aboriginal heritage. Low intensity transects were also undertaken across the survey area (Appendix F).

Archaeological Findings

No Aboriginal heritage sites or areas of Aboriginal cultural heritage value were identified during the July 2015 surveys (Appendix F), and none of the previously recorded Aboriginal heritage sites are located within the area associated with the western extension of the underground mine footprint (i.e. the area subject to survey).

As described above, 142 Aboriginal sites have been previously identified at the NM and surrounds, including above the modified underground mine footprint.

³ This number of sites listed on the AHIMS register differs from the total number of sites recorded at the NM due to one of the sites not having been registered on the AHIMS register when originally provided.

Potential Impacts

Potential impacts associated with the Modification include subsidence or subsidence remediation works associated with the increased longwall panel widths for LW107 to LW120 and the western extension of the underground mining footprint.

Because no Aboriginal objects or areas of cultural heritage value have been identified during the July 2015 surveys, it is concluded that the Modification is unlikely to have an impact on known Aboriginal cultural heritage values within the area associated with the western extension of the underground mine footprint (Appendix F).

Subsidence estimates for the modified underground mine footprint have been provided by Ditton Geotechnical Services (2015). All previously recorded sites located above the modified underground mine footprint are already approved for subsidence impacts associated with the approved NM, and the Modification would only result in minimal changes to the level of subsidence associated with each site (Appendix A).

Ditton Geotechnical Services (2015) has also predicted that there may be a minor increase in ponding across the modified underground mine footprint as a result of the Modification. While some artefact scatters and isolated finds may occur coincident with the areas of increased ponding, these areas would be managed in accordance with the Extraction Plan Land Management Plan (EcoLogical, 2012c) (i.e. ponded areas would be managed to restore natural flow patterns).

On the basis of the above, no sites are anticipated to be significantly impacted as a result of incremental changes in subsidence effects associated with the Modification (Appendix F).

Management and Mitigation Measures

NCOPL would continue to implement the management and mitigation measures described in Appendix F and the Aboriginal Cultural Heritage Management Plan (NCOPL, 2011).

In addition, NCOPL would continue to implement the management and mitigation measures described in the Heritage Management Plan and Land Management Plan in relevant Extraction Plans.

4.10 HISTORIC HERITAGE

4.10.1 Background

A Non-Indigenous Heritage Assessment was prepared for Stage 2 of the NM in November 2009 (Archaeological Surveys & Reports, 2009b), and included an assessment of the impacts associated with the NM.

The assessment undertaken by Archaeological Surveys & Reports (2009b) identified no items of heritage significance at the NM.

4.10.2 Environmental Review

As no items of historic heritage have been identified within the NM or immediate surrounds, it is considered that there would be no impacts on historic heritage associated with the Modification.

No management or mitigation measures are proposed in relation to historic heritage at the NM.

4.11 BIODIVERSITY

4.11.1 Background

Ecotone Ecological Consultants (2009) assessed the potential impacts on flora and fauna (including threatened species) of Stage 2 of the NM using a combination of literature reviews and field surveys. The *Director-General's Environmental Assessment Report* (Department of Planning, 2010) concludes that the flora and fauna surveys conducted at the NM are comprehensive and provide a sound basis to assess the impacts on biodiversity values.

The NM is approved to clear 210.5 ha of native vegetation in the surface disturbance area for mine associated infrastructure. To compensate for impacts from the NM, the *Narrabri Coal Mine Stage 1 and 2 Biodiversity Offset Strategy* (EcoLogical, 2014a) describes an offset package which includes the protection and management of a 422 ha on-site offset area (Figure 12) and an additional 1,243 ha off-site offset area on the 'Kenna' property (EcoLogical, 2014a).

In addition to direct clearance of native vegetation, the approved NM was originally predicted to result in indirect impacts on native vegetation due to subsidence cracking, land instability, reduction in soil moisture, soil erosion, deviation of surface flows and ponding (Ecotone Ecological Consultants, 2009; Ditton Geotechnical Services, 2009). Subsidence impacts were predicted to be greater in the eastern extent of the predicted subsidence zone where shallower depth of cover will lead to more likely surface impacts (Ditton Geotechnical Services, 2009).

The predicted decline in subsidence impacts with increasing depth of cover (Ecotone Ecological Consultants, 2009; Ditton Geotechnical Services, 2009) has been validated through tree health monitoring data gathered to date. EcoLogical (2014b) monitored the health of Inland Grey Box Woodland⁴ beneath LW101 to LW103 following mining. It was identified that impacts progressively declined from east to west. EcoLogical (2014b) recorded a loss of 59% of trees along LW101, 35% of trees along LW102 and 1% of trees along LW103. Following a series of investigations (Section 4.2), the tree loss was attributed to surface cracking damaging the tree root system from a combination of a relatively shallow depth of cover, lighter soils and dry conditions (EcoLogical, 2014b).

The majority of the native vegetation occurs in the west of the predicted subsidence zone (Figure 12) where less subsidence impacts are predicted. This vegetation is on elevated land adjacent to Jacks Creek State Forest or within the Pilliga East State Forest. The eastern half of the predicted subsidence zone (where impacts are predicted to be greater) is mostly non-native cleared land, with patches of Callitris Forest, Riparian Forest and Inland Grey Box Woodland (Ecotone Ecological Consultants, 2009) (Figure 12).

Subsidence impacts on native vegetation are expected to be minimal west of LW103 (e.g. subsidence impacts are expected to be minimal in the Pilliga East State Forest [EcoLogical, 2014b]). The depth of cover west of LW103 is greater than approximately 210 m increasing to approximately 370 m in LW111 to the west. Later in the mine life, the depth of cover will again fall below 210 m during mining of LW118 to LW121 in the east. Above these longwalls, there is approximately 62 ha of native vegetation (Callitris Forest, Riparian Forest and Inland Grey Box Woodland) (Figure 12) which will be subject to subsidence impacts.

NCOPL implements measures to mitigate (remediate) subsidence impacts as described in Section 4.2. In addition, the land-based offset (described above) has been provided to compensate for indirect impacts from subsidence impacts (EcoLogical, 2014a). In the *Narrabri Coal Mine Stage 1 and 2 Biodiversity Offset Strategy*, EcoLogical (2014a) conservatively assumed that the predicted subsidence from the existing/approved NM would impact 10% of the vegetation 'values' within the predicted subsidence zone and equated this to a loss of 202 ha (i.e. 10% of the overall area of vegetation in the predicted subsidence zone, which is considered in the offset package).

Despite the observed subsidence impacts which is considered in the offset package, natural regeneration of saplings, such as Grey Box (*Eucalyptus macrocarpa*), has been observed in areas subject to subsidence (EcoLogical, 2014b). This suggests that the subsidence impacts on native vegetation will be temporary.

4.11.2 Environmental Review

The Modification would not require any change to the total area of native vegetation already approved to be cleared. As described above, 210.5 ha of native vegetation would be cleared for mine associated infrastructure and this native vegetation clearance has been accounted for in the offset package (EcoLogical, 2014a).

The Modification involves less mining beneath native vegetation along the northern boundary of the underground mine footprint, resulting in less potential for impacts to Inland Grey Box Woodland and Riparian Forest (Figure 12). Along the northern boundary of the underground mine footprint, there is approximately 7 ha less Inland Grey Box Woodland and approximately 1 ha less Riparian Forest within the modified underground mine footprint compared to the approved underground mine footprint (Table 5; Figure 12). Similarly, the Modification involves less mining beneath Brown Bloodwood/Pilliga Box Woodland along the northern boundary of the underground mine footprint, although it would result in a greater area of mining beneath this community overall (approximately 17 ha), mostly due to a 60 m extension of the underground mine footprint along the western boundary (Table 5; Figure 12).

⁴ An endangered ecological community listed under the *Threatened Species Conservation Act, 1995* (TSC Act) and *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act).

Table 5
Area of Native Vegetation within the Approved
and Modified Underground Mine Footprint

Vegetation Community	Area of Native Vegetation within the Approved Underground Mine Footprint (ha)	Area of Native Vegetation within the Modified Underground Mine Footprint (ha)	Difference
Brown Bloodwood/Pilliga Box Woodland	1,735	1,752	17
Riparian Forest	60	59	-1
Callitris Forest	20	20	0
Inland Grey Box Woodland	205	198	-7
Total	2,020	2,029	9

In general, the Modification would result in a minor increase in the total area of native vegetation within the underground mine footprint, approximately 9 ha (<0.5%) (Table 5). This additional vegetation comprises Brown Bloodwood/Pilliga Box Woodland which occurs on elevated land where less subsidence impacts are predicted due to greater depth of cover (e.g. approximately 360 m) (Figure 12).

As described in Section 4.2, the Modification would result in a change to the predicted land subsidence impacts through increasing the width of the longwall panels. However, the Modification would not result in additional material changes to the subsidence impacts (e.g. cracking, land instability, reduction in soil moisture, soil erosion, deviation of surface flows and ponding) (Appendix A). Therefore, there would be no material alteration to the existing/approved impacts of the NM on flora or fauna.

Due to a change in the configuration of the longwall panels, the modified underground mine footprint covers approximately 11 ha less land within the on-site offset area, but approximately 13 ha of additional land within Pilliga East State Forest (Figure 12). Despite this change, subsidence impacts on native vegetation are expected to be minimal in Pilliga East State Forest due to the large depth of cover (Section 4.11.1).

The Modification is not likely to result in additional significant impacts on threatened flora, fauna or ecological communities listed under the TSC Act or NSW *Fisheries Management Act, 1994* (FM Act) given:

- The Modification would not require any additional clearance of native vegetation.

- The Modification would not result in additional material changes to the subsidence impacts (e.g. cracking, land instability, reduction in soil moisture, soil erosion, deviation of surface flows and ponding).

In accordance with current practice (EcoLogical, 2012d), NCOPL would continue to undertake pre-clearing surveys by a qualified ecologist to identify the presence of threatened species or communities and use this information to determine appropriate paths for access tracks and other infrastructure with the aim of minimising impacts on threatened species and communities, where practical.

As described in Section 4.2, the existing subsidence impact mitigation measures would continue to be undertaken for the Modification. Since there would be no material alteration to the existing/approved impacts on flora or fauna, no specific additional impact avoidance, mitigation or offset measures are required or proposed.

4.12 ROAD TRANSPORT

4.12.1 Background

Potential road transport impacts associated with the NM were assessed by R.W. Corkery & Co. Pty Ltd (2009).

Road Network

Kamilaroi Highway (State Highway 29) runs generally north-south and to the east of the NM (Figure 1) and provides a link between the Upper Hunter region and the north-west of NSW. In the vicinity of the NM, the Kamilaroi Highway has a single travel lane in each direction, with auxiliary turn lanes at some intersections, and a posted speed limit of 100 kilometres per hour (km/hr).

Kurrajong Creek Road is a local road that provides access from the Kamilaroi Highway to the NM access road and rural properties to the south of the NM. NCOPL sealed approximately 7 km of Kurrajong Creek Road in the vicinity of the NM (R.W. Corkery & Co. Pty Ltd, 2009).

The intersection of the NM access road with Kurrajong Creek Road is located approximately 80 m to the west of the Kamilaroi Highway. A level crossing of the Werris Creek Mungindi Railway is located on Kurrajong Creek Road between the Kamilaroi Highway and the NM access road intersections.

NCOPL upgraded the Kamilaroi Highway/Kurrajong Creek Road and Kurrajong Creek Road/NM access road intersections for the Stage 1 NM. The Werris Creek Mungindi Railway level crossing was also upgraded by NCOPL for the Stage 1 NM.

In accordance with the RMS requirements, the Kamilaroi Highway/Kurrajong Creek Road intersection (including dedicated turning lanes) was upgraded to cater for the maximum anticipated traffic volume arriving at the intersection over the maximum closure time of the Kurrajong Creek Road railway crossing (i.e. approximately 6 minutes) (R.W. Corkery & Co. Pty Ltd, 2009).

NCOPL also upgraded sections of a local unsealed road in the vicinity of the NM (i.e. Greylands Road) for Stage 2 NM.

Traffic Volumes

Traffic volumes on the Kamilaroi Highway in the vicinity of the NM are summarised in Table 6.

**Table 6
Kamilaroi Highway Traffic Movements**

Vehicle Type	Movements/Day
Light Vehicles	1,920
Heavy Vehicles	280
Total	2,200

Source: GTA Consultants, pers. comm., June 2015.

Non-NM related traffic on Kurrajong Creek Road is low (R.W. Corkery & Co. Pty Ltd, 2009).

R.W. Corkery & Co. Pty Ltd (2009) estimated that approximately 260 vehicles per day (520 movements per day) would be generated from the NM on average. Road traffic movements were estimated to peak at approximately 400 vehicles per day (or 800 movements per day).

Road Safety

R.W. Corkery & Co. Pty Ltd (2009) considered the potential road safety implications of the NM and concluded that there were no particular safety issues identified.

Road Maintenance

In accordance with Condition 25, Schedule 3 of Project Approval 08-0144, NCOPL maintains the Kamilaroi Highway/Kurrajong Creek Road and Kurrajong Creek Road/NM access road intersections in consultation with the NSC and to the satisfaction of the RMS.

NCOPL maintains Greylands Road to an all-weather unsealed standard in accordance with Condition 26(b), Schedule 3 of Project Approval 08-0144. NCOPL is in the process of purchasing Greylands Road from the NSC.

In addition, NCOPL financially contributed to the Gunnedah Traffic Management Study in accordance with Condition 27, Schedule 3 of Project Approval 08-0144. The Traffic Management Study (GHD, 2013) analysed the impacts of increased rail traffic on road safety and congestion due to increased closure of rail level crossings within Gunnedah.

Fatigue Management

Fatigue management at the NM is undertaken in accordance with the *Whitehaven Group Fatigue Management Standard* (Whitehaven, 2013). The *Whitehaven Group Fatigue Management Standard* considers travel time before and after work in the fatigue management process.

4.12.2 Environmental Review

Potential Impacts

The Modification would result in additional road traffic movements associated with a minor increase in heavy vehicle movements. An increase in heavy vehicle movements would be required due to increased demand for consumables (e.g. diesel, chemicals) associated with the increased ROM coal production rate.

It is estimated that the number of heavy vehicles per day would increase on average by 2 per day (or 4 movements per day) and a peak increase of 5 per day (or 10 movements per day). As the Modification would not include an increase in the NM workforce (Section 3.9), no additional workforce-related road traffic movements are expected as a result of the Modification.

No product coal or coal rejects are transported from the NM by road (Sections 2.4 and 2.5).

Traffic Volumes

The estimated average and peak increase in heavy vehicle movements associated with the Modification would represent a 0.2% and 0.5% increase in existing Kamilaroi Highway movements, respectively. This minor increase in vehicle movements would be within the range of daily traffic variations and would not result in significant road transport impacts on the surrounding road network.

Road Safety

The Kamilaroi Highway/Kurrajong Creek Road intersection is expected to continue to operate safely during the closure of the Kurrajong Creek Road railway crossing as only a minor increase in heavy vehicle movements (i.e. an average for 2 additional heavy vehicles per day and a maximum of 5 additional heavy vehicles per day) is proposed as part of the Modification.

Given the findings of R.W. Corkery & Co. Pty Ltd (2009) and the increases in road traffic expected as a result of the Modification are minor, it is considered that the Modification is unlikely to result in any safety concerns on the surrounding road network.

Mitigation and Management Measures

NCOPL would continue to undertake road maintenance in accordance with Project Approval 08_0144.

NCOPL would also continue to implement the *Whitehaven Group Fatigue Management Standard* (Whitehaven, 2013).

4.13 HAZARD AND RISK

4.13.1 Background

As part of the Stage 2 EA, R. W. Corkery & Co. Pty Ltd (2009) undertook a hazard and risk screening under *State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)* to determine whether a Preliminary Hazard Analysis was required for the Stage 2 Project.

On-site storage methods designed to reduce potential for hazards considered were:

- Diesel fuel – approved self-bunded fuel tank.
- Lubricating oils and greases – fuel storage area and workshop within the Pit Top Area.
- Explosives – separate explosives magazines greater than 320 m from active areas, other hazardous materials storages, public access points and residences.

The findings of this screening analysis were (R. W. Corkery & Co. Pty Ltd, 2009):

Based on the risk screening method of DUAP (1997), neither the storage nor transport of the hazardous materials to be stored on the Mine Site would result in the Longwall Project being considered potentially hazardous under SEPP 33. As such, there is no requirement to undertake a PHA for the Narrabri Coal Mine – Stage 2 Longwall Project.

4.13.2 Environmental Review

Although the Modification would result in an increase of use of consumables at the NM, the existing storage and handling measures would remain in-place, therefore the overall level of hazard/risk is unlikely to change.

5 STATUTORY CONTEXT

This section outlines the statutory requirements relevant to the assessment of the Modification. It also provides a consideration of the Modification against the objects of the EP&A Act.

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

Stage 2 of the NM was approved under Part 3A of the EP&A Act in 2010 (Project Approval 08_0144).

The NM is a 'transitional Part 3A project' under clause 2 of Schedule 6A of the EP&A Act and therefore section 75W of the EP&A Act continues to apply to modifications to Project Approval 08_0144, notwithstanding its repeal.⁵

As outlined in Section 1.3, NCOPL consulted with the DP&E in May 2015 with regards to seeking the necessary approvals for the Modification and based on this consultation, this EA has been prepared under section 75W of the EP&A Act.

Section 75W of the EP&A Act relevantly provides:

75W Modification of Minister's approval

(1) *In this section:*

Minister's approval means an approval to carry out a project under this Part, and includes an approval of a concept plan.

Modification of approval means changing the terms of a Minister's approval, including:

- (a) *revoking or varying a condition of the approval or imposing an additional condition of the approval, and*
- (b) *changing the terms of any determination made by the Minister under Division 3 in connection with the approval.*

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

- (3) *The request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.*
- (4) *The Minister may modify the approval (with or without conditions) or disapprove of the modification...*

The EP&A Act and the *Environmental Planning and Assessment Regulation, 2000* (EP&A Regulation) set the framework for planning and environmental assessment in NSW. As noted above, Modification is to be assessed under section 75W (Part 3A) of the EP&A Act.

Section 5 of the EP&A Act describes the objects of the EP&A Act as follows:

- (a) *to encourage:*
 - (i) *the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,*
 - (ii) *the promotion and co-ordination of the orderly and economic use and development of land,*
 - (iii) *the protection, provision and coordination of communication and utility services,*
 - (iv) *the provision of land for public purposes,*
 - (v) *the provision and co-ordination of community services and facilities, and*
 - (vi) *the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and*
 - (vii) *ecologically sustainable development, and*
 - (viii) *the provision and maintenance of affordable housing, and*
- (b) *to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and*
- (c) *to provide increased opportunity for public involvement and participation in environmental planning and assessment.*

⁵ Part 3A of the EP&A Act (as in force immediately before its repeal) continues to apply for the NM. The description and quotations of relevant references to clauses of Part 3A in this document are as if Part 3A of the EP&A Act is still in force.

The Modification is considered to be generally consistent with the objects of the EP&A Act, because it is a modification which would:

- incorporate measures for the management and conservation of natural resources (Section 4);
- enable more efficient underground coal mining operations across the NM (Section 3.1.2);
- allow activities to continue on Crown land at the NM;
- not affect the ongoing provision of community services and facilities;
- result in no significant impact on threatened species, populations and ecological communities or their habitats (Section 4.11.2);
- allow continued development of the State's mineral resources (i.e. coal resources) in a manner that minimises environmental impacts through the implementation of the Environmental Management Strategy (Section 2.12) and other measures (Section 4); and
- allow public involvement and participation through consultation activities (Section 1.3), which would be ongoing following the public exhibition of this EA document and DP&E assessment of the Modification in accordance with the requirements of the EP&A Act.

5.2 GENERAL STATUTORY REQUIREMENTS

5.2.1 Other State Legislation

In addition to the EP&A Act, the following NSW Acts may be applicable to the NM, incorporating the Modification:

- *Crown Lands Act, 1989*;
- *Dangerous Goods (Road and Rail Transport) Act, 2008*;
- *Forestry Act, 2012*;
- *Heritage Act, 1977*;
- *Mine Subsidence Compensation Act, 1961*;
- *Mining Act, 1992*;
- *National Parks and Wildlife Act, 1974* (NPW Act);
- *Native Vegetation Act, 2003*;
- *Noxious Weeds Act, 1993*;

- *Protection of the Environment Operations Act, 1997* (PoEO Act);
- *Roads Act, 1993*;
- TSC Act;
- *Water Act, 1912*;
- *Water Management Act, 2000*;
- *Work Health and Safety Act, 2011*; and
- *Work Health and Safety (Mines) Act, 2013*.

Relevant licences or approvals required under these Acts would continue to be obtained for the NM as required. Key plans and licences that would require revision to incorporate the Modification are outlined in Section 5.4.

Additional detail on the likely requirements under the some of the key Acts is provided in the subsections below.

Mining Act, 1992

NCOPL currently holds ML 1609 for activities at the NM. All activities associated with the Modification would be wholly located within the ML 1609 boundary.

Under the *Mining Act, 1992*, environmental protection and rehabilitation are regulated by conditions of mining leases, including requirements for the submission of a Mining Operations Plan prior to the commencement of operations, and subsequent AEMRs/Annual Reviews.

The NM Mining Operations Plan would be updated to include the modified underground mine layout prior to the commencement of the Modification (Section 5.4.2).

Water Management Act, 2000

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 Modification would not materially change licensing requirements for the approved NM (Section 4.4 and 4.5). NCOPL would continue to obtain and hold licences required under the *Water Management Act, 2000*.

Forestry Act, 2012

The *Forestry Act, 2012* provides for the dedication, reservation, control and use of State Forests, timber reserves and Crown lands for forestry and other purposes.

The Modification would involve activities within the Jacks Creek State Forest and the Pilliga East State Forest (Figure 3).

Section 35 of the *Forestry Act, 2012* provides that the exercise of any right under the *Mining Act, 1992* within a State Forest is subject to conditions relating to forestry or the purpose of the reserve.

All activities associated with the Modification are within the boundary of ML 1609. Activities within the Jacks Creek State Forest and the Pilliga East State Forest would continue to be conducted in accordance with the conditions of ML 1609.

National Parks and Wildlife Act, 1974

The NPW Act contains provisions for the protection and management of national parks, historic sites, nature reserves and Aboriginal heritage in NSW.

Section 75U(1) of the EP&A Act outlines authorisations that are not required for a transitional Part 3A project, including the Project Approvals (05_0117 and 08_0135). An Aboriginal Heritage Impact Permit under section 90 of the NPW Act is not required for the Project Approval 08_0144, including the Modification.

Notwithstanding, an ACHA for the Modification has been undertaken in consultation with the Registered Aboriginal Parties (Appendix F).

5.2.2 Environmental Planning Instruments

State environmental planning policies and the local environmental plan that may be relevant to the Modification are discussed below.

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

Mining SEPP regularises the various environmental planning instruments that previously controlled mining activities.

Clause 5(3) of the Mining SEPP gives it primacy where there is an inconsistency between the provisions of the Mining SEPP and the provisions of any other environmental planning instrument (except the *State Environmental Planning Policy (Major Development) 2005*, *State Environmental Planning Policy No. 14 [Coastal Wetlands]* and *State Environmental Planning Policy No. 26 [Littoral Rainforest]*).

Clause 2 – Aims of the Policy

Clause 2 sets out the aims of the Mining SEPP as follows:

- (a) *to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and*
- (b) *to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and*
- (b1) *to promote the development of significant mineral resources, and*
- (c) *to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources, and*
- (d) *to establish a gateway assessment process for certain mining and petroleum (oil and gas) development:*
 - (i) *to recognise the importance of agricultural resources, and*
 - (ii) *to ensure protection of strategic agricultural land and water resources, and*
 - (iii) *to ensure a balanced use of land by potentially competing industries, and*
 - (iv) *to provide for the sustainable growth of mining, petroleum and agricultural industries.*

Clause 7 – Permissible Development

Clause 7(1) of the Mining SEPP states that development for any of the following purposes may be carried out only with development consent:

- (a) *underground mining carried out on any land,*
- ...

The NM (incorporating the Modification) comprises underground mining activities and therefore requires development consent.

Clause 12AA – Significance of Resource

As at 6 August 2015, clause 12AA of the Mining SEPP requires that:

- (1) *In determining an application for consent for development for the purposes of mining, the consent authority must consider the significance of the resource that is the subject of the application, having regard to:*
 - (a) *the economic benefits, both to the State and the region in which the development is proposed to be carried out, of developing the resource, and*
 - (b) *any advice by the Director-General of the Department of Trade and Investment, Regional Infrastructure and Services as to the relative significance of the resource in comparison with other mineral resources across the State.*
- (2) *The following matters are (without limitation) taken to be relevant for the purposes of subclause (1) (a):*
 - (a) *employment generation,*
 - (b) *expenditure, including capital investment,*
 - (c) *the payment of royalties to the State.*
- (3) *The Director-General of the Department of Trade and Investment, Regional Infrastructure and Services is, in providing advice under subclause (1) (b), to have regard to such matters as that Director-General considers relevant, including (without limitation):*
 - (a) *the size, quality and availability of the resource that is the subject of the application, and*
 - (b) *the proximity and access of the land to which the application relates to existing or proposed infrastructure, and*
 - (c) *the relationship of the resource to any existing mine, and*
 - (d) *whether other industries or projects are dependent on the development of the resource.*
- (4) *In determining whether to grant consent to the proposed development, the significance of the resource is to be the consent authority's principal consideration under this Part.*
- (5) *Accordingly, the weight to be given by the consent authority to any other matter for consideration under this Part is to be proportionate to the importance of that other matter in comparison with the significance of the resource.*
- (6) *To avoid doubt, the obligations of a consent authority under this clause extend to any application to modify a development consent.*

The Modification would not significantly change the resource or employment at the NM.

The Modification would increase the period between longwall machine 'change-outs' which currently delay longwall mining operations by approximately 6 to 8 weeks each year. The period between longwall machine 'change-outs' would increase beyond 12 months and therefore longwall mining operations would be able to continue uninterrupted for periods of greater than 12 months. This, coupled with minor operational efficiency gains associated with the wider longwall panels, would allow the annual ROM coal production rate to increase up to approximately 11 Mtpa.

Clause 12 – Compatibility with Other Land Uses

Clause 12 of the Mining SEPP requires that, before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:

- (a) *consider:*
 - (i) *the existing uses and approved uses of land in the vicinity of the development, and*
 - (ii) *whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and*
 - (iii) *any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and*
- (b) *evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and*
- (c) *evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).*

As described in Section 4.3, the existing/approved land use in the vicinity of NM and the Modification area, is characterised by a combination of mining and agricultural (grazing, cereal production and horticulture) land uses as well as the Jacks Creek State Forest and the Pilliga East State Forest.

The potential impacts of the Modification on land resources, groundwater, surface water, noise, air quality, greenhouse gas emissions, Aboriginal and historic heritage, flora, fauna and road transport are described in Sections 4.3 to 4.12.

The Modification would allow for the efficient extraction of coal at the NM (Section 3.1.2).

NCOPL would implement a range of measures to avoid or minimise incompatibility of the Modification with existing and future land uses in the area. This would be achieved through the implementation of the existing Environmental Management Strategy (Section 2.12).

Clause 14 – Natural Resource Management and Environmental Management

Clause 14(1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the approval should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:

- (a) *that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,*
- (b) *that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,*
- (c) *that greenhouse gas emissions are minimised to the greatest extent practicable.*

In addition, clause 14(2) requires that, without limiting clause 14(1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable state or national policies, programmes or guidelines concerning greenhouse gas emissions.

The potential impacts of the Modification on groundwater and surface water resources are discussed in Sections 4.4 and 4.5, including measures to minimise potential impacts which are described in Sections 4.4.2 and 4.5.2.

The potential impacts of the Modification on threatened species and biodiversity are described in Section 4.11, including measures to minimise potential impacts.

Existing greenhouse gas abatement measures at the NM and the potential increase in greenhouse gas emissions associated with the Modification are described in Section 4.8.

Clause 15 – Resource Recovery

Clause 15 of the Mining SEPP requires that:

- (1) *Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery.*
- (2) *Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material.*
- (3) *The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.*

The Modification would allow for the extraction of coal reserves and enable more efficient recovery of underground coal (Section 3.1.2).

It is in NCOPL's financial interest to maximise the efficiency of coal recovery and minimise the generation of coal rejects which require disposal. The Modification would not produce any additional coal rejects.

Clause 16 – Transport

Clause 16(1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following:

- (a) *require that some or all of the transport of materials in connection with the development is not to be by public road,*
- (b) *limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,*
- (c) *require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.*

Product coal is transported from the NM via rail to Newcastle (i.e. no road transport) (Section 2.4). The Modification would not change NM product coal transport (Section 3.4), however, there would be an increase in the average number of trains from 3 trains/day to 4 trains/day.

The potential impacts of the Modification on the road transport network are considered in Section 4.12.

Clause 17 – Rehabilitation

Clause 17 of the Mining SEPP requires that before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the approval should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development.

In particular, the consent authority must consider whether the conditions of consent should:

- (a) *require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or*
- (b) *require waste generated by the development or the rehabilitation to be dealt with appropriately, or*
- (c) *require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under section 145C of the Act and the Contaminated Land Management Act 1997), or*
- (d) *require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.*

The rehabilitation of the NM would be conducted in accordance with the Rehabilitation Management Plan (EcoLogical, 2012b) (Section 2.10).

The Modification would not change the existing/approved rehabilitation strategy.

State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)

Clause 13 of the *State Environmental Planning Policy No. 33 (Hazardous and Offensive Development)* (SEPP 33) requires the consent authority, in considering a Development Application for a potentially hazardous or a potentially offensive industry, to take into account:

- (c) *in the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant, and*
- (d) *any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application), ...*

Whilst the Modification would result in a minor increase in consumables such as diesel and lubricating oils and grease, the Modification is not expected to result in changes to the existing/approved risks and hazards as the proposed activities associated with the Modification are consistent with those for the approved NM (Section 4.13).

Notwithstanding, relevant environmental management plans would be reviewed and, if necessary, revised by NCOPL to include the Modification and manage any associated environmental risk (subject to any modified Project Approval 08_0144 conditions).

State Environmental Planning Policy No. 44 (Koala Habitat Protection)

State Environmental Planning Policy No. 44 (Koala Habitat Protection) requires the consent authority for any Development Application in certain LGAs (including Narrabri) to consider whether land subject to a Development Application is "potential Koala habitat" or "core Koala habitat".

Core Koala habitat comprises land with a resident population of Koalas, whereas potential Koala habitat comprises land with native vegetation with known Koala feed trees constituting at least 15% of the total number of trees present on a site.

An assessment of the NM against the requirements of SEPP 44 was undertaken for the Stage 2 Project by Ecotone Ecological Consultants (2009). While Ecotone (2009) was unable to determine whether core Koala habitat existed at the NM, it was concluded that even in the event that it did occur the NM would be unlikely to affect the lifecycle of the Koala.

The Environmental Assessment Report prepared for the Stage 2 Project noted that the small areas of woodland proposed to be cleared associated with the NM would not affect the lifecycle of the Koala (DoP, 2010). The possible impact would be further mitigated by the proposed pre-clearing surveys to be undertaken prior to each clearing campaign (DoP, 2010).

State Environmental Planning Policy No. 55 (Remediation of Land)

State Environmental Planning Policy No. 55 (Remediation of Land) (SEPP 55) aims to provide a State-wide planning approach to the remediation of contaminated land. Under SEPP 55, planning authorities are required to consider the potential for contamination to adversely affect the suitability of the site for its proposed use.

A consent authority must consider the following under clause 7(1):

- (a) *it has considered whether the land is contaminated, and*
- (b) *if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and*
- (c) *if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.*

Further, under clause 7(2), before determining an application for consent to carry out development that would involve a change of use of land, the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned, carried out in accordance with the contaminated land planning guidelines.

Because the Modification is within the Project Application Area in the Project Approval 08_0144, no change of use is proposed and no preliminary land contamination investigation is required.

Narrabri Local Environmental Plan 2012

The NM is located wholly within the Narrabri LGA (Figure 1). The following identifies the provisions in the *Narrabri Local Environmental Plan, 2012* (Narrabri LEP) which may have relevance to the Modification.

Part 2.3, clause 2 of the Narrabri LEP relevantly provides:

The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.

As outlined above, the consent authority for transitional Part 3A projects is the Minister for Planning.

Under the Narrabri LEP, the Modification area includes lands zoned as RU1 – Primary Production and RU3 – Forestry.

Permissibility

Under the Narrabri LEP “open cut mining” is permissible on lands in the RU1 Zone with development consent. Underground mining is not listed as a permissible use under the Narrabri LEP.

The Narrabri LEP states:

Note. *A type of development referred to in the Land Use Table is a reference to that type of development only to the extent it is not regulated by an applicable State environmental planning policy. The following State environmental planning policies in particular may be relevant to development on land to which this Plan applies:*

...

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

...

Clause 4 of the Mining SEPP relevantly provides:

4 Land to which Policy applies

This Policy applies to the State.

As described above, clause 5(3) gives the Mining SEPP primacy where there is any inconsistency between the provisions in the Mining SEPP and the provisions in any other environmental planning instrument (subject to limited exceptions).

Clause 5(3) relevantly provides:

5 Relationship with other environmental planning policies

(3) ... if this Policy is inconsistent with any other environmental planning instrument, whether made before or after this Policy, this Policy prevails to the extent of the inconsistency.

The practical effect of clause 5(3) for the NM is that if there is any inconsistency between the provisions of the Mining SEPP and those contained in the Narrabri LEP, the provisions of the Mining SEPP will prevail.

As described above, clause 7 of the Mining SEPP provides what types of mining development are permissible only with development consent. In this regard, clause 7(1) states:

7 Development permissible with consent

(1) Mining

Development for any of the following purposes may be carried out only with development consent:

- (a) *underground mining carried out on any land,*

...

The term ‘underground mining’ in the Mining SEPP is given an extended definition in clause 3(2) as follows:

underground mining means:

- (a) *mining carried out beneath the earth’s surface, including bord and pillar mining, longwall mining, top-level caving, sub-level caving and auger mining, and*
- (b) *shafts, drill holes, gas and water drainage works, surface rehabilitation works and access pits associated with that mining (whether carried out on or beneath the earth’s surface),*

but does not include open cut mining.

The effect of clause 7(1), in conjunction with the operation of clause 5(3) of the Mining SEPP, is that notwithstanding any prohibition contained in the land use table of the Narrabri LEP, the Modification is permissible with development consent.

Zone RU1 – Primary Production

Under the Narrabri LEP the objectives of the RU1 – Primary Production zone include:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- *To minimise the fragmentation and alienation of resource lands.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*
- *To allow for non-agricultural land uses that will not restrict the use of other land for agricultural purposes.*

The Modification is consistent with the general objectives of the RU1 – Primary Production zone as mining is a primary industry and the Modification would enable more efficient recovery of underground coal and more efficient integration of mining operations across the NM.

The Modification would not result in additional land resource impacts as it would be wholly located within ML 1609 and would not result in additional surface disturbance beyond that already approved at the NM.

The Modification would not significantly alter the compatibility of the NM with adjoining land uses and the rehabilitated NM will include agricultural final land uses.

Zone RU3 – Forestry

Under the Narrabri LEP the objectives of the RU3 – Forestry zone include:

...

- *To enable other development that is compatible with forestry land uses.*

The Modification is consistent with the general objectives of the RU3 – Forestry zone.

As described in Section 5.2.1, all activities associated with the Modification are within the boundary of ML 1609. Activities within the Jacks Creek State Forest and the Pilliga East State Forest would continue to be conducted in accordance with the conditions of ML 1609.

5.2.3 Commonwealth Legislation

The objective of the EPBC Act is to provide for the protection of those aspects of the environment that are of national environmental significance.

Proposals that are likely to have a significant impact on a matter of environmental significance are defined as a controlled action under the EPBC Act. Proposals that are, or may be, a controlled action are required to be referred to the DoE to determine whether or not the action is a controlled action.

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

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

The NM was determined to be a controlled action under the EPBC Act (EPBC 2009/5003) and was subsequently approved on 17 August 2009.

The potential impacts of the Modification on flora and fauna have been assessed in Section 4.11.

The potential impacts of the Modification on water resources have been assessed in Appendices B and C, and are summarised in Sections 4.4 and 4.5. NCOPL holds adequate licence entitlements to account for the potential take of water associated with the Modification.

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

5.3 NSW GOVERNMENT POLICY

5.3.1 Strategic Regional Land Use Plan

As part of the Strategic Regional Land Use Policy, the NSW Government introduced a 'Gateway Process' for the upfront assessment of the impacts of State Significant mining and coal seam gas proposal on Strategic Agricultural Land (NSW Government, 2012b).

The Strategic Regional Land Use Policy and the 'Gateway Process' apply to new State Significant Development applications or modifications for mining projects located outside of existing mining lease areas (NSW Government, 2012b).

The Modification area is wholly contained within ML 1609, therefore the 'Gateway Process' does not apply to assessment of the Modification (NSW Government, 2012b).

An assessment of potential impacts on land resources is presented in Section 4.3.

An assessment against the provisions of the Aquifer Interference Policy is provided in Section 5.3.2.

5.3.2 Aquifer Interference Policy

The AIP (NSW Government, 2012a) has been developed by the NSW Government as a component of the NSW Government's Strategic Regional Land Use Policy.

The AIP applies State-wide and details water licence and impact assessment requirements.

The AIP has been developed to ensure equitable water sharing between various water users and proper licensing of water taken by aquifer interference activities such that the take is accounted for in the water budget and water sharing arrangements. The AIP also aims to enhance existing regulation, contributing to a comprehensive framework to protect the rights of all water users and the environment in NSW.

The NSW *Water Management Act, 2000* defines an aquifer interference activity as that which involves any of the following:

- *the penetration of an aquifer;*
- *the interference with water in an aquifer;*
- *the obstruction of the flow of water in an aquifer;*
- *the taking of water from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations; and*
- *the disposal of water taken from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations.*

A Groundwater Assessment (HydroSimulations, 2015) has been prepared in consideration of the AIP and the key conclusions are summarised below.

Water Source

The AIP requires all water taken by aquifer interference activities to be accounted for within the extraction limits set by the relevant Water Sharing Plan.

The Water Sharing Plans relevant to the NM include:

- *Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2008.*
- *Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003.*
- *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011.*

Baseline Groundwater Conditions

Baseline groundwater conditions and the existing observed impacts of the approved NM operations on alluvial and porous rock aquifers are discussed in Appendix A.

Modelling of Potential Impacts

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

The potential impacts of the Modification have been assessed by making comparisons between the currently approved and the proposed modified mine plan for the NM.

Licensing Requirements

Details of the current groundwater licences held by NCOPL are summarised in Table 7. The predicted annual groundwater volumes required to be licensed for the approved operations and for the Modification are summarised in Table 8. A figure showing the location of the various applicable water sharing plans is provided as Figure 13.

Comparison of NCOPL's licence entitlements against the predicted annual licensing requirements shows that adequate licences are available to account for the potential take of water associated with the approved NM and the Modification, with the exception of the NSW Murray Darling Basin Porous Rock Groundwater Source (HydroSimulations, 2015). NCOPL would monitor underground mine inflows against model predictions and obtain additional licence(s) volumes of this water source to account for actual inflows, as necessary.

Post-closure annual licensing requirements are expected to be less than the licensing requirements during operation. Given NCOPL currently holds adequate licences to account for the potential take of water associated with the approved NM and the Modification, it is expected NCOPL will have adequate licences to account for the potential post-closure take of water.

Notwithstanding, the numerical groundwater model would be refined over progression of the mine life in order to more accurately calculate the post-closure licensing requirements associated with the NM.

**Table 7
Groundwater Licence Summary**

Licence Number	Description	Valid to	Extraction Limits	Relevant Water Sharing Plan
Water Management Act, 2000				
WAL15922	Water Supply	Perpetuity	248 ML/year	Assigned to the Southern Recharge Groundwater Source under the Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2008.
WAL20131	Water Supply	Perpetuity	150 ML/year	Upper Namoi Zone 5 Namoi Valley (Gin's Leap to Narrabri) Groundwater Source for the Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003
WAL12833	Water Supply	Perpetuity	67 ML/year	
WAL29549	Mining - Low Security	15 January 2025	818 ML/year	Gunnedah – Oxley Basin Murray Darling Basin Groundwater Sources under the Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011 ¹

Source: After HydroSimulations (2015).

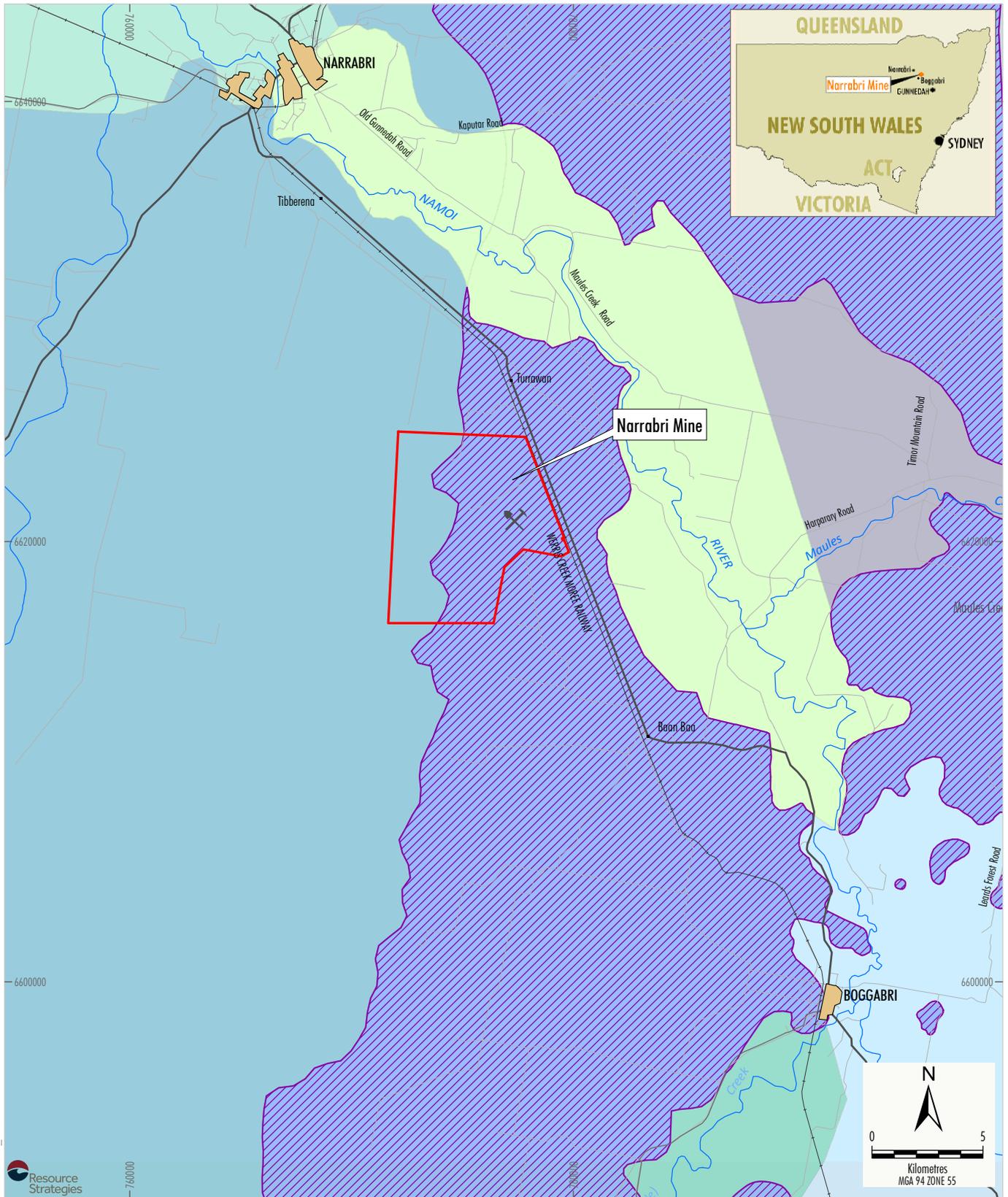
¹ Issued in the Gunnedah – Oxley Basin Murray Darling Basin (Other) Management Zone.

**Table 8
Groundwater Licensing Requirement Summary**

Water Sharing Plan	Management Zone/ Groundwater Source	Predicted Annual Inflow Volumes Requiring Licensing (ML/year)	
		Currently Approved	Modification
<i>Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2008</i>	Southern Recharge Groundwater Source	204	179
<i>Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003</i>	Upper Namoi Zone 5 Namoi Valley (Gin's Leap To Narrabri) Groundwater Source	122	110
<i>Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011</i>	Gunnedah – Oxley Basin Murray Darling Basin Groundwater Sources ¹	856	1,009

Source: After HydroSimulations (2015).

¹ Issued in the Gunnedah – Oxley Basin Murray Darling Basin (Other) Management Zone.



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LEGEND
 Mine Lease Boundary
 Mining Operation

Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011

- Gunnedah-Oxley Basin MDB (Other) Management Zone
- Gunnedah-Oxley Basin MDB Groundwater Source

Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2008

- Southern Recharge Groundwater Source

Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003

- Upper Zone 2, Cox's Creek (Mullaley to Boggabri) Groundwater Source
- Upper Zone 4, Namoi Valley (Keepit Dam to Gin's Leap) Groundwater Source
- Upper Zone 5, Namoi Valley (Gin's Leap to Narrabri) Groundwater Source
- Upper Zone 11, Maules Creek Groundwater Source
- Lower Namoi Groundwater Source



NARRABRI MINE
 Water Sharing Plans

NCOPL also holds a number of licences for groundwater monitoring bores in the porous rock aquifer. These are described in Appendix B.

Minimal Impact Considerations

The AIP establishes minimal impact considerations for highly productive and less productive groundwater. Figure 13 shows the NOW mapping of groundwater in the vicinity of the NM, and Appendix B indicates that the Namoi Alluvium and Great Artesian Basin groundwater sources are highly productive.

An assessment of the Modification against the minimal impact considerations in the AIP was conducted as part of the Groundwater Assessment (HydroSimulations, 2015). The Groundwater Assessment concluded that the Modification is within the 'Level 1' minimal impact considerations outlined in the AIP for highly productive groundwater. Potential drawdown on one privately owned bore would exceed the 'Level 1' AIP trigger for a less productive groundwater source (Appendix B). Make-good provisions would apply to this bore, consistent with the Water Management Plan (URS, 2013).

Relevant Mitigation and Contingency Measures

Other Groundwater Users

The currently approved Water Management Plan (URS, 2013) incorporates a Surface and Groundwater Response Plan which includes a process to deal with a complaint received in relation to loss of groundwater supply. NCOPL would continue to implement the Surface and Groundwater Response Plan for the Modification.

Monitoring and Reporting of Water Make

NCOPL would continue to monitor and report groundwater extraction as required under the conditions of its water licences.

The numerical groundwater model would continue to be refined over progression of the mine life at NM.

5.4 APPROVALS, LICENCES AND PLANS

5.4.1 Management/Monitoring Plans

Some management plans (e.g. the Water Management Plan [URS Australia, 2013]) may require revision to reflect updated environmental management measures or changes to Project Approval 08_0144 conditions resulting from the Modification.

5.4.2 Mining Operations Plan

The current Mining Operations Plan would require revision to reflect the Modification.

6 CONCLUSIONS

NCOPL has conducted a review of the existing/approved NM operations to identify options to improve operational efficiency so that existing/approved NM infrastructure and equipment could be used to increase the ROM coal production beyond 8 Mtpa.

The review identified that the approved underground mine geometry could be changed (i.e. an increase in longwall panel widths for LW107 to LW120 from 295 m to 400 m) to allow for an increase in the ROM coal production rate up to approximately 11 Mtpa.

Operational longwall mining experience to date at the NM indicates that the longwall panel width could be increased to 400 m, and this change would reduce the amount of underground mine development that is required. This change would improve the efficiency of extraction of the NM coal resource (i.e. the Hoskissons Seam).

The Modification would not change the:

- overall life of mine;
- overall surface disturbance areas; and
- major surface infrastructure such as the CHPP, coal stockpiles and train loading.

The Modification is consistent with the subsidence impact performance measures in Project Approval 08_0144 and existing subsidence management measures. The modified underground mine layout is predicted to result in only minor incremental changes to subsidence effects and associated impacts.

Similarly, the increase in processing rate up to approximately 11 Mtpa would increase the use of existing surface infrastructure, without the need of additional infrastructure. Therefore amenity impacts are anticipated to be minor.

The Modification would allow for the continued employment of the existing workforce at the NM.

It is therefore considered that the Modification is justified on environmental, economic and social grounds and that an application to modify Project Approval 08_0144 under section 75W of the EP&A Act is appropriate.

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