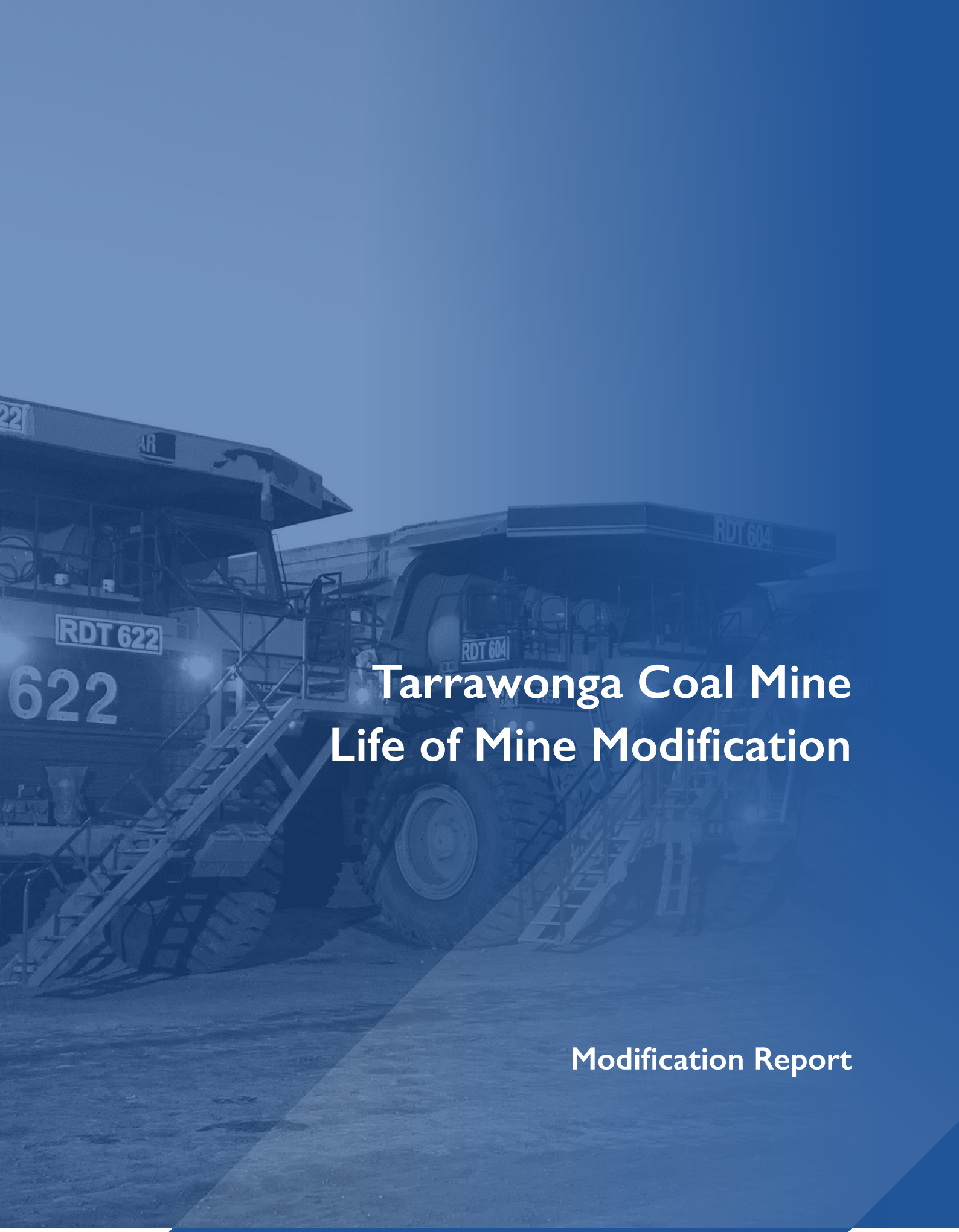


Tarrawonga Coal Mine
Life of Mine Modification

Modification Report

WHITEHAVEN COAL

TABLE OF CONTENTS

1 INTRODUCTION 1-1
1.1 APPROVALS HISTORY 1-1
1.2 OVERVIEW OF THE MODIFICATION 1-1
1.3 OVERVIEW OF THE APPROVED TARRAWONGA COAL MINE 1-6
1.3.1 Mining Operations 1-6
1.3.2 Off-site Sized ROM Coal Transport 1-6
1.3.3 Waste Rock Management 1-9
1.3.4 Water Management 1-9
1.3.5 Mine Facilities Area 1-9
1.4 APPROVED DEVELOPMENT ACTIVITIES 1-9
1.4.1 Goonbri Creek Realignment and Associated Flood Bund and Low Permeability Barrier 1-9
1.5 OTHER NEARBY MINING OPERATIONS 1-10
1.5.1 Boggabri Coal Mine Modification 1-10
1.5.2 Maules Creek Coal Mine 1-10
1.5.3 Vickery Coal Mine 1-10
1.6 ENVIRONMENTAL MONITORING AND MANAGEMENT 1-11
1.7 STRUCTURE OF THE DOCUMENT 1-11
2 DESCRIPTION OF THE MODIFICATION 2-1
2.1 MINING OPERATIONS 2-3
2.1.1 Open Cut Extent 2-3
2.1.2 Indicative Mine Schedule 2-3
2.1.3 Coal Mining and On-site ROM Coal Handling 2-3
2.1.4 ROM Coal Transport and Processing 2-3
2.1.5 Mine Fleet 2-6
2.1.6 Final Void 2-6
2.2 WASTE ROCK MANAGEMENT 2-6
2.3 WATER MANAGEMENT 2-7
2.3.1 Modification Water Management System 2-7
2.3.2 Water Consumption 2-7
2.4 APPROVED DEVELOPMENT ACTIVITIES 2-7
2.4.1 Goonbri Creek Realignment and Associated Flood Bund and Low Permeability Barrier 2-7
2.4.2 Realignment of Existing Infrastructure for the Approved Tarrawonga Coal Mine 2-7
3 STATUTORY AND STRATEGIC CONTEXT 3-1
3.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979 3-1
3.2 OTHER LEGISLATION 3-2
3.2.1 State Legislation 3-2
3.2.2 State Environmental Planning Policies 3-4
3.2.3 Local Environmental Plans 3-9
3.2.4 Commonwealth Legislation 3-10
3.2.5 NSW Government Policy 3-11
3.3 MODIFICATION JUSTIFICATION AND STRATEGIC CONTEXT 3-12
3.3.1 Need for and Objectives of the Modification 3-12
3.3.2 Benefits of the Modification 3-14
4 ENGAGEMENT 4-1
4.1 NSW GOVERNMENT AGENCIES 4-1
4.1.1 Department of Planning, Industry and Environment 4-1
4.2 LOCAL GOVERNMENT AGENCIES 4-1
4.3 FEDERAL GOVERNMENT AGENCIES 4-1
4.4 COMMUNITY CONSULTATIVE COMMITTEE 4-2
4.5 INFRASTRUCTURE OWNERS AND OTHER RESOURCE COMPANIES 4-2
4.5.1 Siding Springs Observatory 4-2
4.5.2 Nearby Mining Companies 4-2
5 ENVIRONMENTAL REVIEW 5-1
5.1 GROUNDWATER 5-1
5.1.1 Existing Environment 5-1
5.1.2 Potential Impacts 5-3
5.1.3 Mitigation Measures, Management and Monitoring 5-6
5.2 SURFACE WATER 5-6
5.2.1 Existing Environment 5-7
5.2.2 Potential Impacts 5-9
5.2.3 Mitigation Measures, Management and Monitoring 5-10
5.3 NOISE 5-11
5.3.1 Existing Environment 5-11
5.3.2 Potential Impacts 5-12
5.3.3 Mitigation Measures, Management and Monitoring 5-16
5.4 AIR QUALITY 5-16
5.4.1 Existing Environment 5-16
5.4.2 Potential Impacts 5-17
5.4.3 Mitigation Measures, Management and Monitoring 5-20
5.5 ROAD TRANSPORT 5-20
5.5.1 Existing Environment 5-20
5.5.2 Potential Impacts 5-22
5.5.3 Mitigation Measures, Management and Monitoring 5-23
5.6 BIODIVERSITY 5-23
5.6.1 Existing Environment 5-23
5.6.2 Potential Impacts 5-28
5.6.3 Mitigation Measures, Management and Monitoring 5-31
5.7 ABORIGINAL CULTURAL HERITAGE 5-32
5.7.1 Existing Environment 5-33
5.7.2 Potential Impacts 5-34
5.7.3 Mitigation Measures, Management and Monitoring 5-34
5.8 ECONOMIC 5-36
5.8.1 Existing Environment 5-36
5.8.2 Potential Impacts 5-36
5.9 VISUAL 5-37
5.9.1 Existing Environment 5-37

5.9.2 Potential Impacts 5-37
5.9.3 Mitigation Measures, Management and Monitoring 5-43
5.10 SOCIAL 5-44
5.10.1 Existing Environment 5-44
5.10.2 Potential Impacts 5-44
5.10.3 Mitigation and Management Measures 5-49
5.11 OTHER ENVIRONMENTAL ASPECTS 5-49
5.11.1 Greenhouse Gas 5-49
5.11.2 Agriculture 5-49
6 REHABILITATION STRATEGY 6-1
6.1 EXISTING REHABILITATION AT THE TARRAWONGA COAL MINE 6-1
6.2 REHABILITATION AT OTHER WHITEHAVEN COAL MINES 6-1
6.2.1 Canyon Coal Mine 6-6
6.2.2 Vickery Coal Mine 6-6
6.2.3 Rocglen Coal Mine 6-6
6.2.4 Werris Creek Coal Mine 6-7
6.3 REHABILITATION OF THE MODIFICATION 6-7
6.3.1 General Rehabilitation and Mine Closure Goals 6-8
6.3.2 Conceptual Post-mining Land Uses and Final Landform 6-8
6.3.3 Rehabilitation Domains and Final Landform Design Concepts 6-10
6.4 GENERAL REHABILITATION PRACTICES AND MEASURES 6-14
6.4.1 Vegetation Clearing Measures 6-14
6.4.2 Soil Management 6-15
6.4.3 Progressive Rehabilitation 6-15
6.4.4 Selection of Native Plant Species for Revegetation 6-16
6.4.5 Re-establishment of Agricultural Land 6-16
6.4.6 Erosion and Sediment Control System 6-17
6.4.7 Weed and Vertebrate Pest Management 6-17
6.5 REHABILITATION MONITORING PROGRAMME 6-17
6.5.1 Rehabilitation Performance Indicators and Completion Criteria 6-18
6.6 MINING OPERATIONS PLAN AND REHABILITATION MANAGEMENT PLAN 6-18
6.7 PLANNING FOR MINE CLOSURE 6-21
7 EVALUATION OF MERITS 7-1
7.1 JUSTIFICATION FOR MODIFICATION APPROVAL 7-1
8 REFERENCES 8-1

LIST OF TABLES

Table 1-1 Summary of the Tarrawonga Coal Mine Environmental Management and Monitoring Regime
Table 2-1 Comparison of the Approved Tarrawonga Coal Mine and the Modification
Table 2-2 Indicative Mine Schedule
Table 3-1 Water Licensing Requirements for the Tarrawonga Coal Mine Incorporating the Modification
Table 3-2 Clause 12AB Non-Discretionary Development Standards for Mining
Table 5-1 Estimated Approved Tarrawonga Coal Mine and Modification Licensing Requirements
Table 5-2 Modification Disturbance Areas and Ecosystem Credit Requirements
Table 5-3 Modification Disturbance Areas and Species Credit Requirements
Table 5-4 Comparison of the Social Impacts for the Approved Tarrawonga Coal Mine and Modification
Table 6-1 Rehabilitation and Mine Closure Goals for the Modification
Table 6-2 Rehabilitation Domains
Table 6-3 Provisional Rehabilitation Objectives, Performance Indicators and Completion Criteria for Native Woodland/Forest Areas

LIST OF FIGURES

Figure 1-1 Regional Location
Figure 1-2 Approved General Arrangement
Figure 1-3 Indicative Modification General Arrangement
Figure 1-4 ROM Coal Road Transport Routes
Figure 1-5a Land Ownership
Figure 1-5b Relevant Land Ownership List
Figure 1-6 Environmental Monitoring Locations
Figure 2-1 Indicative Modification General Arrangement – Year 3
Figure 2-2 Indicative Modification General Arrangement – Year 7

Figure 5-1 Relevant Groundwater Sources
Figure 5-2 Mapped Alluvial Boundary
Figure 5-3 Regional Surface Water and Weather Monitoring Sites
Figure 5-4 Modification Predicted Night Time Noise Contours - Year 3
Figure 5-5 Modification Predicted Night Time Noise Contours - Year 7
Figure 5-6 Modification 24-hour average PM10 Air Quality Contours – Year 3
Figure 5-7 Modification 24-hour average PM10 Air Quality Contours – Year 7
Figure 5-8 Existing Road Network and Traffic Survey Locations
Figure 5-9a Vegetation Communities
Figure 5-9b Vegetation Communities – Modification Pipeline
Figure 5-10 Threatened Species Records
Figure 5-11 Aboriginal Heritage Sites in the Vicinity of the Modification
Figure 5-12 Visual Simulation Locations and Land Ownership
Figure 5-13 Approved View and Visual Simulations – Bellevue
Figure 5-14 Approved View and Visual Simulations – MHPF Bellevue Land
Figure 5-15 Approved View and Visual Simulations – Goonbri Road
Figure 6-1 Indicative Modification General Arrangement – Final Landform
Figure 6-2 Conceptual Rehabilitation Domains

LIST OF PLATES

Plate 6-1 Tarrawonga Coal Mine – Northern Emplacement Reshaping and Fauna Habitat (2011)
Plate 6-2 Tarrawonga Coal Mine – Northern Emplacement Cover Crop Establishment (2011)
Plate 6-3 Tarrawonga Coal Mine – Northern Emplacement Reshaping and Cover Crop Establishment (2011)
Plate 6-4 Tarrawonga Coal Mine – Northern Emplacement Tube Stock Establishment (2018)
Plate 6-5 Tarrawonga Coal Mine – Northern Emplacement (2018)
Plate 6-6 Tarrawonga Coal Mine – Northern Emplacement (2018)
Plate 6-7 Tarrawonga Coal Mine – Northern Emplacement (2018)
Plate 6-8 Tarrawonga Coal Mine – Northern Emplacement (2018)

LIST OF ATTACHMENTS

Attachment 1 Project Approval (11_0047)

LIST OF APPENDICES

Appendix A Groundwater Assessment
Appendix B Surface Water Assessment
Appendix C Noise Assessment
Appendix D Air Quality and Greenhouse Gas Assessment
Appendix E Road Transport Assessment
Appendix F Biodiversity Development Assessment Report
Appendix G Aboriginal Cultural Heritage Assessment
Appendix H Economic Assessment

1 INTRODUCTION

This Modification Report has been prepared for Tarrawonga Coal Pty Ltd (TCPL) for the Tarrawonga Coal Mine Life of Mine Modification (the Modification).

The Tarrawonga Coal Mine is located approximately 42 kilometres (km) north-northwest of Gunnedah in New South Wales (NSW) (Figure 1-1). The Tarrawonga Coal Mine is owned and operated by TCPL, a wholly owned subsidiary of Whitehaven Coal Limited (Whitehaven).

The Tarrawonga Coal Mine is an open cut coal mine which has been in operation since 2006. Run-of-mine (ROM) coal is crushed and screened on-site, and the sized ROM coal is loaded onto on-highway trucks for transport via the Approved ROM Coal Transport Route to the Whitehaven Coal Handling and Preparation Plant (CHPP).

Mining operations at the Tarrawonga Coal Mine are conducted in accordance with Project Approval (PA) 11_0047, as modified.

The Modification would be sought under section 4.55(2) of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

1.1 APPROVALS HISTORY

The Tarrawonga Coal Project was approved (PA 11_0047) by the NSW Planning Assessment Commission under delegation of the NSW Minister for Planning and Infrastructure pursuant to section 75J of the EP&A Act on 22 January 2013.

Additionally, the Tarrawonga Coal Mine was granted approval under the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) on 11 March 2013 (Commonwealth Approval Decision 2011/5923).

PA 11_0047 has been modified on six separate occasions, with the most recent being the Whitehaven Temporary Road Haulage Modification which was approved in November 2018, and allowed for a temporary increase in ROM coal haulage on the southern section of the Approved ROM Coal Transport Route.

TCPL submitted the Tarrawonga Coal Mine Temporary Water Haulage Modification on 20 January 2020 which proposed the trucking of water sourced from the existing Vickery Coal Mine groundwater bore to the Tarrawonga Coal Mine and use of this water at the Tarrawonga Coal Mine. The Tarrawonga Coal Mine Temporary Water Haulage Modification was at the assessment phase at the time of writing this document.

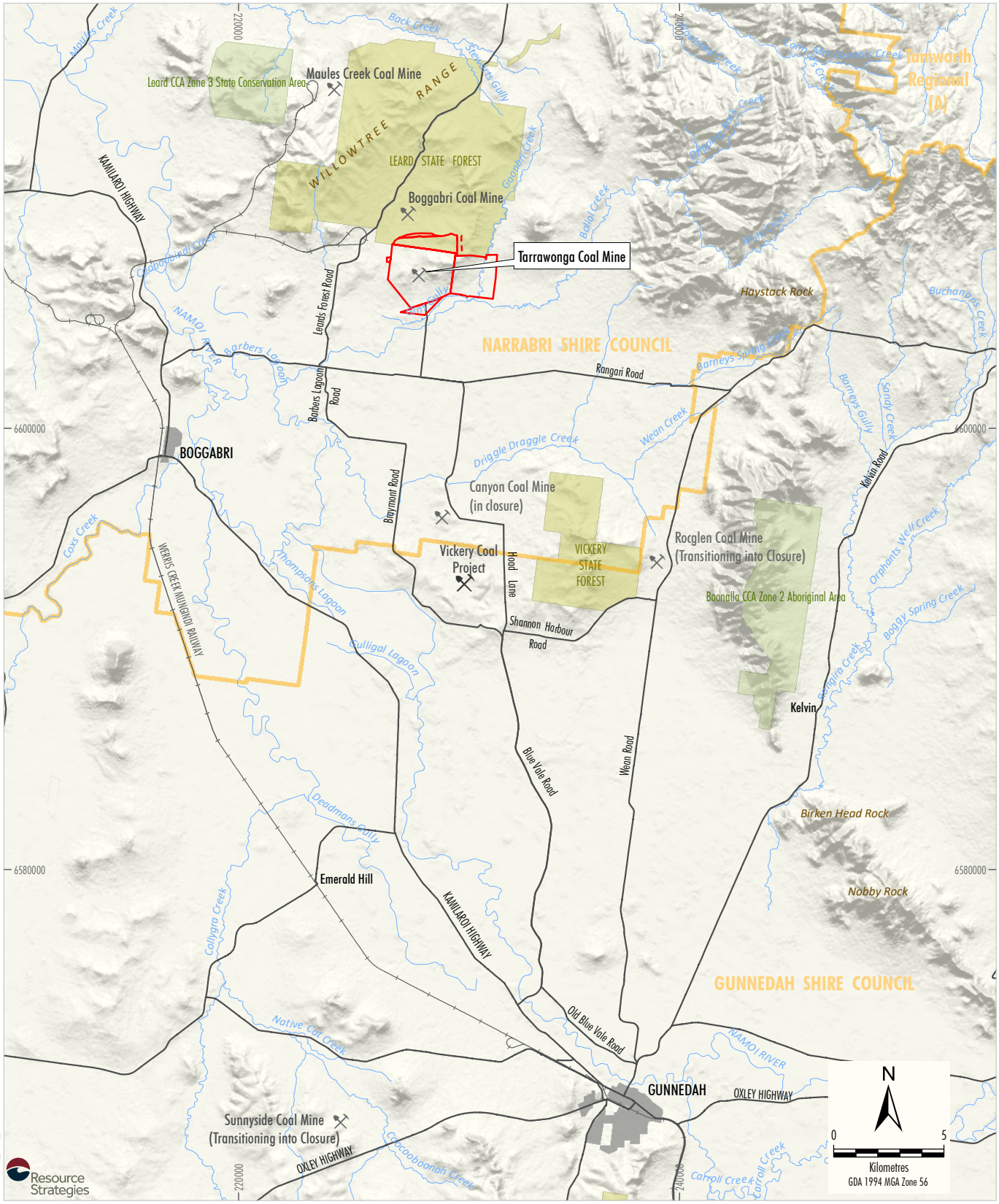
The approved Tarrawonga Coal Mine general arrangement is shown on Figure 1-2. An overview of the approved Tarrawonga Coal Mine is provided in Section 1.3.

1.2 OVERVIEW OF THE MODIFICATION

The main activities associated with the Modification include (Figures 1-3 and 1-4):

- ROM coal production rate increase from 3.0 to 3.5 million tonnes per annum (Mtpa);
- increase in ROM coal transported along the Northern Section of the Approved ROM Coal Transport Route from 3.0 to 3.5 Mtpa;
- reduction of the open cut extent to avoid mining:
  - the Upper Namoi alluvium; and
  - Goonbri Creek.
- revision of the post-mining landform and land use;
- relocation of the ROM coal stockpile and associated infrastructure;
- construction of a new site access road and intersection to allow haulage of ROM coal along a section of Goonbri Road; and
- construction and use of a water transfer pipeline between the Tarrawonga Coal Mine and the proposed Vickery Extension Project (which is the subject of a separate Development Application for State Significant Development [SSD] 7480[1]).

[1] The Vickery Extension Project (SSD 7480) is a proposed extension of the approved Vickery Coal Mine and was submitted to the NSW Department of Planning, Industry and Environment (DPIE) (formerly NSW Department of Planning and Environment [DP&E]) on 14 August 2018.





LEGEND

- Mining Tenement Boundary (ML, CL and AUTH)
- Mining Lease Application Boundary (MLA 1)
- NSW State Forest
- State Conservation Area, Aboriginal Area
- Major Roads
- Railway
- Local Government Boundary

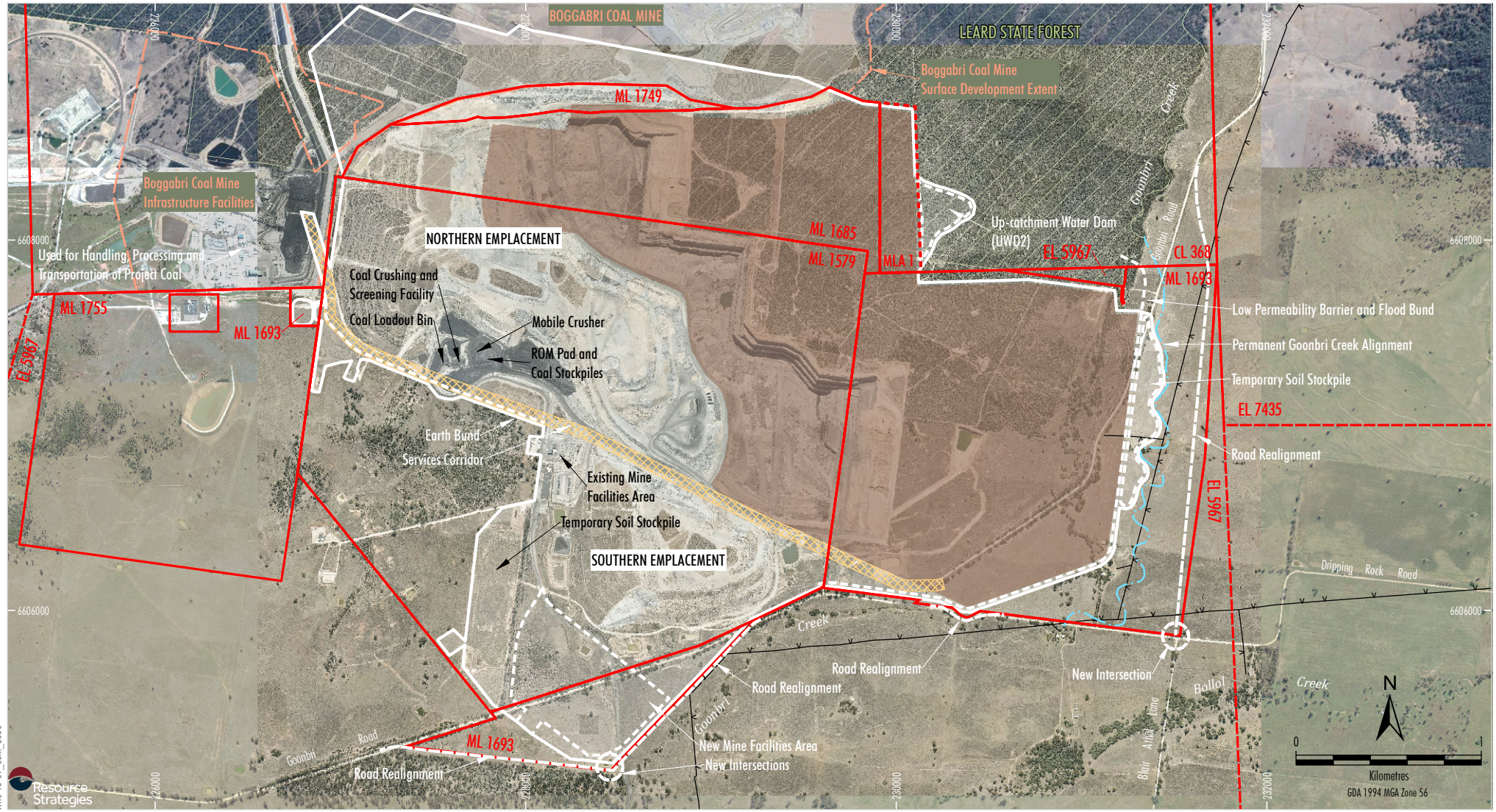
Source: LPMA - Topographic Base (2010); NSW Department of Industry (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Regional Location

Figure 1-1



LEGEND

- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA 1)
- Exploration Licence (EL)
- 11kV Electricity Transmission Line
- 11kV Electricity Transmission Line Realignment
- Leard State Forest
- Approximate Extent of Approved Surface Development
- Approximate Extent of Approved Open Cut

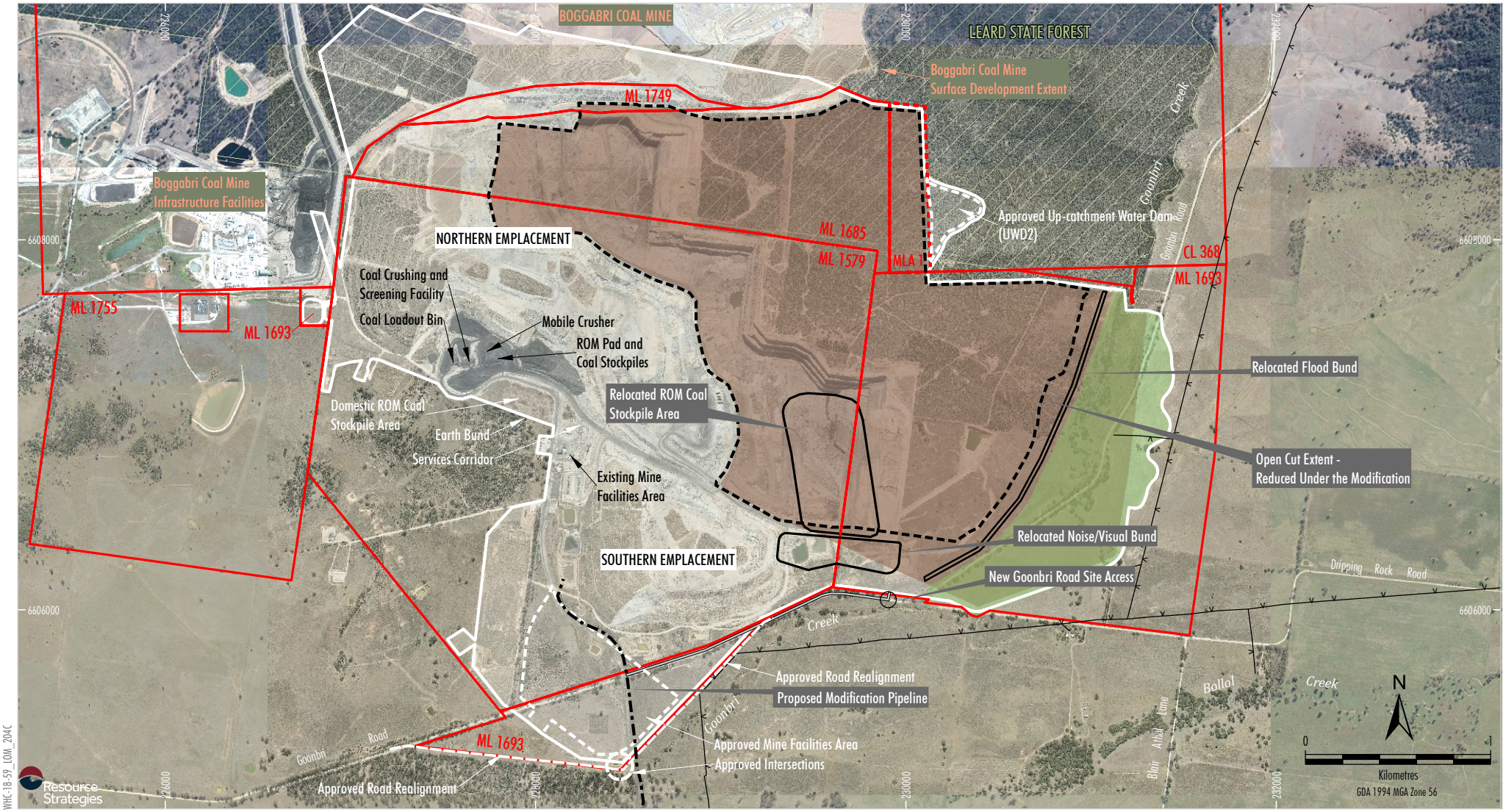
Source: © State of New South Wales and Department of Planning and Environment (2017); © Department Finance, Services & Innovation (2017); Whitehaven Coal (2017); Orthophoto: Whitehaven Coal (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Approved General Arrangement

Figure 1-2



LEGEND

- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA 1)
- 11kV Electricity Transmission Line
- 11kV Electricity Transmission Line Realignment
- Leard State Forest
- Approximate Extent of Approved Surface Development
- Approximate Extent of Approved Open Cut
- Modification Open Cut Extent
- Approved Surface Development Area - No Longer Proposed
- Modification ROM Coal Transport Route Along Goonbri Road
- Indicative Location of Modification Pipeline

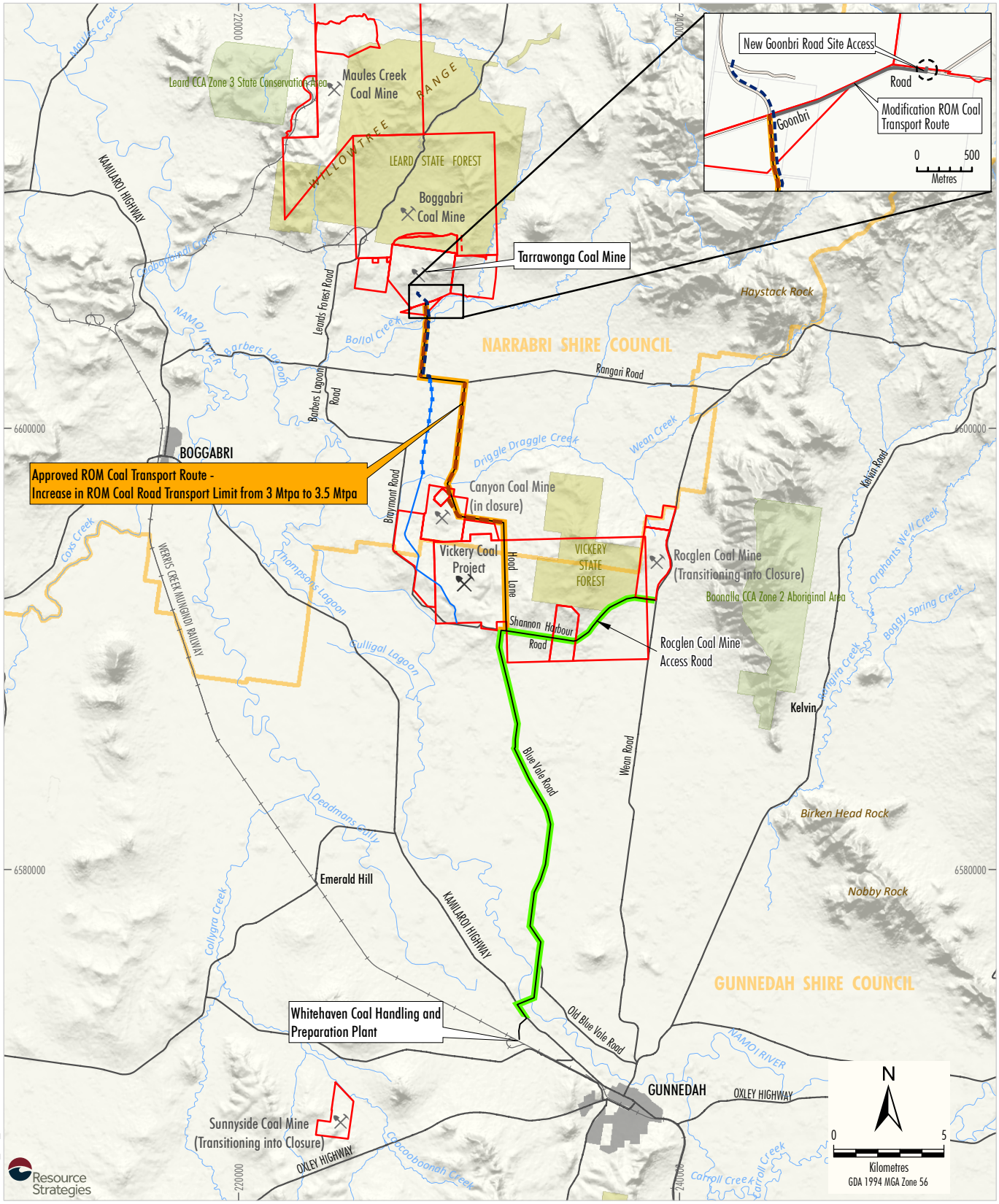
Source: © State of New South Wales and Department of Planning and Environment (2017); © Department Finance, Services & Innovation (2017); Whitehaven Coal (2018); Orthophoto: Whitehaven Coal (2018); Google (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Indicative Modification General Arrangement

Figure 1-3





LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- NSW State Forest
- State Conservation Area, Aboriginal Area
- Major Roads
- Railway
- Local Government Boundary
- WHC Private Haul Road
- Indicative Location of Modification Pipeline
- Proposed Vickery Extension Project Pipeline Location
- Approved ROM Coal Transport Route - Northern Section
- Approved ROM Coal Transport Route - Southern Section

Source: LPMA - Topographic Base (2010); NSW Department of Industry (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

ROM Coal Road Transport Routes

Figure 1-4

1.3 OVERVIEW OF THE APPROVED TARRAWONGA COAL MINE

The approximate extent of the existing and approved surface development (including open cut, mine waste rock emplacement, soil stockpiles and infrastructure areas) at the Tarrawonga Coal Mine is shown on Figure 1-2.

Relevant land ownership information for parcels of land associated with the Tarrawonga Coal Mine and surrounds is provided on Figures 1-5a and 1-5b.

A complete description of the existing/approved Tarrawonga Coal Mine is provided in the environmental approval documentation listed in PA 11_0047.

1.3.1 Mining Operations

The Tarrawonga Coal Mine commenced operations in 2006 and is approved to extract up to 3.0 Mtpa ROM coal using conventional open cut mining methods.

Open cut mining and material handling at the Tarrawonga Coal Mine is currently undertaken up to 24 hours per day, seven days a week.

Coal Mining and ROM Coal Handling

Mined ROM coal is loaded by excavator into haul trucks and transported to the ROM pad and coal stockpile area (Figure 1-2). The capacity of the existing ROM coal stockpile is approximately 150,000 tonnes (t). ROM coal on the ROM pad is transferred into a 40 t loading hopper and conveyed to the on-site coal crushing and screening facility.

The coal crushing and screening facility contains a primary and secondary crusher which produces nominal 150 and 50 millimetre (mm) sized ROM coal, respectively. Sized ROM coal is conveyed to the coal load-out bin for loading into on-highway haul trucks. The on-highway haul trucks transport the ROM coal to the Whitehaven CHPP via the existing site access road (Figures 1-2 and 1-4).

PA 11_0047 requires TCPL to use all reasonable efforts to reach an agreement with the owners of the Boggabri Coal Mine to use this infrastructure to process and transport coal from the Tarrawonga Coal Mine.

The approved Services Corridor to haul ROM coal between the Tarrawonga Coal Mine and Boggabri Coal Mine infrastructure area is shown on Figure 1-2.

Mine Fleet

The mine fleet used at the Tarrawonga Coal Mine varies according to the equipment requirements associated with the advancing open cut mining operations. The existing mine fleet at the Tarrawonga Coal Mine includes a combination of excavators and/or shovels and haul trucks, with a support fleet that includes dozers, scrapers, crushers, haul trucks and water trucks.

Other mining equipment and the plant also used in support of the mine fleet at the Tarrawonga Coal Mine includes a mobile crusher, diesel powered generators, service trucks and lighting plants.

Final Void

At the cessation of mining, a final void would remain at the eastern extent of the open cut under the approved Tarrawonga Coal Mine.

The surface catchment of the approved final void is designed to be minimised by the use of upslope diversions/bunds and contour drains around the perimeter.

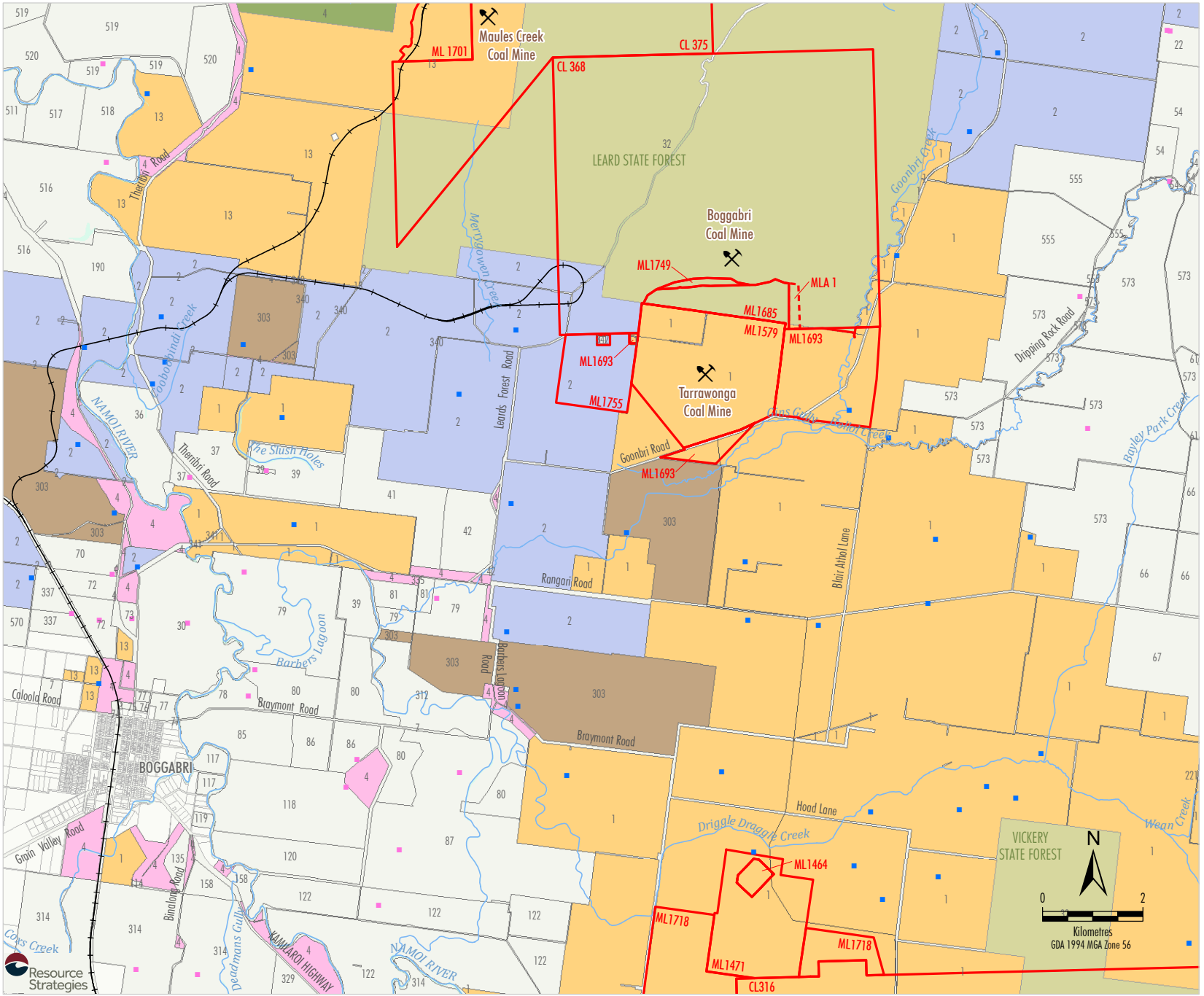
A low permeability barrier is approved to be constructed to minimise the rate of potential alluvial groundwater inflows reporting to the final void in the long-term.

1.3.2 Off-site Sized ROM Coal Transport

Sized ROM coal is transported between the Tarrawonga Coal Mine and the Whitehaven CHPP by a haulage contractor using a fleet of on-highway haulage trucks. PA 11_0047 allows for up to 3.0 Mtpa of ROM coal to be transported from site via the Approved ROM Coal Transport Route.

Sized ROM coal dispatch by road from the Tarrawonga Coal Mine to the Whitehaven CHPP is currently approved between the hours of:

- 6.00 am to 9.15 pm Monday to Friday; and
- 7.00 am to 5.15 pm Saturday.



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- Railway
- NPWS Estate
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Idemitsu Boggabri Coal Owned Land
- Privately-owned Land and Other Land
- Mine-owned Dwelling
- Private Dwellings

Source: NSW Department of Land and Property Information (2017); NSW Department of Industry (2018); Office of Environment and Heritage NSW (2016); Whitehaven Coal Limited (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Land Ownership

Figure 1-5a

WHC-18-59_LOM_202C

Reference No	Landholder
1	Whitehaven Coal Mining Pty Limited
2	Boggabri Coal Pty Limited & Chugoku Electric Power Australia Resources Pty Limited
4	The State of New South Wales
5	State Rail Authority of New South Wales
6	Narrabri Shire Council
7	The Council of the Shire of Namoi
9	Country Rail Infrastructure Authority
13	Aston Coal 2 Pty Limited & ICRA MC Pty Limited & J-Power Australia Pty Limited
22	CJ Westlake
30	MF, TT & SL Hart and PF Rice
32	State Forests of NSW
36	GP & LF Clarke
37	EJ & RJ Browning
39	DV & RJ Gillham
41	KE Woodward & LE James
42	AN Rodstrom
54	PA Devine
66	MG & FJ Farquhar
67	RL & KA Penrose
70	AM & DW Keys
72	EJ & RW Kemp
73	LW & MD Hunt
74	NSW. Grain Corporation Limited
75	GV & SA McDonald
76	DG & RT Nudd
77	KD & GJ McLauchlan
78	JM & NM McKechnie
79	KG Gillham
80	A D Watson Holdings Pty Limited
81	KL Grover
85	Kilmarnock (Boggabri) Pty Limited
86	PJ Watson Holdings Pty Limited

Reference No	Landholder
87	DS Riley
114	LP Mainey & TG Mainey
117	JL & K Davis
118	AD Watson
119	LH Blackford
120	Nambarloo Pty Limited
122	Nandewar Pty Limited
135	Boggabri Golf Club Limited
158	BC Martin & LD Curran
190	LE Christie-Rockliff
221	ME Geddes
303	Whitehaven Coal Mining Pty Ltd & Boggabri Coal Pty Ltd
312	Kinkuna Holdings Pty Limited
314	Global Ag Properties Australia Pty Limited
329	Merrigle Investment Fund Pty Limited
335	KL Grover
337	JC & PJ Bell
340	Boggabri Coal Pty Limited & Chugoku Electric Power Australia Resources Pty Limited
341	Roads and Maritime Services
342	TransGrid
510	FJ Maunder
511	RA Maunder
516	PJ Watson
517	DB Hudson
518	Bresrow Pty Limited
519	Riverway Boggabri Pty Limited
520	BG & KM Bomford
555	MI & PM Mainey
570	RA & CM Collyer
573	MHPF Bellevue Land Pty Ltd

WHC-18-59_LOM 001C

Resource Strategies

Source: LPI (2010 revised 2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Relevant Land Ownership List

Figure 1-5b

Tarrawonga Coal Mine is approved to receive up to 700,000 tonnes per annum (tpa) of coal rejects from the Whitehaven CHPP during the same hours.

The route used to transport sized ROM coal and rejects between the Tarrawonga Coal Mine and Whitehaven CHPP is shown on Figure 1-4. The Approved ROM Coal Transport Route includes sections of both private and public roads.

1.3.3 Waste Rock Management

Mine waste rock (including overburden and interburden) generated from the open cut is either placed as infill in the mine void behind the advancing mining operations (i.e. in-pit emplacement), or placed in one of two adjoining out-of-pit mine waste rock emplacements (i.e. Northern or Southern Emplacements). Used tyres from mining equipment would continue to be stockpiled prior to being safely disposed of in the backfilled mine void as the open cut advances.

The Northern and Southern Emplacements are approved up to a height of approximately 370 and 360 metres (m) Australian Height Datum (AHD), respectively. The approved rehabilitation includes reprofiling the Southern Emplacement and partially infilling the adjoining services corridor so that it integrates with the Northern Emplacement. The approved height of the Southern Emplacement following reprofiling and rehabilitation is approximately 330 m AHD.

The current height of the partially rehabilitated Southern Emplacement is approximately 340 m AHD.

In accordance with Condition 61 of PA 11_0047, the northern sections of the Northern Emplacement are to be fully integrated with the Boggabri Coal Mine final landforms.

1.3.4 Water Management

Existing/approved water management infrastructure at the Tarrawonga Coal Mine includes the following:

- mine water dams;
- sediment basins;
- storage dams;
- on-site drains, diversions and sumps;
- open cut dewatering and transfer pumps and pipelines;
- a groundwater production bore; and
- water sharing infrastructure between the Boggabri – Tarrawonga – Maules Creek Complex (BTM Complex).

TCPL sources water from surface water and groundwater inflows to the open cut, sediment basins and storage dams, and licensed groundwater extraction. TCPL has also sourced water from other Whitehaven-owned mines as well as other sources, subject to availability and agreement with relevant third parties (e.g. the Boggabri Coal Mine) and relevant approvals/licences being in place.

The Tarrawonga Coal Mine currently has six licensed discharge points (LDPs) under Environment Protection Licence (EPL) 12365 for release of excess water.

Further description of the existing water management system at the Tarrawonga Coal Mine is provided in Appendix B.

1.3.5 Mine Facilities Area

An existing mine facilities area is located west of the Southern Emplacement (Figure 1-2). It includes a crib hut, offices, hardstand, first aid building, maintenance workshop, toilets, wash bay and a light vehicle parking area.

TCPL also has approval to relocate the existing mine facilities area to a new mine facilities area (Figure 1-2).

1.4 APPROVED DEVELOPMENT ACTIVITIES

1.4.1 Goonbri Creek Realignment and Associated Flood Bund and Low Permeability Barrier

The approved mine plans include mining through Goonbri Creek and the Upper Namoi alluvium associated with Goonbri Creek. Construction of the permanent Goonbri Creek alignment and associated permanent flood bund and low permeability barrier is required prior to mining within 200 m of the Goonbri Creek alluvium in accordance with Schedule 3, Condition 37 of PA 11_0047.

The permanent flood bund would consist of an engineered clay fill core, which would be sub-excavated into the natural surface. Rock fill armouring would be placed on the eastern side of the clay fill core. The bund would then be topsoiled for revegetation.

In accordance with Schedule 3, Condition 34 of PA 11_0047, the low permeability barrier has the following performance objectives:

- Hydraulically and geomorphologically stable.
- The effectiveness of the Low Permeability Barrier shall be at least 10^{-8} metres per second.
- Negligible change to off-site flooding characteristics (including flood levels, velocities and flood storage capacity).
- Provides suitable protection for flood events up to and including the PMF.

1.5 OTHER NEARBY MINING OPERATIONS

1.5.1 Boggabri Coal Mine Modification

The Boggabri Coal Mine is an open cut coal mine located immediately north of the Tarrawonga Coal Mine (Figure 1-2). The Boggabri Coal Mine is managed by Boggabri Coal Operations Pty Ltd (BCOPL), a subsidiary of Idemitsu Australia Resources Pty Limited (Idemitsu) (80 percent [%]), Chugoku Electric Power Australia Resources Pty Ltd (10%) and NS Boggabri Pty Ltd (10%).

The Boggabri Coal Mine has a maximum extraction rate of 8.6 Mtpa of ROM coal and has an approved mine life of until December 2033. The Boggabri Coal Mine Project Approval (PA 09_0182) includes processing of up to 4.2 Mtpa of ROM coal through the Boggabri Coal Mine CHPP. The Boggabri Coal Mine owns and operates the Boggabri train loading facility, rail loop and rail spur line, and is approved to transport up to 8.6 Mtpa of product coal by rails from the Boggabri Coal Mine.

BCOPL submitted an application to modify PA 09_0182 under section 75W of the EP&A Act in August 2018 (Boggabri Coal Mine Modification 7). The Boggabri Coal Mine Modification 7 proposed amendments to PA 09_0182 in relation to the following:

- realign a small section of the project boundary between the Boggabri Coal Mine and Tarrawonga Coal Mine;
- to allow Boggabri Coal Mine coal to be stockpiled in a stockpile area dedicated for coal from the Tarrawonga Coal Mine under PA 09_0182;
- transporting small quantities of coal via road (less than 200 tpa);
- exploration activities; and
- securing its biodiversity offsets.

Boggabri Coal Mine Modification 7 was approved in May 2019.

1.5.2 Maules Creek Coal Mine

The Maules Creek Coal Mine is an open cut coal mine located approximately 50 km north-northwest of Gunnedah in NSW. The Maules Creek Coal Mine is managed by Maules Creek Coal Pty Ltd, a wholly owned subsidiary of Whitehaven.

The Maules Creek Coal Mine has a maximum extraction rate of 13 Mtpa of ROM coal and has a mine life of 21 years. The Maules Creek Coal Mine contains its own rail spur to transfer ROM coal from site via the Werris Creek to Mungindi Railway Line.

1.5.3 Vickery Coal Mine

The approved Vickery Coal Mine allows for open cut mining with annual ROM coal production of 4.5 Mtpa over a 30 year mine life. ROM coal from the Vickery Coal Mine would be transported by road to the Whitehaven CHPP located 5 km north-west of Gunnedah.

Whitehaven submitted a State Significant Development application for the Vickery Extension Project under Part 4 of the EP&A Act in August 2018. The Vickery Extension Project is currently undergoing final assessment by DPIE and will be referred to the Independent Planning Commission for determination.

The Vickery Extension Project would include a physical extension to the Vickery Coal Mine footprint to gain access to additional ROM coal reserves and to manage the additional waste rock, an increase in the approved ROM coal mining rate up to 10 Mtpa and construction and operation of the Vickery Extension Project CHPP, train load-out facility and rail spur. This infrastructure would be used for the handling, processing and transport of coal from the Vickery Extension Project, as well as other Whitehaven mining operations, including the Modification.

The Vickery Extension Project would include a physical extension to the Vickery Coal Mine footprint to gain access to additional ROM coal reserves and to manage the additional waste rock, an increase in the approved ROM coal mining rate up to 10 Mtpa and construction and operation of the Vickery Extension Project CHPP, train load-out facility and rail spur. This infrastructure would be used for the handling, processing and transport of coal from the Vickery Extension Project, as well as other Whitehaven mining operations, including the Modification.

1.6 ENVIRONMENTAL MONITORING AND MANAGEMENT

The Tarrawonga Coal Mine environmental management system includes various environmental management strategies, plans and programmes that have been developed and implemented since operations commenced in 2006.

A list of strategies, plans and programmes for the Tarrawonga Coal Mine is provided below:

- Environmental Management Strategy.
- Heritage Management Plan.
- Aboriginal Heritage Conservation Strategy.
- Air Quality and Greenhouse Gas Management Plan.
- Blast Management Plan.
- Bushfire Management Plan.
- Noise Management Plan.
- Rehabilitation Management Plan (within the Mining Operations Plan [MOP]).
- Water Management Plan.
- Biodiversity Management Plan.
- Biodiversity Offset Strategy.
- BTM Complex Regional Biodiversity Strategy.
- BTM Complex Air Quality Management Strategy.
- BTM Complex Blast Management Strategy.
- BTM Complex Noise Management Strategy.
- BTM Complex Water Management Strategy.
- BTM Complex Aboriginal Heritage Conservation Strategy.
- Traffic Management Plan.
- Farm Management Plan.
- Final Void Design and Closure Plan (yet to be submitted and approved).

TCPL will continue to implement the existing strategies, plans and programmes at the Tarrawonga Coal Mine, and review and revise them where necessary (in consultation with the relevant regulatory authorities) for the Modification.

Further discussion of the existing content and/or revision of these strategies, plans and programmes for the Tarrawonga Coal Mine is in Section 5.

The Tarrawonga Coal Mine has an extensive environmental monitoring regime. A summary of the existing monitoring and management regime is provided in Table 1-1, and the locations of relevant monitoring sites are shown on Figure 1-6.

1.7 STRUCTURE OF THE DOCUMENT

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

Section 1	Provides an overview of the approved Tarrawonga Coal Mine, the Modification and other nearby mining operations.
Section 2	Provides a description of the Modification.
Section 3	Describes the general statutory and strategic context of the Modification.
Section 4	Describes the consultation undertaken in relation to the Modification.
Section 5	Provides an environmental assessment of the Modification and describes the environmental management systems and measures to manage and monitor any potential impacts.
Section 6	Details the rehabilitation and landscape management strategy for the revised mining operations.
Section 7	Describes the evaluation of merits of the Modification and a justification for modification approval.
Section 8	References.



LEGEND

- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA 1)
- Leard State Forest
- Blast Monitoring Site
- Dust Deposition Gauge
- E-Sampler
- Groundwater Monitoring Piezometer
- Groundwater Monitoring Site
- Surface Water Monitoring
- Licensed Discharge Point
- High Volume Air Sampler
- Meteorological Station
- Attended Noise Monitoring Site
- Real Time Noise Monitoring Site
- TEOM

Source: © State of New South Wales and Department of Planning and Environment (2017); © Department of Finance, Services & Innovation (2017); Whitehaven Coal Limited (2018); Orthophoto: Whitehaven Coal Limited (2018); Google (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Environmental Monitoring Locations

Figure 1-6

WHC-18-59_LOM_209C

Table 1-1
Summary of the Tarrawonga Coal Mine Environmental Management and Monitoring Regime

Environmental Aspect	Environmental Management Documentation[1]	Environmental Monitoring
Land Resources	■ Rehabilitation Strategy ■ Rehabilitation Management Plan ■ Bushfire Management Plan ■ Biodiversity Management Plan ■ Biodiversity Management Strategy ■ BTM Complex Regional Biodiversity Strategy	■ *Meteorology* – Meteorological Station adjacent to mine administration facilities building. ■ *Weeds* – all TCPL owned land. ■ *Pest* – all TCPL owned land. ■ *Temperature* – during tree clearing.
Surface Water	■ Water Management Plan[2] ■ BTM Complex Water Management Strategy	■ *Surface water quality* – SD17 (LDP1), SD9 (LDP2), SB14 (LDP3), SD16 (LDP24), SB23B (LDP26), SB24B (LDP27), BC-U, BC-D and GC-U. ■ Structural integrity of discharge sediment dams and basins after a significant rainfall event (i.e. >50 mm in 24 hour period).
Groundwater	■ Water Management Plan[2] ■ BTM Complex Water Management Strategy	■ *Groundwater levels and quality* – MW1, MW2, MW3 (monitored by Boggabri Coal Mine), MW4, MW5, MW7[3], MW8[3], GW044997, GW031856, GW052266, and Templemore A, Templemore B and TA65[3]. ■ *Groundwater extraction* – sumps within the open cut, as well as advanced dewatering bores.
Air Quality	■ Air Quality and Greenhouse Gas Management Plan ■ BTM Complex Air Quality Management Strategy	■ *Dust deposition* – EB-4, EB-5, EB-6, EB-7, EB-8, EB-9, EB-10, EB-11, EB-12, EB-13, EB-14, EB-15 and EB-16. ■ *PM_{10}* – Flixton[4], Will-gai[4] and Coomalgah High Volume Air Sampler (HVAS) residences. ■ *$PM_{2.5}$* – Wil-gai residence.
Noise and Blasting	■ Noise Management Plan ■ Road Noise Management Plan ■ BTM Complex Noise Management Strategy ■ Blast Management Plan ■ BTM Complex Blast Management Strategy	■ *Attended mine operations noise* – Matong/Coomalgah, Bungalow and Barbers Lagoon residences. ■ *Attended road noise* – Brooklyn 1, Brooklyn 2 and Werona residences. ■ *Blasting* – Tarrawonga and Coomalgah residences. ■ *Real-time* – moved as required. Preference is given to locations that are more likely to be impacted by current operations.
Transport	■ Traffic Management Plan	■ Monitoring and recording undertaken as required.
Heritage	■ Heritage Management Plan ■ BTM Complex Aboriginal Heritage Conservation Strategy	■ Monitoring and recording undertaken as required.
Flora and Fauna	■ Biodiversity Offset Strategy ■ Biodiversity Management Plan ■ BTM Complex Regional Biodiversity Strategy ■ Rehabilitation Strategy ■ Rehabilitation Management Plan	■ *Rehabilitation Monitoring* – rehabilitation areas.

Note: The Goonbri Creek Diversion and Low Permeability Barrier – Monitoring and Management Plan is no longer proposed due to the reduction of the open cut extent for the Modification.

PM_{10} = particulate matter with diameter less than 10 microns.

$PM_{2.5}$ = particulate matter with diameter less than 2.5 microns.

1 As required by the conditions of PA 11_0047 (as modified).

2 Incorporating the Site Water Balance; Surface Water Management Plan; and Groundwater Management Plan.

3 Monitors groundwater level only.

4 Real-time PM_{10} monitoring sites.

Attachment 1 and Appendices A to H provide supporting information as follows:

Attachment 1	Project Approval (11_0047)
Appendix A	Groundwater Assessment
Appendix B	Surface Water Assessment
Appendix C	Noise Assessment
Appendix D	Air Quality and Greenhouse Gas Assessment
Appendix E	Road Transport Assessment
Appendix F	Biodiversity Development Assessment Report
Appendix G	Aboriginal Cultural Heritage Assessment
Appendix H	Economic Assessment

2 DESCRIPTION OF THE MODIFICATION

The Modification would result in no change to the following elements of the approved Tarrawonga Coal Mine:

- mine life and operating hours;
- mining tenements;
- mining methods;
- employment; and
- domestic coal production.

A description of the Modification is provided in this section. A summary of the approved Tarrawonga Coal Mine and the Modification is provided in Table 2-1.

Table 2-1
Comparison of the Approved Tarrawonga Coal Mine and the Modification

Project Component	Summary of Existing/Approved Tarrawonga Coal Mine	Summary of the Modification
Mining Method	Conventional open cut mining of ROM coal.	No change.
ROM Coal Production	ROM coal production of up to approximately 3.0 Mtpa.	ROM coal production rate increase up to approximately 3.5 Mtpa.
Mine Life	A 17 year mine life with operations until December 2030.	No change.
Open Cut Extent	Open cut extent approximately 524 hectares (ha) (Figure 1-2).	Reduction of the open cut extent to approximately 424 ha to avoid mining (Figure 1-3): ■ the Upper Namoi alluvium; and ■ Goonbri Creek.
ROM Coal Handling and Transport	Use of the on-site coal crushing and screening facility and transport of sized ROM coal by road to the Whitehaven CHPP (Figures 1-2 and 1-4). ROM coal transported along the Northern Section of the Approved ROM Coal Transport Route up to 3.0 Mtpa (MOD 1). ROM coal transported along the Southern Section of the Approved ROM Coal Transport Route with a cumulative ROM coal haulage limit from the Tarrawonga Coal Mine, Rocglen Coal Mine and Vickery Coal Mine of up to 3.5 Mtpa (up to 4.5 Mtpa following the construction of the Kamilaroi Highway overpass).	Relocation of the ROM coal stockpile area and associated infrastructure within the approved disturbance area (Figure 1-3) to improve ROM coal haulage efficiency and to allow for the increase in production rate. Haulage of ROM coal by road to the Vickery Extension Project CHPP for processing, once it is approved and constructed[1]. A new site access road and intersection would be constructed to allow for haulage of ROM coal along a section of Goonbri Road (Figures 1-3 and 1-4). Increase to ROM coal transported along the Northern Section of the haul road up to 3.5 Mtpa (Figure 1-4). No change to the cumulative ROM coal haulage limit on the Southern Section of the Approved ROM Coal Transport Route.
Coal Processing and Product Coal Loadout	At the Whitehaven CHPP, sized ROM coal is either directly loaded onto trains or processed in the CHPP prior to being loaded onto trains for transport on the Werris Creek Mungindi Line.	Continue to process ROM coal at the Whitehaven CHPP until the Vickery Extension Project CHPP, train load-out and rail spur infrastructure is constructed and reaches full operational capacity. ROM coal processing would then transition to the Vickery Extension Project CHPP, prior to being loaded onto trains for transport to market[1].
Waste Rock Management	Placement of mine waste rock to in-pit and out-of-pit waste rock emplacements including: ■ Northern Emplacement up to a maximum height of approximately 370 m AHD including full integration with the Boggabri Coal Mine final landform. ■ Southern Emplacement up to a maximum height of approximately 360 m AHD, with the final landform reshaped to 330 m AHD.	Height of Northern Emplacement generally unchanged with localised areas up to approximately 376 m AHD to introduce micro-relief. A revised final landform between the Boggabri Coal Mine and the Modification. Construction of part of the Southern Emplacement final landform up to a height of approximately 370 m AHD.

Table 2-1 (Continued)
Comparison of the Approved Tarrawonga Coal Mine and the Modification

Project Component	Summary of Existing/Approved Tarrawonga Coal Mine	Summary of the Modification
Domestic Coal Production	Use of a mobile crusher for the crushing and screening of up to 150,000 tpa of ROM coal to produce domestic specification coal.	No change.
Water Supply	Mine water supply obtained from surface water and groundwater inflows to pit area, sediment basins and storage dams, and licensed groundwater extraction. An existing pipeline between the Tarrawonga Coal Mine and the Boggabri Coal Mine allows water transfer between the two mines.	No change to existing water management system. Construction of a pipeline to the proposed Vickery Extension Project to facilitate contingency transfer of water between the proposed Vickery Extension Project and the Tarrawonga Coal Mine (Figure 1-4)[1].
Water Management	On-site water management system comprises water management storages and collection drains, runoff diversions, sediment control and open cut dewatering. Construction of the permanent Goonbri Creek alignment, low permeability barrier and permanent flood bund associated with the eastern extension of the open cut. Disposal of excess water via LDPs.	No change to water management system principles. Permanent flood bund requirement for the revised open cut extent to be confirmed via 2-dimensional flood modelling. Construction of the low permeability barrier and interception of Goonbri Creek no longer proposed as a result of the reduction in the open cut extent.
Surface Development Extent and Relocation of Public Infrastructure	The total approved surface development area is shown on Figure 1-2.	The Modification would result in an overall reduction in the total surface development area by approximately 87 ha (Figure 1-3). The approved realignment of a section of Goonbri Road and a section of the Electricity Transmission Line would no longer be required (Figures 1-2 and 1-3).
Mine Facilities Area	The existing Mine Facilities Area (comprising a crib hut, offices, hardstand, first aid building, maintenance workshop, toilets, wash bay and light vehicle parking area) is located south of the open cut. A relocation of the Mine Facilities Area is approved further south of the existing Mine Facilities Area but has not been constructed.	No change.
Mining Operation Hours	24 hours per day, seven days per week.	No change.
Electricity Supply	On-site diesel-powered generators.	TCPL may seek to connect the Tarrawonga Coal Mine to mains power in the future, subject to relevant approvals being in place (i.e. the connection is not part of the Modification application).
Employment	The current operational workforce is approximately 211 on-site personnel. Construction/development activities during the life of the Tarrawonga Coal Mine would require up to approximately 20 additional people for short periods.	No change.
Primary, Secondary and Ancillary Land Use	Partially backfilled final void in the post-mining landform. Post-mining landform to be a combination of native woodland/forest and agricultural uses.	General post-mining landform concepts retained with minor changes to size/location to reflect modified open cut extent. Changes to post-mining landform including some areas of agricultural land to be rehabilitated to woodland to reflect the change in soil resources available for the Modification.

[1] The Vickery Extension Project is subject to a separate Development Application for SSD 7480.

2.1 MINING OPERATIONS

The Modification would result in an increase in the production rate from 3.0 to 3.5 Mtpa to reflect the modified progression of open cut mining operations and waste emplacement.

Modification general arrangements for Years 3 and 7 are shown on Figures 2-1 and 2-2, respectively. These general arrangements are based on planned maximum production and mine progression. The mining layout and sequence shown on Figures 2-1 and 2-2 may vary to take account of localised geological features, coal market volume and quality requirements, mining economics and detailed engineering design.

2.1.1 Open Cut Extent

The Modification would reduce the approved open cut extent in Mining Lease (ML) 1693 (Figure 1-3). This would avoid mining the Upper Namoi alluvium and within 200 m of Goonbri Creek. It would also result in a reduction of recovered coal over the life of the mine by approximately 5.1 million tonnes (Mt) and 65 million bank cubic metres (Mbcm) of waste rock.

Alluvial boundary investigations have been undertaken to inform the extent of the reduced open cut (i.e. to avoid the Upper Namoi alluvium) as discussed in Section 5.1.

The Modification proposes to not construct the low permeability barrier and Goonbri Creek diversion required under Schedule 3, Condition 37 of PA 11_0047 on the basis that mining of the Upper Namoi alluvium is no longer proposed. The modified open cut would be located within 200 m of the Upper Namoi alluvium, however, would remain at least 200 m from Goonbri Creek.

2.1.2 Indicative Mine Schedule

The staging of the open cut mining operations would be determined by the requirements of the coal market, product specification and/or blending requirements. As these requirements are likely to vary over the life of the Modification, the development sequence of the open cut and coal extraction rates may also vary.

An indicative mine schedule for the Modification is provided in Table 2-2.

Table 2-2
Indicative Mine Schedule

Year	Waste Rock (Mbcm)	ROM Coal (Mtpa)
1*	20.1	2.3
2	27.3	2.9
3	38.2	3.5
4	34.0	3.5
5	37.4	3.5
6	36.1	3.5
7	34.0	3.5
8	27.1	2.7
9	24.0	2.4
10	23.6	2.1
11	11.1	1.0
Total	**312.9**	**30.9**

* Assumed Modification commencement date is 1 January 2020.

2.1.3 Coal Mining and On-site ROM Coal Handling

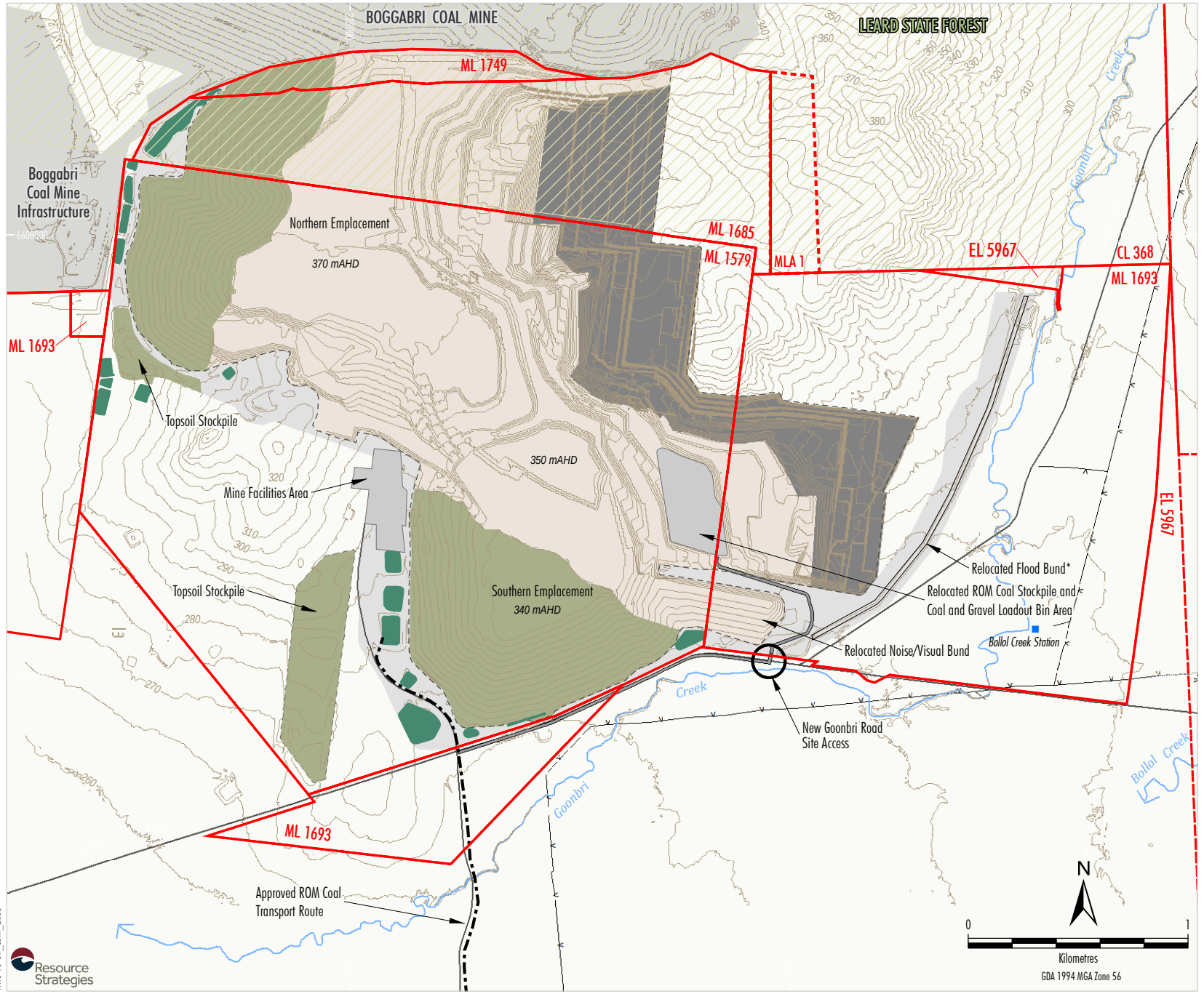
There would be no change to the approved open cut mining methods for the Modification. The existing ROM pad and coal stockpiles, associated coal crushing and screening plant and coal and gravel load-out bin would be relocated to improve ROM coal haulage efficiency (Figure 1-3).

2.1.4 ROM Coal Transport and Processing

A new access road would be constructed from the relocated ROM coal stockpile area to Goonbri Road (Figure 1-3). A new intersection would be constructed on Goonbri Road to provide more efficient access into the site for vehicles transporting coal, gravel and rejects to the relocated ROM stockpile and open cut (Figure 1-3).

The Modification would result in an increase to the haulage along the Northern Section of the Approved ROM Coal Transport Route from 3.0 to 3.5 Mtpa (Figure 1-4).

The existing mine access road used for ROM coal haulage would be retained and used by the workforce, delivery and visitor vehicles.



LEGEND

- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA 1)
- Exploration Licence (EL)
- Leard State Forest
- 11kV Electricity Transmission Line
- 11kV Electricity Transmission Line Realignment
- Stream ≥ 3rd Order
- Mine-owned Dwelling
- Indicative Active Mining and Waste Rock Emplacement Area
- Indicative Active Open Cut
- Indicative Infrastructure/Water Management Area
- Indicative Rehabilitated Area
- Indicative Location of Water Storage
- Modification ROM Coal Transport Route Along Goonbri Road
- Indicative Location of Modification Pipeline

*Note: * Extent of flood bund subject to detailed design.*

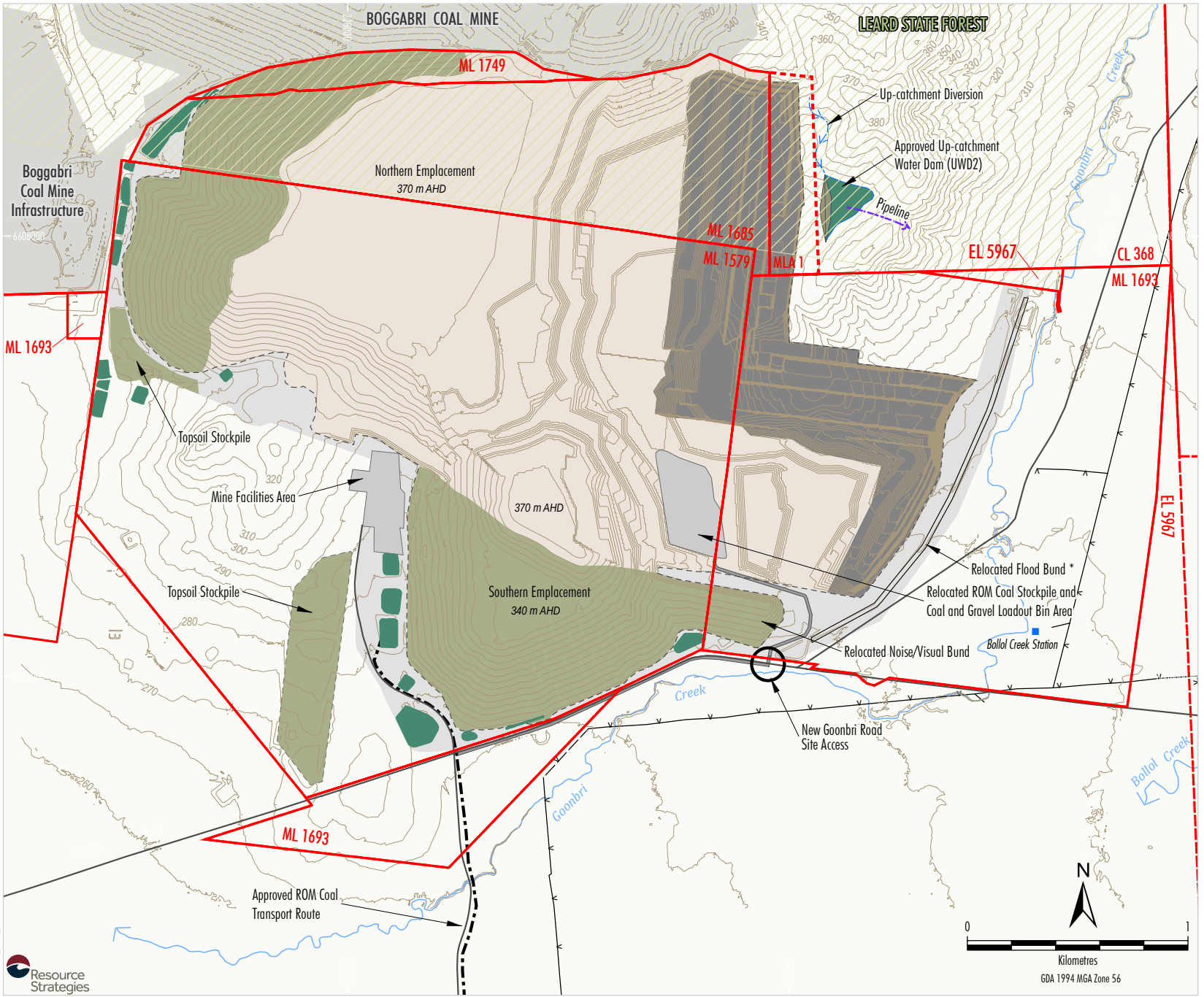
Source: © State of New South Wales and Department of Planning and Environment (2017); © Department of Finance, Services & Innovation (2017); Whitehaven Coal Limited (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Indicative Modification General Arrangement - Year 3

Figure 2-1



LEGEND

- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA 1)
- Exploration Licence (EL)
- Leard State Forest
- 11kV Electricity Transmission Line
- 11kV Electricity Transmission Line Realignment
- Stream ≥ 3rd Order
- Mine-owned Dwelling
- Indicative Active Mining and Waste Rock Emplacement Area
- Indicative Active Open Cut
- Indicative Infrastructure/Water Management Area
- Indicative Rehabilitated Area
- Indicative Location of Water Storage
- Modification ROM Coal Transport Route Along Goonbri Road
- Indicative Location of Modification Pipeline

*Note: * Extent of flood bund subject to detailed design.*

Source: © State of New South Wales and Department of Planning and Environment (2017); © Department of Finance, Services & Innovation (2017); Whitehaven Coal Limited (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Indicative Modification General Arrangement - Year 7

Figure 2-2

ROM coal would continue to be transported to the Whitehaven CHPP for processing and train load-out during the initial years of the Modification. Coal rejects would continue to be transported from the Whitehaven CHPP to the Tarrawonga Coal Mine by road to be disposed on-site in accordance with existing management and approval requirements.

Consistent with the approved Tarrawonga Coal Mine, reject material from the Whitehaven CHPP would continue to be progressively co-disposed with waste rock material within the footprint of the open cut. All reject material would continue to be placed at least 30 m within the open cut boundary, and would be placed at least 5 m below the final landform surface of the open cut infill area. The operational protocols for reject material placement would continue to be detailed in the MOP.

The Vickery Extension Project (SSD 7480) proposes the construction of a CHPP at the Vickery Coal Mine. Once the Vickery Extension Project CHPP, train load-out and rail spur infrastructure is constructed and reaches full operational capacity, ROM coal processing from the Tarrawonga Coal Mine would transition to the Vickery Extension Project CHPP. Tarrawonga Coal Mine ROM coal would be transported via the private haul road and placed on the Vickery Extension Project ROM pad for subsequent rehandling, processing and transportation.

Coal rejects generated by the processing of Tarrawonga Coal Mine ROM coal at the Vickery Extension Project CHPP would be disposed of at the Vickery Coal Mine in accordance with relevant management requirements of the Vickery Extension Project (i.e. if approved).

2.1.5 Mine Fleet

The mobile equipment used for the Modification would vary according to the requirements of the open cut mining operations. It would include a combination of excavators and/or shovels and haul trucks, with a support fleet that includes dozers, scrapers, crushers, haul trucks and water trucks.

An indicative list of major mobile equipment used for impact assessment purposes for the Modification is provided in the Noise Assessment (Appendix C).

2.1.6 Final Void

The Modification would result in a change to the final void location and size due to the reduction in the open cut extent. The final void would be designed to avoid the Upper Namoi Alluvium and to achieve the rehabilitation objectives outlined in Schedule 3, Condition 61 of PA 11_0047:

…

- *Minimise the size and depth of the final void as far as is reasonable and feasible.*
- *Minimise the drainage catchment of the final void as far as is reasonable and feasible.*
- *Negligible high wall instability risk.*
- *Minimise risk of flood interaction for all flood events up to and including the Probable Maximum Flood level.*

…

A final void water balance has been prepared for the end of the Tarrawonga Coal Mine life and is summarised in Section 5.2 and presented in the Surface Water Assessment (Appendix B).

2.2 WASTE ROCK MANAGEMENT

The Modification waste emplacement landforms have been developed to reflect the modified production schedule and open cut extent, maximise mining efficiency and to address surface water management requirements during operations and post-mining.

The height of the Northern Emplacement would generally be up to approximately 370 m AHD. The Modification would introduce micro-relief (i.e. gently undulating surfaces) up to approximately 376 m AHD to assist in drainage design that replicates natural drainage systems and improve integration of the landform with the surrounding environment.

The Southern Emplacement final landform would be constructed up to a height of approximately 370 m AHD (Figure 2-2). The Southern Emplacement would be integrated with the Northern Emplacement during operations, following the relocation of the ROM Coal Stockpile as the approved Services Corridor would no longer be required (Figures 2-1 and 2-2).

The Modification final landform and the integration with the Boggabri Coal Mine are discussed in Section 6.

2.3 WATER MANAGEMENT

2.3.1 Modification Water Management System

The principles of the existing water management system would be retained under the Modification. Minor changes to the approved water management system would be required, including (Section 5):

- Relocation of sediment dams, drains and water storages to reflect the modified mining sequence, landforms and open cut extent.
- Relocation of water transfer infrastructure including pumps and pipelines.
- Relocation of approved flood bunds to reflect the modified open cut extent.
- Relocation of swales, drop structures and drains to reflect the modified final landform.

2.3.2 Water Consumption

TCPL would continue to source water from surface water and groundwater inflows to the open cut, sediment basins and storage dams, and licensed groundwater extraction (Section 1.3). TCPL would also continue to source water from other Whitehaven-owned mines as well as other sources, subject to availability and agreement with relevant water licence holders (e.g. the Boggabri Coal Mine) and relevant approvals being in place.

The Modification would include construction of a water transfer pipeline that connects to the proposed Vickery Extension Project (Figure 1-4).

Future transfer of water from the Vickery Extension Project (if approved) is subject to the limits of its approval/licensing requirements.

2.4 APPROVED DEVELOPMENT ACTIVITIES

2.4.1 Goonbri Creek Realignment and Associated Flood Bund and Low Permeability Barrier

The extent of the open cut would be reduced under the Modification to avoid mining the Upper Namoi alluvium. In addition, mining would not occur within 200 m of Goonbri Creek. The realignment of Goonbri Creek and construction of the Low Permeability Barrier (required by Schedule 3, Condition 37 of PA 11_0047) are, therefore, no longer proposed under the Modification (Figure 1-3).

A permanent flood bund may be required to prevent inundation of the final void from Goonbri Creek. The permanent flood bund would be designed to an extent and height that would provide protection against the peak flood height associated with a PMF event. 2-dimensional modelling would be undertaken to confirm the flood bund design.

2.4.2 Realignment of Existing Infrastructure for the Approved Tarrawonga Coal Mine

Goonbri Road

The approved realignment of Goonbri Road east and south of the Open Cut would no longer be required under the Modification due to the reduced development extent (Figures 1-2 and 1-3).

Electricity Transmission Line

The approved realignment of the 11 kilovolt Electricity Transmission Line east of the open cut would no longer be required under the Modification due to the reduced development extent (Figures 1-2 and 1-3).

3 STATUTORY AND STRATEGIC CONTEXT

3.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979

The Tarrawonga Coal Project was approved (PA 11_0047) by the NSW Planning Assessment Commission under delegation of the NSW Minister for Planning and Infrastructure pursuant to section 75J (under Part 3A) of the EP&A Act on 22 January 2013.

Amendments made to the EP&A Act that removed the ability for Part 3A project approvals to be modified under the former section 75W of the EP&A Act took effect on 1 March 2018.

The Tarrawonga Coal Project was declared an SSD under Clause 6 of Schedule 2 to the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* via Government Gazette on the 17 August 2018.

Given the SSD status, approval for the proposed Modification has been sought under section 4.55(2) of the EP&A Act as it is substantially the same development to the existing operations for which consent was originally granted for Tarrawonga Coal Project (PA 11_0047), as modified, as described in Section 1.

Section 4.55(2) of the EP&A Act states:

> ***4.55 Modifications of consents - generally***
>
> *…*
>
> *(2)* ***Other modifications***
> *A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if:*
>
> *(a) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all), and*
>
> *(b) it has consulted with the relevant Minister, public authority or approval body (within the meaning of Division 4.8) in respect of a condition imposed as a requirement of a concurrence to the consent or in accordance with the general terms of an approval proposed to be granted by the approval body and that Minister, authority or body has not, within 21 days after being consulted, objected to the modification of that consent, and*
>
> *(c) it has notified the application in accordance with:*
>
> *(i) the regulations, if the regulations so require, or*
>
> *(ii) a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and*
>
> *(d) it has considered any submissions made concerning the proposed modification within the period prescribed by the regulations or provided by the development control plan, as the case may be.*
>
> *…*

Clause 3BA of Schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* relevantly provides:

> ***3BA Winding-up of transitional Part 3A modification provisions on cut-off date of 1 March 2018 and other provisions relating to modifications***
>
> *…*
>
> *(6) In the application of section 4.55 (1A) or (2) or 4.56 (1) of the Act to the following development, the consent authority need only be satisfied that the development to which the consent as modified relates is substantially the same development as the development authorised by the consent (as last modified under section 75W):*
>
> *(a) development that was previously a transitional Part 3A project and whose approval was modified under section 75W,*
>
> *…*

The consent authority is, therefore, required to satisfy itself that any consent as modified (i.e. Modifications 6 and 7) would result in the Tarrawonga Coal Mine remaining substantially the same development as was last modified under section 75W (i.e. Modification 5), inclusive of consideration of the changes arising from previously approved modifications.

A Statement of Environmental Effects (i.e. this Modification Report) has been prepared in support of the application to modify PA 11_0047. The Modification would require addition of a lot and DP (Lot 2 / DP 1131282) to the Schedule of Lands presented in Appendix 1 of PA 11_0047. Lot 2 DP 1131282 is owned by Whitehaven.

3.2 OTHER LEGISLATION

3.2.1 State Legislation

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

- *Biodiversity Conservation Act, 2016* (BC Act);
- *Contaminated Land Management Act, 1997;*
- *Crown Lands Act, 1989;*
- *Dams Safety Act, 1978;*
- *Dams Safety Act, 2015;*
- *Dangerous Goods (Road and Rail Transport) Act, 2008;*
- *Explosives Act, 2003;*
- *Fisheries Management Act, 1994;*
- *Forestry Act, 2012;*
- *Heritage Act, 1977;*
- *Mining Act, 1992;*
- *National Parks and Wildlife Act, 1974;*
- *Natural Resources Access Regulator Act, 2017;*
- *Roads Act, 1993;*
- *Petroleum (Onshore) Act, 1991;*
- *Pipelines Act, 1967;*
- *Protection of the Environment Operations Act, 1997* (PoEO Act);
- *Soil Conservation Act, 1938;*
- *Water Act, 1912;*
- *Water Management Act, 2000;*
- *Work Health and Safety Act, 2011; and*
- *Work Health and Safety (Mines and Petroleum Sites) Act, 2013.*

Relevant licences or approvals required under these Acts would continue to be obtained by the Tarrawonga Coal Mine as required, including relevant revisions to key plans, licences and agreements to incorporate the Modification.

Additional detail on the likely requirements of the Modification under some of the key Acts is provided in the sub-sections below.

Mining Act, 1992

The Modification does not seek an increase to the approved open cut extent.

Consistent with the approved Tarrawonga Coal Mine (TCPL, 2012), Whitehaven would apply for Mining Lease Application (MLA) 1 (Figure 1-3) to cover the north-eastern portion of the approved extent of the open cut.

Under the *Mining Act, 1992*, environmental protection and rehabilitation are regulated by conditions included in all mining leases, including requirements for the submission of a MOP prior to the commencement of operations, and subsequent Annual Reviews.

The Tarrawonga Coal Mine MOP (TCPL, 2019a) would be updated to incorporate the Modification.

Protection of the Environment Operations Act, 1997

The PoEO Act and the *NSW Protection of the Environment Operations (General) Regulation, 2009* set out the general obligations for environmental protection for development in NSW, which is regulated by the Environment Protection Authority (EPA).

The Tarrawonga Coal Mine is currently licensed under EPL 12365 to conduct “mining for coal” and “coal works” as defined in Schedule 1 of the PoEO Act. EPL 12365 would be varied as required for the Modification, subject to approval (e.g. to include the new lot in the EPL premises condition).

National Parks and Wildlife Act, 1974

The *National Parks and Wildlife Act, 1974* contains provisions for the establishment, preservation and management of national parks, historic sites and Aboriginal heritage in NSW.

Section 4.41 of the EP&A Act outlines authorisations that are not required for an SSD authorised by a development consent under Division 4.7 of Part 4 of the EP&A Act. An Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act, 1974* is not required for the Tarrawonga Coal Mine, including for the Modification.

Notwithstanding, an Aboriginal Cultural Heritage Assessment (ACHA) has been undertaken for the Modification to assess the potential impacts on Aboriginal heritage due to the Modification (Section 5.7).

Dams Safety Act, 1978 and Dams Safety Act, 2015

The *Dams Safety Act, 2015* was assented on 28 September 2015, although some provisions of this Act have not yet commenced. The objects of the *Dams Safety Act, 2015* are to manage matters relating to dams safety, and promote the application of risk management.

The *Dams Safety Act, 1978* continues to regulate the safety of certain dams until the relevant provisions of the *Dams Safety Act, 2015* commence.

The Tarrawonga Clean Water Dam is listed as a "prescribed dam" under the *Dams Safety Act, 1978* and a "declared dam" under the *Dams Safety Act, 2015*. There are no changes proposed to Prescribed or Declared Dams under the Modification. TCPL would continue to manage the Tarrawonga Clean Water Dam in accordance with the requirements of the *Dams Safety Act, 1978* and *Dams Safety Act, 2015*.

Roads Act, 1993

Works or structures that disturb the surface of a public road or connect a road to a classified road require consent under section 138 of the NSW *Roads Act, 1993*. The Modification would involve the construction of a new intersection on Goonbri Road to provide access to and from the relocated ROM coal stockpile area for vehicles transporting coal, gravel and rejects (Section 2.1.4). The section of Goonbri Road that would form part of the revised ROM Coal Transport Route would be sealed as part of the Modification.

TCPL would apply for necessary consents under section 138 of the *Roads Act, 1993* for the Modification, subject to Modification approval. TCPL would undertake the intersection and road upgrade works in consultation with the Narrabri Shire Council (NSC).

Biodiversity Conservation Act, 2016

The BC Act provides an approach to be followed for conducting assessment of a development's impacts on threatened species and ecological communities.

The impact of the Modification on threatened species, populations and ecological communities were assessed as part of the Biodiversity Development Assessment Report (Appendix F). AMBS Ecology & Heritage (2019) concluded that the Modification would have a negligible impact on threatened species and populations with the implementation of appropriate mitigation and management measures.

An objective of the NSW Offset Policy is to provide greater flexibility for proponents to meet their offset requirements while ensuring the best and most credible offsets are provided. The residual offset requirements identified in Table 5-2 would be offset using one, or a combination, of the following (NSW Office of Environment and Heritage [OEH], 2014):

- land-based offsets;
- acquiring or retiring credits under the biobanking scheme in the BC Act;
- making payments into an offset fund once established by the NSW Government; and/or
- providing supplementary measures as outlined in the NSW Offset Policy (OEH, 2014).

Finalisation and security of the Biodiversity Offset Strategy would be subject to approval of the Modification.

Water Management Act, 2000

Consideration of the Modification against the water management principles and access licence dealing principles under the *Water Management Act, 2000* was discussed in the Tarrawonga Coal Project Environmental Assessment (EA) (TCPL, 2012).

The Groundwater Assessment (Appendix A) prepared for the Modification considers the additional licensing requirements for the Tarrawonga Coal Mine incorporating the Modification.

The Modification results in a reduction in the maximum water licensing requirements from both the Gunnedah-Oxley Basin Murray Darling Basin (MDB) Groundwater Source and Upper Namoi Zone 4, Namoi Valley (Keepit Dam to Gins Leap). The water licensing requirements are summarised in Table 3-1.

Appropriate water access licences would continue to be held by Whitehaven for the Tarrawonga Coal Mine incorporating the Modification.

TCPL would continue to obtain and hold licences required under the *Water Management Act, 2000*.

3.2.2 State Environmental Planning Policies

Various State Environmental Planning Policies (SEPPs) potentially of relevance to the Modification were described in the Tarrawonga Coal Project EA, including:

- *State Environmental Planning Policy (State Significant Precincts) 2005*;
- *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP);
- *State Environmental Planning Policy (Infrastructure) 2007*;
- *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33);
- *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44); and
- *State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55).

In addition to the application of the relevant SEPPs as described in the Tarrawonga Coal Project EA, additional detail on the likely Modification requirements under some of the key SEPPs is provided in the sub-sections below.

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

Clause 7

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,*
>
> *(b) mining carried out:*
>
> *(i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or*
>
> *(ii) on land that is, immediately before the commencement of this clause, the subject of a mining lease under the Mining Act 1992 or a mining licence under the Offshore Minerals Act 1999,*

The Modification areas (i.e. the Modification pipeline to the proposed Vickery Extension Project, and new site access road and intersection along Goonbri Road) is on land where industry or agriculture may be carried out under the *Narrabri Local Environmental Plan 2012* (Narrabri LEP).

Table 3-1
Water Licensing Requirements for the Tarrawonga Coal Mine Incorporating the Modification

Water Sharing Plan	Management Zone	TCPL Allocation (Shares) (megalitres)	Predicted Average/Maximum Annual Inflow Volumes Requiring Licensing (ML/annum)[1]	
			Operational	Post-mining
Murray-Darling Porous Rock Water Sharing Plan 2012	Gunnedah - Oxley Basin MDB (Other)	300	74 (Average) 99 (Maximum)	36 (Average) 52 (Maximum)
Upper and Lower Namoi Groundwater Sources 2019	Upper Namoi Zone 4, Namoi Valley (Keepit Dam to Gins Leap) Groundwater Source	0	Negligible[2]	Negligible

ML/annum = megalitres per annum.

1 Source: Appendix A.

2 Indirect losses into lower formations were calculated to be 0.08 ML/annum.

Clause 12

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).

Land use in the vicinity of the Tarrawonga Coal Mine is characterised by a combination of coal mining operations, agricultural land, rural residences and the village of Boggabri. The Modification areas are contained entirely within the approved Tarrawonga Coal Mine Application area (TCPL, 2012), except for a small section of the Modification pipeline to the proposed Vickery Extension Project, south of Rangari Road. This section of the pipeline is located on Lot 2 / DP 1131282, which is included in the proposed Vickery Extension Project Development Application area.

As such, the Modification is considered compatible with existing and approved land uses.

The potential impact of the Modification on surrounding land uses are described in Appendices A to H and summarised in Section 5.

TCPL would, where practicable, 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 Tarrawonga Coal Mine Environmental Management Strategy and management plans (Section 1.6) and other measures for the Modification (Section 5).

Clause 12AB – Non-Discretionary Development Standards for Mining

Section 4.15(2) of the EP&A Act prescribes:

> *If an environmental planning instrument or a regulation contains non-discretionary development standards and development, not being complying development, the subject of a development application complies with those standards, the consent authority:*
>
> *(a) is not entitled to take those standards into further consideration in determining the development application, and*
>
> *(b) must not refuse the application on the ground that the development does not comply with those standards, and*
>
> *(c) must not impose a condition of consent that has the same, or substantially the same, effect as those standards but is more onerous than those standards,*
>
> *and the discretion of the consent authority under this section and section 4.16 is limited accordingly.*

Clause 12AB identifies non-discretionary development standards for the purposes of section 4.15(2) of the EP&A Act in relation to the carrying out of development for the purposes of mining.

Table 3-2 provides each of the non-discretionary development standards listed in clause 12AB of the Mining SEPP and a summary of the conclusions of the Modification. Where the Modification complies with the non-discretionary development standards in clause 12AB of the Mining SEPP, the Minister must act in accordance with the clause and section 4.15(2) of the EP&A Act.

Clause 13

Clause 13(2) 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:

(a) consider:

(i) the existing uses and approved uses of land in the vicinity of the development, and

Table 3-2
Clause 12AB Non-Discretionary Development Standards for Mining

Subclause of Clause 12AB	Compliance of the Modification
(3) Cumulative noise level *The development does not result in a cumulative amenity noise level greater than the recommended amenity noise levels, as determined in accordance with Table 2.2 of the Noise Policy for Industry, for residences that are private dwellings.*	The cumulative noise levels from the concurrent operation of the Modification and other mining projects would comply with the recommended acceptable amenity criterion outlined in Table 2.2 of the *Noise Policy for Industry* and PA 11_0047 at all relevant receivers (Section 5.3 and Appendix C).
(4) Cumulative air quality level *The development does not result in a cumulative annual average level greater than 25 µg/m^3 of PM_{10} or 8 µg/m^3 of $PM_{2.5}$ for private dwellings.*	The Modification would not result in any additional exceedances of the cumulative annual average level greater than 25 micrograms per cubic metre (µg/m^3) of PM_{10} or 8 µg/m^3 of $PM_{2.5}$ at any privately-owned dwellings when considered cumulatively with existing background sources and other mining projects (Section 5.4 and Appendix D).
(5) Airblast overpressure *Airblast overpressure caused by the development does not exceed:* *(a) 120 dB (Lin Peak) at any time, and* *(b) 115 dB (Lin Peak) for more than 5% of the total number of blasts over any period of 12 months,* *measured at any private dwelling or sensitive receiver.*	The approved Tarrawonga Coal Mine (TCPL, 2012) predicted no exceedances of relevant airblast or vibration criteria would occur at any privately-owned residences. TCPL proposes no change to the existing blasting practices at the Tarrawonga Coal Mine. Blasting associated with the Modification is not expected to generate elevated overpressure and vibration levels relative to those associated with the approved operations (Section 5.3 and Appendix C).
(6) Ground vibration *Ground vibration caused by the development does not exceed:* *(a) 10 mm/sec (peak particle velocity) at any time, and* *(b) 5 mm/sec (peak particle velocity) for more than 5% of the total number of blasts over any period of 12 months,* *measured at any private dwelling or sensitive receiver.*	The approved Tarrawonga Coal Mine (TCPL, 2012) predicted no exceedances of relevant airblast or vibration criteria would occur at any privately-owned residences. TCPL proposes no change to the existing blasting practices at the Tarrawonga Coal Mine. Blasting associated with the Modification is not expected to generate elevated overpressure and vibration levels relative to those associated with the approved operations (Section 5.3 and Appendix C).
(7) Aquifer interference *Any interference with an aquifer caused by the development does not exceed the respective water table, water pressure and water quality requirements specified for item 1 in columns 2, 3 and 4 of Table 1 of the Aquifer Interference Policy for each relevant water source listed in column 1 of that Table.*	The Modification would have "minimal impact" (as defined by the NSW *Aquifer Interference Policy* [AIP] [NSW Government, 2012]) to the water table, water pressure and water quality requirements for the relevant 'highly productive' water source (Section 5.1 and Appendix A).

(ii) whether or not the development is likely to have a significant impact on current or future extraction or recovery of minerals, petroleum or extractive materials (including by limiting access to, or impeding assessment of, those resources), and

(iii) any ways in which the development may be incompatible with any of those existing or approved uses or that current or future extraction or recovery, and

(b) evaluate and compare the respective public benefits of the development and the uses, extraction and recovery 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).

The existing and approved use of the land in the vicinity of the Modification includes coal mining. The final landforms of the Modification would be integrated with the adjoining Boggabri Coal Mine (Section 6.3.3).

As such, no measures to avoid or minimise incompatibility with existing and approved surrounding land uses are considered to be required. Potential cumulative impacts associated with the Modification and the proposed Vickery Extension Project, Maules Creek Coal Mine and Boggabri Coal Mine have been considered in Section 5.

Clause 14

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, programs or guidelines concerning greenhouse gas emissions.

The potential impacts of the Modification on groundwater and surface water resources are described in Sections 5.1 and 5.2, along with measures to minimise potential impacts.

The potential impacts of the Modification on threatened species and biodiversity are described in Section 5.6, along with measures to avoid and minimise potential impacts.

The Modification would result in a reduction in life of mine greenhouse gas emissions compared to the approved Tarrawonga Coal Mine (Section 5.4).

Clause 15

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.*

A key element of the Modification is to increase efficiency of resource recovery through the proposed increase in annual open cut ROM coal production and changes to mining fleet (Section 2.1).

Clause 16

Clause 16(1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining 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.*

ROM coal would continue to be transported from site by the Approved ROM Coal Transport Route for the Modification, with a new site access point proposed off Goonbri Road (i.e. haulage trucks would need to traverse a small section of Goonbri Road to the new site access point). The Approved ROM Coal Transport Route includes haulage along a section of Whitehaven's existing private haul road.

As there would not be any increase in peak employees/contractors, there would be no change in the maximum daily operational vehicle movements for the Modification.

The section of Goonbri Road that would be used for ROM coal haulage under the Modification would be sealed. The sealing of Goonbri Road and construction of the new T-intersection from Goonbri Road into the mine site would be undertaken in accordance with Austroads Guidelines and in consultation with the NSC (Appendix E).

The Modification proposes the processing of ROM coal at the Vickery Extension Project CHPP, following approval and commissioning of the CHPP and rail infrastructure. This would remove the requirement to haul ROM Coal along the Approved ROM Coal Transport Route, south of the Vickery Extension Project. Modification product coal would be transported via rail from the Vickery Extension Project (subsequent to its approval and commissioning).

Clause 17

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 conditions of the 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 strategy for the Tarrawonga Coal Mine, incorporating the Modification, is presented in Section 6.

The Modification proposes changes to the approved final land uses and rehabilitation of the Tarrawonga Coal Mine. The Modification would result in an overall increase in agricultural land of approximately 47 ha compared to the approved Tarrawonga Coal Mine, as described in Section 6.

The Rehabilitation Management Plan and MOP would be revised to incorporate the Modification.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

SEPP 44 requires the consideration in certain Local Government Areas (LGAs) (including Narrabri and Gunnedah) as to whether the land which is the subject of the Development Application comprises "potential koala habitat" or "core koala habitat".

An assessment of Koala habitat for the Modification for the purposes of SEPP 44 has been undertaken (Section 5.6 and Appendix F). The assessment determined that some vegetation communities within the Modification areas meet the definition of potential Koala habitat, however, do not meet the definition of "core koala habitat". Additionally, there are no recent sightings or evidence of Koalas recorded in the Modification areas.

Based on these findings, the provisions of SEPP 44 are not applicable to the Modification and the consent authority can be satisfied as to these matters.

State Environmental Planning Policy No. 55 – Remediation of Land

SEPP 55 applies to the whole of NSW and is concerned with the remediation of contaminated land. Under SEPP 55, consent authorities are required to consider the potential for contamination to adversely affect the suitability of a site for its proposed use.

Further, under Clause 7(2) of SEPP 55, before determining an application for consent to carry out development that would involve a "change of use" of land, a consent authority must consider a "preliminary investigation" of the land concerned where:

- the application for consent is to carry out development that would involve a "change of use"; and
- that "change of use" is relevant to certain land specified in clause 7(4) of SEPP 55.

The certain land specified in clause 7(4) on which the "change of use" must relate is either:

- land that is an "investigation area" – defined in SEPP 55 as land declared to be an investigation area by a declaration in force under Division 2 of Part 3 of the NSW *Contaminated Land Management Act, 1997*; or
- land on which development for a purpose referred to in Table 1 of the contaminated land planning guidelines (being Managing Land Contamination – Planning Guidelines SEPP 55 – Remediation of Land [Department of Urban Affairs and Planning and EPA, 1998]) is being, or is known to have been, carried out.

The portions of the Modification located within the Tarrawonga Coal Mine MLs do not involve a "change of use" because they are within existing MLs. The new site access road and intersection along Goonbri Road would be located outside of the existing Tarrawonga Coal Mine MLs but within the Tarrawonga Coal Project Development Application Area (Appendix 1 of PA 11_0047).

A Land Contamination Assessment was undertaken as part of the Tarrawonga Coal Project EA for the approved Development Application area (Appendix 1 of PA 11_0047) (Lloyd Consulting Pty Ltd, 2011). The Land Contamination Assessment concluded that the land was suitable for the land use change from agriculture to the development of the Tarrawonga Coal Mine.

The Modification pipeline to the proposed Vickery Extension Project would arguably involve a change of land use as the pipeline would extend beyond existing MLs, but would remain within the approved Tarrawonga Coal Mine Project Application area with the exception of a small section south of Rangari Road.

The Vickery Extension Project Land Contamination Assessment included areas within Lot 2 DP 1131282 (SESL Australia, 2018). SESL Australia (2018) identified a number of 'features of interest' around the greater investigation area included in the assessment. No features of interest were found near the Modification pipeline within Lot 2 DP 1131282. Therefore, the portion of the proposed pipeline within Lot 2 DP 1131282 would not involve a "change of use" as it would be located within the Vickery Extension Project Development Application boundary and be connected to the proposed pipeline extending to the north of the Vickery Extension Project, subject to its approval.

3.2.3 Local Environmental Plans

The Approved ROM Coal Transport Route lies within the Gunnedah Shire Council (GSC) and NSC LGAs. Given this, the Tarrawonga Coal Project EA considered the *Gunnedah Local Environmental Plan 2012* (Gunnedah LEP) and Narrabri LEP.

PA 11_0047 currently allows ROM coal to be transported along the Approved ROM Coal Transport Route within the Gunnedah and Narrabri LGAs, subject to road maintenance agreements with the GSC and NSC.

Whitehaven currently implements road maintenance agreements with the GSC and NSC (Section 5.5), and these agreements would continue for the Modification. While there would be an increase in ROM coal transported to the Whitehaven CHPP due to the Modification (up to a total of 3.5 Mtpa along the Northern Section of the Approved ROM Coal Transport Route), ROM coal is currently approved to be transported at a rate of 3.0 Mtpa along the Approved ROM Coal Transport Route in accordance with the conditions of PA 11_0047. The Modification proposes a minor change to the Approved ROM Coal Transport Route to permit haulage along a section of Goonbri Road to a new site access point.

On this basis, further consideration of the Gunnedah LEP is not required in the context of the Modification. Further consideration of the Narrabri LEP for other relevant components of the Modification is provided in the sub-sections below.

Narrabri Local Environmental Plan

The Tarrawonga Coal Mine and Modification is located within the Narrabri LGA (apart from a portion of the Approved ROM Coal Transport Route located within the Gunnedah LGA), including the reduction in open cut extent, new site access road and intersection with Goonbri Road and the Modification pipeline to the proposed Vickery Extension Project, and is covered by the Narrabri LEP.

Permissibility

Clause 2.3(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.*

Under the Narrabri LEP, the Modification areas (i.e. the Modification pipeline and site access road and intersection) includes additional land zoned as RU1 – Primary Production.

Zone Objectives

RU1 – Primary Production

Under the Narrabri LEP, "water supply systems" and "roads" are permissible with consent on lands zoned RU1 – Primary Production.

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

- *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 RU1 – Primary Production zone as the construction of the Modification pipeline and new intersection off Goonbri Road would enhance the productivity of the Tarrawonga Coal Mine, and is not anticipated to restrict the use of other adjoining land uses.

3.2.4 Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act, 1999

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

A proposal that is, or may be, a controlled action is required to be referred to the Commonwealth Minister for the Environment for a determination as to whether or not the action is a controlled action. Relevant components of the Modification (i.e. the Modification pipeline to the proposed Vickery Extension Project and new site access road and intersection off Goonbri Road) were referred to the Commonwealth Department of Environment and Energy (DEE) on 5 September 2019.

Nonetheless, matters of national environmental significance have been considered for this Modification and include:

- world heritage properties;
- wetlands listed under the Ramsar Convention;
- listed threatened species and ecological communities;
- listed migratory species protected under international agreements;
- nuclear actions;
- the Commonwealth marine environment;
- national heritage places; and
- water resources, in relation to coal seam gas development and large coal mining developments.

The Modification involves only minor alterations to the approved extent of mining at the Tarrawonga Coal Mine (i.e. would result in a reduced extent of open cut mining). Additional surface disturbance areas to those currently approved would be limited to the construction of a new site access road and intersection along Goonbri Road and Modification pipeline to the proposed Vickery Extension Project. It is these components of the Modification that have been referred under the EPBC Act.

No threatened flora species or populations (including Threatened Ecological Communities) were recorded in the Modification areas by surveys undertaken for the Modification. No threatened flora species listed under the EPBC Act were identified in the Modification areas and none are likely to be impacted by the Modification (Appendix F). It is noted that one flora species (Slender Darling Pea [*Swainsona murrayana*]) was assumed to be present under the precautionary principle as it was unable to be surveyed due to the timing of the Modification surveys despite the Modification areas being unlikely habitat (Appendix F). Nevertheless, the Modification would not result in significant impact to any threatened flora species.

Two threatened fauna species were identified within the Modification areas (Section 5.6):

- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis*); and
- Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris)*.

Fauna habitats within the Modification areas were generally poor quality (Section 5.6). On this basis, it is considered that the Modification would not result in significant impact to any threatened fauna species (Appendix F).

The proposed Modification is not considered likely to have a significant impact on any of the other protected matters listed under the EPBC Act.

3.2.5 NSW Government Policy

Aquifer Interference Policy

The AIP (NSW Government, 2012) 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 would also enhance existing regulation, contributing to a comprehensive framework to protect the rights of all water users and the environment in NSW.

The *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 (Appendix A) has been prepared in consideration of the AIP and the key conclusions are summarised below.

Drawdowns at privately-owned bores in the vicinity of the Tarrawonga Coal Mine are not predicted to exceed the AIP minimal impact criterion of 2 m due to the Modification (Appendix A).

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 Tarrawonga Coal Mine coal resource is located within the Maules Creek sub-basin of the Early Permian Bellata Group, which lies within the *Water Sharing Plan for the NSW Murray-Darling Basin Porous Rock Groundwater Sources 2012*. The Tarrawonga Coal Mine is covered by three Water Sharing Plans related to the Upper Namoi alluvium (Section 5.1):

- *Water Sharing Plan for the Namoi Unregulated and Alluvial Water Sources 2012*;
- *Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2016*; and
- *Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2019*.

Licensing Requirements

The Groundwater Assessment (Appendix A) considers licensing requirements for the Tarrawonga Coal Mine incorporating the Modification. These requirements are summarised in Table 3-1. TCPL would continue to obtain and hold licences required under the *Water Management Act, 2000*.

Minimal Impact Considerations

The AIP establishes minimal impact considerations for highly productive and less productive groundwater.

An assessment of the Modification against the minimal impact considerations in the AIP was conducted as part of the Groundwater Assessment (Appendix A).

The Groundwater Assessment concluded the Modification is within the 'Level 1' minimal impact considerations outlined in the AIP.

3.3 MODIFICATION JUSTIFICATION AND STRATEGIC CONTEXT

3.3.1 Need for and Objectives of the Modification

The Modification is proposed on the basis it would:

- maximise the economic recovery of coal within the approved open cut extent by seeking approval to mine within 200 m of the Upper Namoi alluvium (but would avoid mining the Upper Namoi alluvium itself), while avoiding economically prohibitive capital costs;
- reduce some potential environmental effects associated with mining the Upper Namoi alluvium and Goonbri Creek (i.e. potential impacts on water resources) and associated surface disturbance;
- reduce the total surface disturbance by approximately 87 ha, including avoidance of productive agricultural land associated with Goonbri Creek;
- provide more efficient coal extraction via an increase in the ROM coal mining rate from 3.0 to 3.5 Mtpa;
- provide an alternative contingency water supply from surplus water from the proposed Vickery Extension Project (subject to the Vickery Extension Project's approval, commissioning and water extraction/licensing limits); and
- allow the Tarrawonga Coal Mine to operate consistent with all other existing environmental limits for the Tarrawonga Coal Mine.

Further justification of the Modification is provided below.

Mining Rate, Mine Life and Workforce

The ROM mining rate at the Tarrawonga Coal Mine since approval of the Tarrawonga Coal Project has been slower than that originally proposed in the Tarrawonga Coal Project EA (TCPL, 2012).

The Modification does not propose a change to the existing Tarrawonga Coal Mine life or workforce, on the basis the Modification would allow mining at a higher rate (i.e. increase from 3.0 to 3.5 Mtpa). This can be achieved by the existing workforce by:

- increasing the capacity of fleet (i.e. replacing haul trucks and excavators with larger sized models); and
- increasing and optimising the number of shifts of the existing workforce (as existing shifts do not utilise the approved 24 hours per day, seven days per week allowable operational hours).

Potential environmental effects of the increased mining rate have been assessed as part of the Modification Report in Section 5.

Change of Open Cut Extent

Condition 37, Schedule 3 of PA 11_0047 requires TCPL to construct the Goonbri Creek diversion and low permeability barrier prior to undertaking any mining operations within 200 m of the regionally mapped Upper Namoi alluvium. Other associated works would include realignment of a section of Goonbri Road and an 11 kilovolt electricity transmission line. TCPL considers the capital costs of these works to be economically prohibitive under the current market conditions. In the absence of these capital works, TCPL would cease mining at 200 m from the Upper Namoi alluvium under PA 11_0047.

The potential loss of coal associated with not carrying out the above works and stopping mining at the 200 m offset from the Upper Namoi alluvium is approximately 8.5 Mt (i.e. the total coal within the Upper Namoi alluvium plus the 200 m offset). The strip ratio of overburden to coal increases to the east up to approximately 12:1 due to the dip of the coal seams resulting in higher mining costs, per tonne of coal extracted.

A Groundwater Assessment been undertaken to assess the potential impacts on groundwater resources due to the Modification (Section 5.1). Numerical modelling was conducted to assess potential groundwater impacts under the Modification (i.e. mining within 200 m of the Upper Namoi alluvium without the low permeability barrier).

The numerical modelling showed that groundwater inflows to the open cut were reduced under the Modification compared to the approved Tarrawonga Coal Mine. Further, inflows from the Upper Namoi alluvium were predicted to be negligible during operations and post-mining (Appendix A).

The Modification proposes to maximise the extraction of economic coal without the requirement to construct the low permeability barrier, electricity transmission line realignment, Goonbri Road realignment and Goonbri Creek diversion. Approximately 3.4 Mt of additional ROM coal would be extracted under the Modification compared to a scenario where mining stops at the 200 m offset from the Upper Namoi alluvium.

Final Void and Revised Landforms

The reduced mine footprint associated with the Modification necessitates the requirement to relocate the approved final void.

The proposed relocation and redesign of the final void under the Modification is justified on the basis it would:

- be located outside of the Upper Namoi alluvium and groundwater modelling predicts negligible inflows from the Upper Namoi alluvium post-mining;
- be located at least 200 m from Goonbri Creek;
- improve geotechnical stability by benching the walls and reducing their slope (Section 6.3.3);
- remain a groundwater sink post-mining; and
- result in a smaller catchment area reporting to the final void.

The Modification also involves improvements to the final mine landforms. The Modification would improve the integration of the Northern and Southern Emplacements and would introduce micro-relief (i.e. gently undulating surfaces) to assist in drainage design that replicates natural drainage systems and improve integration of the landforms with the surrounding environment.

An assessment of potential visual impacts has been undertaken for the Modification (Section 5.9). Visual impacts of the Tarrawonga Coal Mine incorporating the Modification are expected to be similar to those assessed in the Tarrawonga Coal Mine EA (TCPL, 2012).

Water Transfer Pipeline

In addition to the surface water and groundwater collected on-site (Section 1.3), TCPL uses an existing groundwater production bore and water sharing between the BTM Complex (i.e. in accordance with the BTM Water Management Strategy) to meet its operational water demand.

Where required, extraction/transfer of water from external sources is subject to approval of the respective projects and associated licensing requirements.

An alternative contingency water supply could be surplus water from the Vickery Extension Project, should it be approved.

The Modification pipeline connecting to the pipeline extending north of the Vickery Extension Project would facilitate contingency transfer of water.

The Modification does not include the extraction of water from the Vickery Extension Project, as this is subject to the Vickery Extension Project Development Application. Potential impacts associated with the extraction of water from the Vickery Extension Project have been assessed in the Vickery Extension Project EIS (Whitehaven, 2018b).

Future transfer of water from the Vickery Extension Project (if approved) would be subject to the limits of its approval/licensing requirements.

New Site Access and Off-site Coal Haulage

The Modification proposes the relocation of the existing ROM coal stockpile (and associated infrastructure) to the east of the Northern Emplacement (within currently approved disturbance limits). The relocation is proposed on the basis that it would provide more economically efficient haulage of ROM coal to the stockpile (i.e. shorter haulage route) and would reduce associated emissions (e.g. dust).

The relocated ROM coal stockpile results in the proposed change to the Northern Section of the Approved ROM Coal Transport Route, with haulage trucks utilising a short section of Goonbri Road to access the relocated ROM coal stockpile. A T-intersection would be constructed on Goonbri Road.

The Modification also proposes an increase in the haulage rate along the Northern Section of the Approved ROM Coal Transport Route from 3.0 to 3.5 Mtpa.

A Road Transport Assessment been undertaken to assess potential impacts of the Modification on traffic generation, intersection capacity and road safety (Section 5.5). A portion of Goonbri Road would be upgraded and sealed to a standard consistent with the requirements of the *Guide to Road Design Part 3: Geometric Design* (Austroads, 2016) between the intersection with the Whitehaven Private Haul Road and a new T-intersection (Appendix E) would be constructed for access to the relocated ROM coal stockpile. Works would be undertaken in consultation with the NSC.

The Road Transport Assessment concluded that traffic volumes along Goonbri Road are sufficiently low that drivers would experience negligible restriction to their freedom of movement as a result of other vehicles (Section 5.5).

3.3.2 Benefits of the Modification

The following benefits would result from the Modification:

- the open cut extent would avoid mining the Upper Namoi alluvium and Goonbri Creek which would result in:
  - a reduction in drawdown in the water table for the Modification compared to the approved Tarrawonga Coal Mine; and
  - reduced inflows from the Upper Namoi alluvium into the open cut during operations and post-mining (Section 5.1).
- overall reduction in the total surface disturbance by approximately 87 ha, including avoidance of productive agricultural land associated with Goonbri Creek; and
- upgrading of a section of Goonbri Road for the Approved ROM Coal Transport Route.

4 ENGAGEMENT

4.1 NSW GOVERNMENT AGENCIES

TCPL continues to consult with relevant State, Commonwealth, and local Government agencies on a regular basis in relation to the current operations of the Tarrawonga Coal Mine.

4.1.1 Department of Planning, Industry and Environment

TCPL met with the DP&E (now within the DPIE) on 4 October 2018 to provide an overview of the Modification and key environmental assessments to be undertaken to supplement the Modification.

TCPL wrote to the DP&E on 25 October 2018 and 3 May 2019 regarding the Modification, the proposed approval pathway and the scope of the environmental assessment. The DP&E subsequently wrote to TCPL confirming it agreed with TCPL's proposed approval pathway and environmental assessment scope.

An update on the Modification and a summary of the environmental study findings was sent to the DPIE in August 2019.

Other NSW Government Agencies

In April 2019, TCPL provided a briefing letter that included information on the Modification to the following NSW Government agencies:

- OEH (now the DPIE – Biodiversity Conservation Division);
- NSW Department of Industry – Water (DI – Water) (now within the DPIE);
- NSW EPA;
- NSW Division of Resources and Geoscience (DRG) (now within the DPIE);
- NSW Resources Regulator;
- NSW Roads and Maritime Services (RMS);
- Transport for NSW;
- NSW Department of Industry – Fisheries;
- NSW Department of Industry – Lands;
- NSW Health; and
- Local Land Services.

TCPL met with DPIE – Water, the Natural Resources Access Regulator, the DPIE – Biodiversity Conservation Division (formerly the OEH) and the EPA in July 2019 to provide an update on the Modification and a summary of the environmental study findings.

The RMS provided comments on the Modification in a letter dated 7 May 2019. The Modification Report considers the comments from RMS in Section 5 and Appendix E.

4.2 LOCAL GOVERNMENT AGENCIES

The Tarrawonga Coal Mine is located within the NSC LGA (Figure 1-1). In addition, the Approved ROM Coal Transport Route is also located in the GSC LGA.

TCPL holds regular meetings with the NSC and GSC in relation to both the Tarrawonga Coal Mine and Whitehaven's other nearby existing and proposed operations (e.g. Maules Creek Coal Mine and Vickery Extension Project).

A letter was issued to the NSC and GSC in April 2019 providing an overview of the proposed Modification and key environmental assessments to be undertaken.

TCPL met with the NSC in July 2019 to provide an update on the Modification and a summary of the environmental study findings.

4.3 FEDERAL GOVERNMENT AGENCIES

TCPL met with the DEE in January 2019 to provide an overview of the Modification and proposed referral under the EPBC Act.

TCPL lodged a Referral for the Modification under the EPBC Act with the DEE in September 2019 for the proposed Modification Pipeline and the Modification ROM Coal Transport Route along Goonbri Road.

4.4 COMMUNITY CONSULTATIVE COMMITTEE

A Community Consultation Committee (CCC) has been established for the approved Tarrawonga Coal Mine with meetings held quarterly. The CCC consists of representatives from the local community, NSC, GSC and Whitehaven.

An overview of the Modification and environmental studies were provided to the CCC during meetings held on 13 February 2019 and 15 and 16 May 2019.

4.5 INFRASTRUCTURE OWNERS AND OTHER RESOURCE COMPANIES

4.5.1 Siding Springs Observatory

The Siding Springs Observatory is located approximately 125 km south-west of the Tarrawonga Coal Mine. As such, the Modification is within the Dark Sky Region, as defined in the Dark Sky Planning Guideline (DP&E, 2016).

A letter was sent to the Siding Springs Observatory in April 2019 providing information on the Modification and offering a meeting to discuss the Modification and potential environmental impacts, with a focus on potential night lighting impacts.

TCPL met with the Siding Springs Observatory in July 2019 to provide further information on the Modification and an update on the environmental assessment.

4.5.2 Nearby Mining Companies

Whitehaven regularly meets with Idemitsu, owners of the Boggabri Coal Mine regarding operation of the Tarrawonga and Maules Creek Coal Mines.

Whitehaven met with Idemitsu in June 2019 to provide an overview of the Modification.

5 ENVIRONMENTAL REVIEW

5.1 GROUNDWATER

A Groundwater Assessment for the Modification was undertaken by HydroSimulations (now trading as SLR Consulting Australia Pty Ltd [SLR]) (2019) and is presented in Appendix A.

A description of the existing environment in relation to groundwater is provided in Section 5.1.1. Section 5.1.2 describes the potential impacts of the Modification on groundwater resources (including cumulative impacts), while Section 5.1.3 outlines mitigation and management measures (including licensing considerations) and monitoring.

5.1.1 Existing Environment

Previous Assessment

A groundwater assessment for the approved Tarrawonga Coal Mine was prepared by Heritage Computing (2012).

A numerical regional groundwater model covering an area of approximately 1,518 square kilometres (km^2) (33 km east-west and 46 km north-south) was used to simulate the potential effects of the approved Tarrawonga Coal Mine on the local and regional aquifer systems and groundwater users. The regional groundwater model incorporated the Maules Creek Coal Mine and Boggabri Coal Mine in the north, and Rocglen Coal Mine in the south and was calibrated based on available data from January 2006 to December 2010.

Key findings from the approved Tarrawonga Coal Mine Groundwater Assessment (Heritage Computing, 2012) were:

- As mining progresses, the open cut would act as a groundwater sink.
- Average groundwater inflows to the open cut (prior to it intersecting the alluvial groundwater system) from the porous rock groundwater system would be approximately 0.5 megalitres per day (ML/day) (ranging from 0.4 to 0.7 ML/day).
- Total inflows to the Tarrawonga Coal Mine open cut (from the porous rock and alluvial groundwater systems) would vary between approximately 0.4 and 1.1 ML/day over the life of the Tarrawonga Coal Mine.
- Maximum inflows to the open cut (from the alluvial groundwater system) were approximately 0.5 ML/day in Year 12 of the Tarrawonga Coal Project.
- Drawdown effects on groundwater users in the vicinity of the approved Tarrawonga Coal Mine would not be significant (i.e. would be less than 1 m) and would, therefore, not materially affect the existing or potential future beneficial use of groundwater.

Existing Hydrological Regime

The Tarrawonga Coal Mine is located in the Gunnedah Basin, which contains sedimentary rocks, including coal measures, of Permian and Triassic age.

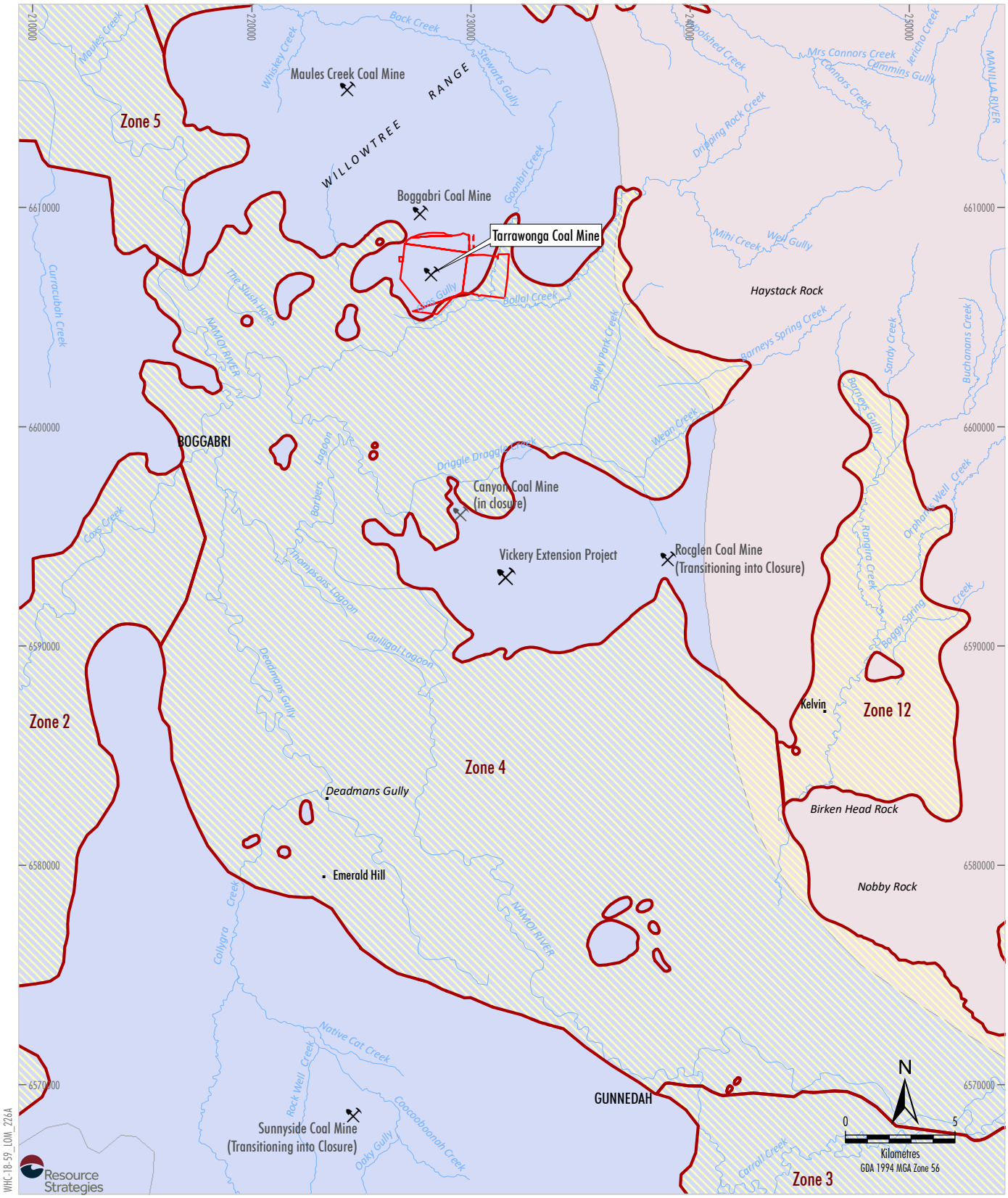
Heritage Computing (2012) identified two distinct groundwater systems in the Tarrawonga Coal Mine area:

- Porous Rock groundwater system – including the coal measures of the Maules Creek Formation; and
- Alluvial groundwater system – associated with the low-lying flood plains of the Upper Namoi.

The Tarrawonga Coal Mine coal resource is located within the Maules Creek sub-basin of the Early Permian Bellata Group, which lies within the *Water Sharing Plan for the NSW Murray-Darling Basin Porous Rock Groundwater Sources 2012*. The Tarrawonga Coal Mine targets coal seams in the Maules Creek Formation within the 'Gunnedah-Oxley Basin – Namoi' Management Zone defined in the *Water Sharing Plan for the NSW Murray-Darling Basin Porous Rock Groundwater Sources 2012*.

The Tarrawonga Coal Mine is covered by three Water Sharing Plans related to the Upper Namoi alluvium (Figure 5-1):

- *Water Sharing Plan for the Namoi Unregulated and Alluvial Water Sources 2012*;
- *Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2016*; and
- *Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2019*.





LEGEND

Mining Tenement Boundary (ML, CL and AUTH)

Mining Lease Application Boundary (MLA 1)

Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2019

Alluvial Groundwater Source

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

Gunnedah-Oxley Basin MDB Groundwater Source

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

New England Fold Belt MDB Groundwater Source

Source: Geoscience AustraliaTopographic Base (2006); NSW Department of Industry (2015); NOW (2011)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Relevant Groundwater Sources

Figure 5-1

A draft *Water Sharing Plan for the Namoi Alluvial Groundwater Sources 2019* was exhibited from 11 June 2019 to 20 July 2019. Following its commencement, the *Water Sharing Plan for the Namoi Alluvial Groundwater Sources 2019* would replace the *Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2019,* the *Water Sharing Plan for Namoi Unregulated and Alluvial Water Sources 2012* and the *Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvial and Fractured Rock Water Sources 2010*.

Alluvial sediments associated with the Bollol Creek, Goonbri Creek and Nagero Creek surface drainages exist to the east, south and west of the Tarrawonga Coal Mine. These alluvial sediments are part of the Upper Namoi Alluvium within the Namoi Valley (Keepit Dam to Gins Leap) Groundwater Source, also known as the Upper Namoi Zone 4 Groundwater Source.

Recharge to the groundwater systems occurs from rainfall and runoff infiltration, lateral groundwater flow and some leakage from surface water sources (e.g. the Namoi River). Although groundwater levels are sustained by rainfall recharge, they are controlled by topography, geology and surface water levels in local drainages (Appendix A).

Local groundwater tends to mound beneath hills, with ultimate discharge to local drainages and loss by evapotranspiration through rock outcrops and vegetation where the water table is near the ground surface (Appendix A).

Alluvium Boundary Investigation

The lateral extent of alluvium associated with Goonbri Creek was assessed by SLR using soil field assessment techniques (Appendix A). The assessment methodology consisted of transects, observation sites and soil sample laboratory analysis. Sites were classified into alluvial, non-alluvial and alluvial-boundary sites. The mapped alluvial boundary is shown on Figure 5-2.

Ground truthing of the slope proved to be indicative of the alluvial boundary as the non-alluvial landform exhibited slopes of between 2.5% and 5% which was easily distinguished against the near level to level alluvial plain within 5 to 10 m (Appendix A).

The Modification open cut extent would not intercept the regionally mapped alluvials or alluvials mapped by SLR (2019) (Figure 5-2).

Groundwater Users

Heritage Computing (2012) identified 635 registered bores within the regional numerical groundwater model area for the approved Tarrawonga Coal Mine Groundwater Assessment. The majority of the registered bores are located within the Upper Namoi Alluvium. In addition, the Tarrawonga Coal Mine Water Management Plan (TCPL, 2018) outlined 121 registered bores within 5 km of the Tarrawonga Coal Mine, of which 67 are on land owned by Whitehaven or BCOPL.

Existing Groundwater Monitoring and Management

The Tarrawonga Coal Mine currently operates in accordance with the Tarrawonga Coal Mine Water Management Plan (TCPL, 2018).

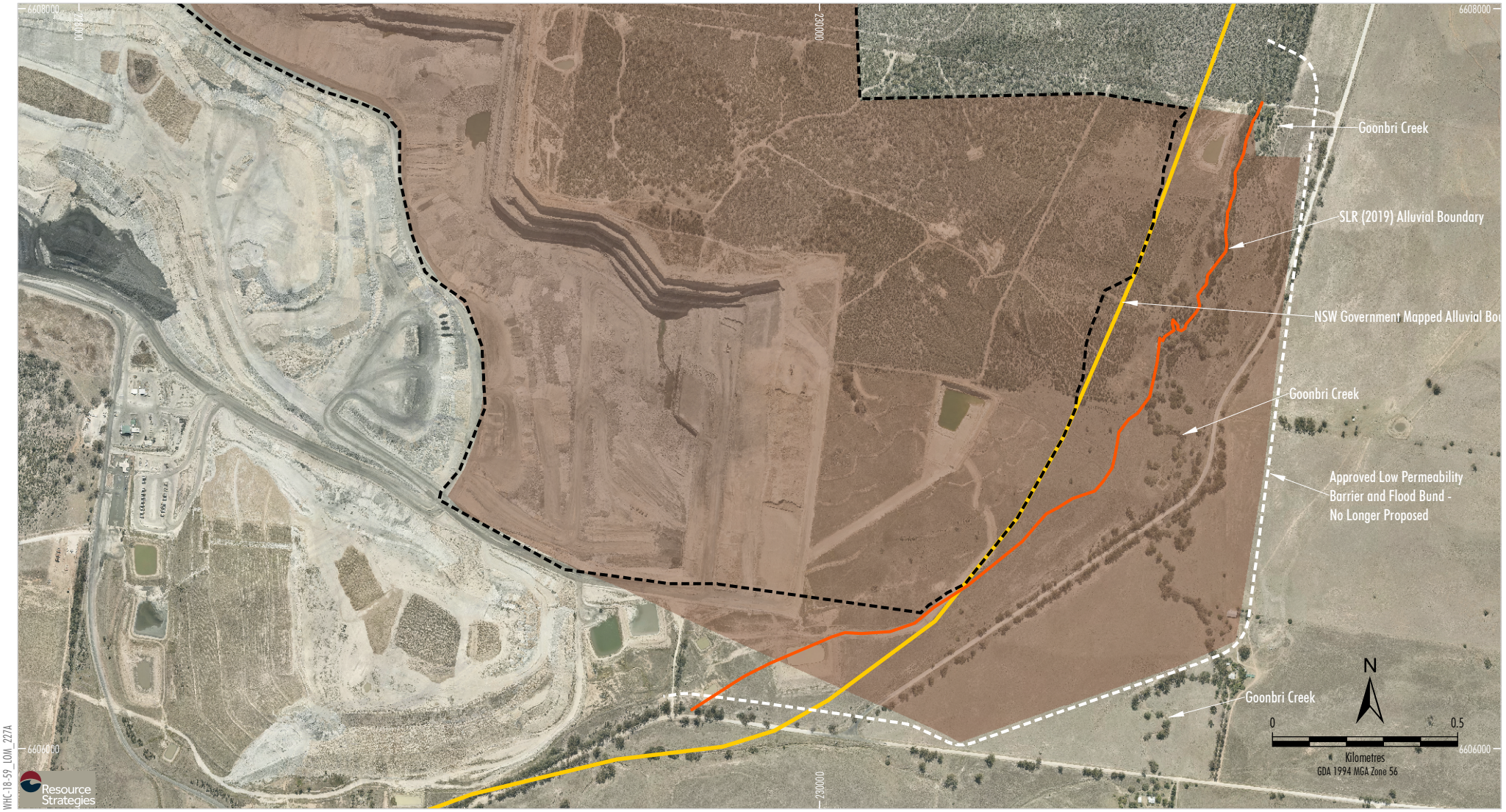
In addition to the Tarrawonga Coal Mine Water Management Plan, the BTM Complex Water Management Strategy (Idemitsu and Whitehaven, 2019) is implemented to detect cumulative impacts on groundwater levels due to the Maules Creek Coal, Boggabri Coal and Tarrawonga Coal Mines. The BTM Complex Water Management Strategy outlines the approach taken by the BTM Complex to monitor and collectively manage the potential cumulative surface water and groundwater impacts of their operations.

5.1.2 Potential Impacts

Model setup

Groundwater modelling has been conducted in accordance with the Australian Groundwater Modelling Guidelines (Barnett *et al*., 2012) to evaluate the potential impacts of the Modification on groundwater resources. The existing groundwater model for the Tarrawonga Coal Mine (Heritage Computing, 2012) has been recalibrated using the additional data obtained from the updated monitoring network since 2012.

Numerical modelling was conducted using MODFLOW-USG Beta (Appendix A). Consistent with the approved Tarrawonga Coal Mine Groundwater Assessment (Heritage Computing, 2012), the numerical regional groundwater model covers an area of approximately 1,518 km^2 (33 km east-west and 46 km north-south) and incorporates the Maules Creek Coal Mine and Boggabri Coal Mine in the north, and Rocglen Coal Mine in the south (Appendix A).



LEGEND

- Approximate Extent of Approved Open Cut
- Modification Open Cut Extent
- Mapped Alluvium Subcrop Exposure (NSW Government Mapping)
- SLR (2019) Mapped Alluvial Boundary

Source: © State of New South Wales and Department of Planning and Environment (2017); © Department of Finance, Services & Innovation (2017); SLR (2019)
Orthophoto: Whitehaven Coal Limited (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Mapped Alluvial Boundary

Figure 5-2

The recalibrated groundwater model is based on available data from January 2006 to June 2018 and was used to simulate the potential effects of the Tarrawonga Coal Mine on the local and regional aquifer systems and groundwater users. The recalibrated model achieved a scaled Root Mean Square value of 7.6%, which is within the Australian Groundwater Modelling Guideline (Barnett *et al.*, 2012) values of between 5 and 10% for acceptable model calibration (Appendix A).

The recalibrated groundwater model was used to assess the potential incremental impacts of the Modification by comparing modelling results for approved versus modified modelling scenarios.

Modelled Impacts

Groundwater modelling was undertaken based on the Modification mine plans, which do not include the low permeability barrier. Key findings of the Groundwater Assessment are (Appendix A):

- Inflows into the open cut are reduced under the Modification compared to the approved Tarrawonga Coal Mine, with average Modification inflows of 0.2 ML/day.
- Inflows from the Upper Namoi alluvium into the open cut would be negligible during operations and post-mining (indirect losses into lower formations were predicted to be 0.08 ML/annum).
- A reduction in drawdown in the water table for the Modification is predicted compared to the approved Tarrawonga Coal Mine.
- The maximum drawdown at privately-owned bores from the Upper Namoi Alluvium is predicted to be no more than 1 m, and would not materially affect the existing or potential future beneficial use of groundwater.
- The Modification has a reduced impact on streamflow compared to the approved Tarrawonga Coal Mine.

The predicted inflows from the porous rock during the life of mine ranged from 58 to 99 ML/annum for the Modification. Post-mining groundwater inflows from the coal seams or interburden attributed to the *Water Sharing Plan for the NSW Murray-Darling Basin Porous Rock Groundwater Sources 2012* is predicted to be up to 52 ML/annum, which is well below the current licences held be TCPL for the approved Tarrawonga Coal Mine (i.e. 300 ML).

There would be no direct groundwater inflow from the Upper Namoi Alluvium to the open cut. Incidental losses through enhanced leakage (i.e. vertical loss) from the Upper Namoi Alluvium to the underlying formations are predicted to be negligible (at less than 0.08 ML/annum).

The post-mining groundwater numerical modelling indicates that the final void would act as a permanent groundwater sink. No significant groundwater quality impact is expected from groundwater interactions with the final void water. Therefore, it is unlikely the water quality of any surface water body would be impacted by groundwater migrating from the final void (Appendix A).

Cumulative Impacts

The Groundwater Assessment included consideration of the cumulative impacts of the Modification, the Boggabri Coal Mine, the Maules Creek Coal Mine and the Rocglen Coal Mine.

Appendix A describes the predicted take from each of the Tarrawonga Coal Mine (Modification), Boggabri Coal Mine, Maules Creek Coal Mine and the Rocglen Coal Mine.

Aquifer Interference Policy

The alluvial groundwater system associated with the floodplains of the Namoi River south, east and west of the Tarrawonga Coal Mine open cut falls within the Upper Namoi Zone 4, Namoi Valley (Keepit Dam to Gins Leap) Groundwater Source (Zone 4) of the *Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2019* (Figure 5-1). Zone 4 is defined as 'highly productive' under the AIP (NSW Government, 2012) although in reality, yields and water quality can vary considerably (Appendix A).

Based on the findings of the groundwater modelling and assessment, the Modification meets the Level 1 minimal impact consideration classification of the AIP for 'highly productive' groundwater associated with the Upper Namoi Zone 4 Alluvium and the MDB Porous Rock (Appendix A).

The AIP considerations are discussed further in Section 3.

5.1.3 Mitigation Measures, Management and Monitoring

As described in Section 2.4.1, TCPL no longer proposes to mine into the Upper Namoi Alluvium, and subsequently the construction of the low permeability barrier and Goonbri Creek realignment are no longer proposed.

HydroSimulations (2019) recommends that the groundwater monitoring program currently in use be continued to monitor the groundwater effects of the Modification (including triggers for investigation), with the addition of the following monitoring bores (Appendix A):

- Two bores in the Northern Overburden Emplacement behind the advancing open cut.
- Two bores in the Upper Namoi alluvium between the open cut and Goonbri Creek.
- One bore in the Upper Namoi alluvium to the east of Goonbri Creek.

TCPL would progressively update the Tarrawonga Coal Mine Water Management Plan to incorporate the Modification and proposed monitoring.

TCPL would continue to implement the existing BTM Complex Water Management Strategy at the Tarrawonga Coal Mine, and review and revise where necessary (in consultation with the relevant regulatory authorities) for the Modification. The purpose of the BTM Complex Water Management Strategy is to outline the approach taken by Idemitsu and Whitehaven to monitor and collectively manage cumulative surface water and groundwater impacts at the BTM Complex.

Groundwater Licensing

Licence requirements resulting from the proposed changes in open cut mining operations and extent for the Modification have been estimated by HydroSimulations (2019). Peak licensing requirements would reduce as a result of the Modification compared to the approved Tarrawonga Coal Mine (Table 5-1).

Whitehaven would hold groundwater licences to account for mining at the Tarrawonga Coal Mine incorporating the Modification, as required.

5.2 SURFACE WATER

A Surface Water Assessment for the Modification was undertaken by HydroEngineering and Consulting Pty Ltd (HEC) and is presented in Appendix B.

The existing water management system is described in Section 1.3, with the proposed changes to incorporate the Modification described in Section 2.3.

Table 5-1
Estimated Approved Tarrawonga Coal Mine and Modification Licensing Requirements

Water Sharing Plan	Management Zone	Predicted Average/Maximum Annual Inflow Volumes Requiring Licensing (ML/annum)			
		Approved Tarrawonga Coal Mine[1]		Modification[2]	
		Operational	Post-mining[3]	Operational	Post-mining[3]
Murray-Darling Porous Rock Water Sharing Plan 2012	Gunnedah - Oxley Basin MDB (Other)	209 (Average) 252 (Maximum)	167 (Maximum)	74 (Average) 99 (Maximum)	52 (Maximum)
Upper and Lower Namoi Groundwater Sources 2019	Upper Namoi Zone 4, Namoi Valley (Keepit Dam to Gins Leap) Groundwater Source	142 (Average) 198 (Maximum)	Negligible[4]	Negligible[5]	Negligible

[1] Source: Heritage Computing (2012).

[2] Source: Appendix A.

[3] Groundwater inflows would reduce as the final void water level reaches equilibrium over many decades.

[4] The model predicted extra 'alluvium to porous rock' leakage induced beyond low permeability barrier is up to 5 ML/annum (0.013 ML/day) and the reduced recharge due to excavated alluvium up to 6 ML/annum (0.016 ML/day) at 1.2% recharge.

[5] Indirect losses into lower formations were calculated to be 0.08 ML/annum (Appendix A).

A description of the existing environment in relation to surface water is provided in Section 5.2.1. Section 5.2.2 describes the assessment of potential impacts of the Modification (including cumulative impacts), and Section 5.2.3 outlines mitigation and management measures and monitoring.

5.2.1 Existing Environment

A surface water assessment for the approved Tarrawonga Coal Mine was prepared by Gilbert & Associates Pty Ltd (Gilbert & Associates) (now HEC) (2011).

Previous Assessment

The approved Tarrawonga Coal Mine would involve removal of a 3 km section of Goonbri Creek within the Tarrawonga Coal Mine open cut and the establishment of a permanent Goonbri Creek alignment and associated flood bund to the east and south-east of the open cut.

The Tarrawonga Coal Mine would alter the existing Nagero Creek and Bollol/Goonbri Creek catchments, resulting in changes to flows in local watercourses and drainage lines due to the progressive development of the approved Tarrawonga Coal Mine Water Management System and associated capture and re-use of surface water runoff from operational disturbance areas (Gilbert & Associates, 2011).

The Tarrawonga Coal Mine water management system (including mine water surge dams) has been designed with the objective to securely contain mine water on-site, and minimise the potential for spills off-site (Gilbert & Associates, 2011).

A low risk of adverse water quality impacts from controlled releases at LDPs in accordance with EPL 12365 was predicted for the approved Tarrawonga Coal Mine. Releases from passively managed storages are also considered to have a very low risk of adversely affecting downstream waters (Gilbert & Associates, 2011).

Hydrology

The Tarrawonga Coal Mine is located entirely within the Namoi River catchment. The Namoi River has a catchment area of approximately 42,000 km^2. The Namoi River is a tributary of the Barwon River, which ultimately flows into the Murray-Darling System (Appendix B).

The local drainage catchments associated with the Tarrawonga Coal Mine are Nagero Creek, Goonbri Creek and Bollol Creek, which ultimately flow into the Namoi River just north of Boggabri (Figure 5-3).

Bollol Creek rises in the north-south trending range to the east of the Tarrawonga Coal Mine and is an ephemeral waterway which flows south and west through a confined valley before dispersing onto the alluvial flats. Flows in Bollol Creek generally continue as overland flow in a south-westerly direction to eventually reach Barbers Lagoon, which flows into the Namoi River (Appendix B).

Goonbri Creek rises on the eastern slopes of the Willowtree Range. The creek flows generally southward along the eastern boundary of the Leard State Forest and is flanked on its eastern side by Middle Mountain and Goonbri Mountain, which form a discontinuous line of hills. Downstream of the Tarrawonga Coal Mine, Goonbri Creek flows generally westward and south-westward, crossing the approved ROM Coal Transport Route and ultimately disperses as overland flow on the adjacent alluvial flats and the Namoi River floodplain (Appendix B).

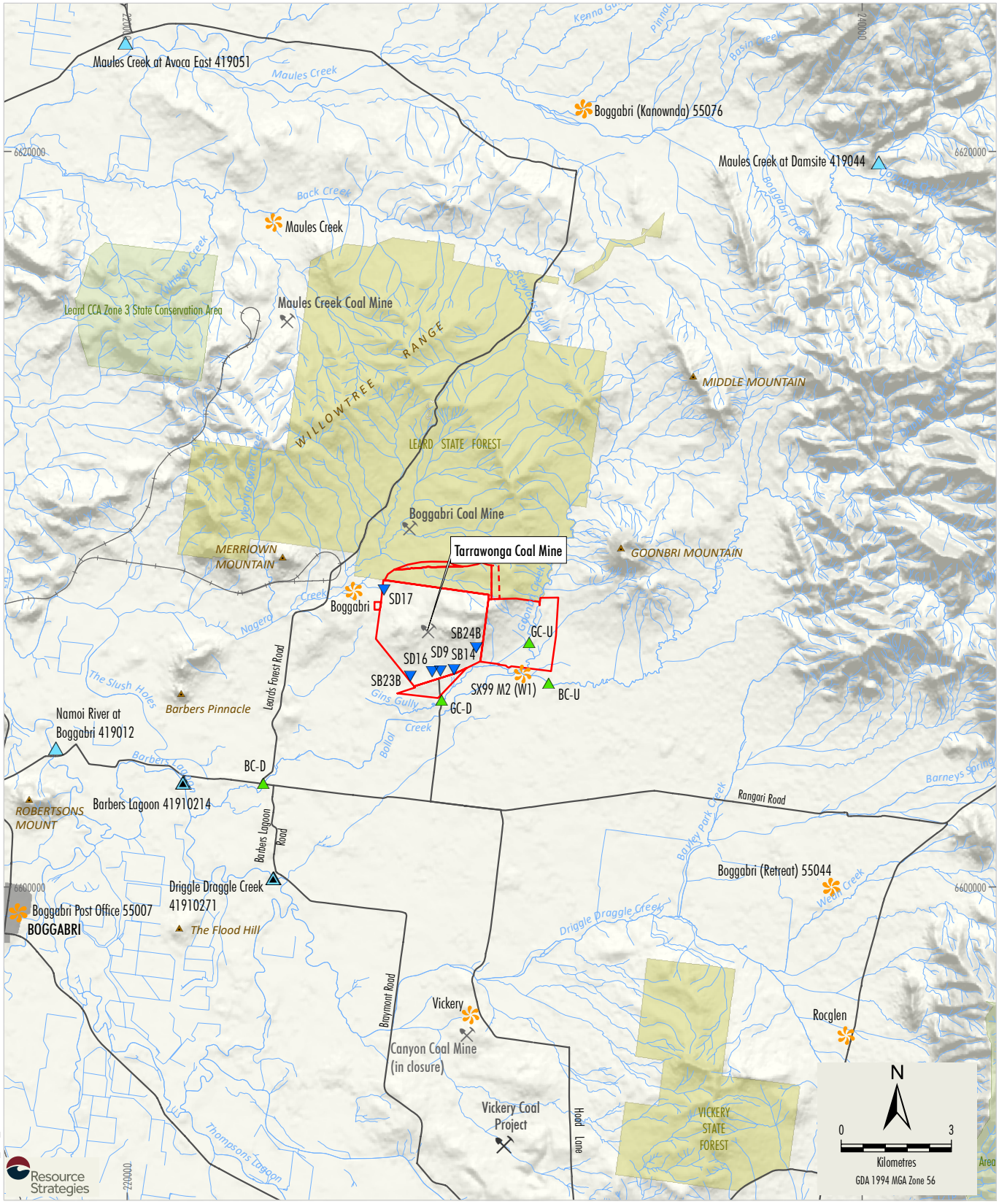
Nagero Creek rises along the south-western margins of the Willowtree Range, in Leard State Forest. Nagero Creek is also an ephemeral waterway, which flows generally south-west into a series of lagoons known as The Slush Holes, before ultimately draining into the Namoi River (Appendix B).

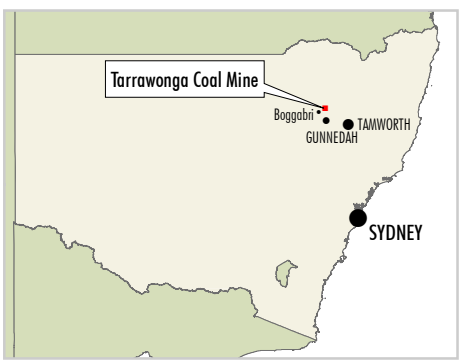
A portion of the catchment of Nagero Creek in the northern part of ML 1579 is captured within the existing/approved Tarrawonga Coal Mine water management system for on-site usage and to prevent sediment laden runoff entering the creek.

Licensed Discharge Points

The Tarrawonga Coal Mine is subject to EPL 12365, which includes licensed wet weather release into the Goonbri Creek catchment at LDPs 2, 3, 24, 26 and 27, and into the Nagero Creek catchment at LDP 1 (Figure 5-3).

Water quality samples are collected following wet weather discharges from the Tarrawonga Coal Mine in accordance with EPL 12365.





LEGEND

- Mining Tenement Boundary (ML, CL and AUTH)
- Mining Lease Application Boundary (MLA 1)
- NSW State Forest
- State Conservation Area, Aboriginal Area
- Major Roads
- Railway
- Surface Water Monitoring
- Licensed Discharge Point
- Meteorological Station
- Gauging Stations
- Water Quality Monitoring Location

Source: LPMA - Topographic Base (2010); NSW Department of Industry (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Regional Surface Water and Weather Monitoring Sites

Figure 5-3

The majority of wet weather and controlled release events occurred prior to 2015. Since 2015, one wet weather release event has occurred in 2018 (Appendix B).

EPL 12365 specifies water quality concentration limits of constituents discharged at monitoring/discharge points at the Tarrawonga Coal Mine.

Surface Water Quality

HEC (2019) has reviewed the baseline water quality data for the regional and local surface water resources at the Tarrawonga Coal Mine and makes the following conclusions:

- The regional surface water systems were characterised by near neutral pH to alkaline conditions, except for the Namoi River at Gunnedah, which recorded slightly acidic to alkaline conditions. Slightly acidic to alkaline conditions were also recorded in Goonbri Creek, Bollol Creek and Nagero Creek.
- The regional surface water systems generally had elevated levels of electrical conductivity (EC) and turbidity in comparison with the Australian and New Zealand Environmental and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) Aquatic Ecosystems (Upland Rivers in NSW) guideline trigger value. The recorded EC exceeded the ANZECC & ARMCANZ (2000) guideline default trigger value in 8% and 29% of samples collected at the upstream and downstream monitoring sites on Goonbri Creek, respectively.
- Total Suspended Solids (TSS) concentrations recorded in Maules Creek at Avoca East were low in comparison with TSS concentrations recorded in Goonbri Creek and Nagero Creek.

A full suite of surface water quality results for regional and local surface water resources and site water storages is provided in Appendix B.

Flooding

The Namoi River valley has experienced a number of significant floods. The largest confirmed flood occurred in February 1955, with significant floods also being recorded in January 1971, February 1984 and November 2000 (NSW Department of Land and Water Conservation, 2003).

Flooding along the reaches of the Namoi River nearest to Boggabri is characterised by outbreaks from the main channel and associated inundation of the extensive floodplain areas on both sides of the river channel. Floodplain flow is dominated by flow in flood runners (i.e. preferential flow paths during flood events). Flow patterns are also affected by a series of relic channels which form semi-permanent lagoons between floods (NSW Department of Land and Water Conservation, 2003).

The section of Goonbri Creek adjacent to Tarrawonga Coal Mine, and a small portion of the south-western extent of the Tarrawonga Coal Mine, are located in the Upper Namoi Valley Floodplain Management Plan Management Zone C. Flood work approvals in the Upper Namoi Management Zone C are subject to the assessment criteria specified in the *Floodplain Management Plan for the Upper Namoi Valley Floodplain 2019* under the *Water Management Act 2000.*

5.2.2 Potential Impacts

An operational and post-mining site water balance was prepared by HEC for the Modification (Appendix B).

Surface Water Flow Regime

Consistent with the approved Tarrawonga Coal Mine, the Modification would result in changes to flows in local watercourses and drainage lines due to the progressive development of the Modification Water Management System and associated capture and re-use of surface water runoff from operational disturbance areas.

The Modification involves altering the Nagero Creek, Bollol/Goonbri Creek catchments. In general, the Modification results in less catchment loss (and therefore streamflow) when compared to the approved Tarrawonga Coal Mine due to the reduction in surface disturbance proposed for the Modification (Appendix B).

Predicted cumulative catchment impacts involving the Boggabri Coal Mine, Maules Creek Coal Mine and Tarrawonga Coal Mine on total flow in the associated surface water catchments have been assessed based on the estimated maximum reduction in total catchment area from the three operations and can be found in Appendix B.

Surface Water Quality

The Tarrawonga Coal Mine Water Management System is designed to contain water collected in the open cut as well as runoff from the active waste rock emplacement areas and the mine infrastructure areas for re-use on-site. Consistent with the approved Tarrawonga Coal Mine, during extended wet periods, a Mine Water Surge Storage may be established in advance of the open cut mining area to enable the open cut to be rapidly dewatered. This would minimise disruption to operations during prolonged or intense rainfall that cannot otherwise be quickly removed from the open cut without exceeding the capacity of the existing Tarrawonga Coal Mine water storages (Gilbert & Associates, 2011).

The site water balance results indicate that there would be no uncontrolled releases of this water from the Water Management System (Appendix B).

HEC concluded the sediment basins/dams would continue to operate in accordance with the Tarrawonga Coal Mine EPL 12365 (Appendix B).

Accordingly, it is expected that there be a low risk of adverse water quality impacts on the adjacent surface water systems due to the Modification (Appendix B).

Flooding

A permanent flood bund may be required to prevent inundation of the final void from Goonbri Creek. The permanent flood bund would be designed to an extent and height that would provide protection against the peak flood height associated with a PMF event. 2-dimensional modelling would be undertaken to confirm the flood bund design (Section 2.4.1).

Flood modelling of the Tarrawonga Coal Mine incorporating the Modification has been undertaken by HEC in accordance with the *Australian Rainfall and Runoff: A Guide to Flood Estimation* (Ball *et al*., 2019). Peak flow water levels in Goonbri Creek were modelled using the HEC-RAS modelling package (Appendix B). The flood modelling indicates that the revised open cut extent would be above the elevation of the PMF event (Appendix B).

Post Mining Surface Water Impacts

Final void site and salt water balance modelling has been undertaken for the Modification (Appendix B).

The model simulates inflow from incident rainfall, surface water runoff and groundwater inflow. Water would be lost from the final void through evaporation only (i.e. the final void would remain a groundwater sink). The final void would not spill to downstream watercourses (Appendix B).

As described in Section 5.1.2, groundwater inflows from the alluvial groundwater system post-mining would be negligible (Appendix A).

A final void water recovery analysis, including model predicted groundwater inflows (Appendix A), has been conducted as part of the Surface Water Assessment (Appendix B). Consistent with the approved Tarrawonga Coal Mine, the analysis shows that the final void would operate as a sink. The results of the final void water recovery analysis can be found in Appendix A and it includes long term water quality predictions (salinity).

5.2.3 Mitigation Measures, Management and Monitoring

The principles of the existing water management system would be retained under the Modification, with minor changes to incorporate the Modification landforms during operations, as required.

Localised erosion and sediment controls would be implemented during the pipeline installation consistent with Landcom (2004).

TCPL would continue to implement the existing BTM Complex Water Management Strategy at the Tarrawonga Coal Mine, and review and revise where necessary (in consultation with the relevant regulatory authorities) for the Modification. The purpose of the BTM Complex Water Management Strategy is to outline the approach taken by Idemitsu and Whitehaven to monitor and collectively manage cumulative surface water and groundwater impacts at the BTM Complex, respectively.

TCPL would undertake 2-dimensional flood modelling to determine an extent and height that would provide protection against the peak flood height associated with a PMF event (Appendix B).

5.3 NOISE

A Noise Assessment for the Modification has been prepared by Wilkinson Murray (2019) in accordance with the NSW *Noise Policy for Industry* (NPfI) (EPA, 2017) and is presented in Appendix C.

Consideration was also given to the *Voluntary Land Acquisition and Mitigation Policy* (VLAMP) (NSW Government, 2018).

Aspects relating to noise emissions are discussed in the subsections below.

5.3.1 Existing Environment

Previous Assessment

The most recent noise assessment was prepared by Wilkinson Murray for the approved Tarrawonga Coal Mine (Wilkinson Murray, 2011).

Operational Noise

With regard to the operational noise impacts associated with the approved Tarrawonga Coal Mine, Wilkinson Murray (2011) concluded that:

- All privately-owned receivers would comply with the 35 A-weighted decibels (dBA) equivalent continuous noise level ($L_{Aeq,15\ minute}$) operational noise criteria during the daytime.
- All privately-owned receivers would comply with the 35 dBA $L_{Aeq,15\ minute}$ night-time operational noise criteria conditions during calm metrological conditions.
- Three receivers (properties formerly noted as 43, 44a and 45) would exceed the 35 dBA $L_{Aeq,15\ minute}$ evening and night-time operational noise criteria during adverse meteorological conditions.

Vacant Land Assessment

Wilkinson Murray (2011) assessed the potential impacts on private vacant land and concluded that greater than 25% of vacant property exceeded the 40 dBA $L_{Aeq,15\ minute}$ at former property 49 in the vicinity of the Tarrawonga Coal Mine.

Since 2012, Whitehaven and BCOPL have acquired a number of properties surrounding the Tarrawonga Coal Mine, including properties formerly noted as 38, 43, 44, 45 and 49.

Road Traffic Noise

Road traffic noise was assessed by Wilkinson Murray for the approved Tarrawonga Coal Mine. Wilkinson Murray (2011) concluded that the closest privately-owned receivers to the Approved ROM Coal Transport Route achieve the relevant road noise criteria.

Noise Management and Monitoring

The approved Noise Management Plan has been prepared to manage Project-specific and cumulative noise impacts associated with the Tarrawonga Coal Mine. The Noise Management Plan describes the noise monitoring program, which consists of a combination of operator-attended and continuous real-time noise monitoring, as well as an Automatic Weather Station (Figure 1-6).

TCPL implements a range of noise control and management measures at the Tarrawonga Coal Mine, including mine planning controls, operational controls, engineering controls, a real-time response protocol, meteorological forecasting and continuous improvement to identify and manage noise impacts aimed to achieve compliance with the approved noise criteria.

Complaints

TCPL maintains a complaints register in accordance with PA 11_0047. The complaints register is made available quarterly to the CCC and a summary is provided every 12 months in the Tarrawonga Coal Mine Annual Review.

A small number of community complaints have been received at the Tarrawonga Coal Mine, namely:

- 2013 – no operational noise complaints;
- 2014 – one complaint about operational noise and three complaints regarding both operational noise and dust levels;
- 2015 – no operational noise complaints;
- 2016 – one complaint regarding both operational noise and dust levels;
- 2017 – no operational noise complaints; and
- 2018 – no operational noise complaints.

The complaints register shows the number of noise related complaints has reduced from the peak recorded in 2014. The reduction in complaints is considered to reflect the effective implementation of noise management measures at the Tarrawonga Coal Mine (e.g. real time noise monitoring, land acquisition, etc.).

5.3.2 Potential Impacts

Noise modelling was conducted by Wilkinson Murray (Appendix C) to predict potential noise impacts from the Tarrawonga Coal Mine incorporating the Modification.

Assessment of Meteorological Conditions

The meteorological conditions adopted for the Noise Assessment are based on data obtained from the Tarrawonga Coal Mine meteorological station for approximately a six year period from January 2013 to October 2018. The meteorological data was assessed in accordance with Fact Sheet D of the NPfI to determine the significance of noise-enhancing meteorological conditions.

Analysis of the temperature inversions indicated that temperature inversions are a feature of the area. Temperature inversions with winds from the northern, north-northeastern, north-eastern, east-northeastern, eastern, and north-northwestern directions are found to have frequencies of occurrence ranging from 13.7% to 19.1% in winter, therefore, these winds have been included in the modelling in combination with temperature inversions. Drainage flow winds are considered too infrequent for all other directions.

Appendix C outlines the adopted NPfI meteorological conditions for the Noise Assessment.

Modelling Scenarios

Wilkinson Murray modelled and assessed two scenarios to determine potential noise impacts associated with the Modification (Appendix C):

- Modification Year 3 – which represents the first year that the Modification reaches the proposed maximum ROM coal production rate (3.5 Mtpa) and volume of displaced waste rock material expected to be the highest for the mine life. This scenario considers the mining operations with relocated ROM coal stockpile and associated infrastructure in place. Coal mining and waste material removal activities would be concentrated near the south-east corner and central-northern part of the open cut extent.
- Modification Year 7 – which represents ROM coal production at the proposed maximum rate of 3.5 Mtpa, with volumes of displaced waste material still relatively high. Coal mining and waste material removal activities would be concentrated in the eastern portion of the proposed open cut extent and north-east corner of the open cut extent.

Operational Noise

Low-frequency Noise Assessment

A low-frequency noise assessment was undertaken by Wilkinson Murray in accordance with the NPfI. Wilkinson Murray concluded that no modifying factor correction for low-frequency noise is warranted for the Modification (Appendix C).

Monitoring results would be assessed against the NPfI with respect to modifying factors (including for low-frequency noise). If monitoring results are found to contain dominant low-frequency content appropriate modifying factors would be applied to measured noise levels (Appendix C).

Operational Noise Assessment

The Environmental Noise Model was used to simulate the Modification components using noise source information (i.e. indicative sound power levels and locations) and to predict noise levels at relevant receiver locations (Appendix C).

It was predicted that the Tarrawonga Coal Mine incorporating the Modification would comply with the relevant PA 11_0047 operational noise criteria and amenity noise levels at all identified privately-owned receivers and the Leard State Forest locations (Appendix C).

Indicative noise contours for the night time conditions under adverse meteorological conditions incorporating the Modification for each of the Modification Year 3 and 7 scenarios are shown on Figures 5-4 and 5-5, respectively.

Cumulative Noise

Cumulative noise impacts resulting from the concurrent operation of the Modification, Boggabri Coal Mine and the Maules Creek Coal Mine were assessed against the PA 11_0047 cumulative noise assessment criteria.

The cumulative noise impacts resulting from the concurrent operations at the three mines would comply with the PA 11_0047 cumulative noise criteria and NPfI amenity noise levels at all privately-owned receivers and the Leard State Forest locations (Appendix C).

Road Traffic Noise

Wilkinson Murray conducted a qualitative assessment of the potential road traffic noise impacts. Due to the considerable distance between the two closest receivers to the Approved ROM Coal Transport Route (receiver 79a [approximately 5.3 km from the Approved ROM Coal Transport Route] and receiver 573b [approximately 6.8 km from the Approved ROM Coal Transport Route]), the Modification is not expected to generate any road traffic noise impacts on the surrounding privately-owned receivers (Appendix C).

Wilkinson Murray concluded that compliance with the PA 11_0047 road traffic noise criteria is expected at all privately-owned receivers surrounding the Modification (Appendix C).

Construction Noise

Potential noise impacts were assessed using the Environmental Noise Model for the construction of the:

- site access road and intersection off Goonbri Road;
- water transfer pipeline to the proposed Vickery Extension Project; and
- relocation of the ROM coal stockpile and associated infrastructure.

Construction activities associated with the Modification would occur during the recommended standard hours according to the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009). (Appendix C).

Construction noise levels combined with operational noise would comply with the operational noise criteria at all identified privately-owned receivers and all three Leard State Forest locations (Appendix C).

25% of Land Assessment

The VLAMP (NSW Government, 2018) outlines voluntary land acquisition noise rights apply where:

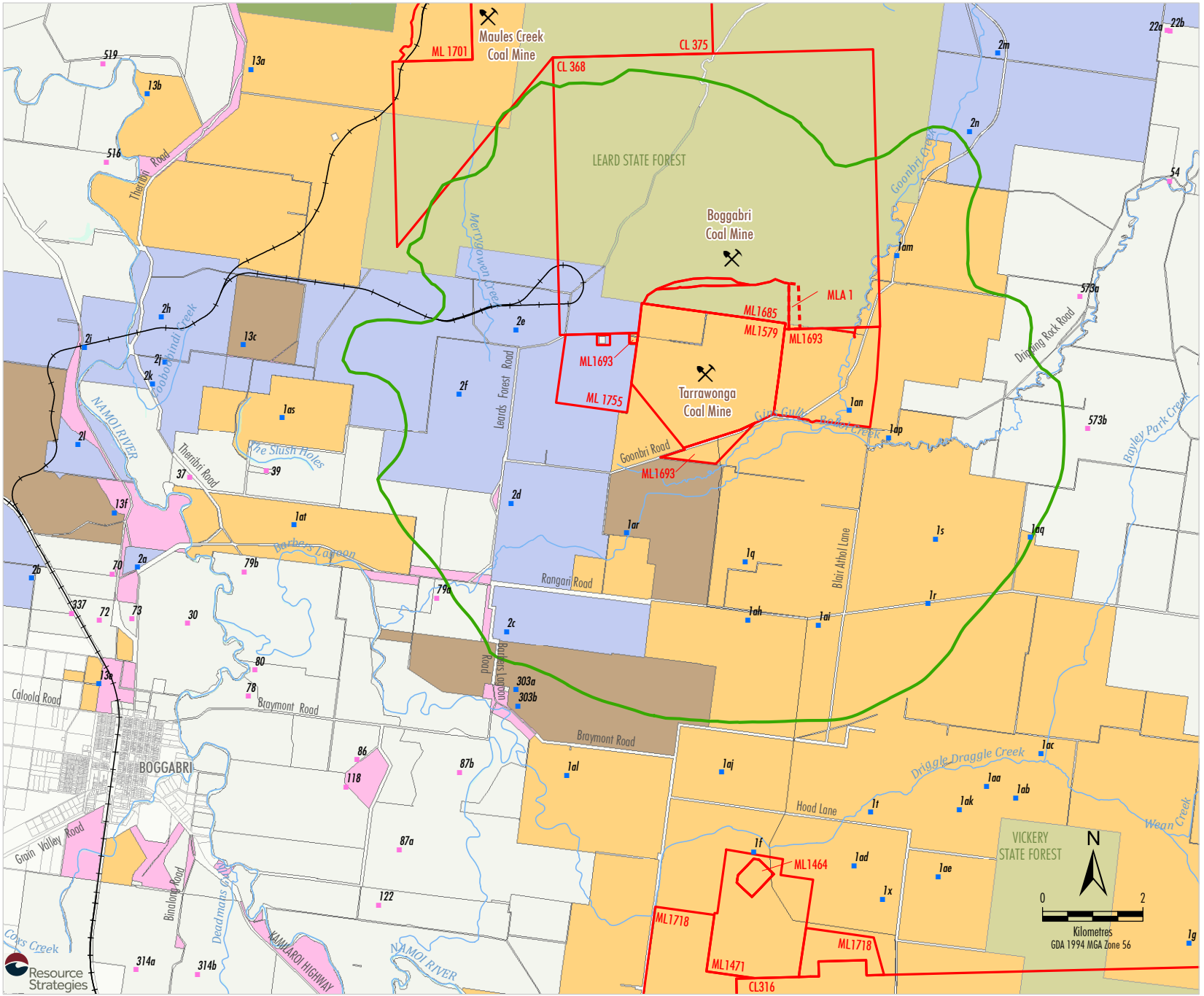
> *…the noise generated by the development would contribute to exceedances of the acceptable noise levels plus 5 dB in Table 2.2 of the NPfI on more than 25% of any privately-owned land*

The assessment indicates that the vacant land noise criterion specified under the VLAMP (45 dBA $L_{Aeq,Period}$ or 48 dBA $L_{Aeq,15\ minute}$ at night) is complied with at all surrounding privately-owned properties (Appendix C).

The assessment indicates that the PA 11_0047 privately-owned land criterion is complied with at all surrounding privately-owned properties (Appendix C).

Blasting

A qualitative assessment of blasting impacts was undertaken by Wilkinson Murray for the Modification (Appendix C). TCPL proposes no changes to the existing blasting practices at the Tarrawonga Coal Mine.



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- Railway
- NPWS Estate
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Idemitsu Boggabri Coal Owned Land
- Privately-owned Land and Other Land
- Mine-owned Dwelling
- Private Dwellings
- Modification Predicted Noise Contours (35 dB[A])

Source: NSW Department of Land and Property Information (2017); NSW Department of Industry (2018); Office of Environment and Heritage NSW (2016); Wilkinson Murray (2019); Whitehaven Coal Limited (2018)

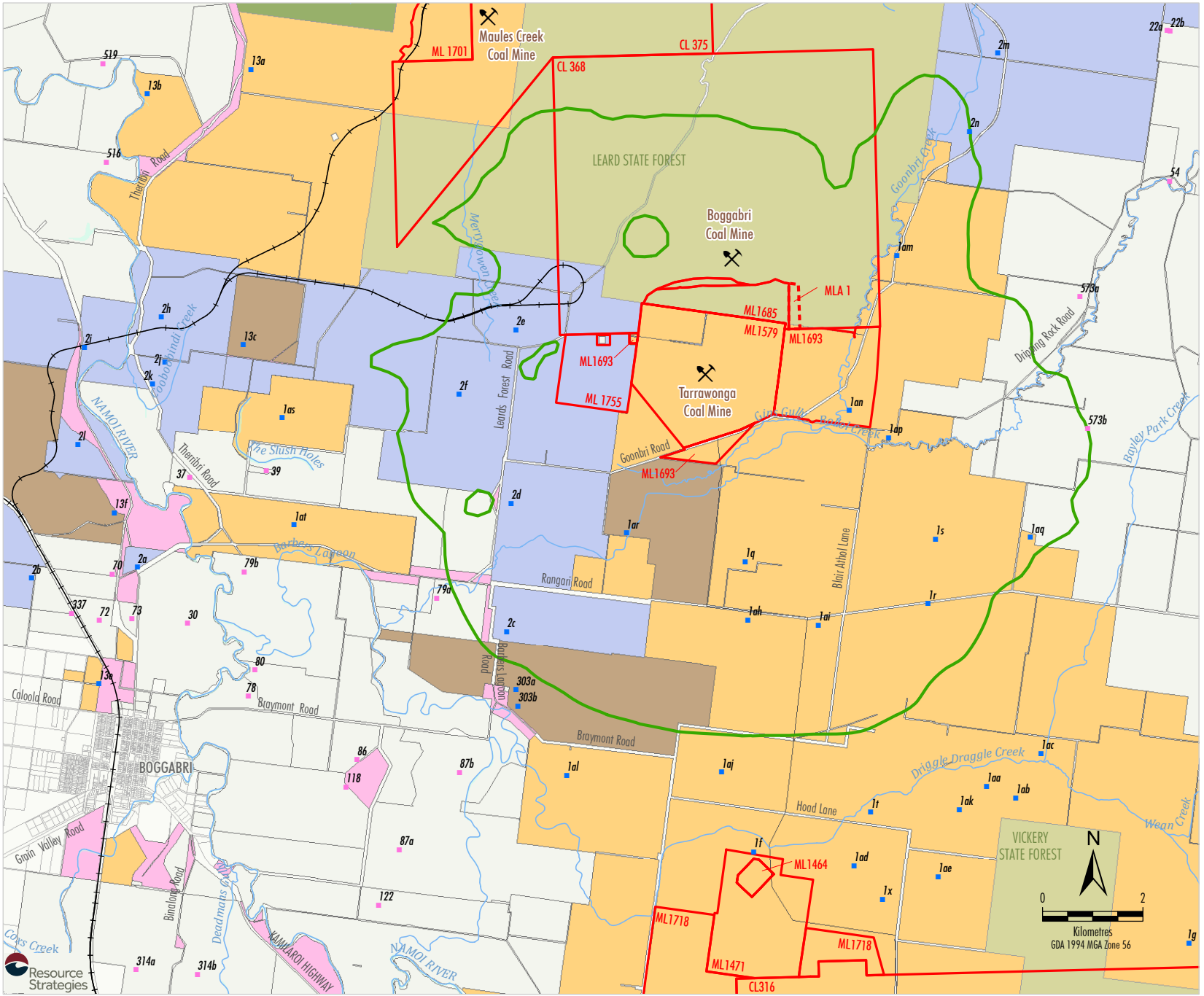
WHITEHAVEN COAL

TARRAWONGA COAL MINE

Modification Predicted Night Time Noise Contours - Year 3

Figure 5-4

WHC-18-59_LOM_218D



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- Railway
- NPWS Estate
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Idemitsu Boggabri Coal Owned Land
- Privately-owned Land and Other Land
- Mine-owned Dwelling
- Private Dwellings
- Modification Predicted Noise Contours (35 dB[A])

Source: NSW Department of Land and Property Information (2017); NSW Department of Industry (2018); Office of Environment and Heritage NSW (2016); Wilkinson Murray (2019); Whitehaven Coal Limited (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Modification Predicted Night Time Noise Contours - Year 7

Figure 5-5

WHC-18-59_LOM_219D

Blasting associated with the Modification is not expected to generate elevated overpressure and vibration levels relative to those associated with the approved operations (Appendix C).

5.3.3 Mitigation Measures, Management and Monitoring

TCPL proposes to relocate an approved noise/visual bund to reduce noise and visual impacts associated with fixed and mobile plant at the relocated ROM coal stockpile (Figure 1-3).

Noise and blasting mitigation and management measures for the existing Tarrawonga Coal Mine are described in the Noise Management Plan (TCPL, 2014a) and the Blast Management Plan (TCPL, 2014b). These plans would be reviewed and updated to incorporate the Modification.

TCPL implements the BTM Complex Noise Management Strategy (Idemitsu and Whitehaven, 2017a) and the BTM Complex Blast Management Strategy (Idemitsu and Whitehaven, 2014). The purpose of these strategies is to outline the approach taken by Idemitsu and Whitehaven to monitor and collectively manage cumulative noise and blasting impacts, respectively.

5.4 AIR QUALITY

An Air Quality and Greenhouse Gas Assessment for the Modification was undertaken by Ramboll (2019) and is presented as Appendix D. Aspects relating to air quality are discussed in the subsections below.

5.4.1 Existing Environment

Previous Assessment

An air quality assessment to assess the potential impacts of the approved Tarrawonga Coal Mine was undertaken in 2012 (PAEHolmes, 2012).

The assessment predicted that there would be no exceedances of 24-hour average or annual average criteria for PM_{10}, Total Suspended Particulate (TSP) or dust deposition levels due to emissions from the approved Tarrawonga Coal Mine-only.

The assessment identified the potential for cumulative 24-hour PM_{10} exceedances at one privately-owned receiver (former property 44a) and cumulative annual average PM_{10} exceedances at one privately-owned receiver (former property 45). The cumulative assessment considered emissions from the approved Tarrawonga Coal Mine, the Boggabri Coal Continuation Project and the Maules Creek Coal Mine (PAEHolmes, 2012).

In addition, one privately-owned vacant property (formerly property 49) is predicted to exceed the 24-hour PM_{10} criterion over greater than 25% of its area (PAEHolmes, 2012).

Since 2012, Whitehaven and BCOPL have acquired a number of properties surrounding the Tarrawonga Coal Mine, including properties formerly noted as 44a, 45 and 49 that were predicted to potentially exceed cumulative 24-hour PM_{10} criterion.

Air Quality Management and Monitoring

The approved Air Quality and Greenhouse Gas Management Plan (TCPL, 2015a) describes the air quality management and monitoring regime at the Tarrawonga Coal Mine.

The Air Quality Management Plan describes:

- PA 11_0047 air quality criteria;
- ongoing air quality controls and management procedures;
- dust monitoring locations and frequency, comprising (Figure 1-6):
  - tapered element oscillating microbalances (TEOMs) measuring PM_{10} and $PM_{2.5}$ continuously (i.e. real-time monitoring);
  - HVASs measuring PM_{10} on a one day in six cycle; and
  - dust deposition gauges.
- exceedance management and notification procedures.

Existing Air Quality

Air quality monitoring results reported in the most recent Tarrawonga Coal Mine Annual Review (TCPL, 2019b) showed cumulative dust levels were below PA 11_0047 criteria for 2018, with the exception of isolated exceedances of the 24-hour PM_{10} criterion, which were attributable to regional smoke haze events and/or local background sources not associated with the Tarrawonga Coal Mine (TCPL, 2019b).

Complaints

TCPL maintains a complaints register in accordance with PA 11_0047. All dust related complaints received by TCPL are responded to and investigated in accordance with the Air Quality and Greenhouse Gas Management Plan.

There was one complaint reported in the 2018 Annual Review relating to dust (TCPL, 2019b). There has been a total of five complaints reported over the last three Annual Review reporting periods (i.e. 2016 to 2018). This is a significant decrease since the peak in recorded dust complaints in the 2012/2013 reporting period, when 23 complaints were recorded over the 12 month period.

5.4.2 Potential Impacts

Modelling Methodology

Air quality dispersion modelling has been conducted by Ramboll (2019) to assess potential impacts for the operational scenario representative of maximum potential air quality impacts for the Tarrawonga Coal Mine incorporating the Modification.

Relevant to potential air quality impacts, Years 3 and 7 of the Modification were chosen for the air quality modelling scenarios, consistent with the Modification years chosen for the Noise Assessment (Appendix C). Justification for selecting the modelling scenario years is provided in Section 5.3.2 and Appendix D.

Emissions Estimation

Emissions of PM_{10} and $PM_{2.5}$ associated with the modelling scenarios were estimated by Ramboll (2019) using contemporary emission estimation methodologies, in accordance with the *Approved Methods for the Modelling and Assessment for Pollutants in New South Wales* (EPA, 2016).

Meteorological Conditions and Model Setup

Analysis of meteorology for the region is primarily based on meteorological monitoring stations operated by Whitehaven and Idemitsu within the BTM Complex. The period of January to December 2017 was selected for modelling, being the most recent and complete calendar year available at the time of modelling (Appendix D).

Dispersion modelling for the air quality assessment used the CALMET/CALPUFF modelling system, commonly used in NSW for applications where non-steady state conditions may occur (i.e. in complex terrain) (EPA, 2016) (Appendix D).

Cumulative impacts are assessed by combining the contribution from the Modification with the existing ambient air quality environment. Cumulative modelling considered the emissions from the Boggabri Coal Mine, Maules Creek Coal Mine and Vickery Coal Mine (including the proposed Vickery Extension Project).

Predicted Impacts

Modification Only

Concentrations of TSP, PM_{10} and $PM_{2.5}$ as well as dust deposition levels were predicted by Ramboll (Appendix D).

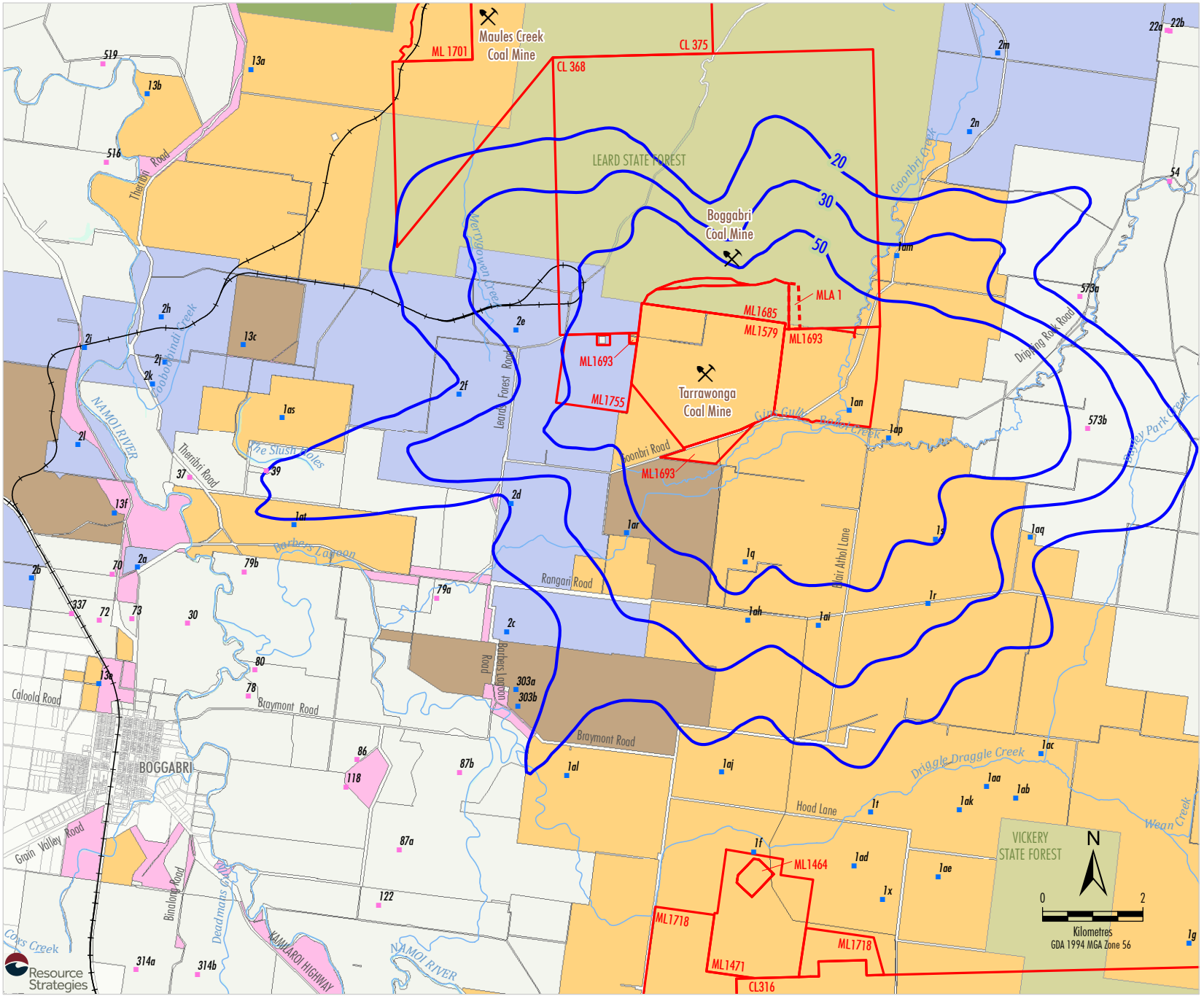
There were no predicted exceedances of the Modification-only 24-hour PM_{10}, annual average PM_{10}, $PM_{2.5}$ and TSP concentrations and dust deposition levels (Appendix D).

In addition, 24-hour average and annual average $PM_{2.5}$ concentrations were predicted to be below reporting guidelines at all privately-owned residences (Appendix D).

Contours showing predicted Modification-only 24-hour PM_{10} concentrations for Modification Years 3 and 7 are provided on Figures 5-6 and 5-7, respectively.

Cumulative

For the assessment of cumulative 24-hour average PM_{10} concentrations, modelling results are initially presented for existing mines plus background. The results show that without the contribution from the Tarrawonga Coal Mine (either approved operations or the proposed Modification), exceedances are predicted across all receptors of the 50 $\mu g/m^3$ criteria.



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- Railway
- NPWS Estate
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Idemitsu Boggabri Coal Owned Land
- Privately-owned Land and Other Land
- Mine-owned Dwelling
- Private Dwellings
- Modification-only 24-hour PM_{10} Air Quality Contour ($\mu g/m^3$)

Source: NSW Department of Land and Property Information (2017); NSW Department of Industry (2018); Office of Environment and Heritage NSW (2016); Ramboll (2019); Whitehaven Coal Limited (2018)

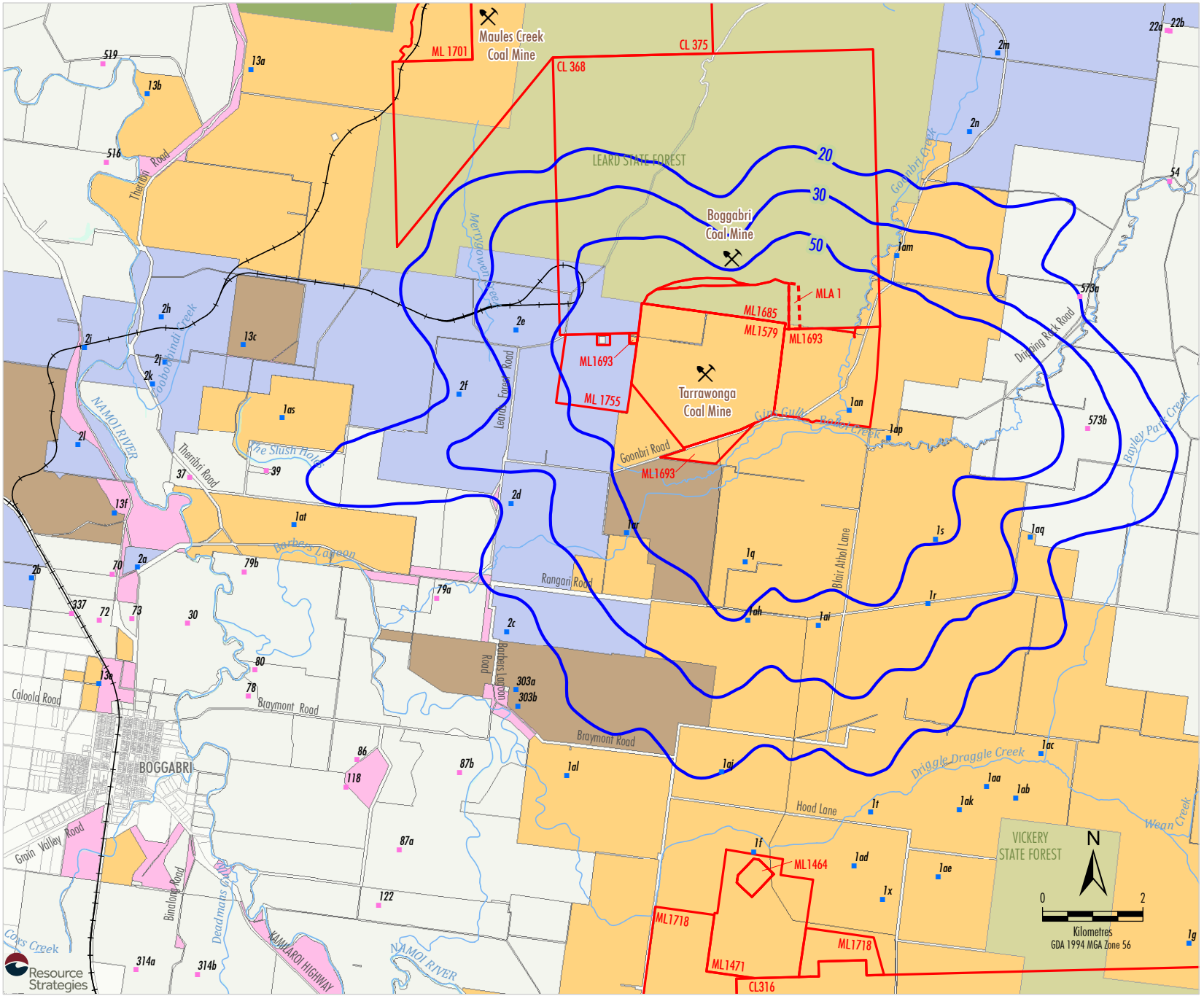
WHITEHAVEN COAL

TARRAWONGA COAL MINE

Modification 24-hour average PM_{10} Air Quality Contours - Year 3

Figure 5-6

WHC-18-59_LOM_212C



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- Railway
- NPWS Estate
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Idemitsu Boggabri Coal Owned Land
- Privately-owned Land and Other Land
- Mine-owned Dwelling
- Private Dwellings
- Modification-only 24-hour PM_{10} Air Quality Contour ($\mu g/m^3$)

Source: NSW Department of Land and Property Information (2017); NSW Department of Industry (2018); Office of Environment and Heritage NSW (2016); Ramboll (2019): Whitehaven Coal Limited (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Modification 24-hour average PM_{10} Air Quality Contours - Year 7

Figure 5-7

WHC-18-59_LOM_213C

In the absence of the implementation of real-time controls, there is a minor contribution of 24-hour average PM_{10} concentrations from the Modification (maximum increase of up to approximately 4 µg/m³ and an average of approximately 1.1 µg/m³ across all privately-owned receivers), which would result in one additional exceedance day at seven privately-owned receivers and four additional exceedance days at two privately-owned receivers (Appendix D).

However, the BTM Complex Air Quality Management Strategy (Idemitsu and Whitehaven, 2017b) is specifically designed to prevent short-term exceedances, by applying proactive, reactive or corrective measures across the BTM Complex when potential short-term exceedances are predicted or detected.

There are no private receptors where the cumulative 24-hour average $PM_{2.5}$ concentrations are greater than 25 µg/m³ (Appendix D).

25% Land Assessment

No privately-owned property is predicted to experience exceedances of the VLAMP (NSW Government, 2018) or PA 11_0047 air quality criteria on greater than 25% of land (Appendix D).

5.4.3 Mitigation Measures, Management and Monitoring

TCPL would continue to implement the existing air quality management measures described in the Air Quality and Greenhouse Gas Management Plan to minimise dust emissions and comply with relevant dust criteria in PA 11_0047. The Air Quality and Greenhouse Gas Management Plan would be updated, where necessary, to incorporate the Modification.

TCPL would also continue to implement the BTM Complex Air Quality Management Strategy (Idemitsu and Whitehaven, 2017b). This strategy is used to outline the approach taken by Idemitsu and Whitehaven to monitor and collectively manage cumulative air quality impacts.

5.5 ROAD TRANSPORT

A Road Transport Assessment for the Modification has been prepared by The Transport Planning Partnership (TTPP) and is presented in Appendix E.

5.5.1 Existing Environment

ROM coal is crushed and screened on-site, and the sized ROM coal is loaded onto on-highway trucks for transport via the Approved ROM Coal Transport Route to the Whitehaven CHPP (Figure 1-4).

The public roads along the Approved ROM Coal Transport Route include Rangari Road, Hoad Lane, Shannon Harbour Road, Blue Vale Road and Kamilaroi Highway.

Road Hierarchy and Conditions

State Roads

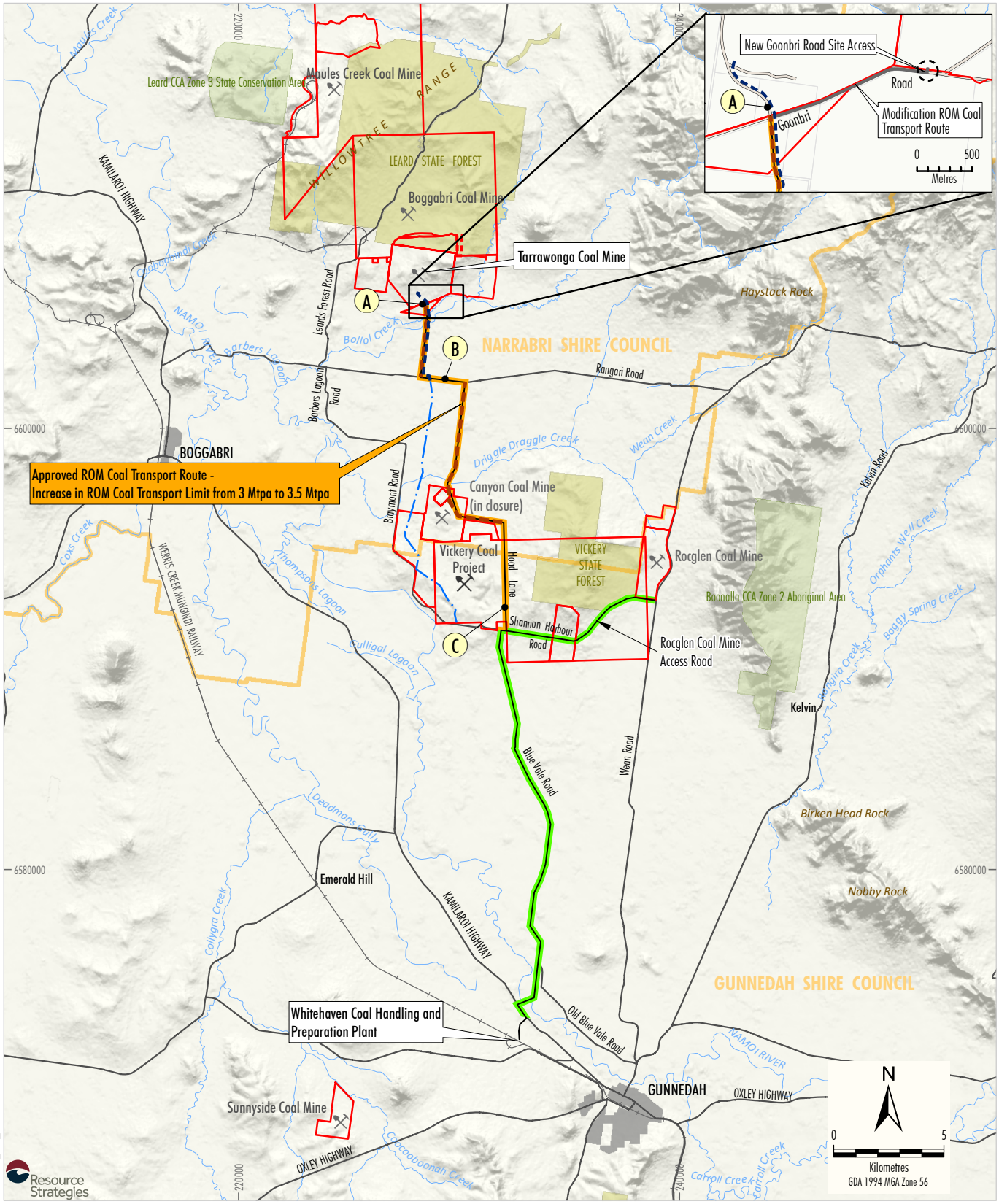
Kamilaroi Highway (State Highway 29) runs generally north-south to the west of the Tarrawonga Coal Mine and provides a link between the Upper Hunter region and the north-west of NSW. The Kamilaroi Highway provides access to regional centres such as Gunnedah, Boggabri, Narrabri and Bourke. The Kamilaroi Highway forms a small portion of the Southern Section of the Approved ROM Coal Transport Route (Figure 5-8).

Along the section of the Kamilaroi Highway which forms part of the Approved ROM Coal Transport Route (i.e. between the Blue Vale Road intersection and the turnoff to the Whitehaven CHPP), the Kamilaroi Highway has a single travel lane and a posted speed of 100 km/h.

Regional Roads

Rangari Road (Main Road 357) runs in an approximately east-west direction and is located to the south of the Tarrawonga Coal Mine (Figure 5-8) and links between the Kamilaroi Highway and Manilla.

Rangari Road typically has a single travel lane in each direction, and a posted speed limit of 80 km/h. Rangari Road forms a portion of the Northern Section of the Approved ROM Coal Transport Route (Figure 5-8) and is sealed along this portion.





LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- NSW State Forest
- State Conservation Area, Aboriginal Area
- Major Roads
- Railway
- Local Government Boundary
- Whitehaven Private Haul Road
- Indicative Location of Modification Pipeline
- Proposed Vickery Extension Project Pipeline Location
- Approved ROM Coal Transport Route - Northern Section
- Approved ROM Coal Transport Route - Southern Section
- A — Traffic Count Volume

Source: LPMA - Topographic Base (2010); NSW Department of Industry (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Existing Road Network and Traffic Survey Locations

Figure 5-8

WHC-18-59_LOM_225B

Resource Strategies

Local Roads

Hoad Lane provides a connection northwards from Blue Vale Road at the Braymont Road/Blue Vale Road intersection, then an east-west connection to Braymont Road (Figure 5-8). A private road access to the former Canyon Coal Mine (part of the Northern Portion of the Approved Road Transport Route) intersects with Hoad Lane (Figure 5-8).

The Whitehaven Private Haul Road forms the majority of the Northern Section of the Approved ROM Coal Transport Route. The Whitehaven Private Haul Road joins the existing Tarrawonga Coal Mine site access road to Rangari Road, then from Rangari Road to Hoad Lane (Figure 5-8).

Goonbri Road is a local road network and it does not form part of the Approved ROM Coal Transport Route. Goonbri Road runs south and east of the Tarrawonga Coal Mine. Goonbri Road has a single travel lane in each direction and has an intersection with the Whitehaven Private Haul Road south of the Tarrawonga Coal Mine (Figure 5-8). Apart from a short section near its intersection with the Whitehaven Private Haul Road, Goonbri Road is unsealed.

Current Network Operation

Roads

TTPP has assessed the operation of the existing intersections and road network along the Northern Section of the Approved ROM Coal Transport Route. Tube counts were commissioned in October 2018 at three locations along the Northern Section of the Approved ROM Coal Transport Route (Figure 5-8) and the traffic volumes are presented in Appendix E.

The traffic survey counts were assessed in accordance with the *Guide to Traffic Management Part 3: Traffic Studies and Analysis* (Austroads, 2017) and indicate that drivers on the surveyed public roads are expected to experience good conditions, with minimal restrictions on desired travel speed or overtaking.

Goonbri Road experiences peak traffic demands of approximately seven and eight vehicles per hour during the morning and evening peak periods, respectively (Halcrow, 2011). Traffic volumes along Goonbri Road are sufficiently low that drivers would experience negligible restriction to their freedom of movement as a result of other vehicles (Appendix E).

Crash Data

TTPP (2019) undertook an assessment of crash data from the RMS for the period of 1 July 2013 to 31 December 2017 for roads including, and in the vicinity of the Approved ROM Coal Transport Route (Appendix E).

TTPP concluded that the crash history of the Approved ROM Coal Transport Route does not highlight any particular crash causation factors on the Approved ROM Coal Transport Route.

5.5.2 Potential Impacts

Potential traffic impacts of the Modification on traffic generation, intersection capacity and road safety are assessed in Appendix E and summarised below.

The Modification involves an increase in haulage along the Northern Section of the Approved ROM Coal Transport Route and the construction of a new site access point along Goonbri Road. The Approved ROM Coal Transport Route would be modified such that haulage trucks would exit the Tarrawonga Coal Mine via the new site access, before travelling along a 1.4 km section of Goonbri Road to the Whitehaven Private Haul Road (Figure 1-3).

Modification Traffic Generation

Traffic movements along the Northern Section of the Approved ROM Coal Transport Route would increase from approximately 524 traffic movements per day to 612 traffic movements per day along the Northern Section of the Approved ROM Coal Transport Route for the Modification (i.e. an increase of 88 vehicle movements per day) (Appendix E).

The new site access intersection along Goonbri Road would experience, on average, 20 haulage trucks turning left onto the new site access road per hour, and 20 haulage trucks turning right onto Goonbri Road per hour. There would be no demand for right turn movements from Goonbri Road or left turn movements on to Goonbri Road (Appendix E).

TTPP undertook a comparison between the threshold volumes and the peak hourly volumes on the Approved ROM Coal Transport Route (Figure 5-8). The existing peak hourly traffic volumes are well below the threshold volumes (Appendix E).

The Modification would have a very minor impact on the Percent Time Spent Following, and no impact on the Level of Service along the Northern Section of the Approved ROM Coal Transport Route during peak times.

New Goonbri Road Site Access Intersection

A new T-intersection is proposed under the Modification to provide a new site access point along Goonbri Road.

Haulage trucks would make a right turn onto Goonbri Road when existing the Tarrawonga Coal Mine, and a left turn off Goonbri Road when entering the Tarrawonga Coal Mine.

The new T-intersection would be designed and constructed in accordance with Austroads Guidelines and in consultation with the NSC. A Basic Auxiliary Left turn treatment would be required at this intersection (Appendix E).

Goonbri Road Whitehaven Private Haul Road Intersection

The Modification would result in a redistribution of haulage truck movements at the existing Goonbri Road and Whitehaven Private Access Road four-way intersection.

Haulage trucks would make a left turn from Goonbri Road onto the Whitehaven Private Haul Road and a right turn from the Whitehaven Private Haul Road onto Goonbri Road (the existing Approved ROM Coal Transport Route facilitates haulage trucks travelling straight through this intersection along the Whitehaven Private Haul Road) (Figure 2-1).

Auxiliary storage or deceleration lanes are not warranted on any of the approaches at this intersection. TTPP recommended that the existing intersection be assessed to ensure that the swept paths of the haulage trucks are satisfactory at this intersection (Appendix E). This would be undertaken as part of the application under section 138 of the *Roads Act, 1993* for the Modification.

Road Safety

TTPP undertook a review of the existing crash data in the vicinity of, and including, the Approved ROM Coal Transport Route. The review did not highlight any particular crash causation factors on the Approved ROM Coal Transport Route that may be exacerbated by increased traffic demand (Appendix E).

5.5.3 Mitigation Measures, Management and Monitoring

Whitehaven's Traffic Management Plan for the Tarrawonga Coal Mine (Whitehaven, 2017) contains requirements and procedures including:

- requirements for the operation of haul trucks during school bus hours;
- road dust minimisation on unsealed roads;
- compliance with cumulative haulage limits;
- management of complaints; and
- vehicle movement audits.

Goonbri Road

A portion of Goonbri Road would be upgraded and sealed to a standard consistent with the requirements of the *Guide to Road Design Part 3: Geometric Design* (Austroads, 2016) between the intersection with the Whitehaven Private Haul Road and the new site access T-intersection (Appendix E). Works would be undertaken in consultation with the NSC.

5.6 BIODIVERSITY

A Biodiversity Development Assessment Report has been prepared by AMBS (2019) in accordance with the reporting requirements of the NSW *Biodiversity Offsets Policy for Major Projects* and underlying *Biodiversity Assessment Method* (OEH, 2017), and is presented in Appendix F.

A description of the existing environment relating to the biodiversity values of the Modification areas is provided in Section 5.6.1. Section 5.6.2 describes the potential impacts of the Modification, and Section 5.6.3 outlines mitigation measures, management, monitoring and the biodiversity offset strategy.

5.6.1 Existing Environment

The Tarrawonga Coal Mine is situated predominantly on the hills and foot slopes adjoining the Leard State Forest. Land use in the region is dominated by agriculture, mining associated with the Tarrawonga Coal Mine and other nearby mines, and proposed biodiversity conservation areas associated with the Tarrawonga Coal Mine and other nearby mines.

The Modification areas are located within the:

- Brigalow Belt South Interim Biogeographic Regionalisation of Australia (IBRA) Region;
- Liverpool Plains IBRA subregion; and
- Liverpool Alluvial Plains landscape (Mitchell Landscapes).

Surveys for the Modification

Specific flora surveys were conducted in the Modification areas (i.e. associated with surface disturbance) and surrounds to identify the Plant Community Types (PCTs), and target potentially occurring threatened flora species and ecological communities. These surveys were undertaken in January 2019 by AMBS (Appendix F).

Fauna surveys were undertaken in January 2019. Survey techniques included harp traps, Anabats, camera traps, reptile searches, call playback, spotlighting, bird surveys, pitfall traps and opportunistic sightings.

Vegetation Communities

Vegetation communities were mapped within the Modification areas based on PCTs. Vegetation communities are described in Appendix F and include (Figures 5-9a and 5-9b):

1. Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion (PCT 101); and
2. Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion (PCT 847).

Other vegetated areas within the Modification areas were either degraded land dominated by exotic species or agricultural land. These areas did not conform to a native PCT.

Threatened Flora Species and Populations

No threatened flora species or populations listed under the BC Act and/or EPBC Act were recorded within the Modification areas during the recent surveys (Appendix F).

One flora species, Slender Darling Pea (*Swainsona murrayana*), can only be surveyed for in the month of September so was not targeted during surveys undertaken in January 2019. The Modification areas are unlikely to provide habitat for this species due to the highly disturbed nature of the groundlayer, however, *Swainsona murrayana* was conservatively assumed to be present for the purposes of the BioBanking Assessment Methodology (BAM) calculator (Appendix F).

Threatened Ecological Communities

While moderate to low in condition, the semi-cleared woodland and derived native grassland areas of PCT 101 (Plates 5-1 and 5-2) are likely to form part of the following TEC (Appendix F):

- BC Act: *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* (Endangered Ecological Community [EEC]).
- EPBC Act: *Poplar Box Grassy Woodland on Alluvial Plains* (EEC).

The areas of PCT 101 consisting of mature trees over an exotic dominated groundlayer does not conform to either of the above TEC's given the high level of exotic species (Appendix F).

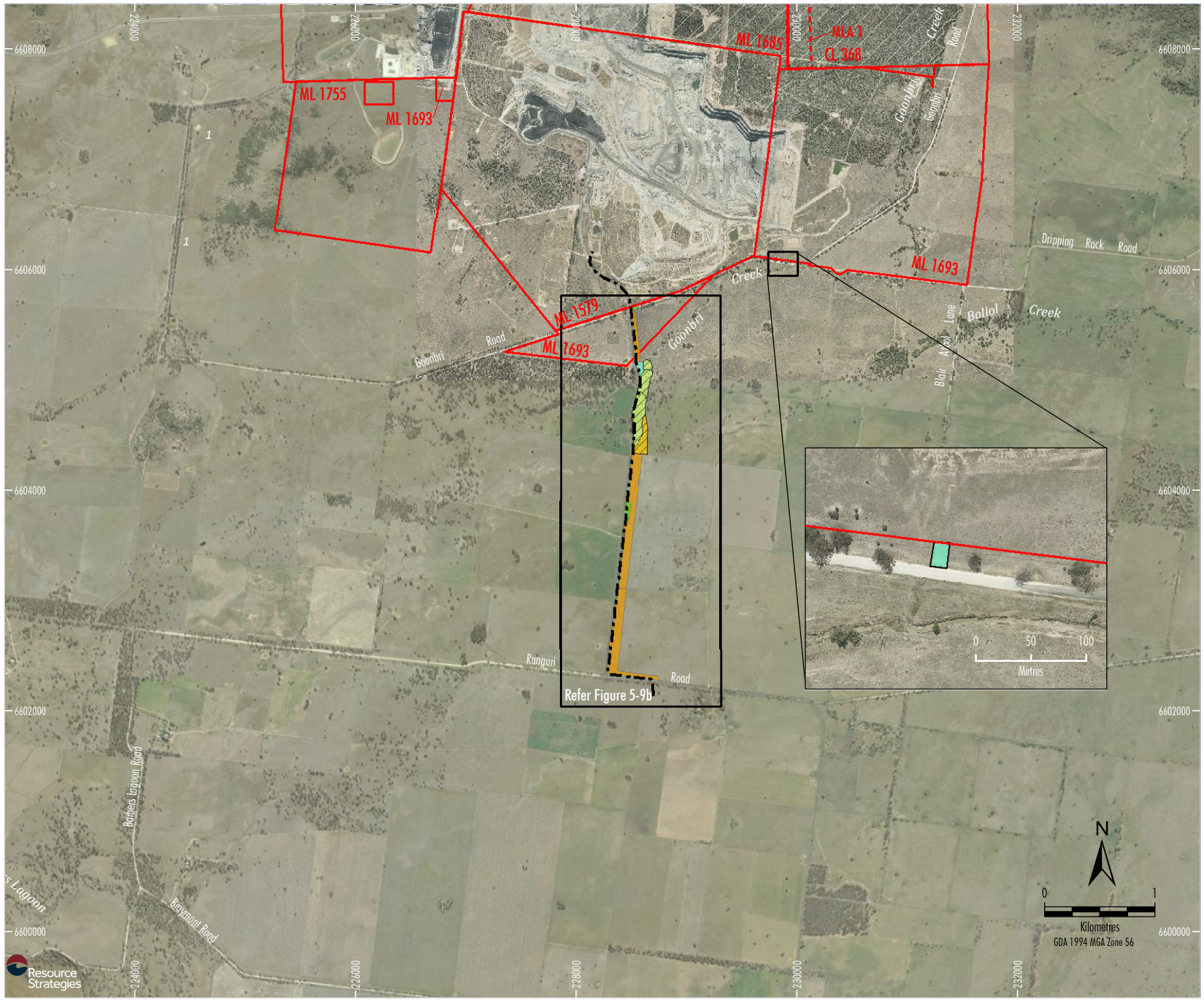
Fauna Habitat

Fauna habitat in the Modification areas consists of a suite of broad habitat elements including (Appendix F):

- exotic grassland/pasture;
- semi-cleared woodlands; and
- native grasslands.

Fauna habitats within the Modification areas were generally poor quality, given there were (Appendix F):

- no native understorey present throughout the majority of the Modification areas;
- no large tree hollows or rocky outcrops observed;
- no mistletoe or fruit bearing trees;
- no evidence of raptor nests; and
- no permanent water sources (including dams).



LEGEND

- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA 1)
- Leard State Forest
- Indicative Location of Modification Pipeline Disturbance
- Indicative Location of Modification ROM Coal Transport Route along Goonbri Road

Vegetation Communities

- PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland DNG
- PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland ExDG
- PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland SCW
- PCT 847 Grey Box - Blakely's Red Gum - Yellow Box grassy open forest SCW
- Planted native trees
- Degraded land primarily exotic species
- Agricultural land

Threatened Ecological Communities

- Endangered Ecological Community

DNG = Derived native grassland
ExDG = Exotic dominated ground
SCW = Semi-cleared woodland

Source: © State of New South Wales and Department of Planning and Environment (2017); © Department of Finance, Services & Innovation (2017); Whitehaven Coal Limited (2018); BioNet (2019); Flora Search (2011); Cenwest Environmental Services (2011); AMBS (2019 Orthophoto: Whitehaven Coal Limited (2018); Google (2018);

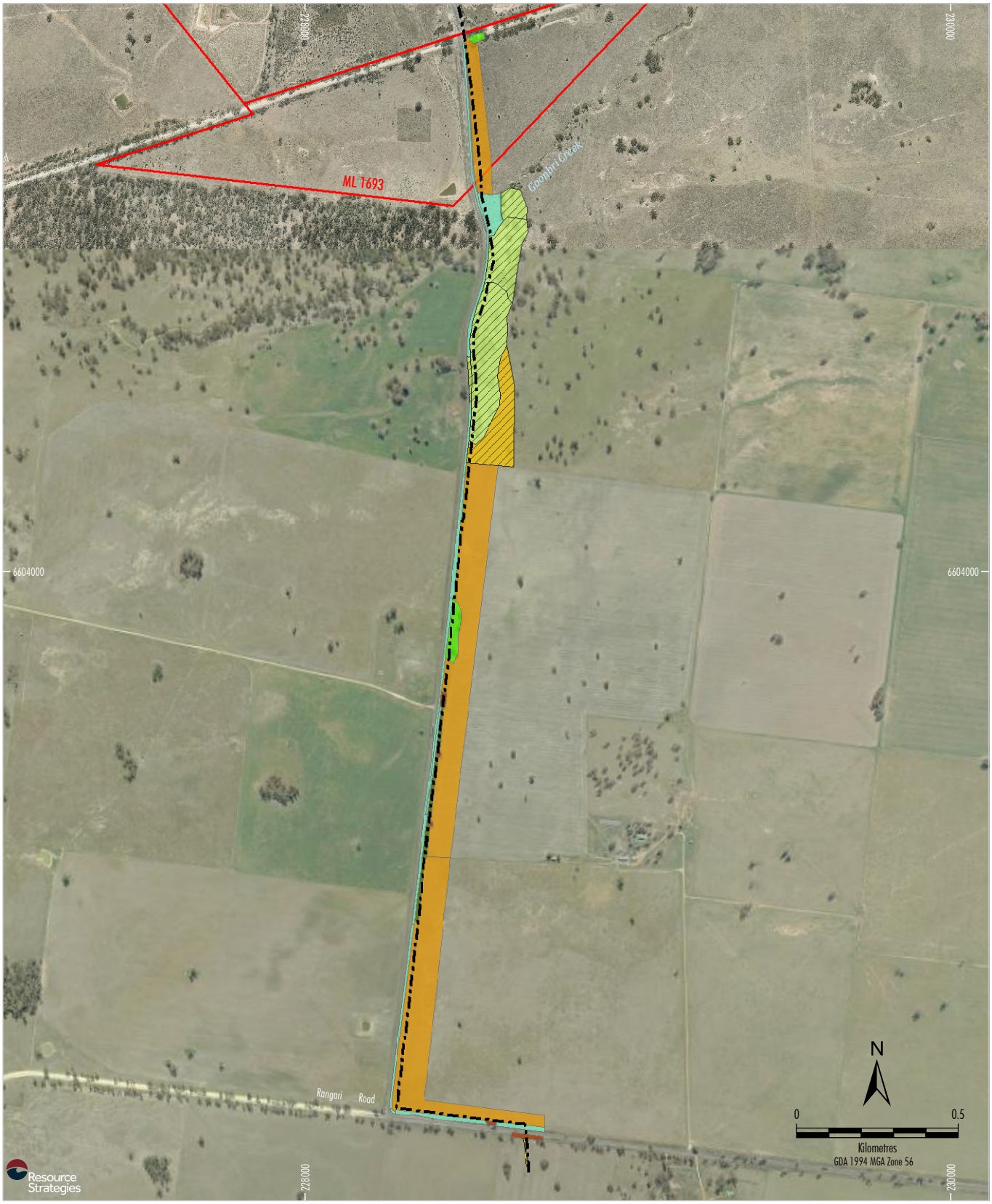
WHITEHAVEN COAL

TARRAWONGA COAL MINE

Vegetation Communities

Figure 5-9a

WHC-18-59_LOM_220B



WHC-18-59_LOM_221B

LEGEND

Mining Lease Boundary (ML & CL)

Indicative Location of Modification Pipeline Disturbance

Vegetation Communities

- PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland DNG
- PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland ExDG
- PCT 101 Poplar Box - Yellow Box - Western Grey Box grassy woodland SCW
- PCT 847 Grey Box - Blakely's Red Gum - Yellow Box grassy open forest SCW
- Planted native trees
- Degraded land primarily exotic species
- Agricultural land

Threatened Ecological Communities

Endangered Ecological Community

DNG = Derived native grassland
ExDG = Exotic dominated ground
SCW = Semi-cleared woodland

Source: © State of New South Wales and Department of Planning and Environment (2017); © Department of Finance, Services & Innovation (2017); Whitehaven Coal Limited (2018); BioNet (2019); Flora Search (2011); Cenwest Environmental Services (2011); AMBS (2019) Orthophoto: Whitehaven Coal Limited (2018); Google (2018))

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Vegetation Communities - Modification Pipeline

Figure 5-9b



Plate 5-1: PCT 101 – Semi-cleared Woodland. Source: AMBS (2019)



Plate 5-2: PCT 101 – Derived Native Grassland. Source: AMBS (2019)

Threatened Fauna Species and Populations

The Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) and Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*) (both listed as Vulnerable under the BC Act) were the only threatened fauna species positively identified within the Modification areas (Figure 5-10) (Appendix F).

Threatened Fauna Species and Populations

The Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) and Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*) (both listed as Vulnerable under the BC Act) were the only threatened fauna species positively identified within the Modification areas (Figure 5-10) (Appendix F).

The two threatened fauna species listed above are both 'ecosystem credit species' (i.e. species that can be predicted to be present based on a habitat assessment as defined in the BAM). No threatened fauna species that are species credit species have been recorded within the Modification areas (Appendix F).

5.6.2 Potential Impacts

Native Vegetation Clearance

The Modification would require the clearance of 0.25 ha of native woodland and grassland communities along with areas of exotic vegetation. This would include approximately 0.13 ha of threatened ecological communities listed under the BC Act and EPBC Act.

It should be noted that the Modification would result in a net reduction in disturbance (compared to the approved Tarrawonga Coal Mine) by approximately 87 ha, including areas of native grassland and riparian vegetation which would provide habitat for threatened species.

Table 5-2 presents the relative areas of native vegetation present within the Modification areas, including the areas of threatened ecological communities.

Indirect Impacts

Potential indirect impacts from the Modification on terrestrial biodiversity (e.g. increased sedimentation and weed occurrence) have been assessed in Appendix F. AMBS (2019) concludes, given the relatively minor nature of the works proposed as part of the Modification, there would be no significant indirect impacts on biodiversity.

Ecosystem Credit Species under the NSW Offset Policy

The BAM (OEH, 2017) requires the use of an online program (the *Credit Calculator for Major Projects and BioBanking* [the Credit Calculator]) to assess biodiversity impacts and determine the biodiversity offset requirements for those impacts.

The result of running the Credit Calculator is that the Modification requires a Biodiversity Offset Strategy that accounts for a total of five ecosystem credits (Table 5-2).

Species Credit Species under the NSW Offset Policy

The Modification requires a Biodiversity Offset Strategy that accounts for four species credits for the Slender Darling Pea, which is conservatively assumed to be present based on the survey requirements for this species which have not been completed, despite AMBS (2019) concluding that the Modification is unlikely to impact this species (Table 5-3) (Appendix F).

Weed and Pest Species

The potential impacts from weed and pest species associated with the Modification are not considered to be significantly greater than those for the approved mining operations (Appendix F).

Potential impacts from weed and pest species associated with the Modification would be mitigated as described in Section 5.6.3.

Cumulative Impacts

The Modification would result in disturbance of approximately 0.25 ha of native vegetation.



LEGEND

- Mining Lease Boundary (ML & CL)
- Leard State Forest
- Indicative Location of Modification Pipeline Disturbance
- Indicative Location of Modification Goonbri Road Access Road
- Fork-tailed Swift
- Grey-crowned Babbler (eastern subspecies)
- White-throated Needletail
- Brown Treecreeper (eastern subspecies)
- Dusky Woodswallow
- Speckled Warbler
- Square-tailed Kite
- Turquoise Parrot
- Yellow-bellied Sheathtail-bat

Source: © State of New South Wales and Department of Planning and Environment (2017); © Department of Finance, Services & Innovation (2017); Whitehaven Coal Limited (2018); BioNet (2019); Flora Search (2011); Cenwest Environmental Services (2011); (1) OEH (2016); (2) AMBS (2019)
Orthophoto: Whitehaven Coal Limited (2018); Google (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Threatened Species Records

Figure 5-10

Table 5-2
Modification Disturbance Areas and Ecosystem Credit Requirements

PCT Number	PCT Name	Form	EEC/CEEC?	Area Proposed to be Disturbed (ha)	Ecosystem Credits Required
PCT 847	Grey Box - Blakely's Red Gum - Yellow Box grassy open forest of the Nandewar Bioregion and New England Tableland Bioregion	Semi-cleared Woodland (low condition)	N/A	0.08	2
PCT 101	Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	Semi-cleared Woodland (moderate condition)	BC Act: *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* (EEC). EPBC Act: *Poplar Box Grassy Woodland on Alluvial Plains* (EEC).	0.08	2
PCT 101	Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	Derived Native Grassland (low condition)		0.05	0*
PCT 101	Poplar Box - Yellow Box - Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion	Mature trees over exotic dominated groundlayer (low condition)	N/A	0.04	1
Total Native Vegetation				**0.25**	**5**
Exotic Grasslands				**2.1**	-

Source: AMBS (2019)

CEEC = Critically Endangered Ecological Community

* This community has a vegetation integrity score of less than 15, and consequently no offsets are required for this vegetation zone (AMBS, 2019).

The change in potential cumulative impacts on threatened species and communities arising from the Modification is considered to be minimal because:

- the clearance is localised compared to the wider distribution of the species (their habitats) and communities;
- the loss of approximately 0.25 ha of native vegetation would be short-term as the Modification involves re-establishment of native woodland/forest in mine rehabilitation areas (Section 6);
- the Modification involves a net reduction in disturbance by approximately 87 ha; and
- the Biodiversity Offset Strategy would compensate for the loss and increase movement corridors for genetic exchange, foraging habitat and increased breeding resources for threatened fauna species in the medium and long-term (Appendix F).

5.6.3 Mitigation Measures, Management and Monitoring

Avoidance

As stated in Section 5.6.2, the Modification would result in a net reduction in disturbance (compared to the approved Tarrawonga Coal Mine) by approximately 87 ha, including areas of native grassland and riparian vegetation which would provide habitat for threatened species.

Further to this, the potential impacts of the Modification have been reduced through early planning and avoiding areas of native PCT and fauna habitat where possible. A preliminary assessment was commissioned by TCPL (AMBS, 2018 pers, comm.) to survey a larger study area of up to approximately 50 m from the edge of the road, as this area was being considered as the location of the pipeline. The field surveys identified areas of native PCT and fauna habitat to the east of the road reserve, including a number of large potential hollow-bearing trees. Further, the density of trees is greater to the east of the road reserve.

The preliminary report recommended that the pipeline be located within the road reserve, on the western side of the road reserve fence. Locating the pipeline in this area minimised the area of native PCT that would be impacted, maximised the use of areas of exotic or poor condition habitats, and minimised the number of native trees that would be removed.

Mitigation and Management Measures

The mitigation and management measures outlined in the existing Tarrawonga Coal Mine Biodiversity Management Plan (Eco Logical Australia [Eco Logical], 2015) would continue to be implemented for the Modification. This would include:

- avoiding the removal of trees and shrubs wherever possible;
- pre-clearance surveys undertaken prior to clearing activities by a suitably qualified ecologist, following the Land Disturbance Protocol;
- two-staged clearing approach, with a suitably trained fauna ecologist present during the removal of any potential hollow-bearing trees, in accordance with the Biodiversity Management Plan;
- salvage of hollow-bearing trees, logs and woody ground debris for reuse in rehabilitation areas, where practicable, using the Stage 1 and 2 clearing protocol;
- weed control measures including, as a minimum, control of Priority Weeds and High Threat Exotics prior to construction works;
- hygiene protocols to minimise the risk of spreading plant diseases; and
- erosion and sediment control measures.

The existing Biodiversity Management Plan would be updated to incorporate the Modification.

TCPL will continue to implement the Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report (Umwelt Australia Pty Ltd, 2017) and review and revise where necessary to incorporate the Modification.

Table 5-3
Modification Disturbance Areas and Species Credit Requirements

Common Name	Scientific Name	Area	Credits
Slender Darling Pea	*Swainsona murrayana*	0.2	4

The primary purpose of the Leard Forest Regional Biodiversity Strategy is to provide a strategic framework for the management and implementation of the biodiversity offset programs already established by the BTM Complex and to provide guidance for co-ordinated management with other land managers within the precinct area.

Biodiversity Offset Options

The existing Biodiversity Offset Strategy for the Tarrawonga Coal Mine would be augmented with an additional Biodiversity Offset Strategy for the Modification to account for additional residual impacts on flora and fauna.

An objective of the NSW Offset Policy is to provide greater flexibility for proponents to meet their offset requirements while ensuring the best and most credible offsets are provided. The residual offset requirements identified in Table 5-2 would be offset using one, or a combination, of the following (OEH, 2014):

- land-based offsets;
- acquiring or retiring credits under the biobanking scheme in the BC Act;
- making payments into an offset fund once established by the NSW Government; and/or
- providing supplementary measures as outlined in the NSW Offset Policy (OEH, 2014).

Finalisation and security of the Biodiversity Offset Strategy would be subject to approval of the Modification.

5.7 ABORIGINAL CULTURAL HERITAGE

An ACHA was prepared for the Modification by Whincop Archaeology Pty Ltd (Whincop) (2019) and is presented in (Appendix G).

Background

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

- *Aboriginal cultural heritage consultation requirements for proponents 2010* (Consultation Guidelines) (NSW Department of Environment, Climate Change and Water [DECCW], 2010a);
- *Aboriginal Cultural Heritage: Standards and Guidelines Kit* (National Parks and Wildlife Service, 1997);
- *Ask First: A Guide to Respecting Indigenous Heritage Places and Values* (Australian Heritage Commission, 2002);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b);
- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (Department of Environment and Conservation, 2005);
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010c);
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011);
- *National Parks and Wildlife Act 1974: Part 6 Approvals – Interim Community Consultation Requirements for Applicants* (NSW Department of Environment and Climate Change, 2004);
- *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects* (Minerals Council, 2010);
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites, 2013); and
- *Engage Early* (Department of the Environment, 2016).

A description of Aboriginal heritage in the vicinity of the Tarrawonga Coal Mine is provided in Section 5.7.1. Section 5.7.2 describes the potential impacts of the Modification on Aboriginal heritage, including cumulative impacts, and Section 5.7.3 outlines mitigation measures, management and monitoring.

5.7.1 Existing Environment

Aboriginal Cultural Heritage Assessment

The ACHA (Appendix G) incorporates relevant information from previous assessments, the results of Modification field surveys and associated consultation with the Aboriginal community, including:

- results from extensive fieldwork and archaeological investigations undertaken previously by archaeologists and representatives of the Aboriginal community at the Tarrawonga Coal Mine and surrounds;
- search results from the Aboriginal Heritage Information Management System database and other heritage registers;
- results from extensive consultation with the Aboriginal community regarding archaeological and cultural heritage values at the Tarrawonga Coal Mine and surrounds;
- results from field work and archaeological investigations undertaken for other nearby mining operations and Boggabri and Maules Creek Coal Mines; and
- a detailed description of the methods implemented and the results of archaeological and cultural surveys conducted by archaeologists and representatives of the Aboriginal community for the Modification in 2019.

The key steps involved in the preparation of the ACHA and associated consultation are described below.

Previous Archaeological Investigations

A number of Aboriginal heritage surveys and assessments have previously been undertaken in the Modification areas and surrounds, including:

- Kamminga (1978) for the nearby Boggabri Coal Mine.
- Haglund (1985) for the coal mining areas north of Gunnedah.
- Balme (1984) for the north central river systems.

Other previous investigations within the broader region include intensive survey associated with several nearby coal mines (i.e. Vickery, Boggabri, and Maules Creek Coal Mines). These investigations are described in Appendix G.

Aboriginal Community Consultation

The ACHA for the Modification included consultation with nine Registered Aboriginal Parties (RAPs), in general accordance with the requirements of the Consultation Guidelines (DECCW, 2010a).

Aboriginal stakeholder groups had been previously identified as having an interest in the management of Aboriginal heritage at the approved Tarrawonga Coal Mine (in accordance with the requirements of the Consultation Guidelines).

Three existing RAPs for the Tarrawonga Coal Mine were registered for the consultation process associated with the Modification. All RAPs were invited to attend an information session to provide them with an additional opportunity to raise any cultural issues or comments/perspectives regarding the Modification.

Consultation with the Aboriginal community regarding the Modification has been extensive and involved various methods of communication including written and verbal correspondence, an information session, archaeological survey attendance and review of relevant draft reports and methodologies.

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

Archaeological Findings

Field surveys within the Modification areas were undertaken by Whincop (2019) on 4 and 5 February 2019 in consultation with the representatives of the RAPs.

No Aboriginal heritage sites or artefacts were identified within the Modification areas (Appendix G), and no specific areas or places of cultural value were identified by RAPs during the archaeological survey undertaken for the Modification. Four extant Aboriginal cultural heritage sites are located within 50 m of the Modification areas (Figure 5-11), three of which have been assessed as being of low scientific significance and one is considered moderate (Appendix G).

There were no specific areas or places of cultural value identified by the RAPs during the archaeological survey undertaken for the Modification. Previous assessments and surveys have identified and documented cultural values for the Tarrawonga Coal Mine and surrounds, which are summarised in Appendix G.

5.7.2 Potential Impacts

While the Modification would have no direct impact on known Aboriginal heritage sites or cultural values within the Modification areas or immediate surrounds, Whincop (2019) has identified the potential for indirect impacts such as accidental disturbance by peripheral activities and inappropriate visitation of known Aboriginal cultural heritage sites, including the unauthorised removal of Aboriginal objects.

Whincop (2019) notes that there remains potential for additional Aboriginal cultural heritage sites to be located within the extent of the Modification (e.g. sites that may have been obscured by grass or soil at the time of the survey). Consequently, the strategy for managing any previously unidentified sites outlined in the Tarrawonga Coal Mine Heritage Management Plan (TCPL, 2015b), would continue to be implemented for the Modification (Appendix G).

As no Aboriginal heritage sites have been identified in the Modification areas or immediate surrounds, the Modification is not expected to cause a loss of heritage resources that could be viewed as being very rare or unique or unlikely to exist elsewhere (Appendix G). Therefore, the Modification would not result in any significant cumulative impact on Aboriginal heritage in the region.

The Modification would result in the avoidance of a number of Aboriginal cultural heritage sites located in the vicinity of Goonbri Creek that are currently approved for disturbance, due to the net reduction in footprint.

5.7.3 Mitigation Measures, Management and Monitoring

The Tarrawonga Coal Mine Heritage Management Plan and *Aboriginal Heritage Conservation Strategy: Maules Creek Coal Mine, Tarrawonga Coal Project, Boggabri Coal Mine, and Related Biodiversity Offset Areas* (University of Queensland Cultural and Heritage Unit, 2017) would be revised to incorporate the Modification, in consultation with the DPIE – Biodiversity and Conservation Division and the relevant RAPs (in relation to the management of Aboriginal heritage values).

The mitigation and management measures outlined in the existing Tarrawonga Coal Mine Heritage Management Plan would continue to be implemented for the Modification. These would include:

- A cultural heritage awareness component is to be included within all staff inductions to promote awareness of site locations and obligation of Whitehaven staff and contractors to not harm Aboriginal cultural heritage objects.
- Any Aboriginal heritage sites which have been and may be identified during the development of the Modification should be recorded and registered in a comprehensive Aboriginal Cultural Heritage Sites Database. This database is to be maintained for the life of the mine and made available to all relevant staff and contractors.
- Should additional Aboriginal heritage sites be identified, they would be effectively fenced off and inspected annually. These protocols should be applied to the four extant Aboriginal cultural heritage sites within 50 m of the Modification areas to ensure inadvertent harm is avoided.



LEGEND

- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA 1)
- Leard State Forest
- Indicative Location of Modification Pipeline Disturbance
- Indicative Location of Modification ROM Coal Transport Route onto Goonbri Road

Aboriginal Heritage Sites

- Aboriginal Heritage Site (March 2011 Survey)
- Aboriginal Heritage Site (AHIMS Database)

Source: © State of New South Wales and Department of Planning and Environment (2017); © Department of Finance, Services & Innovation (2017); Whitehaven Coal Limited (2018); Kayandel (2011); AHIMS (2019); Whincop (2019)
Orthophoto: Whitehaven Coal Limited (2018); Google (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Aboriginal Heritage Sites in the Vicinity of the Modification

Figure 5-11

WHC-18-59_LOM_217B

- If a new potential site or artefact is discovered, works in the area which would impact the site or artefact would cease immediately and a qualified archaeologist, as well as RAPs, arranged to assess the find. If confirmed to be culturally significant, the site would be registered in the database and, subject to the recommendations of the archaeologist and RAPs, objects from the site would be properly collected prior to work continuing in the area.
- Should any skeletal remains be detected during the course of the Modification, work with the potential to impact the remains would cease immediately and the find would be reported to the relevant authorities (including the Police, the DPIE – Biodiversity and Conservation Division and RAPs). Subject to the Police requiring no further involvement, the management of any Aboriginal skeletal remains would be determined in consultation with DPIE and the RAPs.
- Ongoing consultation would be undertaken with relevant RAPs over the life of the Tarrawonga Coal Mine, including appropriate Aboriginal representation during archaeological fieldwork.

5.8 ECONOMIC

An Economic Assessment was prepared for the Modification by AnalytEcon Pty Ltd (AnalytEcon) (2019) and is presented in (Appendix H).
The Economic Assessment was prepared in accordance with the *Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (NSW Government, 2015) and the *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (DP&E, 2018).

5.8.1 Existing Environment

A Socio-Economic Assessment was undertaken for the approved Tarrawonga Coal Mine by Gillespie Economics (2011). The Socio-Economic Assessment indicated that the Tarrawonga Coal Project would provide significant economic stimulus to the regional and NSW economies (Gillespie Economics, 2011).

The Economic Assessment (Appendix H) included consideration of the impacts of the Modification on both the regional (i.e. Gunnedah, Narrabri, Liverpool Plains and Tamworth LGAs) and NSW economies.

5.8.2 Potential Impacts

Under the Modification, TCPL proposes no change to the following elements of the Tarrawonga Coal Mine:

- employment;
- wage, salary and rate payments to local government; and
- mine life and operating hours.

Condition 37, Schedule 3 of PA 11_0047 requires TCPL to construct the Goonbri Creek diversion and low permeability barrier prior to undertaking any mining operations within 200 m of the regionally mapped Upper Namoi alluvium. Other associated works would include realignment of a section of Goonbri Road and an 11 kilovolt electricity transmission line. TCPL considers the capital costs of these works to be economically prohibitive. In the absence of these capital works, TCPL would cease mining at 200 m from the Upper Namoi alluvium under PA 11_0047. AnalytEcon (2019) considers this scenario to be the 'Reference' (i.e. without the Modification) case.

AnalytEcon (2019) compares the Modification, which proposes mining within 200 m of the Upper Namoi alluvium (Section 2.1), to the Reference case.

A summary of the predicted State and regional economic benefits under the Modification can be found below. Further detail is provided in Appendix H.

State Benefits

When compared to the Reference Case (i.e. no mining within 200 m of the Upper Namoi alluvium), the Modification would generate an additional $37 million[2] in benefits in Net Present Value (NPV) in NSW, consisting of (Appendix H):

- an additional $17 million in NPV terms in royalty payments to the NSW Government;
- incremental company income tax payments attributable to NSW of $12 million in NPV terms; and
- incremental profits accruing to NSW shareholders of Whitehaven of $9 million in NPV terms.

[2] Values may not sum due to rounding.

The Modification would generate incremental value added flow-on benefits of $8 million in NPV terms (Appendix H).

Regional Benefits

Given that employment, wages and salary payments would not differ in the Modification Scenario and the Reference case, the direct benefits to the local economy and the incremental flow-on impacts do not differ between the Modification and the Reference case (Appendix H).

Closure of the Tarrawonga Coal Mine

The Modification proposes no change to the closure characteristics of the Tarrawonga Coal Mine.

5.9 VISUAL

5.9.1 Existing Environment

A Visual Assessment was prepared for the approved Tarrawonga Coal Mine EA by Urbis (2011) and described the visual impacts of the approved Tarrawonga Coal Mine in the context of the sensitivity of surrounding viewpoints.

The visual character of the area comprises a dominant agricultural landscape, Leard State Forest and mining landscapes associated with the existing Maules Creek, Boggabri and Tarrawonga Coal Mines.

Key potential viewpoints included a number of private-dwellings in the regional and sub-regional setting (>5 km and 1 – 5 km, respectively) as well as local roads and land uses such as Goonbri Road and Leard State Forest in the local setting (<1 km).

It is noted that a number of the privately-owned dwellings surrounding the Tarrawonga Coal Mine considered as potential sensitive viewpoints in the Tarrawonga Coal Mine EA within the regional and sub-regional setting of the Modification are now mine-owned (Figure 5-12).

Figures 5-13 to 5-15 show simulations of the mine site from the same viewpoint locations (with the exception of the Ambardo dwelling as this is now mine-owned and is no longer representative of potentially sensitive viewpoints) as the 2011 visual simulation. The Tarrawonga Coal Mine EA visual simulations show the landform and proposed rehabilitation of the existing/approved Tarrawonga Coal Mine. These simulations have been updated to reflect the changes to the proposed landforms and rehabilitation as a result of the Modification (Section 5.9.2).

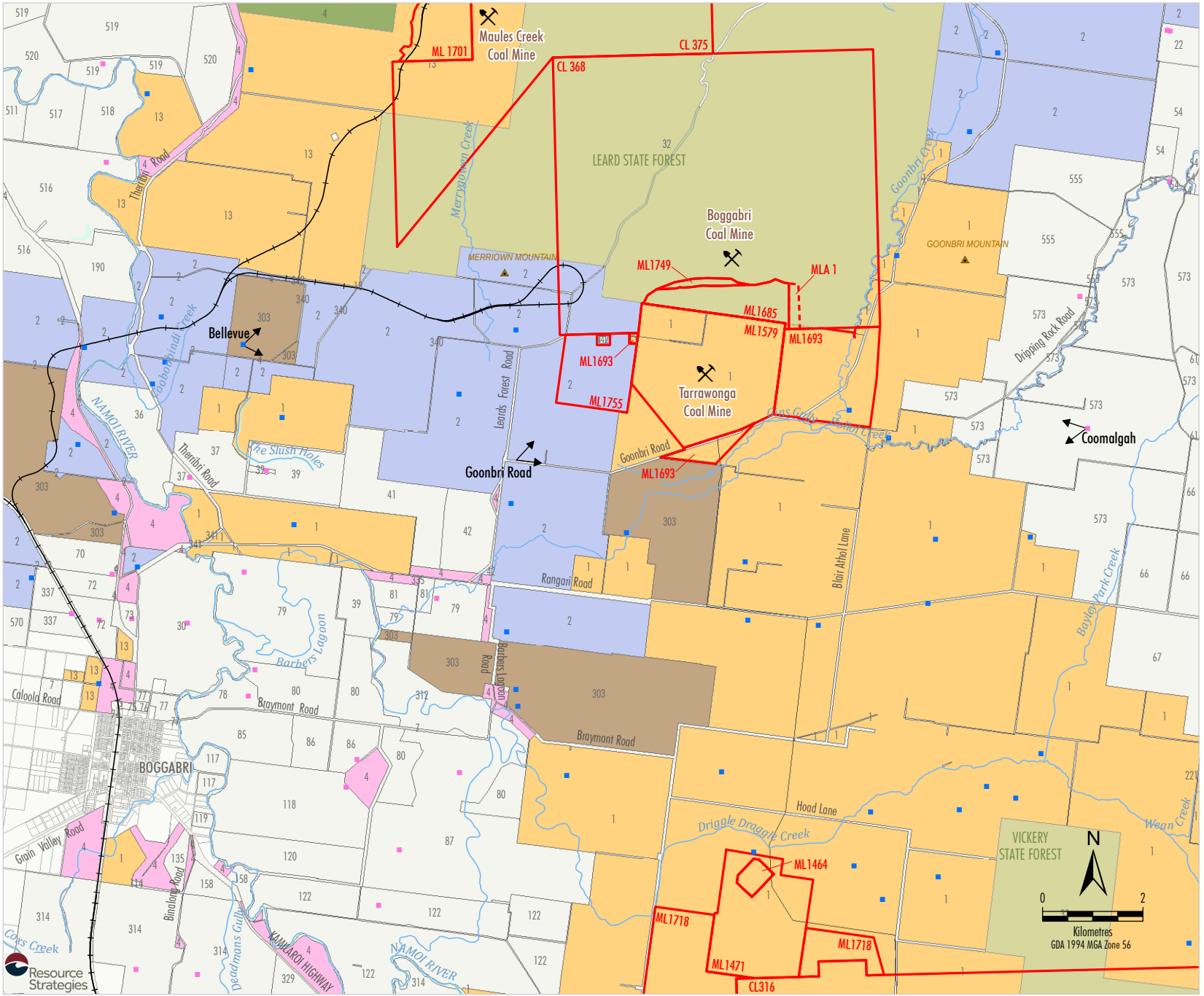
Potential visual impacts due to the Modification are discussed in Section 5.9.2 below, while applicable mitigation and management measures are discussed in Section 5.9.3.

5.9.2 Potential Impacts

The Modification primarily involves a reduction to the approved open cut extent, changes to the extents and elevations of the Northern and Southern Emplacements and relocation of existing infrastructure and mine landforms, which would be generally consistent with the nature and scale of the approved Tarrawonga Coal Mine.

Elements of the Modification considered to have the potential to have some visual impact include the following:

- reduction of the approved open cut extent (which would avoid mining Goonbri Creek);
- relocation of the flood bund; and
- integration of the Northern and Southern Emplacements during operations, including changes to the currently approved height of the Southern Emplacement.



LEGEND

- Mining Tenement Boundary (ML and CL)
- Mining Lease Application Boundary (MLA 1)
- Railway
- NPWS Estate
- State Forest
- Crown Land
- Whitehaven Owned Land
- Whitehaven/Idemitsu Boggabri Coal Joint Owned Land
- Idemitsu Boggabri Coal Owned Land
- Privately-owned Land and Other Land
- Mine-owned Dwelling
- Private Dwellings
- Visual Simulation Location

Source: NSW Department of Land and Property Information (2017); NSW Department of Industry (2018); Office of Environment and Heritage NSW (2016); Whitehaven Coal Limited (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

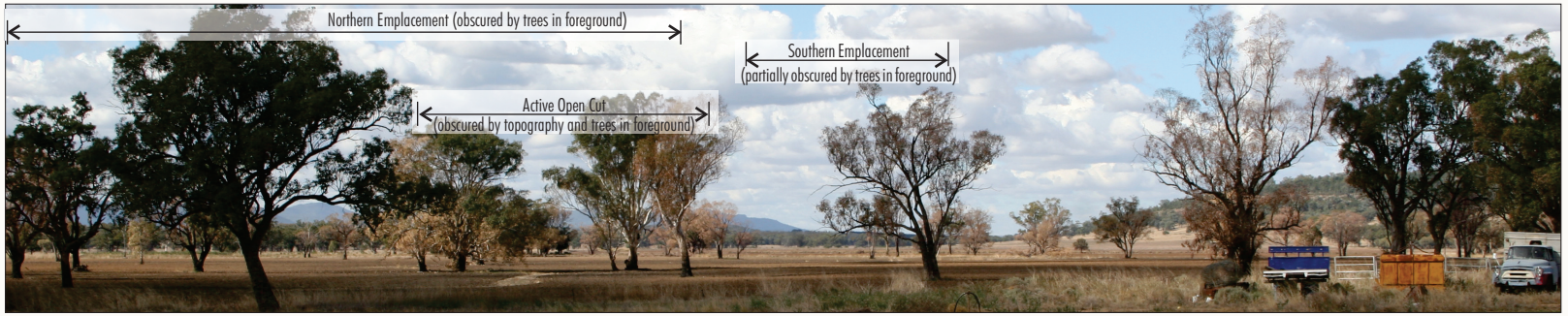
Visual Simulation Locations and Land Ownership

Figure 5-12

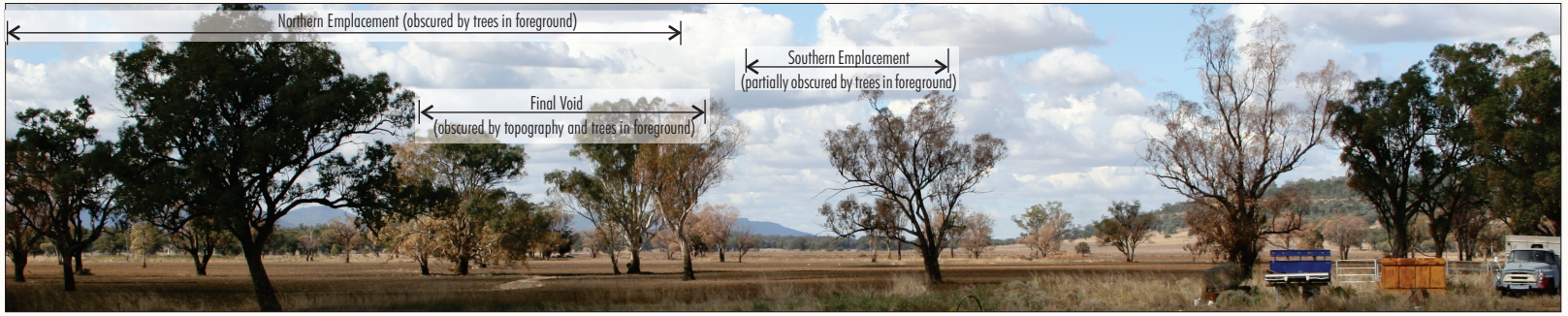
WHC-18-59_LOM_210C



Approved View (approximately Year 2023)



Year 7 Simulation (approximately Year 2026)



Post-Mining Simulation

WHC-18-59_LOM007A

WHITEHAVEN COAL

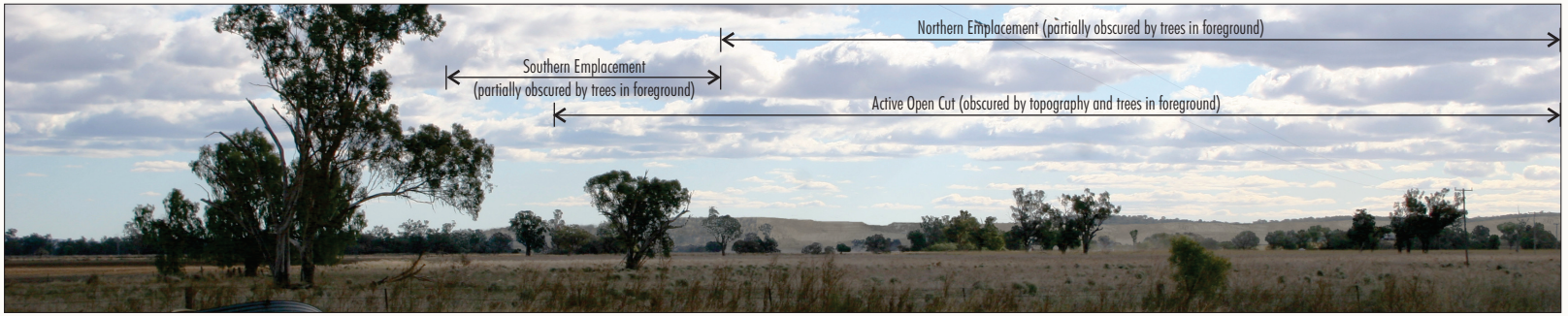
TARRAWONGA COAL MINE

Approved View and Visual Simulations - Bellevue

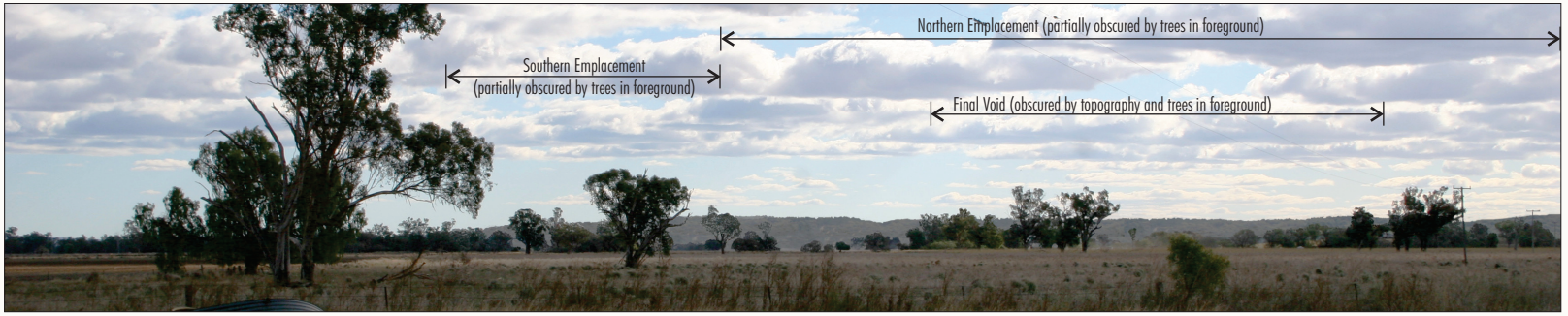
Figure 5-13



Approved View (approximately Year 2023)



Year 7 Simulation (approximately Year 2026)



Post-Mining Simulation

WHC-18-59_LOM006A

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Approved View and Visual Simulations -
MHPF Bellevue Land

Figure 5-14



Approved View (approximately Year 2023)



Year 7 Simulation (approximately Year 2026)



Post-Mining Simulation

WHC-18-59_LOM008A

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Approved View and Visual Simulations - Goonbri Road

Figure 5-15

The height of the Northern Emplacement would generally be up to approximately 370 m AHD. The Modification would introduce micro-relief (i.e. gently undulating surfaces) up to approximately 376 m AHD to assist in drainage design that replicates natural drainage systems and improve integration of the landform with the surrounding environment (Section 2.2). The extent of the landform would be slightly modified to be integrated with the Southern Emplacement, as the approved services corridor to the Boggabri Coal Mine Infrastructure Facilities would no longer be required (Section 2.2). The height of the Southern Emplacement during operations for the Modification would increase from the approved height of 360 to approximately 370 m AHD (i.e. an increase of approximately 10 m).

During rehabilitation, the final height of the Southern Emplacement would remain at approximately 370 m AHD (i.e. an increase of approximately 40 m from the existing approved final landform height). It is noted that these changes, while altering the layout and extent of the approved/existing mine, would effectively be extensions to and consolidation of existing approved landforms for the Tarrawonga Coal Mine.

The other proposed infrastructure relocations (i.e. ROM coal stockpile and associated infrastructure) and additional surface disturbances (i.e. construction of a new site access road and intersection with Goonbri Road) would not be expected to significantly alter the visual impacts of the approved Tarrawonga Coal Mine from potentially sensitive viewpoints given the scale and location of these activities in the context of the existing Tarrawonga Coal Mine.

The water transfer pipeline between the Tarrawonga Coal Mine and the proposed Vickery Extension Project is located further than 2 km from the nearest privately-owned dwellings and would be located along Whitehaven's private haul road, with the exception of a small section crossing Rangari Road (Figure 5-12). As this pipeline would appear typical of the broader agricultural landscape, it is not anticipated the pipeline would contribute any material visual impact to users of the public road network.

Although the Modification would involve the relocation of the flood bund as a result of the reduction in the open cut extent, the relocated landform would be generally consistent with the nature and scale of the currently approved landform. The relocated flood bund would be rehabilitated in accordance with approved rehabilitation methods (Section 6) and once established, would effectively become a visual screen from the Tarrawonga Coal Mine from the eastern and southern extents.

Visual Impact Assessment

Visual simulations were prepared for the viewpoints previously assessed in the Visual Assessment for the Tarrawonga Coal Mine EA (i.e. "Bellevue" dwelling [now mine-owned], "Coomalgah" dwelling [re-named and herein referred to as "MHPF Bellevue Land" in this Modification Report] and a location on Goonbri Road [south of the Tarrawonga Coal Mine]), with the exception of the "Ambardo" dwelling as this is now mine-owned and not representative of sensitive receiver locations (Figure 5-12).

Since the Tarrawonga Coal Mine EA, a number of privately-owned dwellings in the sub-regional and regional settings of the Modification are now mine-owned (Figure 5-12). There are no privately-owned dwellings within the Modification local setting (i.e. <1 km).

The simulations of the Modification landforms were undertaken for the Modification Year 7 as this is representative of the landforms at their maximum heights and, therefore, represent the greatest potential for visual impact. The post-mining final landform simulations illustrate the conceptual landform following completion of mining and rehabilitation activities.

Predicted visual impacts at the locations assessed as part of the Modification visual simulations are discussed below. In addition, potential visual impacts due to night-lighting and cumulative impacts are also described below.

Dwellings

The Tarrawonga Coal Mine EA identified the visual sensitivity of the "Bellevue" and "MHPF Bellevue Land" dwellings as low and moderate, respectively. The "Bellevue" dwelling is now mine-owned and is representative of views from the west, while the "MHPF Bellevue Land" dwelling is representative of views from the east. Consistent with the Tarrawonga Coal Mine EA, the visual impact of the modified emplacements and reduction in open cut extent is considered to be low, as these features, where visible, would be located further than 4 km from these dwellings and would form a minor part of the total view.

Given the nature and scale of the proposed alterations to the landforms for the Modification, it is anticipated that the level of visual impact identified at both the "Bellevue" and "MHPF Bellevue Land" dwellings would be similar to that assessed in the Tarrawonga Coal Mine EA and in the context of existing/approved Tarrawonga Coal Mine.

The levels of visual impact are expected to reduce further to very low at "Bellevue" and low at "MHPF Bellevue Land" following progressive and final rehabilitation of the Modification final landforms.

Roads

The Tarrawonga Coal Mine EA identified the visual sensitivity of the Tarrawonga Coal Mine from Goonbri Road as low. The visual impact of the Modification is considered to be low to very low, as it is not anticipated that users of Goonbri Road would notice material changes to the visual setting as a result of the Modification in the context of existing/approved Tarrawonga Coal Mine. It is noted that public traffic volumes on Goonbri Road are low (Section 5.5). Notwithstanding, the levels of visual impact are expected to reduce to very low following progressive and final rehabilitation of the Modification final landforms.

Night-lighting

The Modification would vary the potential effects of the existing Tarrawonga Coal Mine night-lighting (i.e. lighting from the Modification may be visible at additional locations due to the relocated ROM stockpile and associated infrastructure, and modified emplacements).

In addition, the Modification would also include a minor increase in the mine fleet, and consequently there would be an increase in mobile vehicle-mounted night lighting effects.

Given that the Modification would result in a truncation of the lateral extent of the approved disturbance areas, the nature and scale of the night-lighting for the Modification would be similar to the existing night-lighting at the Tarrawonga Coal Mine.

The Siding Springs Observatory is located approximately 125 km south-west of the Tarrawonga Coal Mine. As such, the Modification is within the Dark Sky Region, as defined in the *Dark Sky Planning Guideline* (DP&E, 2016). It is considered that the Modification would result in a negligible increase in night lighting compared to the approved Tarrawonga Coal Mine.

Cumulative Impacts

It is not anticipated that the Modification would materially affect the cumulative visual impacts of Tarrawonga Coal Mine with the Boggabri Coal Mine in comparison to those assessed as part of the Tarrawonga Coal Mine EA, and therefore potential additional cumulative impacts have not been discussed further.

5.9.3 Mitigation Measures, Management and Monitoring

TCPL would continue to operate in accordance with Condition 57, Schedule 3 of PA 11_0047, which includes implementation of all reasonable and feasible measures to minimise the visual impacts, as well as off-site lighting impacts.

Progressive Rehabilitation

General post-mining landform concepts would be retained for the Modification with minor changes to the size and location of these landforms to reflect the reduction in open cut extent. Changes to the post-mining landforms as a result of the Modification include previously proposed areas of agricultural land to be rehabilitated to woodland to reflect the change in soil resources available for the Modification.

Rehabilitation of the modified final landforms would occur generally in accordance with the methods shown and described in the Tarrawonga Coal Mine EA (TCPL, 2012) and described in Section 6.

TCPL would continue to undertake mine rehabilitation in accordance with Conditions 61, 62, 63 and 64, Schedule 3 of PA 11_0047, and an approved MOP (as approved by the DRG within the DPIE).

Visual Screening

The existing noise/visual bund would be relocated for the Modification to reflect the relocation of the ROM coal stockpile and associated infrastructure to reduce potential views from the south of the Tarrawonga Coal Mine, including Goonbri Road (Figure 1-3).

In addition, the relocated flood bund would effectively become a visual screen from the Tarrawonga Coal Mine from the eastern and southern extents consistent with existing operations, once established.

Night-lighting

Night-lighting at the Tarrawonga Coal Mine would continue to be managed in accordance with Condition 57, Schedule 3 of PA 11_0047. Night-lighting and potential light-pollution due to air quality impacts (i.e. dust emissions) at the existing Tarrawonga Coal Mine, incorporating the Modification, would continue to be managed in accordance with PA 11_0047 and in consideration of the *Dark Sky Planning Guideline* (DP&E, 2016).

Measures to mitigate potential impacts from night-lighting (including sky glow) could include one or more of the following, where practicable and without compromising operational safety (DP&E, 2016):

- Eliminate upward spill light.
- Direct light downwards, not upwards.
- Use shielded fittings.
- Avoid 'over' lighting.
- Switch lights off when not required.
- Use energy efficient bulbs.
- Use asymmetric beams, where floodlights are used.
- Ensure lights are not directed towards reflective surfaces.
- Use warm white colours.

5.10 SOCIAL

An assessment of the existing social environment is provided in Section 5.10.1, the potential social impacts of the Modification, in consideration of the *Social impact assessment guideline For State significant mining, petroleum production and extractive industry development* (DP&E, 2017), is provided in Section 5.10.2, and the mitigation measures are provided in Section 5.10.3.

5.10.1 Existing Environment

A social impact assessment was undertaken for the Tarrawonga Coal Project EA (Gillespie Economics, 2011), which identified the key social impacts associated with the approved Tarrawonga Coal Mine.

Gillespie Economics (2011) considered the potential impacts of the approved Tarrawonga Coal Mine on the regional community infrastructure as a result of the employment and population change. Gillespie Economics (2011) considered the Narrabri and Gunnedah LGAs as the Tarrawonga Coal Mine's primary region of social influence.

Negligible impacts on community infrastructure demand would arise as a result of the approved Tarrawonga Coal Mine. However, cumulative impacts with the Boggabri Coal Mine and Maules Creek Coal Mine would be more significant (Gillespie Economics, 2011).

5.10.2 Potential Impacts

The Modification would not change the existing workforce or approved mine life at the Tarrawonga Coal Mine. As such, no additional demand for services (e.g. housing and health services) in the region are expected.

Table 5-4 provides a comparison between the social impacts identified in the Tarrawonga Coal Project EA (TCPL, 2012) and those predicted for the Modification.

Table 5-4
Comparison of the Social Impacts for the Approved Tarrawonga Coal Mine and Modification

Social Component	Currently Approved (Construction)[1]	Currently Approved (Operation)[1]	The Modification
Population change	■ It is estimated that construction of the Project would result in a direct population increase of 20 people in the region, and an indirect population increase of 35 people. ■ Cumulatively, it is estimated that construction of the Project, together with the Maules Creek and Boggabri Coal Mines, would result in a direct population increase of 352 people. Indirect population increase is estimated at 1,078 people.	■ It is estimated that operation of the Project would result in a direct population increase of 85 people in the region, and an indirect population increase of 137 people. ■ Cumulatively, it is estimated that operation of the Project, together with the Maules Creek and Boggabri Coal Mines in Year 2021, is predicted to result in a direct population increase of 1,467 people. Indirect population increase is estimated at 1,799 people.	■ The Modification would result in no change to employment or mine life and therefore no change to the regional population.
Pressure on short-term accommodation for construction workforce	■ Construction contractors typically use a mix of accommodation including rental houses, apartments, motels, pub hotels and cabins in caravan parks that are located in close proximity to the mine. ■ The Project construction workforce would require approximately 20 accommodation units. Potential cumulative direct construction workforce associated with the Project and the other mining projects would result in the demand for up to 352 accommodations units. ■ There is considerable short-term accommodation in Narrabri and Gunnedah to accommodate the estimated Project-only short-term demand for housing. There is also likely to be considerable opportunity for rentals, given the number of unoccupied properties in these areas. ■ Cumulatively, there is the potential for short-term accommodation that would otherwise be available for tourism to be occupied by construction workers, potentially reducing availability for tourism.	■ Nil.	■ The Modification would result in no change to employment and therefore no change to the demand for short-term accommodation associated with the Tarrawonga Coal Mine.

Table 5-4 (continued)
Comparison of the Social Impacts for the Approved Tarrawonga Coal Mine and Modification

Social Component	Currently Approved (Construction)[1]	Currently Approved (Operation)[1]	The Modification
Increased demand for housing and potential to increase house and rental prices	■ Nil.	■ During operation of the Project, additional direct and indirect demand is likely to be generated for up to 33 residences in Narrabri LGA and 52 residences in Gunnedah LGA. Cumulatively, there is predicted direct and indirect demand for up to 1,307 accommodation units (e.g. houses, units, etc.) in 2021 (when the greatest cumulative impact would occur). While initially, short-term accommodation may house these new families, the demand would be for longer-term rental accommodation or housing purchases. While the Project-only demand for housing is largely insignificant, cumulatively the new demand for housing in the region is likely to be significant. ■ The demand for rental accommodation and to purchase is likely to be at the higher end of the market, due to higher relative wages in the mining sector and where supply is more limited. Where housing supply is insufficient to meet demand, this may manifest itself in increased property prices and higher rent prices. Potential issues exist around whether there would be sufficient supply of investment capital and builders to meet the required housing demand.	■ The Modification would result in no change to employment or mine life and therefore no change to housing demand associated with the Tarrawonga Coal Mine.
Demand for health services	■ There is potential for the Project to increase the demand for public health facilities in the region, such as for hospitals, General Practitioner Medical Services, Dental, Physiotherapy, Chiropractors, Optometrists, etc., via the anticipated increase in population during both construction and operation phase of the Project. ■ While the anticipated population increase during construction and operation of the Project is very small compared to the total populations of the region, any increase is likely to place some additional demand on existing medical services, which are already considered by the community as being under strain. ■ Cumulative changes in population levels would substantially increase demand for health services and facilities.	■ As per the potential impacts described in the construction phase.	■ The Modification would result in no change to employment or mine life and therefore no change to the population associated with the Tarrawonga Coal Mine, which drives demand for public health services.

Table 5-4 (continued)
Comparison of the Social Impacts for the Approved Tarrawonga Coal Mine and Modification

Social Component	Currently Approved (Construction)[1]	Currently Approved (Operation)[1]	The Modification
Pressure on school places and demand for child care facilities	■ Nil.	■ During operation of the Project incoming workers are expected (assuming average family structures) to be associated with some children creating increased demand for education facilities within the region. However, prior to the Tarrawonga Coal Project, there was a decline in enrolments. ■ Cumulative potential developments in the region would contribute to a considerably greater demand for education in both the public and private sectors.	■ The Modification would result in no change to employment or mine life and therefore no change to the population associated with the Tarrawonga Coal Mine, which drives demand for educational and child care facilities.
Increased demand for recreational facilities and other community infrastructure	■ Construction workers have the potential to increase demand for food outlets (e.g. hotel, licenced club, etc.).	■ Negligible Project-only impact on demand for recreational facilities and other community infrastructure. ■ Cumulatively, there may be considerable increase in demand for community services and recreation facilities that would require detailed planning by local and State Government agencies.	■ The Modification would result in no change to employment or mine life and therefore no change to the population associated with the Tarrawonga Coal Mine, which drives demand for community and recreational facilities.
Social division	■ High wages in the mining sector relative to other sectors can potentially result in social divisions between those involved in the mining sector and those who are not. This can be heightened during construction phases of projects when there are high numbers of unattached construction workforces, who may only partially integrate into the community.	■ As per the potential impacts described in the construction phase.	■ The Modification would result in no change to employment or mine life and therefore no change to the potential for social division assessed in the Tarrawonga Coal Project EA.
Changing sense of place	■ Cumulative influxes in populations associated with prospective projects can potentially contribute to a changing sense of place for existing residents, as towns move away from their historical focus on servicing agricultural and forestry enterprises to an increased focus on servicing mining activities. This can be heightened during construction phases of projects when there are high numbers of unattached construction workforces, who may only partially integrate into the community.	■ As per the potential impacts described in the construction phase.	■ The Modification would result in no change to employment or mine life and therefore no change to the potential for a changing sense of place assessed in the Tarrawonga Coal Project EA.

Table 5-4 (continued)
Comparison of the Social Impacts for the Approved Tarrawonga Coal Mine and Modification

Social Component	Currently Approved (Construction)[1]	Currently Approved (Operation)[1]	The Modification
Labour skills shortages and difficulty retaining workers	■ The demand for mining labour can result in skilled labour being drawn away from other professions e.g. domestic trade services, which can result in shortages of these services in the region. The impact of the Project on skills shortages in the region is likely to be negligible. However, it is anticipated that there would be impacts from the cumulative effects of prospective projects in the region.	■ As per the impacts described in the construction phase.	■ The Modification would result in no change to employment or mine life at the Tarrawonga Coal Mine and therefore no change to the demand for mining labour.
Increased crime	■ Influx of single males during the construction phase can be associated with increased crime levels. ■ Also potential for the Project to indirectly result in a decrease in crime rates through providing increased employment opportunities to those currently unemployed. Given that unemployment is a contributing factor in criminal activity, a decrease in the unemployment rate has the potential to reduce crime rates.	■ Nil.	■ The Modification would result in no change to employment at the Tarrawonga Coal Mine and therefore no change to crime rates.

Source: Gillespie Economics (2011).

Note: References to cumulative impacts in this column refers to the combined effects of the Tarrawonga Coal Mine, Boggabri Coal Mine and Maules Creek Coal Mine.

5.10.3 Mitigation and Management Measures

TCPL would continue to implement a range of social impact mitigation and management measures described in the Tarrawonga Coal Project EA (TCPL, 2012), including:

- continuation of the current donations policy which supports education, health and community causes;
- employ local residents preferentially where they have the required skills and experience and demonstrate a cultural fit with the organisation;
- purchase local non-labour inputs to production preferentially where local producers can be cost and quality competitive; and
- include a code of conduct for construction workers with regard to behaviour in the Contractor Induction Program.

Additionally, TCPL would continue to consult with the NSC, GSC and CCC.

5.11 OTHER ENVIRONMENTAL ASPECTS

5.11.1 Greenhouse Gas

An Air Quality and Greenhouse Gas Assessment for the Modification was undertaken by Ramboll (2019) and is presented as Appendix D.

The Modification would result in a reduction in total ROM coal and waste rock quantities over the life of the mine associated with the reduced open cut extent.

Accordingly, there would be a reduction of total greenhouse gas emissions over the life of mine compared to the approved Tarrawonga Coal Mine, including a reduction in scope 3 emissions associated with the reduction in total ROM coal mined by approximately 5.1 Mt (Appendix D).

5.11.2 Agriculture

The approved Tarrawonga Coal Mine includes mining of the Upper Namoi alluvium and Goonbri Creek. Under the approved Tarrawonga Coal Mine, the alluvial soils would be used to establish Class 3 agricultural suitability land in accordance with Schedule 3, Condition 61 of PA 11_0047.

Under the Modification, there would be no mining of the Upper Namoi alluvium. Accordingly, the Modification does not propose the establishment of Class 3 agricultural suitability land.

The Modification would provide approximately 257 ha of rehabilitated land suitable for grazing (i.e. an increase of 47 ha of agricultural land post-mining compared to the approved Tarrawonga Coal Mine).

The rehabilitation of the Tarrawonga Coal Mine and post-mining land uses under the Modification are described in Section 6.

6 REHABILITATION STRATEGY

This section describes the Rehabilitation Strategy for the Modification. This Strategy presents the overall rehabilitation goals and objectives and describes the conceptual post-mining landform and rehabilitation domains for the Modification. This section also describes the general rehabilitation practices and measures that would be implemented for the Modification. Rehabilitation completion criteria have been developed for the existing Tarrawonga Coal Mine. The existing completion criteria would remain largely unchanged for the Modification.

The Rehabilitation Strategy for the Modification would continue to be provisional to allow for the consideration of results from rehabilitation monitoring (Section 6.5) and future rehabilitation trials and research (consistent with current practice).

6.1 EXISTING REHABILITATION AT THE TARRAWONGA COAL MINE

Rehabilitation activities at the Tarrawonga Coal Mine commenced in 2007 and have focused on the Northern and Southern Emplacements.

Photographs showing rehabilitation at the Tarrawonga Coal Mine are provided in Plates 6-1 to 6-8.

The approved rehabilitation objective for the Northern and Southern Emplacements is to re-profile the completed sections to a stable overall slope of approximately 10° and to revegetate the completed landform to open native woodland with flora species characteristic of the local area (TCPL, 2019a). Fauna habitat features (e.g. stag trees) have also been incorporated into the rehabilitation areas (Plates 6-1 and 6-2).

Rehabilitation monitoring results at the Tarrawonga Coal Mine indicate that the initial cover crop has been successful in stabilising the rehabilitation areas, and tube stock establishment has also been largely successful to date with survival rates ranging between approximately 75% and 95% (TCPL, 2010; TCPL, 2019a and Eco Logical, 2018).

A mid-storey layer has developed on the western batters of the Northern Emplacement that consists of juvenile eucalyptus species that are expected to form the canopy as they mature (Eco Logical, 2017a). Rehabilitation monitoring indicates that the majority of the canopy species planted on the Northern Emplacement are between 5 m and 10 m tall (Plates 6-4 to 6-8) with canopy recruitment of Eucalypt species recorded (Eco Logical, 2018).

A number of endemic fauna species continue to be recorded at the rehabilitation sites, including the Eastern Grey Kangaroo (*Macropus giganteus*), Common Wallaroo (*Macropus robustus*), Red-necked Wallaby (*Macropus rufogriseus*), Wall Skink (*Cryptoblepharus virgatus*), Lace Monitor (*Varanus varius*), Eastern Striped Skink (*Ctenotus robustus*), Jacky Dragon (*Amphibolurus muricatus*) and Bearded Dragon (*Pogona barbata*) (Eco Logical, 2017a and TCPL, 2019a).

During 2016, a threatened bird species (Speckled Warbler [*Chthonicola sagittata*]) was recorded within the Tarrawonga Coal Mine rehabilitation area (Eco Logical, 2017a).

A summary of rehabilitation activities undertaken at the Tarrawonga Coal Mine and the rehabilitation monitoring results are documented in the Annual Review.

The Tarrawonga Coal Mine MOP describes site activities and rehabilitation progress planned towards the site's rehabilitation objectives and completion criteria.

6.2 REHABILITATION AT OTHER WHITEHAVEN COAL MINES

Whitehaven is also progressively rehabilitating several of its other closed and operational coal mines in the region, including the Canyon Coal Mine, Vickery Coal Mine, Rocglen Coal Mine, Maules Creek Coal Mine, Werris Creek Coal Mine, Narrabri Coal Mine and Sunnyside Coal Mine (Figure 1-1).



Plate 6-1 Tarrawonga Coal Mine - Northern Emplacement Reshaping and Fauna Habitat Placement (2011)



Plate 6-2 Tarrawonga Coal Mine - Northern Emplacement Cover Crop Establishment (2011)

WHC-18-59_LOM 0054

Source: Whitehaven (2019)



Plate 6-3 Tarrawonga Coal Mine - Northern Emplacement Reshaping and Cover Crop Establishment (2011)



Plate 6-4 Tarrawonga Coal Mine - Northern Emplacement Tube Stock Establishment (2018)

Source: Whitehaven (2019)



Plate 6-5 Tarrawonga Coal Mine - Northern Emplacement (2018)



Plate 6-6 Tarrawonga Coal Mine - Northern Emplacement (2018)

WHC-18-59_LOM 003A

Source: Whitehaven (2019)



Plate 6-7 Tarrawonga Coal Mine - Northern Emplacement (2018)



Plate 6-8 Tarrawonga Coal Mine - Northern Emplacement (2018)

WHC-18-59_LOM 0044

Source: Whitehaven (2019)

6.2.1 Canyon Coal Mine

Whitehaven maintains the Canyon Coal Mine site, which ceased operations in 2009. Rehabilitation activities conducted at the Canyon Coal Mine site have included reshaping of the final void and overburden emplacements, topsoil placement, installation of water management control measures, establishment of a cover crop and other groundcover species, planting of tube stock, and monitoring and maintenance of rehabilitated areas.

The Canyon Coal Mine has been returned to a mixture of open pasture areas and established woodland, and is the model on which all Whitehaven rehabilitation projects are based. Rehabilitation monitoring at the Canyon Coal Mine indicates that (Eco Logical, 2017b):

- Rehabilitation at the Canyon Coal Mine has proven successful to date.
- A stable landform has been developed that has allowed for the relocation and establishment of a functional soil cover with appropriate nutrient and water cycling capabilities.
- Woodland structure and composition elements are trending towards those found in nearby control sites.
- Vegetation affected by a fire event in 2013 resprouted and is re-establishing.
- Rhodes Grass (*Chloris gayana*) remains present at some sites, however, is no longer used in plantings.
- Fauna are more frequently using rehabilitated areas, and bird diversity is increasing with rehabilitation age and is trending toward the diversity found in the nearby control sites. Grey-crowned babblers (*Pomatostomus temporalis temporalis*) have been recorded at several locations across the site for the fourth consecutive year and the Eastern Grey Kangaroo, Common Wallaroo and Swamp Wallaby (*Wallabia bicolor*) have also been recorded.
- With ongoing management, it is highly likely that the site's woodland environment will continue to develop into an important ecological resource.

6.2.2 Vickery Coal Mine

Three rehabilitated open cut mining areas (i.e. Blue Vale, Shannon Hill and Greenwood) and one underground and open cut mining area (i.e. Red Hill) are associated with the Vickery Coal Mine.

Mining operations at the Vickery Coal Mine ceased in 1998, and rehabilitation works subsequently commenced.

Rehabilitation of approximately 405 ha of mining areas was completed in 2000. The areas previously disturbed by mining have been successfully rehabilitated such that the land is suitable for grazing. Areas of woodland vegetation have also been successfully established on the steeper slopes and other areas of the open cut mining landforms.

The rehabilitated areas have been successfully grazed for over a decade with graziers reporting that stock perform well on the rehabilitated areas (Whitehaven, 2018b).

Rehabilitation activities at the Vickery Coal Mine will continue.

6.2.3 Rocglen Coal Mine

Mining operations at the Rocglen Coal Mine ceased in 2019. The rehabilitation strategy for the Rocglen Coal Mine includes the establishment of native vegetation on the western side of the site to connect with the vegetation in the Vickery State Forest and predominantly rehabilitated pasture on the eastern side (GSS Environmental, 2011).

Rehabilitation of the Rocglen Coal Mine has primarily involved revegetation of the Western and Northern Emplacements.

Fauna recorded within the rehabilitated areas were observed coming from and returning to the Vickery State Forest. Bird and terrestrial fauna species richness has increased in the woodland rehabilitation site since 2014, with four threatened bat species recorded in the woodland rehabilitation areas of the Tarrawonga Coal Mine site (Eco Logical, 2017a).

6.2.4 Werris Creek Coal Mine

Whitehaven has undertaken more than 150 ha of rehabilitation at the Werris Creek Coal Mine.

Extensive tubestock planting of overstorey species, including species characteristic of Poplar Box Woodland EEC has been undertaken. Tubestock plantings have reached a height of 4 to 5 m and are progressing towards establishing a native overstorey cover. A large groundcover of native species has also established at the rehabilitation sites.

The rehabilitation monitoring results demonstrate that current rehabilitation progress at the Werris Creek Coal Mine has either already met the target allowable future attribute scores or is expected to achieve the allowable future attribute score as rehabilitation growth progresses and management continues (Whitehaven, 2019).

Pasture rehabilitation areas have been established which will target establishment of Class 3 agricultural land capability.

The rehabilitated landforms at the Werris Creek Coal Mine include slopes of up to approximately 10° which have remained stable since construction (Whitehaven, 2018a).

6.3 REHABILITATION OF THE MODIFICATION

The sections above provide both site-specific evidence of successful mine rehabilitation at the existing Tarrawonga Coal Mine, and demonstration of Whitehaven's successful rehabilitation at other sites.

The current rehabilitation strategy for the Tarrawonga Coal Mine and this rehabilitation strategy for the Modification have been developed based on the experience gained from extensive rehabilitation works undertaken by Whitehaven at the Tarrawonga Coal Mine site and in the region, including consideration of the successful methodologies used at these sites (e.g. slope of the batters, soil depth, revegetation techniques and plant selection).

Development of this rehabilitation strategy for the Modification has also considered contemporary rehabilitation and mine closure guidelines including the *ESG3: Mining Operations Plan (MOP) Guidelines* (Department of Trade and Investment, Regional Infrastructure and Services [DTIRIS], 2013), *Leading Practice Sustainable Development Program for the Mining Industry – Mine Rehabilitation* (Commonwealth of Australia, 2016a), *Leading Practice Sustainable Development Program for the Mining Industry - Mine Closure* (Commonwealth of Australia, 2016b) and the *Integrated Mine Closure Good Practice Guide 2nd Edition* (International Council on Mining and Metals, 2018).

The overall rehabilitation goal and the approved general rehabilitation concepts and objectives for the key final landforms associated with the existing Tarrawonga Coal Mine would remain largely unchanged for the Modification.

The key final landforms that would remain at the completion of mining would remain unchanged and would include:

- Northern Emplacement and open cut infill area;
- Southern Emplacement;
- a final void;
- water management infrastructure; and
- former mine facilities area and infrastructure areas.

As described in Section 2.1.1, the extent of the open cut would be reduced under the Modification to avoid mining the Upper Namoi alluvium and would not occur within 200 m of Goonbri Creek. The realignment of Goonbri Creek and construction of the Low Permeability Barrier are, therefore, no longer proposed under the Modification (Figure 1-3).

The post-mining land uses for the Modification final landform would remain primarily unchanged and would provide a combination of native woodland/forest areas and areas for agricultural use.

6.3.1 General Rehabilitation and Mine Closure Goals

The general rehabilitation and mine closure goals for the Modification are described in Table 6-1 and remain largely the same as for the approved Tarrawonga Coal Mine, except for no longer including realignment of Goonbri Creek and undertaking the Goonbri Creek enhancement measures.

TCPL's mine closure goal for the Modification remains unchanged and is to achieve relinquishment to the satisfaction of the relevant Minister(s) and that all relevant mining tenement and Project Approval conditions will have been met.

Rehabilitated land would be considered suitable for surrender when the nominated standards and/or completion criteria for land use, landform reconstruction, landform stability, revegetation, and beneficial water use have been met or if the relevant Minister(s) otherwise accept the rehabilitation status.

6.3.2 Conceptual Post-mining Land Uses and Final Landform

Conceptual Post-mining Land Uses

The conceptual post-mining land uses of the Modification final landform would continue to comprise a combination of nature conservation (woodland/forest) and agricultural (pasture) land uses, generally consistent with the approved rehabilitation strategy. The Modification proposes that use of the agricultural land be limited to grazing only.

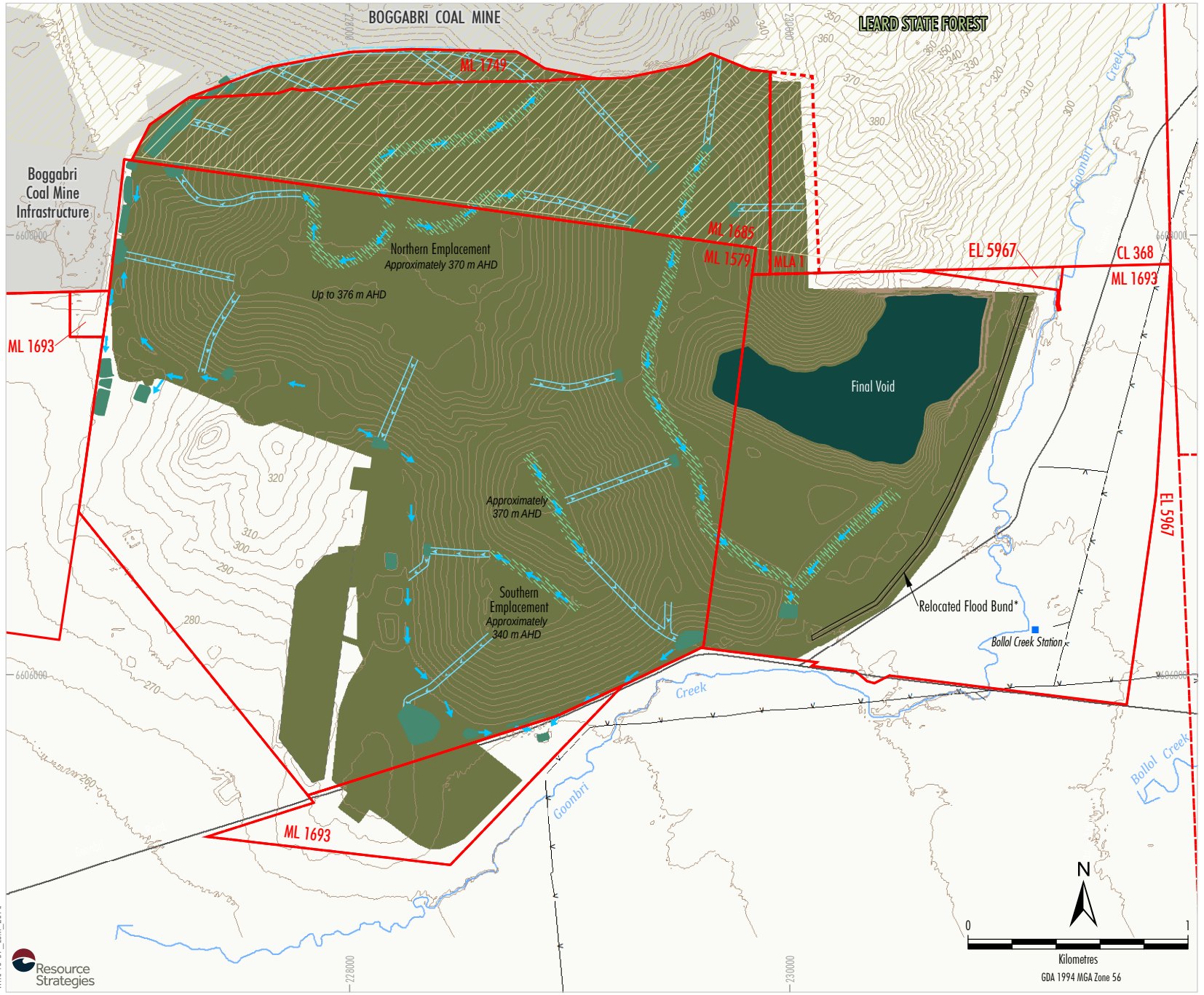
The Modification final landform would provide for a combination of approximately 568 ha of native woodland/forest and some 257 ha of agricultural land suitable for grazing.

Figure 6-1 illustrates the conceptual final landform and post-mining land use areas.

Table 6-1
Rehabilitation and Mine Closure Goals for the Modification

Short-term	Medium- to Long-term
■ Minimise active disturbance areas by progressively rehabilitating, and by restricting clearing to the minimum required for operations. ■ Recover vegetation and habitat resources during clearing activities and re-use in rehabilitated areas to provide habitat resources for fauna (e.g. trees, hollows). ■ Use soil resources stripped from disturbance areas directly for rehabilitation, but if this is not possible, minimise the time soil is stored in temporary stockpiles before being re-used. ■ Install erosion and sediment control measures prior to the commencement of soil stripping and rehabilitation activities. ■ Plant cover crops on newly rehabilitated mine landform areas (and topsoil stockpiles) after completing earthworks, to minimise the potential for soil erosion. ■ Stabilise new infrastructure disturbance areas (e.g. road and dam embankments) as soon as possible by topsoiling and seeding. ■ Maintain vegetation screens to facilitate growth and screening of Modification activities. ■ Progressively backfill the open cut with overburden and interburden and reshape completed areas to their final landform shape so that they can be progressively rehabilitated.	■ Create a physically and chemically stable mine landform that integrates with the adjoining hilly topography of the Willowtree Range. ■ Create micro-relief and macro-relief between landforms (e.g. the Southern and Northern Emplacements) that reflect the characteristics of the surrounding topography. ■ Construct the final top surface of the Northern Emplacement so that it drains in a stable manner to Goonbri Creek or existing drains via swales, rock-lined drop structures and/or sediment basins. ■ Partially backfill the final void to the extent required to minimise long-term drawdown and water quality effects on local groundwater aquifers, so that their beneficial use is not compromised. ■ Construct the final void highwall to achieve negligible instability risk and minimise risk of flood interaction for all flood events up to and including the PMF level. ■ Revegetate the mine landforms to a combination of native woodland/forest and agricultural land uses that meet community and regulatory expectations in consideration of existing land uses and conservation values.

Source: Tarrawonga Coal Project EA (TCPL, 2012).



LEGEND

- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA 1)
- Exploration Licence (EL)
- Leard State Forest
- 11kV Electricity Transmission Line
- 11kV Electricity Transmission Line Realignment
- Mine-owned Dwelling
- Stream ≥ 3rd Order
- Rehabilitated Landform
- Swale/Drainage Path
- Sediment Basin/Farm Dam
- Drop Structure
- Surface Water Flow/Direction

*Note: * Extent of flood bund subject to detailed design.*

Source: © State of New South Wales and Department of Planning and Environment (2017); © Department of Finance, Services & Innovation (2017); Whitehaven Coal Limited (2018); WRM (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Indicative Modification General Arrangement - Final Landform

Figure 6-1

The Modification would result in an increase of agricultural land provided in the final landform compared to the approved Tarrawonga Coal Mine (approximately 47 ha).

Conceptual Final Landform

The conceptual final landform for the Modification has been designed to integrate with the surrounding natural and modified landforms, including consideration of elevation, slope and drainage.

The key features of the Modification final landform are generally consistent with the currently approved Tarrawonga Coal Mine, including:

- Rehabilitated waste rock emplacements incorporating natural landform design features (i.e. micro-relief and macro-relief) that reflect characteristics of the topography found in the adjacent Leard State Forest (e.g. elevated landforms with steeper slopes in some areas relative to the surrounding plains).
- Rehabilitated infilled open cut areas that slope down and merge with the natural topography and drain south towards Goonbri Creek.
- Water management features designed to be stable in the long-term.
- A final void located in ML 1693.
- Rehabilitated infrastructure areas that are flat and contiguous with the surrounding agricultural areas.

6.3.3 Rehabilitation Domains and Final Landform Design Concepts

Consistent with contemporary rehabilitation guidelines, conceptual rehabilitation domains would be used to guide rehabilitation of the Modification. In accordance with the methodology provided in the *ESG3: Mining Operations Plan (MOP) Guidelines* (DTIRIS, 2013), Table 6-2 outlines the primary and secondary domains for the Modification.

The conceptual rehabilitation domains are shown on Figure 6-2. The conceptual post-mining rehabilitation domains for the Modification are as follows:

- Domain 1A: Overburden Emplacement Area and Infilled Open Cut Area – rehabilitated to Native Woodland/Forest;
- Domain 1B: Infilled Open Cut Area – rehabilitated to Agricultural Land suitable for grazing;
- Domain 2B: Former Infrastructure Area – rehabilitated to Agricultural Land suitable for grazing;
- Domain 3B: Former Stockpiled Material Area – rehabilitated to Agricultural Land suitable for grazing;
- Domain 4C: Final Void; and
- Domain 5D: Water Management Infrastructure.

Table 6-2
Rehabilitation Domains

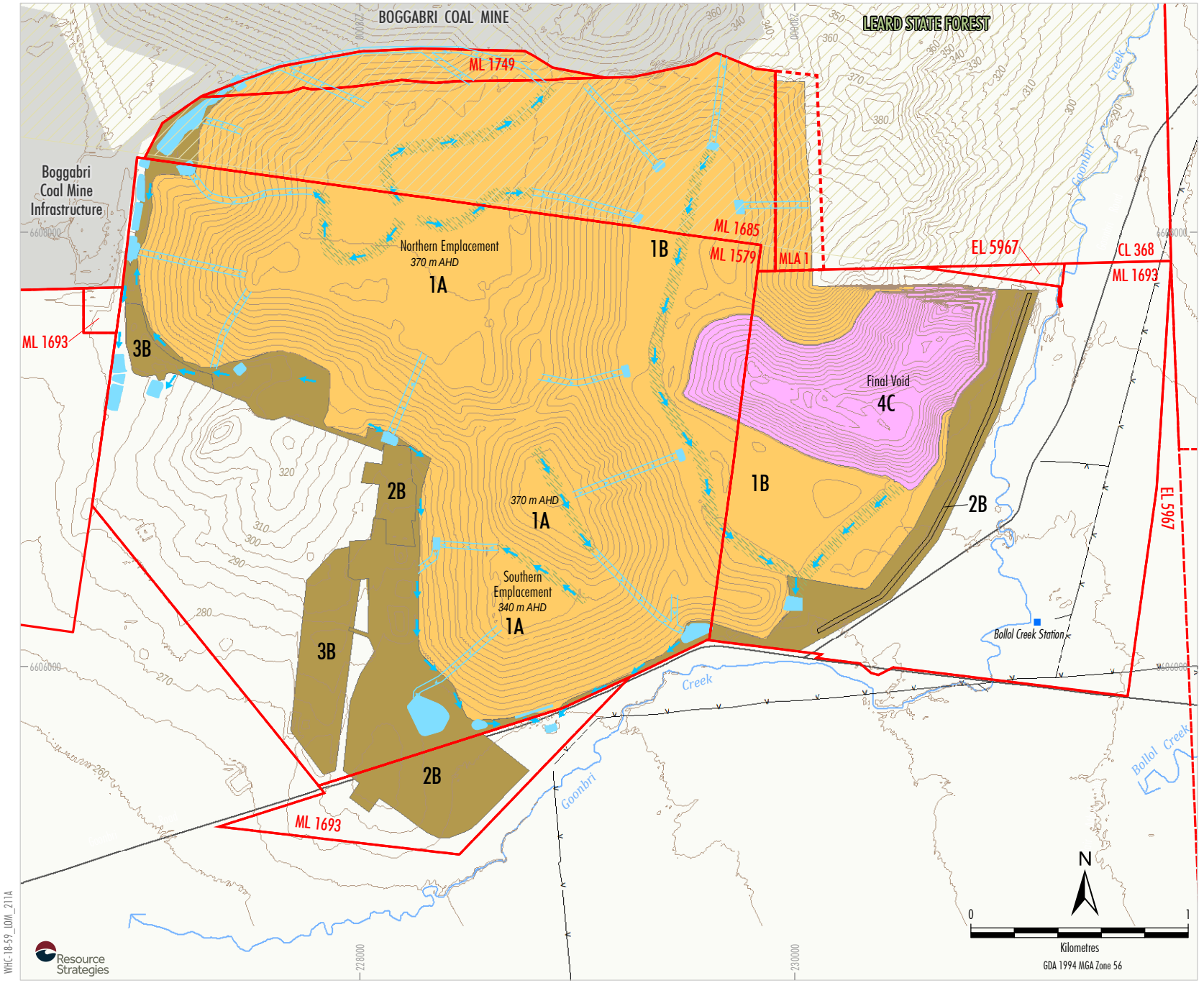
Domain Title	Code
Primary Domains	
Overburden Emplacement Area and Infilled Open Cut Area	1
Infrastructure Area	2
Stockpiled Material	3
Active Open Cut Void	4
Water Management Infrastructure	5
Secondary Domains	
Native Woodland/Forest	A
Pasture/Agricultural Land Suited to Grazing	B
Final Void	C
Water Management Infrastructure	D

Domains 1A and 1B

Northern Emplacement and Open Cut Infill Area

Consistent with the approved rehabilitation strategy, the Northern Emplacement and open cut infill area would be rehabilitated to create a final landform that merges into the undisturbed hilly topography of the Willowtree Range to the north-east in Leard State Forest. The design concepts for the Northern Emplacement would generally remain the same, that is, the emplacement would be constructed predominantly with batter slopes of 10° or shallower and up to approximately 370 m AHD with localised areas up to approximately 376 m AHD to introduce micro-relief, which is consistent with the elevation of hills that existed in the Tarrawonga Coal Mine area prior to the commencement of mining.

The Northern Emplacement would continue to be designed to gently slope up from the natural ground surface on the western edge of ML 1579.



LEGEND

- Mining Lease Boundary (ML & CL)
- Mining Lease Application Boundary (MLA 1)
- Exploration Licence (EL)
- Leard State Forest
- 11kV Electricity Transmission Line
- 11kV Electricity Transmission Line Realignment
- Mine-owned Dwelling
- Stream ≥ 3rd Order
- Swale/Drainage Path
- Drop Structure
- Surface Water Flow/Direction
- 1A — Overburden Emplacement Area and Infilled Open Cut Area - Native Woodland/Forest
- 1B — Infilled Open Cut Area - Pasture/Agricultural Land Suited to Grazing
- 2B — Infrastructure Area - Pasture/Agricultural Land Suited to Grazing
- 3B — Stockpiled Material - Pasture/Agricultural Land Suited to Grazing
- 4C — Open Cut Void
- 5D — Water Management Infrastructure

Source: © State of New South Wales and Department of Planning and Environment (2017); © Department of Finance, Services & Innovation (2017);Whitehaven Coal Limited (2018); WRM (2018)

WHITEHAVEN COAL

TARRAWONGA COAL MINE

Conceptual Rehabilitation Domains

Figure 6-2

The Modification would involve modifying the design of the top surface of the Northern Emplacement to include three elevated catchment areas constructed to approximately 370 m AHD with localised areas up to approximately 376 m AHD to introduce micro-relief. The top surface of the northern extent of the emplacement would remain approximately 1,500 m wide (Figure 6-1).

The shape of the Northern Emplacement top surface (at its northern extent) would also be slightly modified so that incident rainfall would drain from the centre of the emplacement via wide swale drains that gradually slope to the west, north-east and east. Engineered rock-lined drop structures would then facilitate drainage from the top surface swales down the emplacement batters to shallow sediment basins at the base of each structure (Figure 6-1). These drainage features have also been incorporated into the design of the top surface of the Northern Emplacement at its southern extent. The southern extent of the Northern Emplacement would continue to be integrated at a reduced level with the much smaller Southern Emplacement to its south-east.

The slope of the eastern batters of the Northern Emplacement would be lengthened to more gradually slope to the base of the open cut infill area (Figure 6-1), removing the need for the series of terraces currently approved. Shallow stilling ponds would be located at the base of the Northern Emplacement drop structures which would then outfall to a central swale running generally from the northern extent of the open cut infill area to a sediment basin at the south-western extent of the open cut infill area (within ML 1693) (Figure 6-1).

The elevated areas of the Northern Emplacement and the open cut infill area to the east of the Northern Emplacement would be revegetated with native tree, shrub and grass species to achieve a native woodland/forest post-mining land use. Revegetation of these landforms would aim to integrate with the Leard State Forest.

Sediment dams to the west and south of the Northern and Southern Emplacements would be retained in the final landform until runoff water quality is similar to runoff water quality from similar landforms outside the Modification areas. Some dams may also be retained in the Modification final landform as a water source for fauna or for agricultural use (refer to Domain 5D – Water Management Infrastructure).

Integration with Boggabri Coal Mine

The final landform design concept for the southern extent of the Boggabri Coal Mine waste rock emplacement includes similar slope angles to the Modification Northern Emplacement (i.e. approximately 10^{o} or shallower). The Boggabri Coal Mine waste rock emplacement would generally have an east-west orientation and a maximum height of 395 m AHD.

TCPL would continue to implement the Tarrawonga Boggabri Common Boundary Integrated Management Plan, with BCOPL, to guide rehabilitation of the northern extent of the Northern Emplacement. The Tarrawonga Boggabri Common Boundary Integrated Management Plan was prepared in consultation with the then NSW Department of Trade and Investment – Division of Resources and Energy and endorsed by both BCOPL and TCPL in August 2015. The Tarrawonga Boggabri Common Boundary Integrated Management Plan would be reviewed and revised if necessary, to incorporate the Modification. TCPL would continue to consult with BCOPL regarding the implementation of the Tarrawonga Boggabri Common Boundary Integrated Management Plan.

A rock-lined drainage corridor located between the Modification Northern Emplacement and the Boggabri Coal Mine waste rock emplacement would facilitate drainage from these landforms to a series of sediment basins/farm dams to the east of the Modification Northern Emplacement (Figure 6-1). Riparian vegetation including species characteristic of natural riparian systems in the local area would be planted in the surrounds of the drainage corridor.

Southern Emplacement

The Southern Emplacement would be integrated with the Northern Emplacement as part of the Modification.

The top surface of the Southern Emplacement would include a swale drain with engineered rock-lined drop structures to facilitate drainage from the top surface down the emplacement batters. Flows would then be captured within the emplacement toe drain or within several shallow sediment basins to the south of the emplacement (Figure 6-1). Runoff from these drainage paths would eventually enter Goonbri Creek, consistent with the currently approved rehabilitation strategy.

The Southern Emplacement would be constructed predominantly with batter slopes of 10^{o} or shallower.

The Southern Emplacement would be revegetated with native tree, shrub and grass species to achieve a native woodland/forest post-mining land use.

Domains 2B and 3B – Former Infrastructure Areas and Former Stockpile Areas

Consistent with the approved rehabilitation strategy, the approved mine facilities area and operational infrastructure would be removed at the end of the mine life, including:

- coal and gravel crushing, screening and loadout infrastructure;
- administration and workshop buildings and stores;
- heavy vehicle servicing, parking and washdown facilities;
- sewage treatment facilities; and
- hydrocarbon and dangerous goods storage facilities.

During the decommissioning phase, the priority would be to dismantle fixed equipment and infrastructure for removal from site and re-use at another location or recycle.

Non-salvageable/non-recyclable infrastructure would be disposed of at suitable off-site disposal areas, or on-site, subject to demonstration that no land contamination risk would be posed and relevant approvals are obtained.

Land contamination assessments would be conducted and any contaminated soil would be remediated in accordance with the relevant EPA guidelines (under the EP&A Act and the NSW *Contaminated Land Management Act, 1997*).

Some concrete hardstands, internal access roads, sheds, buildings and sediment dams may be retained for post-mining land uses, if agreed with the relevant regulatory authorities and the ultimate landholder.

Once all equipment and infrastructure components have been removed and any contaminated land has been remediated, the approved mine facilities area and any access roads no longer required would be deep ripped, topsoiled and seeded with pasture species for use as agricultural land suitable for managed livestock grazing. Any undisturbed areas within the approved mine facilities area would remain undisturbed. Similarly, former soil stockpile areas would also be deep ripped, topsoiled and seeded with pasture species for agricultural use.

Domain 4C – Final Void

Consistent with the approved Tarrawonga Coal Mine, a final void would remain at the eastern extent of the open cut at the cessation of mining (Figure 6-1). The location of the final void, however, would move to the west due to the reduction in the open cut extent proposed for the Modification.

The geotechnical stability of the highwall on the eastern and northern sides of the final void would be improved as part of the Modification by benching these sides and reducing the overall slope from approximately 60º approved under the Tarrawonga Coal Project EA (TCPL, 2012) to approximately 48º. The overall slope of the western and southern sides of the final void would remain unchanged compared to the approved Tarrawonga Coal Mine at approximately 10° to 15°.

The catchment area of the final void would continue to be defined by diversion channels (Figure 6-1) and is expected to be approximately 123 ha (a reduction of 32 ha of catchment reporting to the final void compared to the approved Tarrawonga Coal Mine). A permanent flood bund may be required along a section of the modified final void. The extent of the flood bund would be subject to 2-dimensional flood modelling (Section 2.4.1).

Inflows into the final void would comprise incident rainfall, runoff and groundwater (including waste rock emplacement infiltration). Once mining operations and backfilling activities in the open cut cease, inflows to the final void would no longer be collected and pumped out, and as a result, the void would gradually begin to fill with water.

Consistent with the approved Tarrawonga Coal Mine, the Modification final void would form a permanent waterbody and would reach an equilibrium level of approximately 255 to 261 mAHD (approximately 19 to 25 m below the spill level) (Appendix B). As a result, the Modification final void would create a localised groundwater sink which would prevent salts or poorer quality groundwater from migrating out from the mine area and adversely impacting the beneficial use of local groundwater aquifers. An equilibrium level of the final void waterbody approaching, but below the pre-mining groundwater level would also minimise the long-term groundwater drawdown associated with the final void.

A final void water recovery analysis has been conducted as part of the Surface Water Assessment (Appendix B). The final void water recovery analysis also included simulations of the long-term salinity of the final void waterbody (Appendix B).

The void would slowly fill to the equilibrium water level of approximately 255 to 261 mAHD over a period of more than 100 years (Appendix B). The salinity of the final void waterbody is predicted to slowly increase over time, reaching some 20,000 milligrams per litre (mg/L) at the end of the recovery simulation (Appendix B). The final void waterbody is not predicted to spill under any of the simulated climatic sequences.

Final void design and mine planning would continue to be undertaken by TCPL in consultation with relevant government agencies as a component of the Rehabilitation Management Plan and MOP approval process (Section 6.6). This would include model verification and re-simulation of the behaviour of the final void waterbody using the results of the groundwater and surface water monitoring programs.

Appropriate safety bunds and/or fencing and signage would be installed around the perimeter of the void to restrict access at mine closure.

Domain 5D – Water Management Infrastructure

Water management objectives for the Modification final landform would remain unchanged. At the cessation of mining activities and once they are no longer required, mine water dams would be emptied by pumping to the final void. Any contaminated soils would be removed and/or treated. The dams would then be either retained for future use as water storages for livestock watering (as agreed with relevant regulatory authorities and the ultimate landholder), or they would be filled and/or reprofiled and revegetated.

Sediment dams would be retained pending the achievement of long-term acceptable water quality in runoff from rehabilitated landforms.

As described in Section 2.4.1, a permanent flood bund may be required to prevent inundation of the final void from Goonbri Creek. The permanent flood bund would be designed to an extent and height that would provide protection against the peak flood height associated with a PMF event. 2-dimensional modelling would be undertaken to confirm the flood bund design. The bund would be revegetated with select species that would assist to maintain the long-term stability of the bund.

6.4 GENERAL REHABILITATION PRACTICES AND MEASURES

The following sub-sections summarise the rehabilitation practices and measures that would continue to be implemented for the Modification.

The success of progressive rehabilitation activities would be regularly evaluated throughout the mine life and the results would be used to inform future rehabilitation initiatives.

6.4.1 Vegetation Clearing Measures

Vegetation clearance would continue to be undertaken progressively (as required) and the area cleared at any particular time would generally be no greater than that required to accommodate the mine's needs for the following twelve months. Areas to be cleared would be delineated, restricting clearing to the minimum area necessary to undertake the approved activities.

Vegetation clearance protocols are documented in the Biodiversity Management Plan and would be used to minimise impacts on flora and fauna. Key components of the vegetation clearance protocols include aspects such as the clear delineation of areas to be cleared of native remnant vegetation, timing and methods to be used, pre-start clearing inspections by a suitably qualified ecologist to minimise impacts on threatened species, and re-use of cleared vegetation debris in revegetation programs.

6.4.2 Soil Management

Soil Management Strategies

The currently approved soil management strategies for the Tarrawonga Coal Mine would continue to be implemented for the Modification.

Management measures that would be implemented during the stripping of soils include:

- Areas of disturbance would be stripped progressively, as required, to reduce potential erosion and sediment generation, and to minimise the extent of topsoil stockpiles and the period of soil storage.
- Areas of disturbance requiring soil stripping would be clearly defined following vegetation clearing.
- Topsoil and subsoil stripping during periods of high soil moisture content (i.e. following heavy rain) would be avoided, wherever practicable, to reduce the likelihood of damage to soil structure.
- In preference to stockpiling, stripped soil would be directly replaced on completed sections of the final landforms where available.

Any long-term soil stockpiles would be managed to maintain long-term soil viability through the implementation of the following management practices:

- Soil stockpiles would be limited to a maximum height of 3 m, with slopes no greater than 1:2 (V:H) and a slightly roughened surface to minimise erosion.
- Soil stockpiles would be constructed to minimise erosion, encourage drainage, and promote revegetation.
- Ameliorants such as lime, gypsum and fertiliser would be applied to the stockpiles where needed to improve the condition of the stripped soil.
- Wherever practicable, soil would not be trafficked, deep ripped or removed in wet conditions to avoid breakdown in soil structure.
- Soil stockpiles would be seeded with a non-persistent cover crop to reduce erosion potential as soon as practicable after stockpiling.
- Soil stockpiles would be located in positions to avoid surface water flows.
- An inventory of soil resources (available and stripped) would be maintained and reconciled annually with rehabilitation requirements.
- Weed control programs would be implemented on soil stockpiles if required.

Soil re-application depths would generally be to a depth of approximately 150 to 200 mm on the open cut infill area to be rehabilitated to agricultural land, and a depth of approximately 0.2 m to be used on woodland rehabilitation areas and other disturbance areas (e.g. former infrastructure areas).

Details of available soil resources, stripping and re-application schedules, and stockpiling inventories would be included in the MOP, and a summary of annual soil management activities would be provided in the Annual Review.

6.4.3 Progressive Rehabilitation

Once mine landform areas are no longer active, these areas would be rehabilitated according to its relevant post-mining land use, either native woodland/forest or pasture/agricultural land.

As an area becomes available for rehabilitation, initial rehabilitation would involve re-profiling the area according to final landform design criteria, re-spreading soil and applying ameliorants which are then deep-ripped along the contour to create a friable soil surface to optimise water infiltration and soil-seed contact. Seed/cover crops are then established following placement of habitat features (e.g. stags, logs).

Indicative progressive areas of rehabilitation for Years 3 and 7 of the Modification are shown on Figures 2-1 and 2-2, respectively. These areas are subject to the further detailed mine planning that would be presented in the MOP.

Descriptions of site rehabilitation stages and campaigns and rehabilitation performance would continue to be described in the Annual Review.

6.4.4 Selection of Native Plant Species for Revegetation

Areas to be revegetated with native vegetation and fauna habitat would initially be stabilised with a non-persistent crop cover. Native tube stock and/or seeds would then be planted/seeded into the rehabilitation areas.

An indicative list of revegetation species for native woodland/forest areas has been developed and includes (TCPL, 2019a):

- Poplar Box (*Eucalyptus populnea*);
- White Box (*Eucalyptus albens*);
- Narrow-leaved Ironbark (*Eucalyptus pilligaenensis*);
- Belah (*Casuarina cristat*);
- Silver Wattle (*Acacia dealbata*);
- White Cypress Pine (*Callitris glaucophylla*);
- Three-awn Speargrass (*Aristida vagans*); and
- Slender Stackhousia (*Stackhousia viminea*).

The revegetation species list includes species characteristic of the Poplar Box Woodland EEC (e.g. Poplar Box overstorey as well as appropriate understorey) and includes species potentially suited to the slope, aspect, soils and substrate of the final landforms to be rehabilitated to native woodland/forest. Drought tolerance has also been considered in native species selection.

The list of suitable native plant species for revegetation of native woodland/forest areas would continue to be provisional and be informed by rehabilitation performance monitoring (on-site and at other nearby Whitehaven operations) and results from relevant research, and in consultation with relevant regulatory agencies as part of the MOP and Rehabilitation Management Plan approval process.

Consistent with the approved rehabilitation strategy, prior to the commencement of revegetation activities in the portion of the Northern Emplacement that extends into Leard State Forest, TCPL would consult with Forestry Corporation of NSW with regard to the revegetation species list, and in particular, the inclusion of tree species that would be suitable for harvesting as timber products in the future.

As described in Section 6.3.3, TCPL would also continue to implement the Tarrawonga Boggabri Common Boundary Integrated Management Plan with BCOPL, which includes revegetation integration measures for both the southern extent of the BCM waste rock emplacement and the Tarrawonga Coal Mine Northern Emplacement.

6.4.5 Re-establishment of Agricultural Land

The assessment of the physical and chemical properties of the soils within the Tarrawonga Coal Mine area (Resource Strategies, 2011) has established that the soils within ML 1693 would be a suitable rehabilitation medium for agricultural land uses post-mining. The soil characteristics are considered to be suitable for this purpose by McKenzie Soil Management (2011) as they have:

- favourable pH values;
- are non-saline;
- their exchangeable sodium percentage values are low enough to be treated easily with coarse-grade gypsum;
- their cation exchange capacity allows for natural decompaction through shrink-swell processes; and
- the favourable properties of these soils would not be modified greatly during stripping, stockpiling and re-spreading.

As described in Section 6.3, the lower flat areas on the open cut infill area would be revegetated with pasture species that would be suitable for sustainable and managed livestock grazing (Figure 6-1). These lower flat areas would be prepared with a total soil profile depth of approximately 150 to 200 mm overlaid on mine waste rock.

Approximately 105 ha of agricultural land suitable for grazing would be re-established on the lower flat areas on the open cut infill area. The approved mine facilities area and former stockpile areas would also be revegetated to an agricultural post-mining land use suitable for grazing. When combined, the Modification would provide approximately 257 ha of rehabilitated land suitable for grazing (i.e. an increase of 47 ha of agricultural land compared to the approved Tarrawonga Coal Mine).

6.4.6 Erosion and Sediment Control System

The site erosion and sediment control system would continue to be managed through the Erosion and Sediment Control Plan, which would be progressively developed and approved (as part of the Water Management Plan) over the life of the Modification. The erosion and sediment control system would be updated periodically to address changes over the mine life. The effectiveness of the system would be assessed through regular monitoring.

The operational sediment and erosion control structures (e.g. sediment dams) would be retained and maintained during the revegetation establishment phase. As described in Section 6.3, following the establishment of self-sustaining, stable final landforms, key elements of the operational sediment control structures would either be left as passive water control storages or would be removed.

6.4.7 Weed and Vertebrate Pest Management

Weed and vertebrate pest management would continue to be implemented for the Modification in accordance with the MOP and Rehabilitation Management Plan to prevent the spread of weeds off-site and the introduction of new weeds onto the site.

Weed control would be implemented as required and any weeds present would be controlled (e.g. if a Priority Weed is found on-site, or if weeds are considered likely to impact on revegetation success).

Weed and vertebrate pest management measures would include:

- Treatment of weeds on topsoil stockpiles prior to re-spreading in rehabilitation areas.
- Inspect and wash down plant and equipment prior to mobilisation to rehabilitation areas.
- Maximising the retention of groundcover (cover crop stubble) when planting tubestock to minimise opportunities for weed activity.
- Installation of fauna exclusion fencing and/or tree guards for newly planted tubestock where predation by grazing herbivores represents a risk to establishment.
- Trapping and/or baiting of animal pests in accordance with the Tarrawonga Coal Mine Biodiversity Management Plan (Eco Logical, 2015).

6.5 REHABILITATION MONITORING PROGRAMME

A rehabilitation monitoring programme has been developed for the Tarrawonga Coal Mine and would continue to be implemented for the Modification.

The rehabilitation monitoring programme is conducted to:

- assess and track the performance of rehabilitated areas against the rehabilitation completion criteria (Section 6.5.1);
- evaluate the effectiveness of rehabilitation techniques used (i.e. success of initial cover crop, success of tree and shrub tubestock plantings, adequacy of drainage controls, and the general stability of the rehabilitation site);
- monitor any potential threats to rehabilitation success (e.g. weed incursion, pest species, dispersive soils, evidence of erosion/sedimentation); and
- determine the requirement for ameliorative/contingency measures such as thinning to reduce the density of revegetated areas, or additional plantings in areas where vegetation establishment has been sub-optimal.

The rehabilitation monitoring program includes regular inspections of rehabilitation areas by TCPL personnel (to observe overall performance and stability of the area) and annual revegetation monitoring surveys undertaken by suitably qualified and experienced specialists. The revegetation monitoring surveys are conducted in accordance with the BAM and include the assessment of fixed monitoring plots in rehabilitation areas against the rehabilitation performance indicators and completion criteria (Section 6.5.1)

Details of the rehabilitation monitoring programme are provided in the MOP and Rehabilitation Management Plan.

A detailed rehabilitation monitoring report would continue to be prepared annually that includes a summary of previous monitoring reports, results of the current year's monitoring and planned remedial works, if required. Results of the monitoring program would be summarised in the Annual Review.

6.5.1 Rehabilitation Performance Indicators and Completion Criteria

Provisional rehabilitation performance indicators and completion criteria have been developed for the Tarrawonga Coal Mine Overburden Emplacement Native Woodland/Forest Domain areas and are provided in Table 6-3. These indicators and criteria have been developed consistent with the methodology provided in the DTIRIS (2013) *ESG3: Mining Operations Plan (MOP) Guidelines* and were developed in consultation with the OEH in 2018.

The vegetation indicators and criteria for the Ecosystem Establishment and Ecosystem Sustainability phases are interim/provisional and have been based on benchmark values for the target biometric vegetation communities given site-specific data from reference sites located within local vegetation communities are currently being collected. Once local reference site data has been collated, site-specific rehabilitation completion criteria for the Overburden Emplacement Native Woodland/Forest Domain areas will be developed.

In addition, rehabilitation performance indicators and completion criteria relevant to Pasture/Agricultural Land areas will also be developed.

Rehabilitation completion criteria for all rehabilitation domains for the Modification will be developed and determined in consultation with relevant regulatory agencies and will be subject to approval by the Resources Regulator and DPIE as part of the MOP and Rehabilitation Management Plan approval process (Section 6.6).

6.6 MINING OPERATIONS PLAN AND REHABILITATION MANAGEMENT PLAN

A MOP describes how rehabilitation is undertaken, details rehabilitation performance and completion criteria and addresses other aspects of rehabilitation including mine closure, final landform concepts and final land use(s).

A revised MOP would be prepared to reflect the Modification in consultation with, and subject to approval by, the NSW Resources Regulator. The revised MOP would be prepared in accordance with the Resources Regulator's *ESG3: Mining Operations Plan (MOP) Guidelines* (DTIRIS, 2013), and would include:

- details of the proposed mining and rehabilitation activities during the MOP term;
- identification of relevant environmental and rehabilitation risks and risk mitigation/treatment methods;
- a description of the post-mining land use(s) and overall rehabilitation objectives for the Modification;
- rehabilitation domains and rehabilitation objectives for each domain;
- rehabilitation performance indicators and completion criteria relevant to the rehabilitation domains;
- details of the rehabilitation activities and methods to be implemented during the MOP term; and
- a description of the rehabilitation monitoring program methodology and location of rehabilitation and reference/analogue monitoring sites.

A Rehabilitation Management Plan would also be developed for the Modification and would be either incorporated within, or consistent with, the MOP.

Table 6-3
Provisional Rehabilitation Objectives, Performance Indicators and Completion Criteria for Native Woodland/Forest Areas

Rehabilitation Objective	Performance Indicator	Completion Criteria
Phase – Decommissioning		
All mine-related infrastructure removed from the site and disposed of at an appropriate facility, relocated to another Whitehaven site, or sold.	Communications, power supply, water supply, and water management services and infrastructure removed.	All infrastructure components dismantled and/or removed from the site unless otherwise agreed with the Administering Authority and landholder.
	Offices, workshops and other buildings removed.	
	Fuel, chemical, explosive storage tanks and containers removed.	
	Roads and rail infrastructure removed.	
	Flammable and hazardous materials such as hydrocarbons, chemicals and explosives removed from site.	
All hazardous materials removed and contaminated areas remediated.	Areas where hazardous materials have been stored or transferred have been assessed for contamination and remediated if required.	Land contamination assessments and remediation (if necessary) conducted in accordance with the relevant legislative requirements.
Groundwater bores and piezometers decommissioned and sealed if no longer required for monitoring or water supply purposes.	Groundwater bores and piezometers stand pipes removed and sealed in accordance with relevant guidelines.	Bentonite seal installed, standpipe and piezometer 'cap' removed and cement grout installed to the surface.
Phase – Landform Establishment		
Mine landform integrates with surrounding landscape and is stable.	Minimal active erosion.	Absence of gullies > 200 mm wide or deep, or gullies are stable.
		Absence of tunnel erosion intake or outlet points.
		Landform has an average overall slope of 10 degrees.
Water quality is non-polluting, similar to water runoff quality from other similar features in the surrounding landscape and appropriate for conservation post-mining land use.	Water quality.	Oil/grease ≤ 10 mg/L.
		EC < 600 µS/cm.
		pH between 6.5 and 8.5.
		TSS < 50 mg/L.
Phase – Growth Medium Development		
Soils ameliorated to sustain native woodland/forest ecosystem.	Re-placed soil depth.	The depth and layering of respread subsoil and topsoil are in accordance with approved rehabilitation concepts.
	Soil physical and chemical properties, including pH, organic matter and phosphorous.	Soil properties are suitable for the establishment and maintenance of selected vegetation species.

Table 6-3 (continued)
Provisional Rehabilitation Objectives, Performance Indicators and Completion Criteria for Native Woodland/Forest Areas

Rehabilitation Objective	Performance Indicator	Completion Criteria
Phase – Ecosystem Establishment[1]		
Native Woodland/Forest rehabilitation is on a trajectory towards a self-sustaining ecosystem and characteristics of the local analogue vegetation communities.	Native Species Richness.	Increase to at least 10% of lower benchmark.
	Native Overstorey Cover.	Increase to at least 10% of lower benchmark.
	Native Mid-storey Cover.	Increase to at least 10% of lower benchmark.
	Native Groundcover (Grasses).	Increase to at least 10% of lower benchmark.
	Native Groundcover (Shrubs).	Increase to at least 10% of lower benchmark.
	Native Groundcover (Other).	Increase to at least 10% of lower benchmark.
	Exotic Plant Cover.	Decreasing number and cover of exotic species.
Phase – Ecosystem Sustainability[1]		
Vegetation of Native Woodland/Forest rehabilitation is developing structure and composition comparable to that of the analogue local vegetation communities.	Native Species Richness.	Increase to at least 80% of lower benchmark.
	Native Overstorey Cover.	Increase to at least 80% of lower benchmark.
	Native Mid-storey Cover.	Increase to at least 80% of lower benchmark.
	Native Groundcover (Grasses).	Increase to at least 80% of lower benchmark.
	Native Groundcover (Shrubs).	Increase to at least 80% of lower benchmark.
	Native Groundcover (Other).	Increase to at least 80% of lower benchmark.
	Exotic Plant Cover.	Less than 10% of domain area.
	% Canopy Recruitment.	Some natural regeneration of Eucalypt canopy species present.
Phase – Relinquishment		
Rehabilitation site meets all relevant completion criteria and is capable of sustaining the post-mining land use.	Achievement of completion criteria.	All relevant completion criteria for the site have been satisfied, or the relevant Minister(s) otherwise accept the rehabilitation status.

Source: TCPL (2019a).

[1] Performance indicators and completion criteria provided are provisional/interim and have been based on the vegetation condition benchmark values for the target biometric vegetation communities using the methodology provided in Table 6 of the OEH (2014) Framework for Biodiversity Assessment (OEH, 2017). Local site-specific completion criteria and performance indicators will be developed from data collected from local reference site vegetation communities.

In accordance with Condition 64, Schedule 3 of PA 11_0047, the Rehabilitation Management Plan would be prepared in consultation with the DP&E (now DPIE), Forestry Corporation of NSW, NSW Department of Industry – Lands and Water Division (now within DPIE), DPIE – Biodiversity and Conservation Division (formerly the OEH), Local Lands Services and the NSC, and to the satisfaction of the DRG.

6.7 PLANNING FOR MINE CLOSURE

Planning for mine closure would be conducted over the life of the mine, in consultation with the NSC, DPIE, Resources Regulator and the CCC, and would consider the amelioration of potential adverse socio-economic effects due to the reduction in employment at mine closure.

TCPL's mine closure goal for the Modification is that the status of the site at relinquishment will be to the satisfaction of the relevant Minister(s) and that all relevant mining tenement and Project Approval conditions will have been met. Disturbed land would be considered suitable for surrender when the nominated rehabilitation completion criteria have been met, or if the relevant Minister(s) otherwise accept the rehabilitation status.

7 EVALUATION OF MERITS

The main activities associated with the Modification include:

- ROM coal production rate increase from 3.0 to 3.5 Mtpa;
- increase in ROM coal transported along the Northern Section of the Approved ROM Coal Transport Route from 3.0 to 3.5 Mtpa;
- reduction of the open cut extent to avoid mining:
  - the Upper Namoi alluvium; and
  - Goonbri Creek.
- revision of the post-mining landform and land use;
- relocation of the ROM coal stockpile and associated infrastructure;
- construction of a new site access road and intersection to allow haulage of ROM coal along a section of Goonbri Road; and
- construction and use of a water transfer pipeline between the Tarrawonga Coal Mine and the proposed Vickery Extension Project (which is the subject of a separate Development Application for SSD 7480[3]).

The Modification would result in no change to the following elements of the approved Tarrawonga Coal Mine:

- mine life and operating hours;
- mining tenements;
- mining methods;
- employment; and
- domestic coal production.

The approved Tarrawonga Coal Mine open cut extent would intersect the Upper Namoi alluvium and Goonbri Creek.

Condition 37, Schedule 3 of PA 11_0047 requires TCPL to construct the Goonbri Creek diversion and low permeability barrier prior to undertaking any mining operations within 200 m of the regionally mapped Upper Namoi alluvium. Other associated works would include realignment of a section of Goonbri Road and an 11 kilovolt electricity transmission line. TCPL considers the capital costs of these works to be economically prohibitive. In the absence of these capital works, TCPL would cease mining at 200 m from the Upper Namoi alluvium under PA 11_0047.

The Modification proposes mining of coal within 200 m of the Upper Namoi alluvium (but would avoid mining the Upper Namoi alluvium itself). This would allow TCPL to maximise the extraction of economic coal without the requirement to construct the infrastructure described above (i.e. the low permeability barrier, Goonbri Creek diversion, road and electricity transmission line realignments). The Modification would result in forgoing coal extraction from some areas permitted under PA 11_0047 (i.e. underlying the Upper Namoi alluvium).

TCPL would continue to monitor, mitigate and manage potential environmental impacts in accordance with their management plans and relevant environmental approvals, which would be reviewed and updated to incorporate the Modification.

7.1 JUSTIFICATION FOR MODIFICATION APPROVAL

Approval of the proposed changes to the Tarrawonga Coal Mine for the Modification is considered to be justified given it would:

- maximise the economic recovery of coal within the approved open cut extent by seeking approval to mine within 200 m of the Upper Namoi alluvium (but would avoid mining the Upper Namoi alluvium itself), while avoiding economically prohibitive capital costs;
- reduce some potential environmental effects associated with mining the Upper Namoi alluvium and Goonbri Creek (i.e. potential impacts on water resources) and associated surface disturbance;

[3] The Vickery Extension Project (SSD 7480) is a proposed extension of the approved Vickery Coal Mine and was submitted to the DPIE (formerly DP&E) on 14 August 2018.

- reduce the total surface disturbance by approximately 87 ha, including avoidance of productive agricultural land associated with Goonbri Creek;
- provide more efficient coal extraction via an increase in the ROM coal mining rate from 3.0 to 3.5 Mtpa;
- provide an alternative contingency water supply from surplus water from the proposed Vickery Extension Project (subject to the Vickery Extension Project's approval, commissioning and water extraction/licensing limits);
- allow the Tarrawonga Coal Mine to operate consistent with all other existing environmental limits for the Tarrawonga Coal Mine.

It is therefore considered that the Modification is justified on environmental, economic and social grounds.

8 REFERENCES

AMBS Ecology & Heritage (2018) p*ers. comms.*

AMBS Ecology & Heritage (2019) *Tarrawonga Coal Mine Life of Mine Modification – Biodiversity Development Assessment Report.* Report prepared for Whitehaven Coal Limited.

AnalytEcon Pty Ltd (2019) *Tarrawonga Coal Mine Life of Mine Modification – Economic Assessment.*

Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand (2000) *Australian Water Quality Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy*.

Australian Heritage Commission (2002) *Ask First: A Guide to Respecting Indigenous Heritage Places and Values.*

Australian International Council on Monuments and Sites (2013) *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance.*

Austroads (2016) *Guide to Road Design Part 3: Geometric Design.*

Austroads (2017) *Guide to Traffic Management Part 3: Traffic Studies and Analysis.*

Ball, J., Babister, M., Nathan, R., Weeks, W., Weinmann, E., Retallick M., and Testoni, I. (2019) *Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia.*

Balme, J.M. (1984) *North Central Rivers Archaeological Project: A Preliminary Pre-fieldwork Report*.

Barnett, B., Townley, L.R., Post, V., Evans, R.E., Hunt, R.J., Peeters, L., Richardson, S., Werner, A.D., Knapton, A. and Boronkay, A. (2012) *Australian Groundwater Modelling Guidelines.*

Commonwealth of Australia (2016a) *Leading Practice Sustainable Development Program for the Mining Industry – Mine Rehabilitation.*

Commonwealth of Australia (2016b) *Leading Practice Sustainable Development Program for the Mining Industry - Mine Closure.*

Department of Environment and Climate Change (2004) *National Parks and Wildlife Act 1974: Part 6 Approvals – Interim Community Consultation Requirements for Applicants*.

Department of Environment and Climate Change (2009) *Interim Construction Noise Guideline*.

Department of Environment and Conservation (2005) *Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation.*

Department of Environment, Climate Change and Water (2010a) *Aboriginal cultural heritage consultation requirements for proponents 2010.*

Department of Environment, Climate Change and Water (2010b) *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales.*

Department of Environment, Climate Change and Water (2010c) *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales.*

Department of Land and Water Conservation (2003) *Carroll to Boggabri Flood Study*.

Department of Planning and Environment (2016) *Dark Sky Planning Guideline.*

Department of Planning and Environment (2017) *Social Impact Assessment Guideline for State significant mining, petroleum production and extractive industry development - September 2017.*

Department of Planning and Environment (2018) *Technical Notes Supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*.

Department of the Environment (2016) *Engage Early: Guidance for proponents on best practice Indigenous engagement for environmental assessments under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).*

Department of Trade and Investment, Regional Infrastructure and Services (2013) *ESG3: Mining Operations Plan (MOP) Guidelines.*

Department of Urban Affairs and Planning and Environment Protection Authority (1998) *Managing Land Contamination – Planning Guidelines SEPP 55 – Remediation of Land*.

Eco Logical Australia (2015) *Tarrawonga Biodiversity Management Plan.* Report prepared for Whitehaven Coal Limited.

Eco Logical Australia (2017a) *Tarrawonga Coal Mine – Rehabilitation Monitoring Report Spring 2016.* Report prepared for Whitehaven Coal Limited.

Eco Logical Australia (2017b) *Canyon Coal Mine – Rehabilitation Monitoring Report Spring 2016*. Report prepared for Whitehaven Coal Limited.

Eco Logical Australia (2018) *Rehabilitation Gap Analysis Action Plan – Tarrawonga Coal Mine*. Prepared for Whitehaven Coal Limited.

Environment Protection Authority (2016) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*.

Environment Protection Authority (2017) *NSW Noise Policy for Industry.*

Gilbert & Associates (2011) *Tarrawonga Coal Project Surface Water Assessment*. Report prepared for Whitehaven Coal Limited.

Gillespie Economics (2011) *Tarrawonga Coal Project Socio-Economic Assessment.* Report prepared for Whitehaven Coal Limited.

GSS Environmental (2011) *Rocglen Coal Mine Extension Project Environmental Assessment – Rehabilitation and Decommissioning Strategy*. Report prepared for Whitehaven Coal Limited.

Haglund, L. (1985) *Archaeological investigations of areas that may be affected by proposed mining for coal in the Gunnedah area, NSW*. Unpublished report to the Vickery Joint Venture.

Halcrow (2011) *Tarrawonga Coal Project Road Transport Assessment.* Report prepared for Whitehaven Coal Limited.

Heritage Computing (2012) *Tarrawonga Coal Project Groundwater Assessment.* Report prepared for Whitehaven Coal Limited.

Hydro Engineering and Consulting (2019) *Tarrawonga Coal Mine Life of Mine Modification Surface Water Assessment and Site Water Balance.* Report prepared for Whitehaven Coal Limited.

HydroSimulations (2019) *Tarrawonga Coal Mine Life of Mine Modification: Groundwater Assessment.* Report prepared for Whitehaven Coal Limited.

Idemitsu Australia Resources Pty Limited and Whitehaven Coal Limited (2014) *Blast Management Strategy For Boggabri – Tarrawonga Maules Creek Complex.*

Idemitsu Australia Resources Pty Limited and Whitehaven Coal Limited (2017a) *Noise Management Strategy For Boggabri – Tarrawonga Maules Creek Complex.*

Idemitsu Australia Resources Pty Limited and Whitehaven Coal Limited (2017b) *Air Quality Management Strategy For Boggabri – Tarrawonga Maules Creek Complex.*

Idemitsu Australia Resources Pty Limited and Whitehaven Coal Limited (2019) *Boggabri Tarrawonga Maules Creek Complex Water Management Strategy.* Report prepared for Whitehaven Coal Limited.

International Council on Mining and Metals (2018) *Integrated Mine Closure Good Practice Guide 2nd Edition*.

Kamminga, J. (1978) *Amax Proposed Coal Mining Operation at Boggabri.*

Landcom (2004) *Managing Urban Stormwater: Soils & Construction Volume 1, 4th edition, March.*

Lloyd Consulting Pty Ltd (2011) *Tarrawonga Coal Project Land Contamination Assessment.* Report prepared for Whitehaven Coal Limited.

McKenzie Soil Management Pty Ltd (2011) *Agricultural Resource and Productivity Assessment: Tarrawonga Coal Project, Boggabri NSW*.

Minerals Council (2010) *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects.*

National Parks and Wildlife Service (1997) *Aboriginal Cultural Heritage: Standards and Guidelines Kit.*

New South Wales Government (2012) *NSW Aquifer Interference Policy: NSW Government policy for the licensing and assessment of aquifer interference activities*.

New South Wales Government (2015) *Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals.*

New South Wales Government (2018) *Voluntary Land Acquisition and Mitigation Policy For State Significant Mining, Petroleum and Extractive Industry Developments.*

Office of Environment and Heritage (2011) *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW.*

Office of Environment and Heritage (2014) *Framework for Biodiversity Assessment.*

Office of Environment and Heritage (2017) *Biodiversity Assessment Method.*

PAEHolmes (2012) *Tarrawonga Coal Project – Air Quality and Greenhouse Gas Assessment.* Report prepared for Whitehaven Coal Limited.

Ramboll (2019) *Tarrawonga Coal Mine Life of Mine Modification Air Quality and Greenhouse Gas Assessment.* Report prepared for Whitehaven Coal Limited.

Resource Strategies Pty Ltd (2011) *Tarrawonga Coal Project Agricultural Resources and Productivity Assessment.*

SESL Australia (2018) *Vickery Extension Project Land Contamination Assessment.* Report prepared for Whitehaven Coal Limited.

SLR Consulting (2019) *Alluvial Boundary Assessment Tarrawonga Coal Mine.*

Tarrawonga Coal Pty Ltd (2010) *Tarrawonga Coal Mine Annual Environmental Management Report 2009 – 2010.*

Tarrawonga Coal Pty Ltd (2012) *Tarrawonga Coal Project – Environmental Assessment.*

Tarrawonga Coal Pty Ltd (2014a) *Tarrawonga Coal Mine Noise Management Plan*.

Tarrawonga Coal Pty Ltd (2014b) *Tarrawonga Coal Mine Blast Management Plan*.

Tarrawonga Coal Pty Ltd (2015a) *Tarrawonga Coal Mine Air Quality and Greenhouse Gas Management Plan*.

Tarrawonga Coal Pty Ltd (2015b) *Tarrawonga Coal Mine Heritage Management Plan*.

Tarrawonga Coal Pty Ltd (2018) *Water Management Plan.*

Tarrawonga Coal Pty Ltd (2019a). *Mining Operations Plan - Tarrawonga Coal Mine - 1 November 2015 to 30 November 2020*.

Tarrawonga Coal Pty Ltd (2019b) *Tarrawonga Coal Mine, Annual Review 2018*.

The Transport Planning Partnership (2019) *Tarrawonga Coal Mine Life of Mine Modification Road Transport Assessment.* Report prepared for Whitehaven Coal Limited.

Umwelt (Australia) Pty Limited (2017) *Leard Forest Regional Biodiversity Strategy Stage 2 – Strategy Report.*

University of Queensland Cultural and Heritage Unit (2017) *Aboriginal Heritage Conservation Strategy: Maules Creek Coal Mine, Tarrawonga Coal Project, Boggabri Coal Mine, and Related Biodiversity Offset Areas*.

Urbis Pty Ltd (2011) *Tarrawonga Coal Project Visual Assessment.* Report prepared for Whitehaven Coal Limited.

Whincop Archaeology Pty Ltd (2019) *Aboriginal Cultural Heritage Assessment for the Tarrawonga Coal Mine Life of Mine Modification in the Narrabri Shire, New South Wales.* Report prepared for Whitehaven Coal Limited.

Whitehaven Coal Limited (2017) *Traffic Management Plan for the Tarrawonga Coal Mine.*

Whitehaven Coal Limited (2018a) *Vickery Extension Project – Environmental Impact Statement*.

Whitehaven Coal Limited (2018b) *Vickery Extension Project – Agricultural Impact Statement*.

Whitehaven Coal Limited (2019) *Vickery Extension Project – Submissions Report*.

Wilkinson Murray (2011) *Tarrawonga Coal Project Environmental Assessment Noise and Blasting Impact Assessment.* Report prepared for Whitehaven Coal Limited.

Wilkinson Murray (2019) *Tarrawonga Coal Mine - Life of Mine Modification Noise Assessment.* Report prepared for Whitehaven Coal Limited.