



INVINCIBLE COLLIERY & CULLEN VALLEY MINE

ENVIRONMENTAL ASSESSMENT
Modifications to PA 07_127 and DA 200-5-2003

for

Coalpac Pty Limited (Administrators Appointed)

March 2014

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

ENVIRONMENTAL ASSESSMENT

INVINCIBLE COLLIERY PA 07_0127 MODIFICATION

AND

CULLEN VALLEY MINE DA 200-5-2003 MODIFICATION

Prepared by:

HANSEN BAILEY
6 / 127 - 129 John Street
SINGLETON NSW 2330

March 2014

for:

COALPAC PTY LIMITED
(Administrators Appointed)
Castlereagh Highway
CULLEN BULLEN NSW 2790

EXECUTIVE SUMMARY

INTRODUCTION

Coalpac Pty Limited (Administrators Appointed) (Coalpac) owns and operates Invincible Colliery and Cullen Valley Mine, located approximately 25 km north-west of Lithgow, NSW. Both operations are near the township of Cullen Bullen, with Cullen Valley Mine and Invincible Colliery located to the north-west and south-east, respectively. Invincible Colliery has been owned and operated by Coalpac since 1988 and Cullen Valley Mine was acquired by Coalpac in 2007.

Current operations at both sites are undertaken in accordance with:

- Project Approval 07_0127 for Invincible Colliery, which was granted on 4 December 2008 by the (then) NSW Minister for Planning under Section 75J in Part 3A of the Environmental Planning and Assessment Act 1979; and
- Development Consent DA 200-5-2003 for Cullen Valley Mine, which was granted on 19 August 2004 by the (then) NSW Minister for Planning under Section 80 in Part 4 of the Environmental Planning and Assessment Act 1979.

Due to the delay in obtaining a major new planning approval for the long term continuation of mining, both mines have recently been placed on care and maintenance, placing pressure upon the Mount Piper Power Station which relies on the mines for a significant proportion of its competitively priced fuel supply requirements. Further to this, the unforseen objections to the continuation of both mining operations have reduced the ability to create an optimal free draining final landform in rehabilitating the existing disturbed areas.

MODIFICATIONS

Modifications to both the existing approvals are required concurrently for Invincible Colliery and Cullen Valley Mine to meet the short term coal supply quality and quantity requirements of the nearby Mount Piper Power Station. These two Modifications have also been specifically designed to achieve an optimised free draining final landform outcome for both existing mining areas as well as the additional areas proposed to be disturbed. The Modifications will support these outcomes via extraction of a 9 million tonne coal resource from areas adjacent to the existing operations of Invincible Colliery and Cullen Valley Mine within current approval criteria, whilst minimising impacts to environmentally sensitive areas.

The Modification of PA 07_0127 for Invincible Colliery seeks approval for the following:

- Extension to the life of PA 07_0127 for four years from December 2016 to December 2020;
- Extension of 88 ha to the 152 ha area approved for open cut mining;
- Extension of 86 ha to the area approved for highwall mining. These highwall mining operations will not result in additional surface disturbance;

- Installation of a water pipeline connecting to the existing Cullen Valley Mine water pipeline which will result in the ability to transfer water between Invincible Colliery and Cullen Valley Mine. The pipeline alignment will largely remain on or adjacent to existing access tracks within the Ben Bullen State Forest; and
- Backfilling of the proposed and residual final voids resulting from existing mining operations and the rehabilitation of areas affected by subsidence from historic underground mining operations in the area to create a free-draining final landform at the conclusion of the proposed mining activities.

The Modification of DA 200-5-2003 for Cullen Valley Mine seeks approval for the following:

- Extension of 62 ha to the 362 ha area approved for open cut mining;
- Extension of 79 ha to areas approved for highwall mining. These highwall mining operations will not result in additional surface disturbance;
- Ability to benefit from the transfer of water to and from Invincible Colliery; and
- Backfilling and rehabilitation of the proposed and residual final voids resulting from existing mining operations to create a free-draining final landform at the conclusion of the proposed mining activities.

The essential elements of the current Cullen Valley Mine and Invincible Colliery planning approvals will remain unaltered by each of the proposed Modifications.

REGULATORY FRAMEWORK

Coalpac was granted Project Approval PA 07_0127 prior to the repeal of Part 3A of the *Environmental Planning and Assessment Act 1979*. As a result, the provisions of the former Part 3A of the *Environmental Planning and Assessment Act 1979*, including Section 75W, will continue to apply.

Coalpac was granted Development Consent DA 200-5-2003 under Part 4 of the *Environmental Planning and Assessment Act 1979.* The development was classified as State Significant Development pursuant to section 76A of the *Environmental Planning and Assessment Act 1979* (as it was then). Clause 8J(8) of the *Environmental Planning and Assessment Regulation 2000* therefore enables the modification of DA 200-5-2003 under Section 75W of the *Environmental Planning and Assessment Act 1979*.

STAKEHOLDER ENGAGEMENT

The stakeholder engagement program for the proposed Modifications included consultation with Local, State and Federal government agencies, the local community and interest groups as well as Aboriginal stakeholders.

IMPACTS, MANAGEMENT AND MITIGATION

To determine the potential environmental and social impacts of the Modification, impact assessments were undertaken in relation to air quality and greenhouse gas, subsurface heating, noise, blasting, ecology, mining stability, surface and groundwater, economics, traffic, soils and land capability, visual, Aboriginal and Non-Aboriginal heritage and rehabilitation and final landform.

The impact assessments undertaken for the environmental and social issues outlined above conclude that the Modifications proposed by Coalpac will generally be consistent with Project Approval PA 07_0127 and Development Consent DA 200-5-2003, respectively.

In addition to the existing conditions of PA 07_0127 and Development Consent DA 200-5-2003 and the existing management and mitigation measures in place for both sites, Coalpac also commits to a range of additional key measures in this Environmental Assessment to ensure that the Modification's environmental impacts are minimised and that a higher quality and sustainable final landform outcome is achieved in the existing and proposed mining areas.

If approved, the additional management and mitigation measures to be put in place for the Modifications will include:

- Development of a stable, free-draining final landform in each of the proposed and existing mining areas which can support a forest and woodland landscape consistent with the surrounding lands within the Ben Bullen State Forest.
- A commitment to increasing the watering rate for unsealed roads from Level 1 to Level 2 as defined in *National Pollutant Inventory: Emission Estimation Technique for Manual for Mining*, thereby reducing air quality impacts;
- Reducing the periods during which coal mining and coal processing activities are undertaken in order to reduce noise impacts;
- Implementation of additional blast monitoring and management procedures if blasting occurs in the vicinity of rock structures and sensitive Aboriginal heritage sites;
- Minimisation of additional disturbance to forest and woodland vegetation communities to as small an area as practical (approximately 151 ha in total) and the avoidance of direct impacts to sensitive ecological areas within the Ben Bullen State Forest;
- Development and implementation of a robust Biodiversity Offset Strategy to provide compensation for the residual ecological impacts of the Modifications;
- Preparation of detailed Subsidence Management Plans for the Modifications. These documents will be prepared in consultation with the relevant regulators and will detail mining design and scheduling for each highwall mining area; and
- Implementation of bunding and tree screening to minimise visual impacts.

JUSTIFICATION

Combined, the Modifications will enable the operations at Invincible Colliery and Cullen Valley Mine to continue to supply competitively priced coal fuel to Mount Piper Power Station in the short term whilst an alternative commercially sustainable fuel supply is secured for that facility. This has the potential to avoid a subsequent impost of increased electricity prices in NSW by the provision of lower cost coal to the operator of Mount Piper Power Station.

At full production the combined operations proposed for the Modifications will also provide the following economic benefits:

- $149M in annual direct and indirect gross regional output;
- $46M in annual direct and indirect regional value added;
- $19M in annual direct and indirect household income; and
- 245 direct and indirect jobs.

The mine plans for the Modifications have also been specifically designed to enable the development of an optimum rehabilitation and final landform outcome for the existing and proposed mining areas at Invincible Colliery and Cullen Valley Mine. The open cut and highwall mining methods proposed have been planned to create surplus overburden material to reform the six existing mine voids (three at Invincible Colliery and a further three at Cullen Valley Mine).

These voids can then be rehabilitated and incorporated, together with the proposed disturbance areas, into a free draining final landform that is consistent with the surrounding landscape and capable of sustaining a native forest vegetative cover of similar composition to that in existence prior to mining.

The essential elements proposed for the Modifications remain generally unaltered from those currently approved and undertaken at Invincible Colliery and Cullen Valley Mine over an extended period with minimal impact upon the local community and the environment.

The mining activities proposed for the Modifications will be carried out in a manner consistent with the principles of Ecologically Sustainable Development and the offsetting principles of the *Environment Protection and Biodiversity Conservation Act 1999*. Further, they are consistent with the “objects” of the *Environmental Planning and Assessment Act 1979* and in the “*public interest*” and thus, it is available for them to be approved.

ENVIRONMENTAL ASSESSMENT STATEMENT

Submission of Environmental Assessment (EA)

Under section 75W of the *Environmental Planning and Assessment Act 1979*

Modification EA Prepared by	
Name:	James Bailey
Qualifications:	B. Natural Resources, MBA
Address:	Hansen Bailey Pty Limited PO Box 473 SINGLETON NSW 2330
In Respect Of:	Invincible Colliery PA 07_0127 Modification EA Cullen Valley Mine DA 200-5-2003 Modification EA
Applicant Name:	Coalpac Pty Ltd
Applicant Address:	Castlereagh Highway CULLEN BULLEN NSW 2790
Proposed modification sought:	Modification to PA 07_0127 for Invincible Colliery Modification to DA 200-5-2003 for Cullen Valley Mine Both Modifications described in **Section 3** of this EA.
Environmental Assessment:	An EA for these Modifications is attached.
Certification:	I certify that I have prepared the contents of this EA, and to the best of my knowledge: • It is in accordance with Section 75W of the *Environmental Planning and Assessment Act 1979*; • Meets the form and content of Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*; • It contains all available information that is relevant to the environmental assessment of the activity to which this Modification EA relates; and • The information contained in this Modification EA is neither false nor misleading.
Signature:	
Name:	James Bailey Director
Date:	March 2014

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1.1 BACKGROUND

Coalpac Pty Ltd (Administrators Appointed) (Coalpac) owns and operates Invincible Colliery and Cullen Valley Mine, located approximately 25 km north-west of Lithgow, NSW. Both operations, Cullen Valley Mine and Invincible Colliery, are located proximate to the township of Cullen Bullen (see **Figure 1**). Invincible Colliery has been owned and operated by Coalpac since 1988 and Cullen Valley Mine was acquired by Coalpac in 2007.

Coal mining at Invincible Colliery commenced around 1901 with an underground operation. Open cut mining has occurred variously over the long history of Invincible Colliery, most notably after the Second World War. Coalpac has conducted open cut mining at Invincible Colliery since 1998, including a period where the mine was placed under Care and Maintenance from 2001 to 2006. The current operations at Invincible Colliery were approved in 2008 via Project Approval (PA) 07_0127 (as modified).

Coal mining at the Cullen Valley Mine site commenced operations in the late 1800's within the former underground operational areas of the Tyldesley Colliery and the Great Western Mine. A range of open cut and underground mining operations have been undertaken since that time at the site which is now occupied by Cullen Valley Mine. The current operations at Cullen Valley Mine were approved in 1997 via Development Consent (DA) 200-5-2003 (as modified in 2004).

Due to the delay in obtaining a major new planning approval for the long term continuation of mining, both mines have recently been placed on care and maintenance creating difficulty for the adjacent power stations that rely on the mines for a significant proportion of their competitively priced fuel supply. Further to this, the unforseen objections to the continuation of both mining operations as a significantly larger development have placed limitations on the ability to rehabilitate the existing mined out areas and create a free draining final landform.

1.2 DOCUMENT PURPOSE

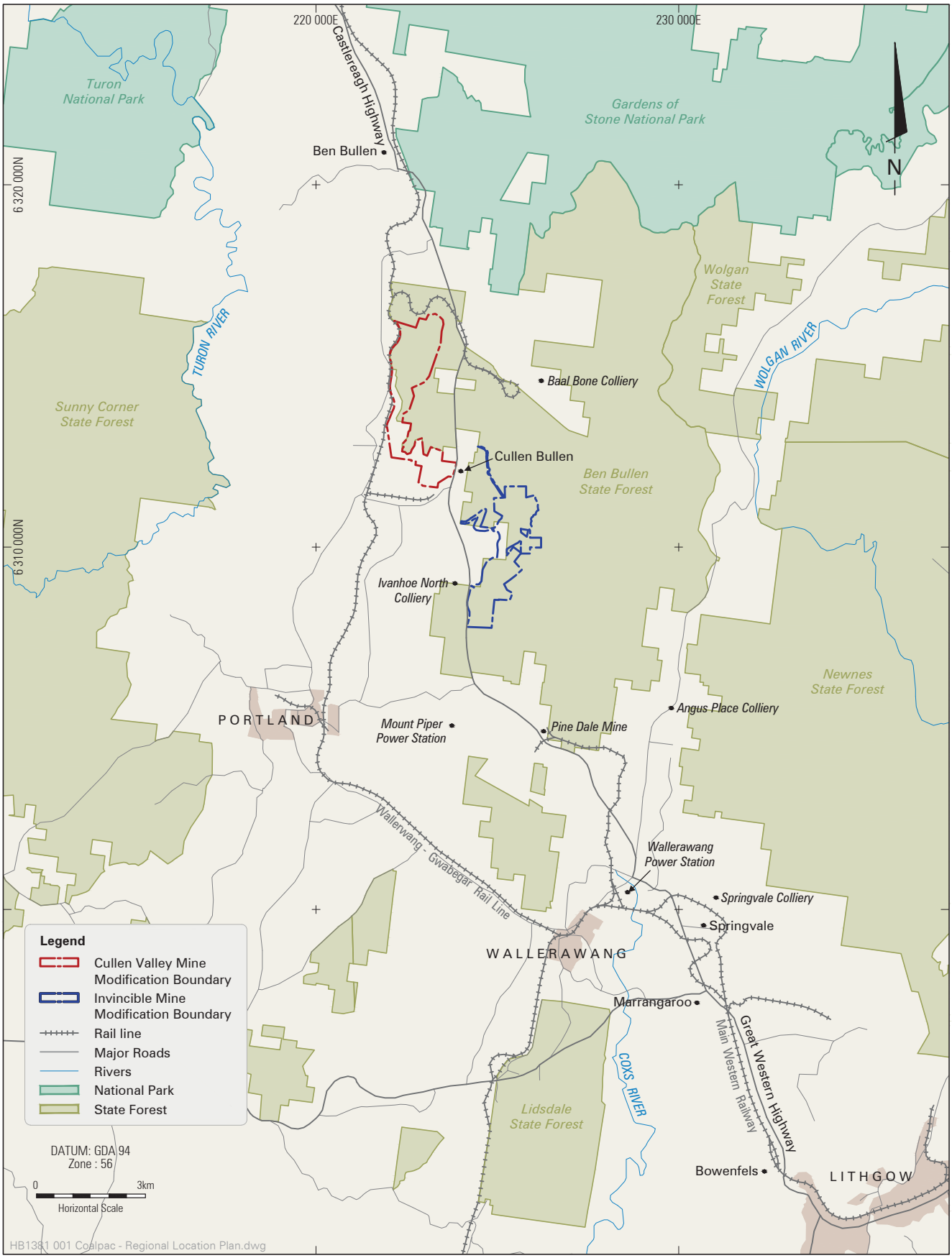
This Environmental Assessment (Modification EA) has been prepared to support applications for the Modification of the existing development approvals for Cullen Valley Mine (DA 200-5-2003) and Invincible Colliery (PA 07_0127) under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (the Modifications).

Modifications to both existing approvals are required to be able to meet the short term coal quality and quantity requirements of the nearby Mount Piper Power Station (MPPS) and to enable the realisation of a high quality rehabilitation and final landform outcome for both the proposed and existing mining areas at the conclusion of these proposed mining activities.

1.2.1 Invincible Colliery

The Modification of PA 07_0127 for Invincible Colliery seeks approval for the following:

- Extension to the life of PA 07_0127 for four years from December 2016 to December 2020;
- Extension of 88 ha to the area approved for open cut mining;



COALPAC MODIFICATIONS

Coalpac Pty Ltd | Hansen Bailey ENVIRONMENTAL CONSULTANTS

Regional Locality

FIGURE 1

- Extension of 86 ha to the area approved for highwall mining. These highwall mining operations will not result in additional surface disturbance;
- Installation of a water pipeline connecting to the existing Cullen Valley Mine water pipeline which will result in the ability to transfer water between Invincible Colliery and Cullen Valley Mine. The pipeline alignment will largely remain on or adjacent to existing access tracks within the Ben Bullen State Forest; and
- Backfilling of the proposed and residual final voids resulting from existing mining operations and the rehabilitation of areas affected by subsidence from historic underground mining operations in the area to create a free-draining final landform.

1.2.2 Cullen Valley Mine

The Modification of DA 200-5-2003 for Cullen Valley Mine seeks approval for the following:

- Extension of 62 ha to areas approved for open cut mining;
- Extension of 79 ha to areas approved for highwall mining. These highwall mining operations will not result in additional surface disturbance;
- Ability to benefit from the transfer of water to and from Invincible Colliery; and
- Backfilling and rehabilitation of the proposed and residual final void resulting from existing mining operations to create a free-draining final landform.

1.3 DOCUMENT STRUCTURE

This EA is structured as follows:

- **Section 2** provides a description of the existing and approved operations at Cullen Valley Mine and Invincible Colliery;
- **Section 3** provides a description of the Modifications for which approval is sought;
- **Section 4** describes the regulatory framework relevant to the Modifications;
- **Section 5** outlines the stakeholder consultation undertaken for the Modifications;
- **Section 6** assesses environmental and socio-economic issues and outlines management and mitigation measures proposed in respect of the Modifications;
- **Section 7** presents Coalpac's Statement of Commitments related to the Modifications;
- **Section 8** provides a conclusion to this EA and a justification for the Modifications; and
- **Sections 9** to **11** lists the abbreviations, references and the study team for this EA.

1.4 MODIFICATION NEED

The Modifications are required to allow the continuation and extension of approved open cut and highwall mining operations at Invincible Colliery and Cullen Valley Mine as currently permitted under PA 07_0127 and DA 200-5-2003, respectively.

The primary need for the Modifications is to ensure the short term continued supply of competitively priced coal to the domestic power generating facilities at the nearby MPPS whilst other strategies for longer term fuel supplies can be explored. The mine plans have also been specifically designed to facilitate the complete rehabilitation of both the proposed and existing mining areas and the establishment of a sustainable free draining final landform at the conclusion of the Modifications mining activities. Further details on the Modifications are provided in **Section 3**.

2 APPROVED OPERATIONS

This section includes a description of the approved operations at Cullen Valley Mine and Invincible Colliery and a discussion of the current status of mining at both sites including infrastructure, rehabilitation and other associated activities.

It also provides a description of the existing environmental management system under which environmental issues at Cullen Valley Mine and Invincible Colliery are managed and an outline of existing ecological offsets that Coalpac has established for each site.

2.1 INVINCIBLE COLLIERY

2.1.1 Regulatory Approvals

Invincible Colliery operates under PA 07_0127 which was granted by the Minister for Planning and Infrastructure on 4 December 2008. PA 07_0127 initially approved the extraction of up to 1.2 Mtpa of ROM coal and up to 0.9 Mtpa of product coal to supply coal to MPPS, Wallerawang Power Station (WPS) and other domestic destinations. Since the granting of PA 07_0127 in 2008, three modifications have been approved by the Minister, including a modification for an increase in the rate of product coal transportation from 0.9 Mtpa to 1.2 Mtpa (in October 2010).

Mining operations approved under PA 07_0127 (as modified) occur within a number of mining authorities held by Coalpac, the status of which is shown in **Table 1**. Coalpac holds the other ancillary environmental licences and approvals to conduct its mining and associated activities at Invincible Colliery which are also summarised in **Table 1**.

The available coal within the approved mining area at the Invincible Colliery has been exhausted and as such, mining operations have been temporarily suspended. In accordance with section 70(1)(a) of the *Mining Act 1992* (Mining Act), approval to suspend mining operations was granted by Department of Trade and Investment Regional Infrastructure and Services Division of Resources and Energy (DRE) on 14 February 2013. Invincible Colliery has been placed in care and maintenance in accordance with the approved Care and Maintenance Mining Operations Plan (MOP) until further notice.

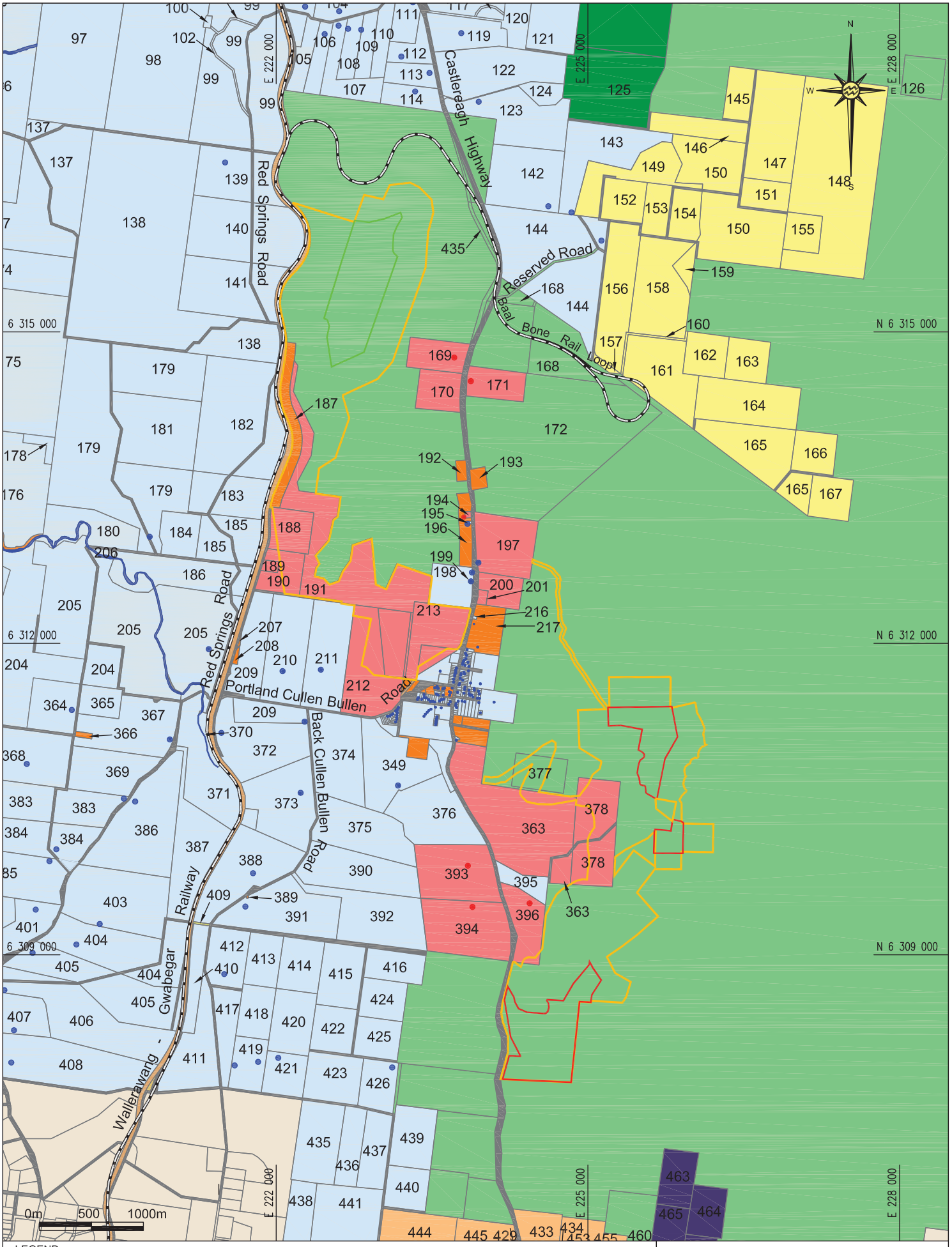
2.1.2 Land Ownership

Land ownership in the vicinity of Invincible Colliery is shown on **Figure 2** and includes the Ben Bullen State Forest to the north, east and south, with a number of private rural residences located to the west of the site. The township of Cullen Bullen is located approximately 1 km to the north-west of Invincible Colliery. The proposed minor extensions to open cut mining operations are more distant from the Cullen Bullen township than those previously undertaken under PA 07_0127 and DA 200-5-2003.

Land ownership in the locality surrounding the Modifications is also listed in **Table 2**.

Table 1
Invincible Colliery Licences and Approvals

Ref	Approval No	Description	Approval Term	Authority
1	PA 07_0127 under Part 3A of the EP&A Act	Invincible Colliery Project Approval	04/12/08 - 04/12/16	DP&I
1a	Invincible Colliery (MOD 1) to PA 07_0117	Amendment to schedule of land provided for PA 07_0127 (purely administrative)	04/12/08 - 04/12/16	DP&I
1b	Invincible Colliery (MOD 2) to PA 07_0117	Modification of the Project Boundary for consistency between this area and the mining authorities held by Coalpac for Invincible Colliery (purely administrative)	04/12/08 - 04/12/16	DP&I
1c	Invincible Colliery (MOD 3) to PA 07_0117	Modification to PA 07_0127 to allow the transportation of up to an additional 300,000 tpa of product coal by public roads to the currently approved destination of MPPS	04/12/08 - 04/12/16	DP&I
2	Mining Lease 1635	Surface Mining Lease (23 ha)	10/09/09 - 10/09/30	DRE
3	Mining Lease 1638	Surface Mining Lease (405 ha)	06/11/09 - 06/11/30	DRE
4	Consolidated Colliery Lease 702	Underground mining lease (1,840 ha)	26/11/1990 – 26/11/24	DRE
5	Exploration Licence 7517	Exploration Licence for area to the east of current operations.	16/4/10 - 16/4/14	DRE
6	Care and Maintenance MOP	Covering ML 1638, ML 1635, CCL 702, EL MPL 266, MLA 431, MLA 393	01/05/13 - 30/06/15	DRE
7	EPL 1095	Invincible Colliery EPL	27 February (Anniversary)	Environment Protection Authority (EPA)
8	Water Extraction	10BL602584 has been replaced with 10AL118580	12/12/12 – 23/12/17	NSW Office of Water (NOW)
9	Monitoring Bore Licences under Part 5 of the Water Act	Monitoring Bore Licences 80BL620114 - 16	Approved in Perpetuity	NOW



LEGEND

- Modification Boundaries
- Invincible Colliery Modification Disturbance Boundary
- Cullen Valley Mine Modification Disturbance Boundary
- Private Freehold Receiver
- Coalpac Owned Receiver
- Rail
- Crown
- Coalpac/Coalpac Shareholders
- National Park
- State Forest
- Wallerawang Collieries
- Rail Corporation NSW
- Delta Electricity
- Centennial Pty. Ltd.
- Private Freehold
- Not Searched

Land Ownership

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: 2

Drawn By:	Date:	Drawing No.:	Revision:	
D.E	14/02/14	23.4.6.9-2A	A	MGA Zone 56

Table 2
Non-Mine Land Ownership

ID	Name	ID	Name	ID	Name
16	JR Tilley & DG McGrath	88	PR & KA Hall	128	PR & KA Hall
17	Destanag Pty Ltd	89	PR & KA Hall	129	PR & KA Hall
40	VA, CA, SL & JA Hantos	91	PR & KA Hall	130	D Barber
41	PR & KA Hall	92	PR & KA Hall	131	D Barber
42	Larkin Pastoral Co Pty Ltd	93	PR & KA Hall	132	D Barber
43	Destanag Pty Ltd	94	PR & KA Hall	133	PR and KA Hall
44	Destanag Pty Ltd	95	Larkin Pastoral Co Pty Ltd	134	PR and KA Hall
45	Destanag Pty Ltd	96	Larkin Pastoral Co Pty Ltd	135	PR and KA Hall
49	Larkin Pastoral Co Pty Ltd	97	RI & GM Larkin	136	PR and KA Hall
50	Larkin Pastoral Co Pty Ltd	98	RI & GM Larkin	137	Larkin Pastoral Co Pty Ltd
52	Larkin Pastoral Co Pty Ltd	99	RI & GM Larkin	138	RI & GM Larkin
53	O'Farrell Pastoral Company Pty Ltd	100	RI & GM Larkin	139	RI & GM Larkin
54	O'Farrell Pastoral Company Pty Ltd	101	RI & GM Larkin	140	RI & GM Larkin
55	CJ & MH O'Farrell Pty Ltd	102	RI & GM Larkin	141	RI & GM Larkin
56	AP & MA Constantinides & DR Gazzard	103	JR & DM Cram	142	PG Desch & KC Farrugia
58	KA & MJ Kirk	104	KA Thomas	143	DB Speirs
59	KA & MJ Kirk	105	A & M Abou-Touma	144	DA & DM Muldoon
60	TJ & BN Gilshenan	106	A & M Abou-Touma	170	Coalpac (formerly BE Nakhle)
61	KM Price	107	G & M Gebrael	173	RK Dickens (Perpetual Lease)
63	RN Harris	108	PJ & CI DI Mauro	174	RK Dickens
64	PR & KA Hall	109	J, P, GG & CG Piccione	175	RK Dickens
65	PR & KA Hall	110	J Hannouche	176	GE Orellana
66	PR & KA Hall	111	A & R Salman	178	RK Dickens
67	PR & KA Hall	112	J Hannouche	179	RK Dickens
68	Larkin Pastoral Co Pty Ltd	113	MB & AM Ringin	180	RK Dickens
69	Larkin Pastoral Co Pty Ltd	114	PJ & EJ Isaacson	181	RK Dickens
70	Larkin Pastoral Co Pty Ltd	115	GA & BS Jessep	182	RK Dickens
71	Larkin Pastoral Co Pty Ltd	116	GA & BS Jessep	183	RK Dickens
72	AP & MA Constantinides & DR Gazzard	117	P & WE Tilley	184	RK Dickens
73	O'Farrell Pastoral Company Pty Ltd	118	GA & BS Jessep	185	RK Dickens
74	JC Murray & KL Mcfarlane	119	LN Goldspink	186	RK Dickens
75	JC Murray & KL Mcfarlane	120	GA & BS Jessep	193	Crown (Cullen Bullen General Cemetery)
76	JC Murray & KL Mcfarlane	121	GA & BS Jessep	194	JGQ Nominees Pty Ltd **
77	JC Murray & KL McFarlane	122	JL Macphee	195	KJ Blackley
79	RI, AM & GM Larkin	123	TW & JA Nolan	197	BE & CE Leisemann & IL & KID Follington **
80	AG Dickson	124	DW Macphee	198	DA Tilley
87	BK Abrahams	127	PR & KA Hall	199	DA Tilley

ID	Name	ID	Name	ID	Name
200	BE & CE Leisemann & IL & KID Follington **	249	GER Young	296	PF Kendall
201	KD & RL Kellam	250	GER Young	297	BJ Scott
202	GJ Keightley	251	GER Young	298	PF & DM Toner
203	JR Gracey	252	GER Young	299	PF Kendall
204	JR Gracey	253	M Pasztor	300	S & H Filla
205	D Dino & J Seraglio	254	RW Selmes	301	CM O'Neill
206	D Dino & J Seraglio	255	GE Lane	302	CJ Conroy
209	DJ Ryan	256	GE Lane	303	AI Miller & BS Wilson
210	FC & K Tilley	257	DJ Tilley	304	AI Miller & BS Wilson
211	BJ & JM Fitzgerald	258	S & H Filla	305	AI Miller & BS Wilson
216	BM Emmott	263	M Stone	306	AI Miller & BS Wilson
218	G & BA Tilley	264	RD & DJ Blackley	307	AI Miller & BS Wilson
219	JR Tilley	267	AW Gleeson & SA Muldoon	308	T Bates
220	KL Bunyon	268	EA & DM Lane	309	ME Stewart
222	CP Bainy	269	RD Blackley	310	SJ Bandiera
223	RJ Whittaker & SR Burrows	270	RD Blackley	311	WG Brown
224	JR Tilley	271	CD & JD McCann	312	LM McDonald
225	JR Tilley	272	Minister for Education & Training (Cullen Bullen Primary School) ^	313	N Viaphay
226	JR Tilley	273	GJ & TA Hutchison	314	KR Waters
227	RG Wright & KL Norris	274	JL & MB Howden	315	KL Godden
228	AA Woods, EJ Nicholls & LH Field	275	JL & MB Howden	316	CE & SM Davis
229	AA Woods, EJ Nicholls & LH Field	276	KJ Blackley (Perpetual Lease)	317	CE & SM Davis
230	CM & BA Gilbert	277	RJ Tilley	318	AW Hall
231	J Fuller	278	FS Gilson	319	AW Hall
232	RM Pyne	279	N & JA Anderson	320	AW Hall
233	TE Caddis & RM Pyne	280	SR Williams	321	N Thorne
234	S Napoli	281	SJ Brooks	322	J & DLA Markowski
235	RK & SM Lane	282	MW Mercer	323	J & DLA Markowski
236	TJ & KO Tilley	283	MW Mercer	324	P Reddan
237	MC Crane	284	VN & E Deveigne	325	SP & SA Duggan
238	DP Rochester	285	E Banks	327	J Playford
239	SG Tweedie	286	MB Banks	328	RP Harris
240	DW & GJ McCann	287	KD Fripp	329	R Bailey
241	WF Fitzgerald	288	MB Banks	330	DJ Annesley
242	WF Fitzgerald	289	NG Harradine	331	GJ & VC Walsh
243	No record held by LPI	290	SW Hobby	332	BN Rochester
244	No record held by LPI	291	A & R Inzitari	333	RP Doyle
245	M Botfield	292	SP Maybury	334	P Warner & YA Harris
246	DW & GJ McCann	293	SP Maybury	335	P Warner & YA Harris
247	KO & SL Rochester	294	A & R Inzitari	336	P Warner & YA Harris
248	PB Draper	295	DR & JA Battersby	337	P Warner & YA Harris

ID	Name	ID	Name	ID	Name
338	GJ Williams	373	WF Fitzgerald	408	RH Griffiths
339	GJ Williams	374	MG Bulkeley	409	VA McFadden
340	GJ Williams	375	MG Bulkeley	410	PJ & SL McFadden
341	GJ Williams	376	MG Bulkeley	411	SJ & DS Taylor
342	GJ Williams	379	VL Chadwick	412	V & F Fava, C Rositano, F Tedesco & E Todorello
343	AG & RL Williams	380	LJ Wallwork	413	V & F Fava, C Rositano, F Tedesco & E Todorello
344	RT & VE Dobson	381	SG & DR Bolzan	414	V & F Fava, C Rositano, F Tedesco & E Todorello
345	DK & K Northey	382	DA & KL Mitchell	415	SJ & DS Taylor
346	GJ & VC Walsh	383	BS Bretherton & B Chandwick	416	SJ & DS Taylor
347	DJ Annesley	384	A Tabone	417	AP & KA Brown
348	RE Gilmore & MG & PJ Bulkeley	385	Ceedive Pty Ltd	418	AP & KA Brown
349	RM Crane	386	TJ Griffiths	419	AP & KA Brown
350	Tanwind Pty Ltd	387	JR Embleton & KJ Kelly	420	SJ & DS Taylor
352	RS Speirs	388	VA McFadden	421	SJ & DS Taylor
353	JM Ellis	390	MG Bulkeley	422	SJ & DS Taylor
354	E Fabits	391	MG Bulkeley	423	SJ & DS Taylor
355	MS Ivey	392	IG Palmer	424	SJ & DS Taylor
356	DC & KT Claydon & JD Garrett	393	JGQ Nominees Pty Ltd **	425	SJ & DS Taylor
357	ST & CP Wilson	394	JGQ Nominees Pty Ltd **	426	JWJ & SM Taylor
358	RJ Duncan	397	J Menchin	427	J Menchin
361	RR Cole	398	J Menchin	428	KJ Taylor
362	RE Gilmore & MG & PJ Bulkeley	399	PJ & TM McFadden	435	GW & JL & TJ & JA Clark
364	JR Gracey	400	D Hart	436	GW & JL & TJ & JA Clark
365	JR Gracey	401	KG & DA Neaves	437	GW & JL & TJ & JA Clark
367	JR Gracey	402	KJ & DK Shaw	438	GW & JL & TJ & JA Clark
368	RA Fuller	403	BR & E Brown	439	JWJ & SM Taylor
369	RA Fuller	404	BR & E Brown	440	JWJ & SM Taylor
370	JA, SE Byron & DC Hutton	405	BR & E Brown	441	GW & JL Clark
371	MA & JL Taylor	406	P W Griffiths	443	Lithgow District Car Club Inc. ^
372	RE Gilmore	407	TJ & SM Griffiths		

*All ID numbers not represented in the above table are outside the frame of **Figure 2**, or are mining, industrial commercial or vacant crown land*

*** Agreement in place with landholder*

^ No residence, or a commercial or public building

2.1.3 Mining Operations

A combination of a truck / shovel open cut and highwall mining operations is approved for use at Invincible Colliery. The Invincible Colliery EA (R.W. Corkery, 2008) also identifies the conceptual layout, equipment requirements and operational areas for the open cut and highwall mining operations. Invincible Colliery is approved to extract coal from all seams down to and including the Lithgow Seam. Highwall mining has been carried out in the Irondale Seam in the open cut mine during 2008 to good effect with no instability or surface subsidence occurring.

When in operation, ROM coal is transported to either the Centralised Coal Crushing and Screening Area or the ROM Pad adjacent to the Invincible Colliery site access road for washing at the Invincible Coal Preparation Plant (ICPP). As noted in **Section 2.1.1**, Invincible Colliery was granted approval in 2010 for the transportation of an additional 0.3 Mtpa of product coal by road, bringing the maximum allowable volume of product coal to 1.2 Mtpa. Mining operations are generally approved to occur between 7:00 am and 10:00 pm, Monday to Saturday inclusive, with the exception of public holidays. Mining in the existing West, Renown (Central) and South pits is not permitted between 6:00 pm and 7:00 am.

2.1.4 Coal Handling and Transport

Coal handling systems at the Invincible Colliery include a Centralised Coal Crushing and Screening Area for sizing and screening of ROM coal, with stockpiling capacity of 15,000 t of ROM coal and 10,000 t of product coal. Separate ROM and product stockpiles are maintained for the screening plant and crusher, with a further product stockpile maintained for the loading of road trucks for the transportation of product coal.

At the ICPP, ROM coal is fed to a Klockner primary breaker for size reduction prior to being transported by conveyor to the Bradford Breaker for sizing and separation from coarse rejects. Sized coal <100 mm from the Bradford Breaker can be fed to two Jig Washers via a small surge bin at a maximum rate of 350 tonnes per hour (tph), which further separates coal into either of the four local product bins or the 5,000 t capacity conical stockpile. Excess coal from the conical stockpile can be pushed to an adjacent 80,000 t stockpile area, as required.

Coarse rejects are conveyed from the ICPP Jig Washer to a reject bin for truck loading. Coarse rejects of appropriate quality are re-washed and combined with the product coal. The remainder is loaded onto empty trucks returning to the open cut mining areas for emplacement. Fine rejects from processing are pumped to a series of storage dams. Consolidated fines in these areas are regularly excavated for coal blending purposes or disposal in the open pit void, which allows for new material to be stored as additional space is created.

Product coal is approved for transportation by road-registered highway trucks to domestic destinations at a rate of 1.2 Mtpa. All product coal leaves the site via the access road onto the Castlereagh Highway. Product coal from the coal crushing and screening area is loaded onto highway trucks via front end loader. Washed coal from the ICPP is loaded onto the highway trucks from an overhead bin located near the site access road.

Product coal is predominantly transported to the MPPS, with approval also in place to supply the WPS on a limited campaign basis for up to two weeks in any three month period, following notification of relevant landholders and approval from DP&I. Up to 0.2 Mtpa of product coal may also be transported to domestic destinations other than the MPPS or WPS.

2.1.5 Infrastructure

Approved mine infrastructure at Invincible Colliery includes site offices, car parks, a workshop, two 75,000 litre self-bunded diesel storage tanks, bathhouse, ICPP, a coal crushing and screening area, site access and haul roads, fine rejects storage and water management system.

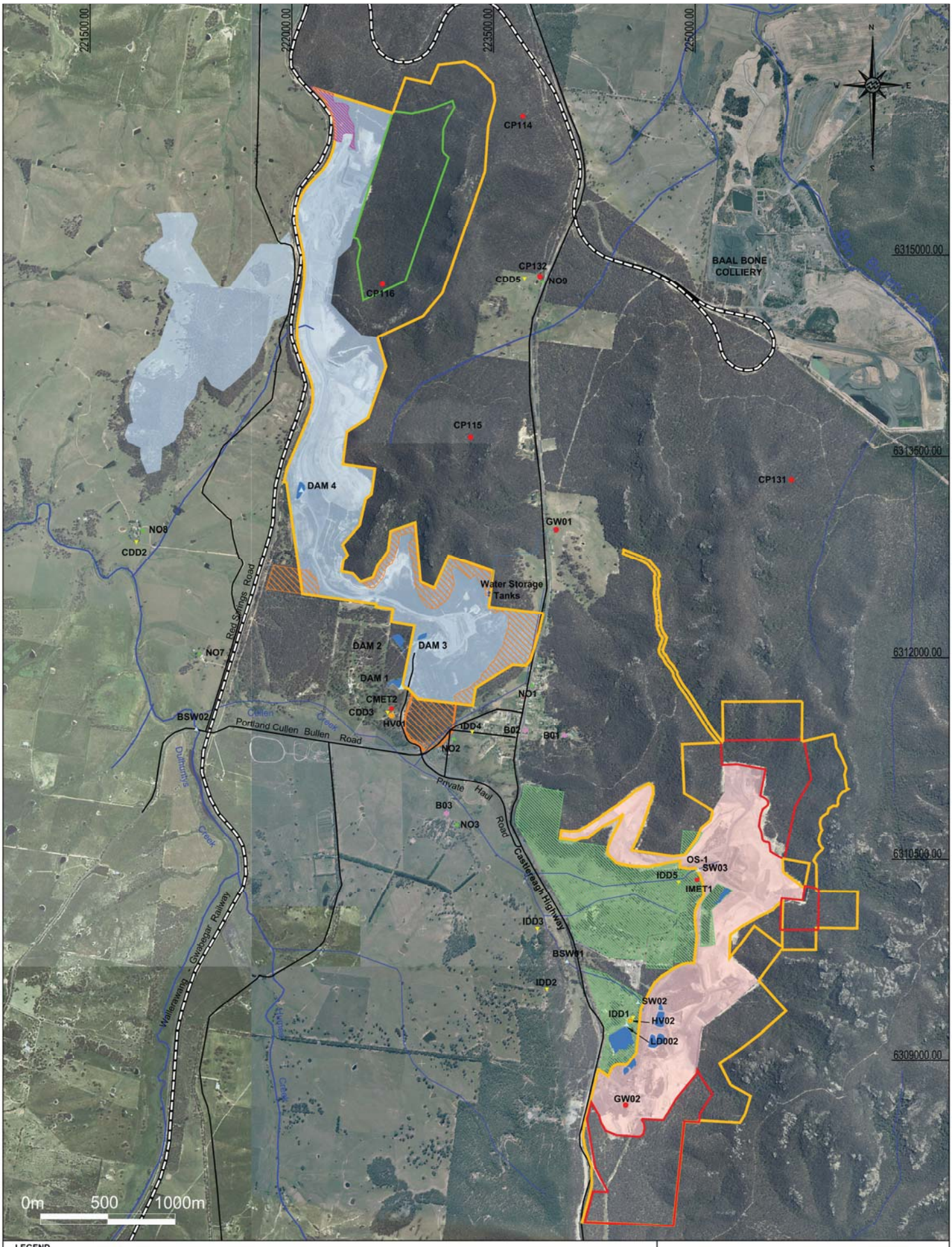
2.1.6 Environmental Management and Monitoring

Coalpac has developed and implemented an Environmental Management System (EMS) and Management Plans for Cullen Valley Mine and Invincible Colliery. Environmental Management Plans are in place for key issues with the potential to impact on the environment and local community. These documents include mitigation measures required for the appropriate control of each.

Coalpac has established a combined Environmental Monitoring Program (EMP) for Cullen Valley Mine and Invincible Colliery to assist in the management and measurement of the environmental performance of the operation. This program includes a network of monitors at the locations illustrated in **Figure 3**. The EMP is undertaken in accordance with relevant Australian Standards and incorporates the monitoring regime in **Table 3**.

Table 3
Coalpac Environmental Monitoring Network

Monitored Parameter	Number of Monitoring Locations	
	Cullen Valley Mine	Invincible Colliery
Depositional Dust	5	5
High Volume Air Sampler (PM_{10})	1	1
Weather Station	1	1
Blast Vibration and Overpressure	3	3
Surface Water Quality	3	4
Noise	5	3
Groundwater	4	2



LEGEND

- Modification Boundaries
- Invincible Colliery Modification Disturbance Boundary
- Invincible Colliery Approved Disturbance
- Cullen Valley Mine Modification Disturbance Boundary
- Cullen Valley Mine Approved Disturbance
- Water Management Structure
- Creeks
- Road
- Rail
- Compensatory Habitat Area
- Bio Diversity Offset Areas
- Clandulla Geebung Conservation Area
- Meteorological Station
- PM_{10} Monitoring
- Blast Monitoring Location
- Surface Water Monitoring Location
- Noise Monitoring Location
- Depositional Dust Gauge
- Groundwater Monitoring Bore

Environmental Monitoring Programs

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: 3

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2.1.7 Ecological Offsets

Coalpac established an offset strategy for Invincible Colliery as a component of PA 05_0065, which was adopted and further developed for PA 07_0127. An *'Augmented Biodiversity Offset Strategy'* (R W Corkery 2008b) was developed for the extended operations to ensure no net loss of biodiversity values in the medium to long term. The document *'Lot 112, DP 877190 Biodiversity Offset Area'* (R.W. Corkery 2008c) was also prepared to supplement the offset strategy to ensure sufficient amounts of offset land were available.

The final offset package approved for the current operations of Invincible Colliery consists of approximately 165 ha of both moderate to good quality native vegetation and degraded agricultural lands, as shown on **Figure 3**. Existing native vegetation communities in these areas consisted primarily of the Tableland Gully Snow Gum – Ribbon Gum Grassy Forest vegetation community, Coxs Permian Red Stringybark – Brittle Gum Woodland, and Tableland Gully Mountain Gum – Broad-leaved Peppermint Grassy Forest. Suitable habitat for the Black Gum, listed as Vulnerable under the *Threatened Species Conservation Act 1995* (TSC Act), is provided within the existing Invincible Colliery offsets. A significant assemblage of Aboriginal cultural material is also preserved within the offset in an extensive open camp site complex (Invincible OS1).

To ensure that these areas are appropriately managed in the long term, Coalpac has developed an overall strategy called the *'Implementation of Biodiversity Offset Areas'* (Coalpac 2009). This strategy outlines and describes the proposed implementation process that Coalpac will employ to achieve the outcomes of the above mentioned documents and the *'Landscape Management Plan for Invincible Colliery'* (Global Soil Systems 2009). The Biodiversity Offset Areas in place for approved Invincible Colliery operations are being progressively enhanced. These enhancement activities include fencing of offset areas, feral animal and weed control and infill revegetation with native tubestock species and the use of direct seeding techniques. The ongoing performance of these ecological offset areas is monitored on an annual basis at fixed sites that are representative of different vegetative age structures.

2.2 CULLEN VALLEY MINE

2.2.1 Regulatory Approvals

Cullen Valley Mine operations are approved under Development Consent (DA) 200-5-2003 and occur within a number of mining authorities, the status of which are shown in **Table 4**.

Table 4 also lists supporting planning documents to DA 200-5-2003 and the ancillary environmental licences and approvals held by Coalpac to conduct operations at Cullen Valley Mine.

The '*Feldmast Coal Project EIS'* (IEC, 1997) (Feldmast EIS) and '*Cullen Valley Open Cut Extension EIS'* (IEC, 2004) (Cullen Valley Mine EIS) identify the extent of approved open cut, highwall and underground mining at Cullen Valley Mine. Cullen Valley Mine is approved to sell up to 1 Mtpa product coal. Of this volume, no more than 250,000 t may be transported to destinations other than the MPPS.

Table 4
Cullen Valley Mine Licences and Approvals

Ref	Approval No	Description	Approval Term	Authority
1	DA-200-5-2003 under Part 4 of the EP&A Act	Development Consent	19/08/04 - 19/08/25	DP&I
1b	DA-200-5-2003 MOD	Approval modified to permit up to 0.25 Mtpa product coal to be delivered by road to domestic destinations other than MPPS	19/08/04 - 19/08/25	DP&I
2	Mining Lease 1455	Mining Lease (open cut) (55 ha)	19/08/99 - 19/09/20	DRE
3	Mining Lease 1488	Lease extension granted (open cut / highwall) (93 ha)	21/06/01 - 21/06/22	DRE
4	Mining Lease 1556	Mining Lease (underground / highwall) (809 ha)	20/09/04 - 20/09/25	DRE
5	Mining Lease 1557	Mining Lease (open cut / highwall) (102 ha)	20/09/04 - 20/09/25	DRE
6	Authorisation 324	Authorisation for area to east of the Castlereagh Highway	25/08/83 - 09/04/14	DRE
7	Authorisation 420	Authorisation for area to west of the railway	12/01/90 – 09/04/14	DRE
8	Exploration Licence 5712	Exploration Licence for area to the west of railway	10/04/00 – 09/04/14	DRE
9	Exploration Licence 6007	Exploration Licence for area to the north-east of Cullen Valley Mine	08/10/02 – 07/10/14	DRE
10	Care and Maintenance MOP	Care and Maintenance MOP	14/02/13 – 01/07/15	DRE
11	Environmental Protection Licence (EPL) 10341	Cullen Valley Mine Environment Protection Licence	10 December (Anniversary)	EPA
12	Dangerous Goods Notification Acknowledgement 35/036178	Cullen Valley Mine Dangerous Goods Notification	14 January (Anniversary)	WorkCover NSW
13	Monitoring Bore Licences under Part 5 of the Water Act	Monitoring Bore Licences 80BL620108 - 13	Approved in Perpetuity	NOW
14	Water Extraction	Water Access Licence 27898	16/01/12 – 05/07/15	NOW

2.2.2 Land Ownership

Land ownership in the vicinity of Cullen Valley Mine is shown on **Figure 2** includes the Ben Bullen State Forest to the east, with a number of private rural residences located to the north, south and west of the site. The township of Cullen Bullen is located approximately 1 km to the south-west of Cullen Valley Mine. The proposed minor extensions to open cut mining operations are more distant from Cullen Bullen than previously conducted.

Land ownership in the locality surrounding the Modifications is listed in **Table 2**.

2.2.3 Mining Operations

Open cut mining operations involve the extraction of coal from the combined Katoomba / Middle River / Moolarben; Upper Irondale; Irondale; and the coalesced Lidsdale / Lithgow Seams within the Illawarra Coal Measures.

The available coal within the approved mining area at Cullen Valley Mine has been practically exhausted and as such mining operations have been temporarily suspended. Under Section 70(1)(a) of the Mining Act, approval to suspend mining operations was granted by DRE on 14 February 2013. Cullen Valley Mine has been placed in care and maintenance in accordance with the approved Care and Maintenance MOP until further notice.

Highwall and underground mining operations were also approved under the Feldmast EIS. These operations included:

- Highwall mining operation of the Irondale Seam and coalesced Lidsdale / Lithgow Seam in areas exposed by open cut mining; Highwall mining has been carried out in both seams in the open cut mine during 2008 to good effect with no instability or surface subsidence occurring; and
- An underground operation using continuous miner units to access the Irondale and Lithgow Seams and the remnant resources of the Tyldesley Colliery workings.

Mining operations are approved to occur 24 hours per day, seven days a week, with blasting occurring between 9:00 am and 3:00 pm Monday to Friday, inclusive.

2.2.4 Coal Handling and Transport

Coal handling at Cullen Valley Mine includes a coal crushing and sizing plant which conveys coal to the product stockpile prior to being loaded into coal haulage trucks for transport to approved domestic destinations.

Haulage of product coal by road is approved between 7:00 am and 5:30 pm, Monday to Friday, and 7:00 am to 5:00 pm on no more than 30 Saturdays annually, in accordance with the requirements of the Office of Environment and Heritage (OEH) and Lithgow City Council (LCC). This is undertaken by a fleet of semi-trailers that access the Castlereagh Highway from the 1.3 km private haul road located adjacent to the Cullen Valley Mine site access intersection.

2.2.5 Infrastructure

Mine infrastructure at Cullen Valley Mine comprises site offices, a workshop, car park and bathhouse facilities, access roads, mine water storage, 100,000 t coal stockpile and infrastructure including a 75,000 litre self-bunded fuel storage tank and the existing water reticulation system with associated pipelines, holding tanks and pumping equipment.

2.2.6 Ecological Offsets

As a requirement of DA 200-5-2003, Coalpac has established and maintains Compensatory Habitat Areas to offset the environmental impacts from land disturbance associated with the existing Cullen Valley Mine. These areas comprise a total area of approximately 51.4 ha, as shown on **Figure 3**.

The Cullen Valley Mine Compensatory Habitat Areas are located adjacent to existing rehabilitation areas at the mine and the adjacent Ben Bullen State Forest. They are managed to conserve and enhance the ecological communities present, which include Sandstone Dry Ridgetop Woodland, Tablelands Sheltered Valley Forest, and Tablelands Dry Woodland.

The ongoing monitoring and management of the Compensatory Habitat Areas for Cullen Valley Mine is undertaken in accordance with the approved Cullen Valley Mine Flora and Fauna Management Plan.

3 MODIFICATIONS DESCRIPTION

A description of the Modifications proposed to Cullen Valley Mine and Invincible Colliery, including the indicative timing, mining methods, need for each Modification and the alternatives considered, are provided in this section.

3.1 INTRODUCTION

The primary objective of the combined Modifications is to extend the life of current mining activities to facilitate continuity of short term competitively priced fuel supply to MPPS, and at the same time facilitate the practical conclusion of mining and rehabilitation of the proposed and existing approved mining areas at the Invincible Colliery and Cullen Valley Mine.

The mine plans which are being proposed for these Modification applications for Invincible Colliery and Cullen Valley Mine promote:

- The principles of Ecologically Sustainable Development (ESD);
- The minimisation of environmental and social impacts; and
- The optimisation of a rehabilitation strategy for the existing disturbed areas at each mine site.

3.2 MODIFICATION ALTERNATIVES CONSIDERED

The alternatives considered for the development of the mine plans for the Modifications are described below.

3.2.1 Invincible Colliery

Option 1 – Do Nothing

The 'do nothing' approach would result in Coalpac completing rehabilitation on site in accordance with existing requirements of PA 07_0127 and in consultation with relevant NSW regulatory agencies. Invincible Colliery would remain under Care and Maintenance status until site closure in December 2016 upon the expiry of PA 07_0127.

This option severely disrupts competitively priced fuel supply to MPPS which in turn may cause a significant cost impost to electricity consumers in NSW (NSW Treasury, 2013). The consideration of economic impacts of the Modifications is discussed further in **Section 6.11**.

Further to the above, the cessation of open cut mining without these Modifications will result in the sub-optimal rehabilitation of the currently approved mining areas. There is currently insufficient overburden material available to avoid leaving a large water sink in the locality of each of the three mining voids currently open at Invincible Colliery. These sinks would not be able to be rehabilitated and revegetated to a level that could provide high quality native forest and woodland communities found in the local area in the long term (see **Section 6.17.7**) and this option would also result in a sub-optimal post-mining landscape that is not fully integrated with the surrounding lands in the Ben Bullen State Forest.

This option was therefore not considered to be in satisfaction of the Objects of the EP&A Act, which aims to encourage the proper development of natural resources for the purpose of promoting the social and economic welfare of the community.

In particular, the additional open cut and highwall mining operations proposed (see **Section 3.2**) will allow the development of higher quality rehabilitation and a stable, free draining final landform outcome for Invincible Colliery which again is consistent with the object of the EP&A Act to encourage *"…the promotion and co-ordination of the orderly and economic development of land"*.

Adopting this option would also result in a further loss of direct and indirect employment opportunities and socio-economic benefits in addition to a loss of benefits and royalties or other payments to both the Federal and NSW State Governments during the additional approval period sought for PA 07_0127 out to December 2020.

Option 2 – Open Cut Operation Only

The 'open cut only' approach would result in Coalpac extending open cut mining operations at Invincible Colliery to include additional areas outside of those proposed for the Modification. This mine plan option would create additional environmental impacts due to the increased disturbance footprint required to access the coal resources required during the additional four years of operations proposed for PA 07_0127.

The combined open cut / highwall operation proposed for Invincible Colliery under the Modification was considered to provide the best economic and environmental outcome. This will be achieved by the extraction of the coal resources required for short term supply to MPPS, with no discernible additional surface disturbance through the use of highwall mining methods, where feasible.

Option 3 – Highwall Mining Operation Only

While the 'highwall mining only' approach would reduce the need for additional surface disturbance from mining activities, sufficient coal resources are not available to be accessed via this mining method alone from the existing open cut highwalls at Invincible Colliery as approved under PA 07_0127. This option would also not liberate the additional volume of overburden required to fully rehabilitate existing disturbance areas.

Option 4 – Combined Open Cut / Highwall Operation

This option considered the extension of open cut mining activities at Invincible Colliery into three additional areas to the north, south and east of approved disturbance areas at the site and the development of associated highwall mining operations.

This mine plan was adopted for assessment in this document as it was considered to provide the best balance between accessing the remaining coal resources adjacent to approved mining areas at Invincible Colliery while at the same time avoiding areas in proximity to the site that are deemed to be most sensitive to environmental impacts (by total avoidance or the use of highwall mining methods).

The combined open cut / highwall operation also provides the volume of materials required to allow the development of higher quality rehabilitation and a stable, free draining final landform. This fully mitigates the current issue of residual final voids at Invincible Colliery that would otherwise result.

3.2.2 Cullen Valley Mine

Option 1 – Do Nothing

The 'do nothing' approach would result in Coalpac completing rehabilitation on site in accordance with the existing requirements of DA 200-5-2003 and in consultation with relevant NSW regulatory agencies. Cullen Valley Mine would remain on Care and Maintenance status until the closure of the site in August 2025 following expiry of DA 200-5-2003.

This option severely disrupts competitively-priced fuel supply to MPPS which in turn may cause a significant cost impost to electricity consumers in NSW (NSW Treasury, 2013). The assessment of the economic impacts of the Modification is discussed further in **Section 6.11**.

Further to the above, the cessation of open cut mining without these Modifications will result in the sub-optimal rehabilitation of the currently approved mining areas. There is currently insufficient overburden material available for establishing an optimal final landform and avoid leaving a large water sink in the locality of each of the two main mining voids currently open at Cullen Valley Mine. These sinks would not be able to be rehabilitated and revegetated back to a level that could provide high quality native forest and woodland communities found in the local area in the long term (see **Section 6.17.7**) and this option would also result in a sub-optimal post-mining landscape that is not fully integrated with the surrounding lands in the Ben Bullen State Forest.

This option was therefore not considered to be in satisfaction of the Objects of the EP&A Act, which aims to encourage the proper development of natural resources for the purpose of promoting the social and economic welfare of the community. In particular, the additional open cut and highwall mining operations proposed will allow the development of higher quality rehabilitation and an optimised final landform outcome for Invincible Colliery which again is consistent with the object of the EP&A Act to encourage *"…the promotion and co-ordination of the orderly and economic development of land"*.

Adopting this option would also result in a further loss of direct and indirect employment opportunities and socio-economic benefits in addition to a loss of benefits and royalties or other payments to both the Federal and NSW State Governments during the remaining duration of DA 200-5-2003.

Option 2 – Open Cut Operation Only

The 'open cut only' approach would result in Coalpac extending open cut mining operations at Cullen Valley Mine to include additional areas outside of those proposed for the Modification. This mine plan option would create additional environmental impacts due to the increased disturbance footprint required to access the coal resources required during the remaining duration of DA 200-5-2003.

The combined open cut / highwall operation proposed for Cullen Valley Mine under the Modification was considered to provide the best economic and environmental outcome, by achieving the extraction of coal resources required to supply MPPS, while minimising additional surface disturbance through the use of highwall mining methods, where feasible.

The expansion of Cullen Valley Mine further to the north and south of the extension area proposed for the Modification was also found to have the potential to increase amenity impacts to residential receptors (from air quality and noise impacts) and to impact on a population of the threatened Clandulla Geebung plant species.

The development of the Hillcroft mining area described in the Feldmast EIS (to the west of existing Cullen Valley Mine operations) is also not feasible as a stand-alone operation when consideration is given to the amenity impact potential, the scale of the Modification and the need to develop infrastructure to access this area over the Wallerawang – Gwabegar Rail Line and Red Springs Road.

Option 3 – Highwall Mining Operation Only

While the 'highwall mining only' approach would reduce the need for additional surface disturbance from mining activities, sufficient coal resources are not available to be accessed via this mining method from the existing open cut voids at Cullen Valley Mine as approved under DA 200-5-2003. This option would also not liberate the additional overburden required to fully rehabilitate existing disturbance areas.

Option 4 – Underground Operation Only

Development of the underground mining operation described in the Feldmast EIS is not considered feasible at this time due to the scale of the Modification proposed, the need to develop a range of additional infrastructure items to support such an operation and high level of risk present as a result of adverse ground conditions for safe underground operations. Detailed design work and modelling of subsidence impacts associated with underground mining would also be required prior to commencement of underground operations at Cullen Valley Mine.

The alternative proposed is to replace higher cost, manned underground mining methods with highwall mining. Highwall mining is an economic coal recovery method which removes the risk of endangering mineworkers' health and safety, as well as being a lower impact extraction method to provide a greater level of protection to the surface from the impacts of subsidence.

Option 5 – Combined Open Cut / Highwall Operation

This option considered the extension of open cut mining activities at Coalpac into an additional area to the east of northern extent of disturbance currently approved at the site and the development of associated highwall mining operations.

This mine plan for this option (detailed in **Section 3.4**) was adopted for assessment in this document as it was considered to provide the best balance between accessing the remaining coal resources adjacent to approved mining areas at Cullen Valley Mine while at the same time avoiding areas in proximity to the site that are deemed to be most sensitive to environmental impacts (by the use of highwall mining methods or total avoidance).

The combined open cut / highwall operation also provides the volume of materials required to allow the development of higher quality rehabilitation and a stable, free-draining final outcome in the long term, avoiding the current issue of residual final voids at Cullen Valley Mine that would otherwise result.

3.3 INVINCIBLE COLLIERY MODIFICATION

The Invincible Colliery Modification seeks approval for the following:

- Extension to the life of PA 07_0127 for four years from December 2016 to December 2020;
- Extension of 88 ha to the area approved for open cut mining. The approved area of open cut mining in the existing Project Approval is 152 ha;
- Extension of 86 ha to the area approved for highwall mining. These highwall mining operations will not result in additional surface disturbance. The approved area of highwall mining in the existing Project Approval is 56 ha;
- Installation of a water pipeline connecting to the existing Cullen Valley Mine water pipeline which will result in the ability to transfer water between Invincible Colliery and Cullen Valley Mine. The pipeline alignment will be on or adjacent to existing access tracks within the Ben Bullen State Forest; and
- Backfilling of the proposed and residual final voids resulting from existing mining operations and the rehabilitation of areas affected by subsidence from historic underground mining operations in the area to create a free-draining final landform at the conclusion of the mining activities proposed for the Modification.

3.3.1 Mining Operations

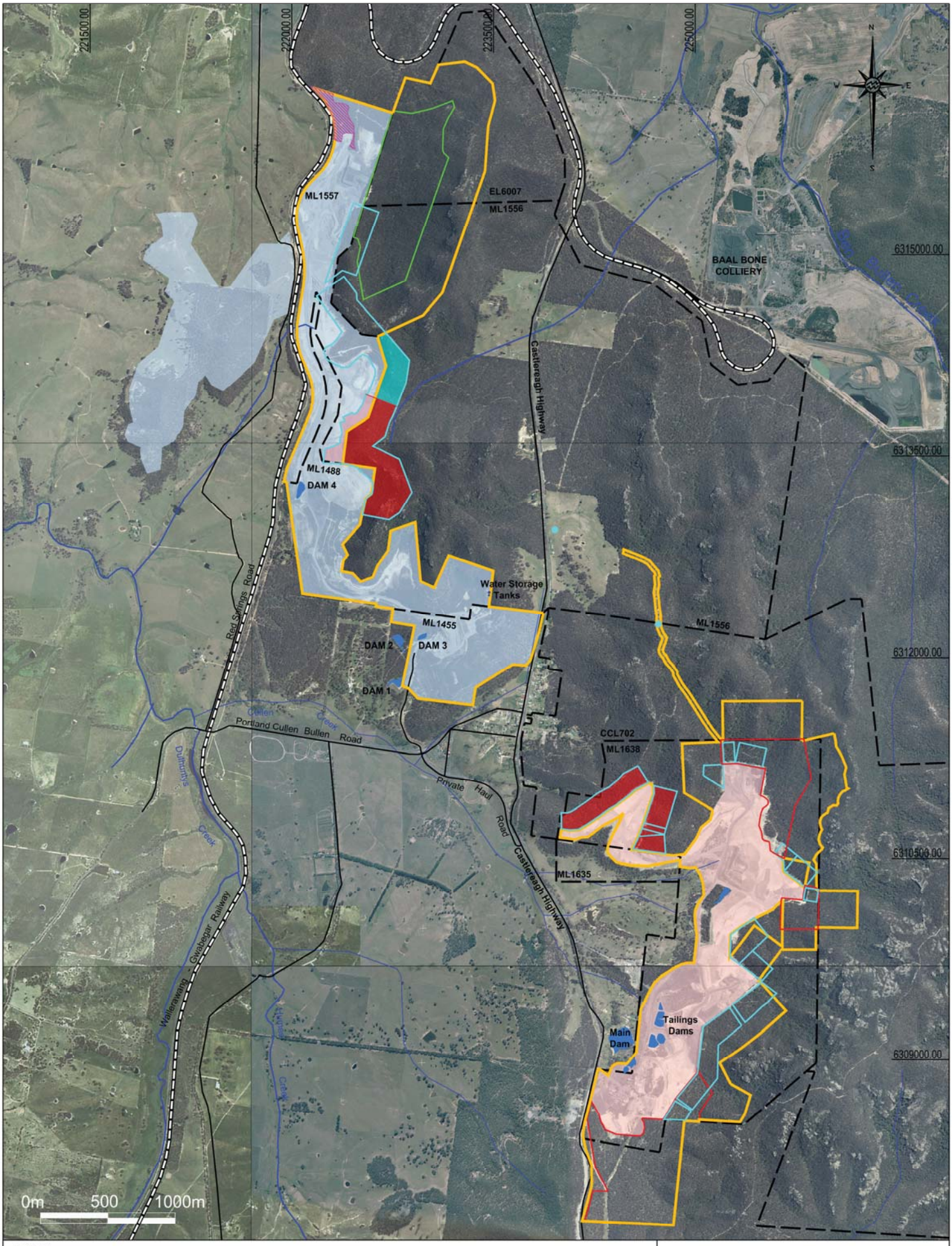
The proposed extension to mining operations at Invincible Colliery would occur via open cut and highwall mining methods in three areas within the Ben Bullen State Forest. These areas are adjacent to the northern, eastern and southern extent of the currently approved open cut mining footprint for the site (see **Figure 4**). The modified open cut mining activities will result in the disturbance of an additional 88 ha to the current disturbance area of 152 ha approved under PA 07_0127.

The additional highwall mining activities will occur subsurface in an area of up to 86 ha and will not result in any additional surface disturbance.

A conceptual mine plan for Year 2 of the Modification is presented in **Figure 5**. Invincible Colliery will continue to produce up to 1.2 Mtpa of product coal for the additional period of mining operations proposed by the Modification.

3.3.2 Product Transport

The extension of PA 07_0127 to December 2020 will require an associated four year increase in the period in which product coal can be transported from the Invincible Colliery to market destinations. During this time, all other arrangements for the transportation of product coal from the site by truck (up to 1.2 Mtpa) are proposed to continue in accordance with the existing conditions of PA 07_0127.



LEGEND

- Coalpac Mining Leases
- Modification Boundaries
- Invincible Colliery Modification Disturbance Boundary
- Invincible Colliery Approved Disturbance
- Cullen Valley Mine Modification Disturbance Boundary
- Cullen Valley Mine Approved Disturbance
- Proposed Staging Pump & Water Storage Tanks
- Creeks
- Road
- Rail
- Clandulla Geebung Conservation Area
- Water Management Structure
- Approved Highwall Mining Areas
- Approved Highwall Mining Areas Not To Be Recovered As Rehabilitation Is Complete
- Approved Highwall Mining Areas & Remains Available

Modification Layout

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: 4

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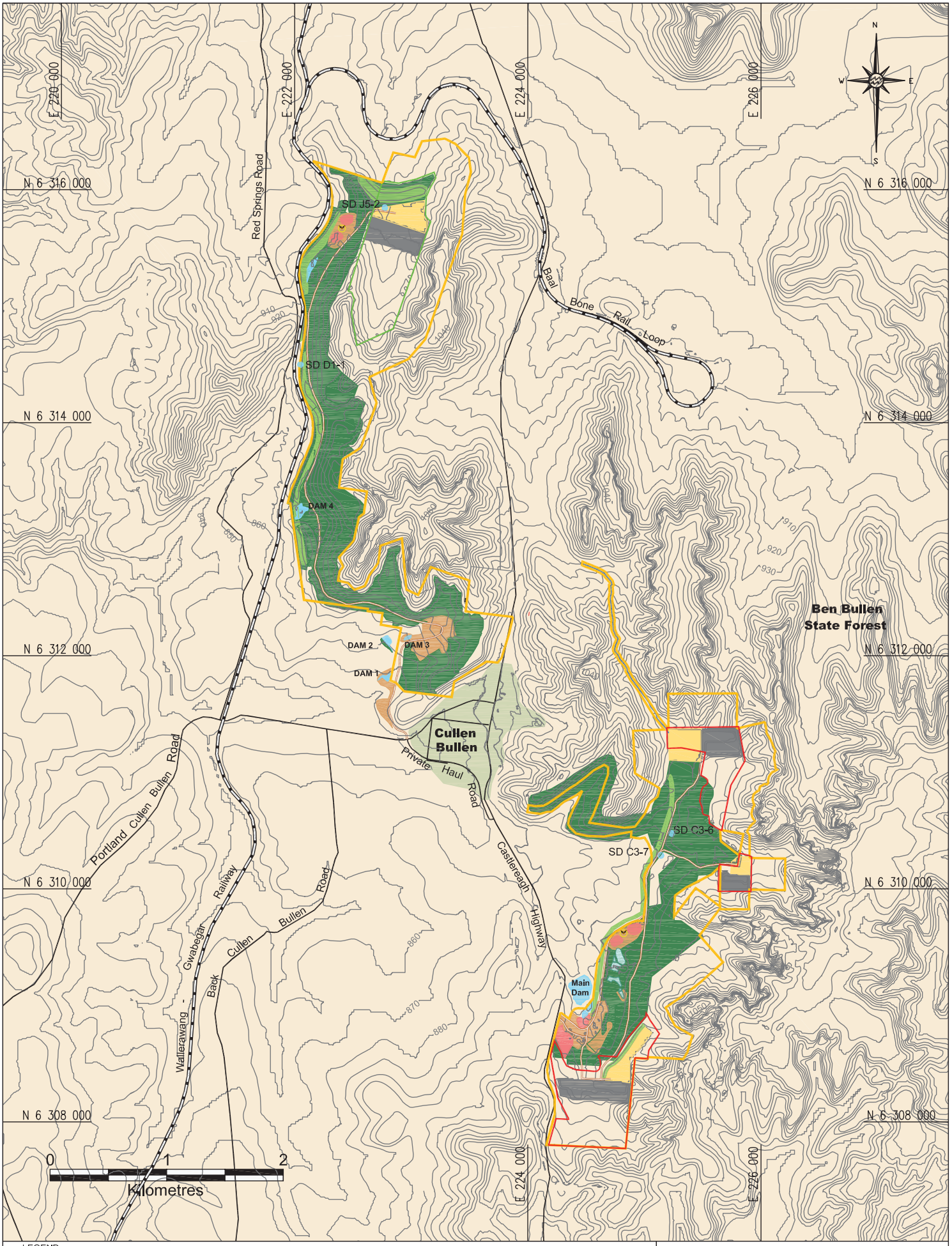

LEGEND

- Modification Boundaries
- Invincible Colliery Modification Disturbance Boundary
- Cullen Valley Mine Modification Disturbance Boundary
- Roads
- Indicative Haul Road
- Water Pipeline
- Rail
- Infrastructure Area
- Tailings Drying Area
- Rehabilitation
- Noise Bunds
- Water Storage
- Coal Stockpile
- Active Mining
- Overburden Emplacement
- Residential Area

Conceptual Year 2 Mine Plan

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: 5

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3.3.3 Water Management

Connection of the existing Cullen Valley Mine water pipeline to the proposed pipeline from Invincible Colliery will allow the transfer of mine water to and from the adjacent Cullen Valley Mine for operational use (including dust suppression and to manage historic underground heating) on an as-needs basis.

The proposed section of water pipeline will largely be placed on existing access tracks within the Ben Bullen State Forest where ever practical to minimise disturbance, and will be buried as required for operational reasons (see **Figure 4**).

From its southern extent within the Northern Mining Area proposed for this Modification, the pipeline will extend for approximately 1.6 km to Coalpac controlled lands located to the east of the Castlereagh Highway. A water bore controlled by Coalpac at this site (Bore 27898) has the capacity to provide water to and from the existing storage tanks at the Cullen Valley Mine infrastructure area.

3.3.4 Rehabilitation and Final Landform

The Modification is also required to ensure the orderly rehabilitation of disturbance from the approved open cut mining areas and the backfilling of the three residual final voids at Invincible Colliery. The additional mining proposed for the Modification will also allow the rehabilitation of portions of the Southern Mining Area that have previously been impacted by subsidence resulting from abandoned underground workings in the Ivanhoe Colliery. The conceptual final landform following the conclusion of the Modifications and development of rehabilitation communities is presented in **Figure 6**, with cross sections of key areas shown on **Figure 7**.

The extension to mining operations proposed will facilitate the development of a free-draining final landform at the conclusion of these proposed mining activities at Invincible Colliery that can support the establishment of a native forest of similar structure to that currently surrounding the area.

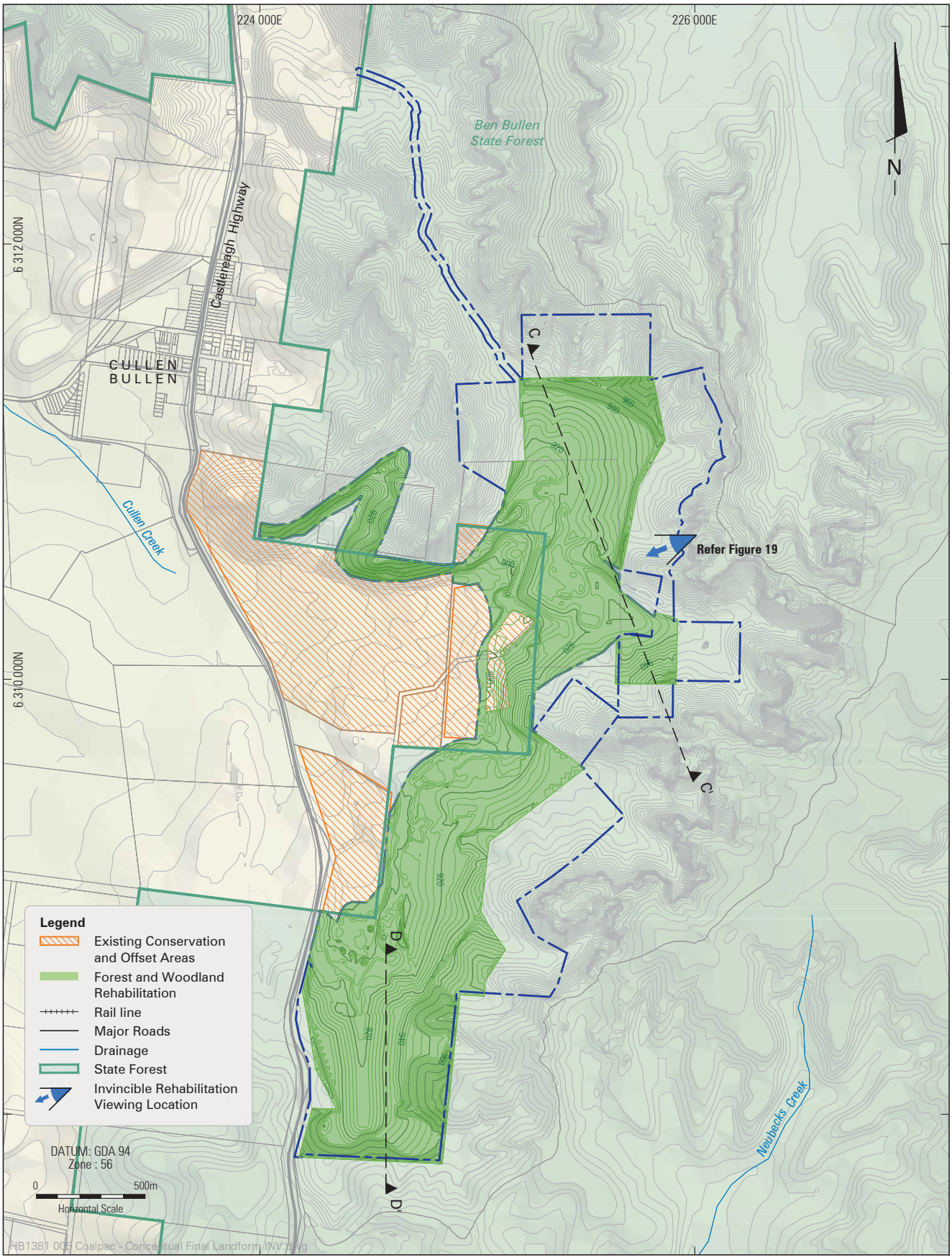
3.4 CULLEN VALLEY MINE MODIFICATION

The Cullen Valley Mine Modification seeks approval for the following:

- Extension of 62 ha to areas approved for open cut mining. The approved area of open cut mining in the existing Development Consent is 362 ha;
- Extension of 79 ha to areas approved for highwall mining. These highwall mining operations will not result in additional surface disturbance. The approved area of highwall mining in the existing Project Approval is 68 ha;
- Ability to benefit from the transfer of water to and from Invincible Colliery; and
- Backfilling and rehabilitation of the proposed and residual final voids resulting from existing mining operations to create a free-draining final landform at the conclusion of the mining activities proposed for the Modification.

3.4.1 Mining Operations

The proposed extension to mining operations at Cullen Valley Mine would occur via open cut and highwall mining methods in an area within the Ben Bullen State Forest.

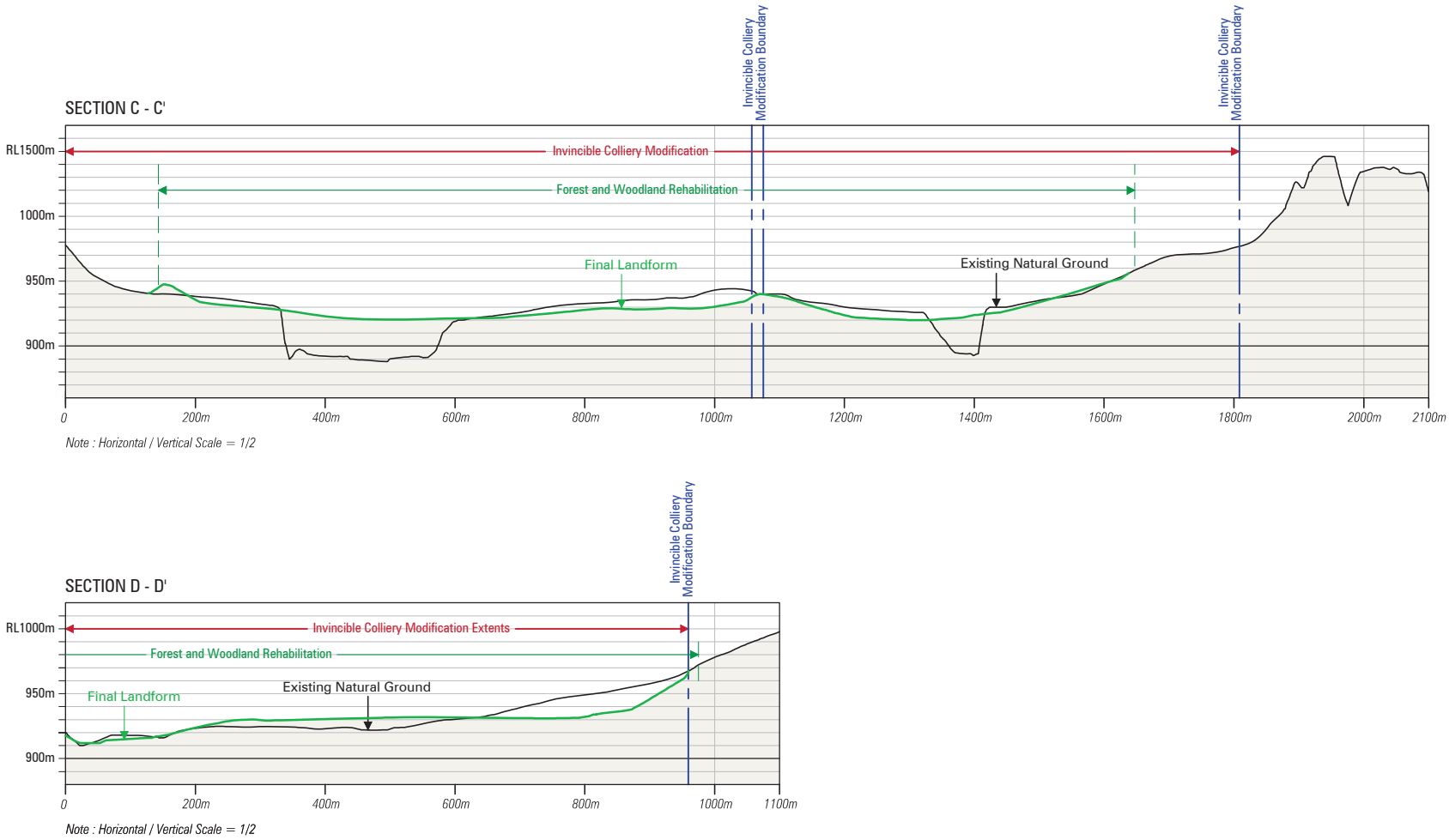


COALPAC MODIFICATIONS

Coalpac Pty Ltd | Hansen Bailey ENVIRONMENTAL CONSULTANTS

Conceptual Post-Mining Landform
- Invincible Colliery

FIGURE 6



HB1381 008 Coalpac - Conceptual Final Landform Section 2.dwg

COALPAC MODIFICATIONS

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Conceptual Post-Mining Landform Sections
- Invincible Colliery

FIGURE 7

This area is adjacent to the northern extent of the currently approved open cut mining footprint (see **Figure 4**). The modified mining activities will result in the disturbance of an additional 62 ha to the current disturbance area of 362 ha approved for open cut mining under DA 200-5-2003.

The additional highwall mining activities would occur in an area of up to 79 ha and not result in any surface disturbance.

A conceptual mine plan for Year 2 of the Modification is presented in **Figure 5**. Cullen Valley Mine will continue to produce up to 1 Mtpa of product coal for the additional period of mining operations proposed for the Modification.

3.4.2 Water Management

The Modification is also seeking approval to accept mine water from Invincible Colliery via new water storage tanks in the locality of Bore 27898 through an existing pipeline which connects this bore to the existing water storage tanks at Cullen Valley Mine. The new water storage tanks will be fed by a new pipeline from Invincible Colliery. A staging pump and storage tanks will be located within an existing disturbance area located in the Ben Bullen State Forest (see **Figure 4**).

The mine water sourced from Invincible Colliery will be used to supplement process water requirements for dust suppression and for the ongoing management of the historic subsurface heating issue in the underground workings.

The volume of water to be transferred in this manner from Invincible Colliery will not exceed 750 ML in any calendar year (averaged over a four year period).

3.4.3 Rehabilitation and Final Landform

The Modification is also required to ensure the orderly rehabilitation of disturbance from the approved open cut mining areas at Cullen Valley Mine and the backfilling of the final voids The voids that would otherwise remain at the northern end of the currently approved areas are largely due to the avoidance of a known population of Clandulla geebung (*Persoonia marginata*) (see **Section 6.6**) and the resulting premature suspension of operations in that area.

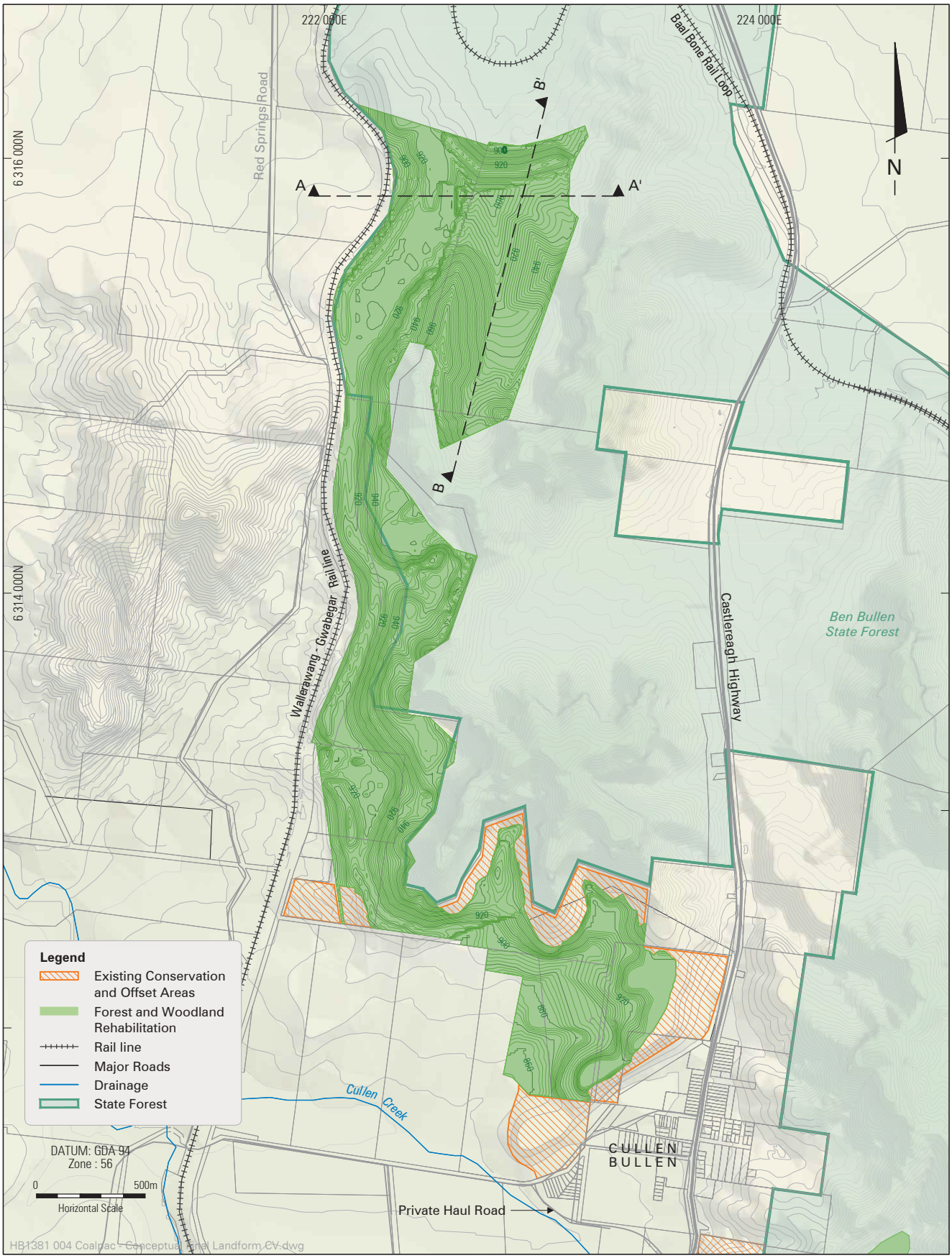
The additional mining proposed for the Modification has been specifically designed to facilitate the creation of a free-draining final landform at the conclusion of mining activities that can support the establishment of a native forest of similar structure to that currently surrounding the area.

The conceptual final landform following the conclusion of the Modifications and development of rehabilitation communities is presented in **Figure 8**, with cross sections of key areas shown on **Figure 9**.

3.5 MODIFICATION INTERACTIONS

In addition to the individual proposals described in **Section 3.3** and **Section 3.4**, the approval of both Modifications is required to allow Coalpac the ability to provide product coal of the required quality (through blending of coal from both operations) and volumes needed to supply short term competitively priced coal fuel to MPPS.

The approval of both of the Modifications as proposed will allow the competitive and cost-effective supply of coal to satisfy fuel demand at MPPS and mitigate any potential increase in fuel costs which may otherwise be passed on to electricity consumers in NSW.

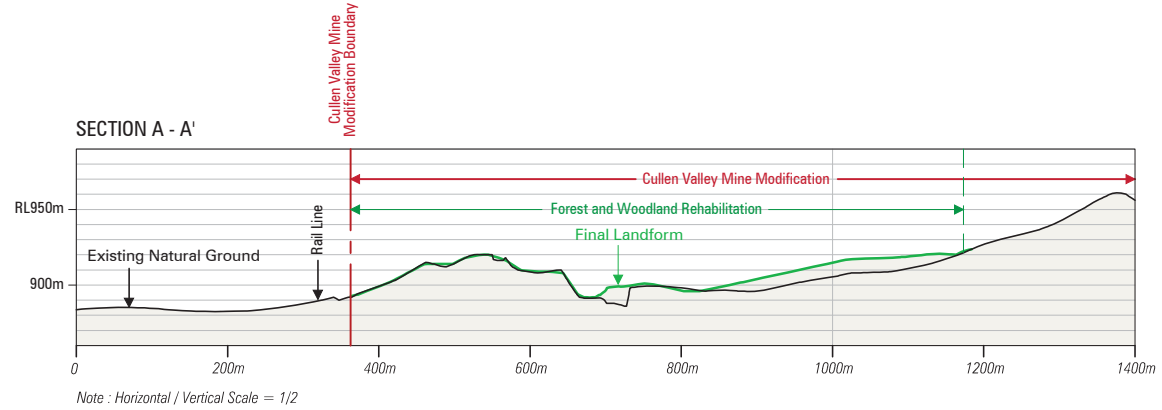


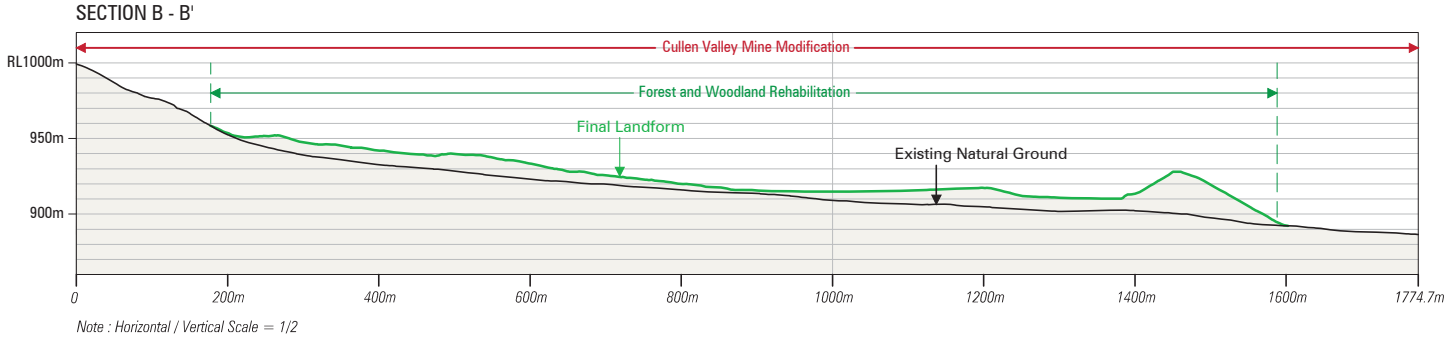
COALPAC MODIFICATIONS

Coalpac Pty Ltd | Hansen Bailey ENVIRONMENTAL CONSULTANTS

Conceptual Post-Mining Landform
- Cullen Valley Mine

FIGURE 8





HB1381 007 Coalpac - Conceptual Final Landform Section 1.dwg

COALPAC MODIFICATIONS

Coalpac Pty Ltd | Hansen Bailey ENVIRONMENTAL CONSULTANTS

Conceptual Post-Mining Landform Sections
- Cullen Valley Mine

FIGURE 9

4 REGULATORY FRAMEWORK

This section describes the regulatory framework under which Invincible Colliery and Cullen Valley Mine are approved to operate as relevant to the Modifications proposed for each site. It discusses the ability of the Minister for Planning and Infrastructure to modify PA 07_0127 and DA 200-5-2003 under section 75W of the EP&A Act and describes the approvals process for each. It also discusses the requirements for other licences and approvals as a result of the proposed Modifications.

4.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

4.1.1 Existing Development Consents

Invincible Colliery PA 07_0127

On 4 December 2008, Coalpac was granted PA 07_0127 for the Invincible Colliery under section 75J in Part 3A of the EP&A Act by the (then) Minister for Planning. The conditions of PA 07_0127 require that the development be conducted '*generally in accordance with*' the supporting EA documents (Schedule 2, Condition 2 of PA 07_0127) and the conditions of PA 07_0127 (as modified).

PA 07_0127 authorises the undertaking of mining operations on site until 4 December 2016.

Cullen Valley Mine DA 200-5-2003

On 18 August 2004, Lithgow Coal Company Pty Limited was granted DA 200-5-2003 under section 80 in Part 4 of the EP&A Act by the (then) Minister for Infrastructure and Planning. DA 200-5-2003 was classified as "*state significant development*''. The development was approved on the basis of the environmental impact statement that was described within the Feldmast Coal Project Cullen Bullen EIS and the Cullen Valley Mine Lease Extension Project EIS. Condition 2 under Schedule 3 of DA 200-5-2003 requires that the development be conducted '*generally in accordance with*' the supporting EIS documents and the conditions of DA 200-5-2003 (as modified).

DA 200-5-2003 authorises mining operations on site until 19 August 2025.

4.1.2 Power to Modify

Invincible Colliery PA 07_0127

Coalpac was granted PA 07_0127 under Part 3A of the EP&A Act. Part 3A was repealed on 1 October 2011. However, Schedule 6A of the EP&A Act provides that the provisions of the former Part 3A continue to apply to "transitional Part 3A projects".

Clause 12 of Schedule 6A of the EPA Act provides that section 75W (as in force immediately prior to the repeal of Part 3A of the EPA Act) applies to facilitate modifications of approvals referred to in clause 8J(8) of the *Environmental Planning ad Assessment Regulation 2000*.

Clause 2 of Schedule 6A, provides that 'transitional Part 3A projects' include 'approved projects'. 'Approved project' is defined in Schedule 6A (Clause 1(2) provides that words in Schedule 6A have the same meaning as they had in the former Part 3A – where 'approved project' means a development which has been declared to be one to which Part 3A applies …" … *to the extent that it is approved by the Minister under this Part* …"

As Invincible Colliery development was approved under Part 3A, Invincible Colliery constitutes a transitional Part 3A project. The provisions of Part 3A therefore continue to apply to the Invincible Colliery, including section 75W under which this Modification is sought.

Cullen Valley Mine DA 200-5-2003

Clause 8J(8) of the *Environmental Planning & Assessment Regulation 2000* (EP&A Regulation) addresses the applicability of section 75W of the EP&A Act to developments that were not approved under Part 3A. Clause 8J(8) relevantly states:

"(8) For the purposes only of modification, the following development consents are taken to be approvals under Part 3A of the Act and section 75W of the Act applies to any modification of such a consent:

(c) a development consent granted by the Minister under Part 4 of the Act (relating to State significant development) before 1 August 2005 or under clause 89 of Schedule 6 to the Act".

The Lithgow Coal Company Pty Limited was granted DA 200-5-2003 under Part 4 of the EP&A Act on 16 December 2004. The development was classified as State Significant Development pursuant to section 76A of the EP&A Act (as it was then). Therefore, clause 8J(8) of the EP&A Regulation enables the modification of DA 200-5-2003 under section 75W of the EP&A Act.

4.1.3 Landowner Consent and Notification – Both Modifications

Clause 8F of the EP&A Regulation applies to transitional Part 3A projects. Clause 8F provides that the consent of the landowners is not required for a modification application under section 75W of the EPA Act for '… *any activity that is related to mining …*'. Notice of the development application must be given to the public through an advertisement published in a newspaper circulating in the area of the project within 14 days after the making of the application. Coalpac will give notice to the public in accordance with clause 8F of the EP&A Regulation.

All land which is the subject of both Modification applications is owned by Coalpac, subject to an agreement with Coalpac, or located on lands within the Ben Bullen State Forest. Coalpac has an advanced draft agreement with Forestry Corporation NSW regarding the operations as described in this EA for the proposed Modification. This agreement will be finalised and executed if the Modifications are approved.

4.1.4 Section 75W of the EP&A Act

The applications for both Modifications are made under section 75W of the EPA Act (kept alive by virtue of Schedule 6A EPA Act). The Minister is the consent authority.

Section 75W states:

> *"(1) In this section:*
>
> ***Minister's approval** means an approval to carry out a project under this Part, and includes an approval of a concept plan.*
>
> ***modification of approval** means changing the terms of a Minister's approval, including:*
>
> *(a) revoking or varying a condition of the approval or imposing an additional condition of the approval, and*
>
> *(b) changing the terms of any determination made by the Minister under Division 3 in connection with the approval.*
>
> *(2) The proponent may request the Minister to modify the Minister's approval for a project. The Minister's approval for a modification is not required if the project as modified will be consistent with the existing approval under this Part.*
>
> *(3) The request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.*
>
> *(4) The Minister may modify the approval (with or without conditions) or disapprove of the modification.*
>
> *(5) The proponent of a project to which section 75K applies who is dissatisfied with the determination of a request under this section with respect to the project (or with the failure of the Minister to determine the request within 40 days after it is made) may, within the time prescribed by the regulations, appeal to the Court. The Court may determine any such appeal."*

In *Barrick Australia Limited v Williams* [2009] NSWCA 275, Justice Basten found that section 75W "*confers on the Minister an implicit obligation to be satisfied that the request falls within the scope of the section".* It was accepted that to engage the power to modify under section 75W, the Minister is called upon to form a view as to whether the proposed changes amount "*to a radical transformation of the terms of the existing development consent*". The court held that this finding is a question of jurisdictional fact for the Minister.

In making that comparison between what is proposed and what is already approved, the Minister will compare what is proposed in this application with "…*the approval, with any earlier modifications, as it stood at the time of the modification request. The relevant comparison … is with the modified development consent as at the date of the modification request*." (Williams v Minister for Planning 2009 BC 200900319, page 54).

These Modifications do not constitute a "*radical transformation*" from what has been approved under PA 07_0127 for Invincible Colliery and DA 200-5-2003 for Cullen Valley Mine. The following essential elements of Cullen Valley Mine and Invincible Colliery will remain unaltered by each of the proposed Modifications:

- Mining and other equipment,
- Mining methodology,
- Hours of operation,
- Manning levels,
- Coal handling and processing,
- Coal transport and access to site,
- Water management (apart from the introduction of the new proposed inter-mine pipeline),
- Reject handling,
- Total annual output of ROM and product coal; and
- Total duration of mining (in the case of Cullen Valley Mine. Note that the Modification sought in respect of the Invincible Colliery PA 07_0127 seeks to extend the duration of mining by 4 years).

The developments approved by PA 07_0127 and DA 200-5-2003 will remain in the same locality, mining coal from the same seams, using the same mining methodology.

The principal changes to the development which would arise from approval to the modifications are as follows.

Invincible Colliery

- The duration of approval under PA 07_0127 extended by 4 years (from 8 years to 12 years);
- Extension to approved open cut mining areas from 152 ha by 88 ha (proposed);
- Extension to approved highwall mining areas from 56 ha by 86 ha (proposed);
- Rehabilitation of the site to improve environmental outcomes in the long term; and
- Installation of a water pipeline to link the site to Cullen Valley Mine.

Cullen Valley

- Extension to approved open cut mining areas from 362 ha by 62 ha (proposed);
- Extension to approved highwall mining areas from 68 ha by 79 ha (proposed);
- Rehabilitation of the site to improve environmental outcomes in the long term; and
- Installation of a water pipeline to link the site to Invincible Colliery.

4.1.5 Objects of the EP&A Act

The objects of the EP&A Act are stated in section 5 of the Act.
"The objects of this Act are:

(a) to encourage:

(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,

(ii) the promotion and co-ordination of the orderly and economic use and development of land,

(iii) the protection, provision and co-ordination of communication and utility services,

(iv) the provision of land for public purposes,

(v) the provision and co-ordination of community services and facilities, and

(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

(vii) ecologically sustainable development, and

(viii) the provision and maintenance of affordable housing, and

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.'

The elements of 'ecologically sustainable development' are (see section 6(2) of the Protection of the Environment Operations Act 1997 NSW) are as follows:

(a) the precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

(b) In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The proposed Modifications are consistent with the objects of the EP&A Act, as discussed in **Section 8**.

4.2 ENVIRONMENTAL PLANNING INSTRUMENTS

4.2.1 SEPP (Mining, Petroleum Production and Extractive Industries) 2007

Section 75J(3) of the EPA Act gives the Minister the power (but does require the Minister) to consider the provisions of environmental planning instruments which do not (because of section 75R) apply to a project. As a statement of public/government policy it is open for the Minister to conclude that it is appropriate to take into consideration the provisions of SEPP Mining in determining the applications. In particular, clause 12AA is a recent amendment to SEPP Mining (November 2013) and, accompanied by a media release from the relevant Minister, said "*The potential investment and employment benefits for regional communities are now an important consideration when deciding on major mining projects in New South Wales. … The Significance of the resource – as established by the Government, not the applicant – must then be carefully weighed against any potential environmental, social and enmity impacts.*"

Clause 12AA of SEPP Mining provides that the consent authority must consider the significance of the mineral resource. Clause 12AA relevantly states (our emphasis):

"12AA Significance of Resource

(1) In determining an application for consent for development for the purposes of mining, the consent authority must consider the significance of the resource that is the subject of the application, having regard to:

(a) the economic benefits, both to the State and the region in which the development is proposed to be carried out, of developing the resource, and

(b) any advice by the Director-General of the Department of Trade and Investment, Regional Infrastructure and Services as to the relative significance of the resource in comparison with other mineral resources across the State.

(2) The following matters are (without limitation) taken to be relevant for the purposes of subclause (1) (a):

(a) employment generation,

(b) expenditure, including capital investment,

(c) the payment of royalties to the State."

Clause 12 of SEPP Mining requires the consent authority to consider the compatibility of the proposed development with existing and approved land uses in the vicinity of the development. Clause 13 requires the Minister to consider the compatibility of the proposed development with surrounding mines, petroleum production facilities and extractive industries.

In the case of both modifications the "*significance of the resource*" may be viewed from the perspective of the direct matters referred in clause 12AA(2) of SEPP Mining (set out above) as well as (the indirect) matters such as the fact that the Cullen Valley Mine and Invincible Colliery are located immediately adjacent to the MPPS and are an important and cost effective source of fuel for the MPPS the receipt of which enables electricity generation at best possible economics which benefit flows to the state as a whole by bringing average electricity prices down.

Clause 12AB of SEPP Mining also sets out a series of "*non discretionary development standards for mining*" all of which are satisfied by the developments the subject of these Modifications if they were to be approved.

Part 4AA of SEPP Mining outlines the Gateway Process that applies to proposed mining developments on Strategic Agricultural Land (SAL). Pursuant to Schedule 6A "*Transitional Arrangements – Repeal of Part 3A*", Clause 20(4)(b)(ii), a site verification certificate confirming that the Modifications do not fall on Biophysical SAL will be required to be issued by the Director-General of DP&I.

4.2.2 Lithgow City Local Environmental Plan 1994

The Modifications are located within the Lithgow City Local Government Area (LGA). The relevant environmental planning instrument for the Lithgow City LGA is the *Lithgow City Local Environmental Plan 1994* (Lithgow City LEP).

The Modifications are located on land zoned as either 1(a) – Rural (General) or 1(f) – Rural (Forestry). Clause 9 of the LEP states the objectives and development controls:

The objectives of Zone 1(a) are:

- *(a) protecting, enhancing and conserving:*
  - *(i) rural land, in particular prime crop and pasture land, in a manner which sustains its efficient and effective agricultural production potential,*
  - *(ii) soil, by controlling and locating development in accordance with soil capability,*
  - *(iii) forests of existing and potential commercial value for timber production,*
  - *(iv) valuable deposits of minerals, coal and extractive materials, by controlling the location of development for other purposes in order to ensure the efficient extraction of those deposits,*
  - *(v) trees and other vegetation in environmentally sensitive areas, where the conservation of the vegetation is significant for scenic amenity or natural wildlife habitat or is likely to control land degradation,*
  - *(vi) water resources for use in the public interest, preventing the pollution of water supply catchment and major water storages,*
  - *(vii) localities of significance for nature conservation, including places with rare plants, wetlands and significant wildlife habitat, and*
  - *(viii) items of heritage significance,*

(b) preventing the unjustified development of prime crop and pasture land for purposes other than agriculture,
(c) facilitating farm adjustments,
(d) minimising the cost to the community of:
(i) fragmented and isolated development of rural land, and
(ii) providing, extending and maintaining public amenities and services,
(e) providing land for other non-agricultural purposes, in accordance with the need for that development, and
(f) providing for the separation of conflicting land uses.

Open cut mining is permissible with development consent on land zoned as 1(a) – Rural (General).

The objectives of Zone 1(f) are:

(a) to identify land managed by the Forestry Commission under the Forestry Act 1916,
(b) to preserve existing forests within the City of Lithgow, while allowing compatible development, and
(c) to prevent pollution of water supply catchments and water quality in major water storages.

Mining is permissible with development consent on land zoned as 1(f) – Rural Forestry.

A draft *Lithgow City Local Environment Plan 2013* (draft Lithgow LEP) was placed on public exhibition in 2013. The draft Lithgow LEP is currently being amended in response to public submissions. At present, the Lithgow City LEP remains the relevant local planning instrument.

Under sections 75J and 75R EPA Act, the Minister may, but is not required to, take into consideration the provisions of the abovementioned LEP and draft LEP.

4.3 APPROVALS UNDER OTHER NSW LEGISLATION

4.3.1 Exemptions

Invincible Colliery

As a transitional Part 3A project, Invincible Colliery will continue to be subject to section 75U and 75V of the EP&A Act. Section 75U states that the following authorisations and approvals are not required for projects that have been approved under Part 3A of the EP&A Act:

(a) the concurrence under Part 3 of the Coastal Protection Act 1979 of the Minister administering that Part of the Act,
(b) a permit under section 201, 205 or 219 of the Fisheries Management Act 1994,
(c) an approval under Part 4, or an excavation permit under section 139, of the Heritage Act 1977,
(d) an Aboriginal heritage impact permit under section 90 of the National Parks and Wildlife Act 1974,
(e) an authorisation referred to in section 12 of the Native Vegetation Act 2003 (or under any Act to be repealed by that Act) to clear native vegetation or State protected land,

(f) a bush fire safety authority under section 100B of the Rural Fires Act 1997,

(g) a water use approval under section 89, a water management work approval under section 90 or an activity approval under section 91 of the Water Management Act 2000.

Section 75V of the EPA Act provides:

An authorisation of the following kind cannot be refused if it is necessary for carrying out an approved project and is to be substantially consistent with the approval under this Part:

(a) an aquaculture permit under section 144 of the Fisheries Management Act 1994,

(b) an approval under section 15 of the Mine Subsidence Compensation Act 1961,

(c) a mining lease under the Mining Act 1992,

(d) a production lease under the Petroleum (Onshore) Act 1991,

(e) an environment protection licence under Chapter 3 of the Protection of the Environment Operations Act 1997 (for any of the purposes referred to in section 43 of that Act),

(f) a consent under section 138 of the Roads Act 1993,

(g) a licence under the Pipelines Act 1967.

Cullen Valley Mine

Clause 8J(8) of the EP&A Regulation provides that a development consent modified using section 75W of the EP&A Act does not become an approval under Part 3A of the Act. Section 75U and 75V EPA Act apply in respect of "an approved project" which is defined in section 75A EPA Act as "*… a project to the extent that it is approved by the Minister under this Part …*".

4.3.2 Protection of the Environment Operations Act 1997

Invincible Colliery

Section 48 of the *Protection of the Environment Operations Act 1997* (POEO Act) provides that an Environment Protection Licence (EPL) is required for scheduled activities under the Act. Under clause 28 of Schedule 1 of the POEO Act, "*mining for coal*" is deemed to be a scheduled activity if the daily production exceeds 500 tonne, or if the disturbance area exceeds 4 ha. Invincible Colliery constitutes a scheduled activity and therefore requires an EPL.

Coalpac currently holds EPL 1095 for the Invincible Colliery. Coalpac will seek amendment to the EPL for the Modification as required.

Cullen Valley Mine

Cullen Valley Mine also constitutes a scheduled activity and therefore requires an EPL.

Lithgow Coal Company Pty Limited, a wholly owned subsidiary of Coalpac, currently holds EPL 10341 for the Cullen Valley Mine. Coalpac will seek amendment to the EPL for the Modification as required.

4.3.3 Mining Act 1992

Invincible Colliery

The mining of coal in NSW requires an authority under the *Mining Act 1992* (Mining Act) (a mining lease). Section 5 of the Mining Act provides that mining cannot be undertaken except in accordance with a valid mining authorisation. Section 6 of the Mining Act provides that stipulated mining purposes must not be carried out without a mining lease. Coalpac currently holds ML1638 and ML1635 for open cut mining operations at Invincible Colliery. The proposed Northern and Eastern mining areas are situated entirely within ML1638.

A portion of the proposed Southern mining area is situated outside of Coalpac's existing mining leases. Mining Lease Application (MLA) 431 has been lodged for the area in which the Southern mining area will be established. MLA431 includes the land from the surface to a depth of 900 m, and will include and incorporate the existing part transfer of CCL712 from Ivanhoe Coal Pty Limited (a subsidiary of Centennial Coal Pty Limited).

Pursuant to section 75V of the EP&A Act, a mining lease must be granted for an approved project under Part 3A if the lease is necessary for the carrying out of the project.

Cullen Valley Mine

Mining operations at Cullen Valley Mine are currently conducted within ML1557, ML1455 and ML1488.

The proposed mining area at Cullen Valley Mine is partly located within ML1556, which is held by Lithgow Coal Company Pty Ltd. ML1556 excludes the land from the surface to a depth of 15 m. A new mining lease is therefore required to enable mining from the surface to a depth of 15 m. The proposed mining area is entirely located within Exploration Licence 6007 and Authorisation 420, both of which are held by Lithgow Coal Company Pty Ltd. Coalpac has lodged MLA392, within which the additional mining area proposed for the Cullen Valley Modification will be located.

4.3.4 Native Vegetation Act 2003

Under the Native Vegetation Act 2003 (NV Act) it is an offence to clear native vegetation without development consent for the clearing.

Section 25(l) of the NV Act provides that clearing authorised under the Mining Act is exempt from the provisions of the NV Act. All vegetation clearing associated with the Modifications will occur within mining leases.

4.3.5 National Parks and Wildlife Act 1974

Invincible Colliery

Under section 86 of the *National Parks and Wildlife Act 1974* (NPW Act), it is an offence to harm an Aboriginal object unless the harm is authorised by an Aboriginal Heritage Impact Permit (AHIP).

Pursuant to section 75U of the EP&A Act, an AHIP under section 90 of the NPW Act is not required for Invincible Colliery given that it is an approved Part 3A project.

Cullen Valley Mine

Aboriginal archaeological surveys have determined that there are no Aboriginal objects located within the additional disturbance area proposed for the Cullen Valley Mine Modification. Therefore, an AHIP is not required for the Modification to Cullen Valley Mine.

4.3.6 Water Management Act 2000 and Water Act 1912

The licensing and approvals provisions of the *Water Management Act 2000* (WM Act) apply to water sources that are the subject of a Water Sharing Plan (WSP). Under section 60A of the WM Act, a Water Access Licence (WAL) is required to authorise the taking of water from a water source. Generally this requirement applies to each water source to which a WSP applies.

The licensing regime under the *Water Act 1912* (Water Act) continues to apply to water sources that have not been made the subject of a WSP.

Invincible Colliery

The only WSP that applies to Invincible Colliery is the '*Water Sharing Plan for the NSW Murray-Darling Basin Porous Rock Groundwater Sources 2011'* (Porous Rock WSP).

Invincible Colliery is located within the Sydney Basin Murray Darling Basin (SBMDB) Groundwater Source under the Porous Rock WSP. The WSP applies to all water contained in Permian, Triassic, Jurassic, Cretaceous and Tertiary age rocks, as well as alluvial sediments within the boundary of the SBMDB Groundwater Source.

Coalpac holds groundwater licence 10AL118580 and works approval 10WA118581 (Washery Bore) which replaced the previously held licence 10BL602584.

This bore licence authorises extraction of 26 megalitres (ML) per annum of water from SBMDB Groundwater Source. Peak annual take of water from this water source will be negligible and in any event, less than 26 ML per annum.

The total share component for aquifer licences in this water source is 2,657 unit shares and therefore it is concluded that there is sufficient water licence held for the requirements of the development as modified to enable it to account for all water taken from this water source with appropriate allocation.

All surface water and groundwater (other than that described above) taken by the mine is derived from water sources outside a Water Sharing Plan.

All water taken by the mine is from dirty water runoff from disturbed areas (retained in sedimentation dams and mine water management systems) or from old underground workings which receive dirty water from the mine. The taking of these waters does not require licensing.

Cullen Valley Mine

The only WSP that applies to Cullen Valley Mine is the Porous Rock WSP.

Cullen Valley Mine is located within the SBMDB Groundwater Source under the Porous Rock WSP. The WSP applies to all water contained in Permian, Triassic, Jurassic, Cretaceous and Tertiary age rocks, as well as alluvial sediments within the boundary of the SBMDB Groundwater Source.

Coalpac will require a WAL to authorise water taken from the bedrock strata via inflows to open cut mining areas. Coalpac currently holds WAL 27898 to authorise the taking of water from the SBMDB Groundwater Source in the course of operations at Cullen Valley Mine. Peak annual take of water from the SBMDB Groundwater Source by the Cullen Valley mine as modified has been modelled to be 3.3 ML (see **Appendix E**). WAL 27898 has a share component of 80 units attached to it.

The total share component for aquifer licences in this water source is 2,657 unit shares and therefore it is considered that the water licence held will be sufficient for the requirements of the development as modified to enable it to account for all water taken from this water source with appropriate allocation.

All surface water and groundwater (other than that described above) taken by the mine is derived from water sources outside a Water Sharing Plan.

All water taken by the mine is from dirty water runoff from disturbed areas (retained in sedimentation dams and mine water management systems) or from old underground workings which receive dirty water from the mine. The taking of these waters does not require licensing.

4.4 COMMONWEALTH LEGISLATION

4.4.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas of national significance. The EPBC Act is administered by the Department of Environment (DoE) and provides protection for listed Matters of National Environmental Significance (MNES). There are nine MNES in total:

- Listed threatened species and ecological communities;
- World heritage properties;
- National heritage places;
- Wetlands of international importance;
- Migratory species;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park;
- Nuclear actions; and
- Protection of water resources from coal seam gas development and large coal mine development.

If a proposed action is likely to have a significant effect on one or more MNES, the action is deemed to be a "*controlled action*". The approval of the Commonwealth Minister for the Environment must be obtained before a controlled action can be carried out.

Under section 68 of the EPBC Act, a proposed action must be referred to the Minister if the proponent thinks that the action is or may be a controlled action. If the Minister declares that the proposed action is a controlled action, the action must be the subject of an impact assessment under Part 8 of the EPBC Act. A controlled action cannot be carried out unless the Minister has granted approval under Section 133 of the EPBC Act. A referral under section 68 of the EPBC Act will be made in respect of the proposal described in both Modifications.

5 STAKEHOLDER ENGAGEMENT

This section provides a summary of the stakeholder consultation undertaken for the Modifications by Coalpac.

5.1 REGULATORY ENGAGEMENT

Table 5 provides a summary of the engagement with regulatory stakeholders for the Modifications.

Table 5
Regulatory Stakeholder Consultation Summary

Stakeholder	Consultation	Key Issues and Response
DP&I	19 November 2013 14 January 2014	• Modification mine plans • Avoidance of sensitive areas (ecology and geology) • Amenity impacts • Rehabilitation
DoE	24 January 2014	• Modification mine plans • Impacts to MNES • Rehabilitation • Conservation policy
DRE	16 January 2014	• Modification mine plans • Resource utilisation • Rehabilitation and final voids • Mining tenements
NOW	12 February 2014	• Modification mine plans • Water transfer proposal • Subsurface water management • Groundwater impacts • Cullen Valley Mine subsurface heating management
OEH	21 January 2014 14 February 2014	• Modification mine plans • Rehabilitation • Flora and fauna impacts • Biodiversity Offsets
Forestry Corporation NSW	10 February 2014	• Modification mine plans • Rehabilitation • Access and Compensatory Agreements
LCC	23 January 2014	• Modification mine plans • Community social & economic impacts • Rehabilitation

5.2 LOCAL INTEREST GROUPS

Table 6 provides a summary of the engagement with local interest groups for the Modifications.

Table 6
Local Interest Groups Stakeholder Consultation Summary

Stakeholder	Consultation	Key Issues and Response
Lithgow Business Association	12 February 2014	• Modification mine plans • Community social and economic impacts • Rehabilitation
Lithgow Environmental Group	11 February 2014	• Modification mine plans • Rehabilitation • Biodiversity Offsets
Lithgow Community District Forum	11 February 2014	• Modification mine plans • Community social and economic impacts • Rehabilitation
Cullen Bullen Progress Association Representatives	4 February 2014	• Modification mine plans • Community social, economic and amenity Impacts • Rehabilitation

Coalpac will continue to engage with local interest groups throughout the assessment of the sought Modifications including local Aboriginal groups.

5.3 COMMUNITY ENGAGEMENT

Table 5 provides a summary of the engagement with key community stakeholders for the Modifications. Coalpac will mount a public display at the Cullen Bullen Progress Hall over two days during the public exhibition phase of the assessment process to provide the local community with the opportunity to ask questions directly and gain greater understanding of the proposed Modifications. A newsletter advising the local community of the proposed Modifications and how they can provide comment will be distributed prior to this EA being placed on public exhibition.

Coalpac will continue to engage with the local community during the life of the Modifications using a number of methods, including:

- Direct consultation with neighbouring land owners and industry;
- Direct consultation with Aboriginal stakeholder groups through liaison committees;
- Updates to the Coalpac CCC;
- Updates to the Coalpac website;
- Distribution of community newsletters; and
- Preparation and distribution of Annual Reviews for Invincible Colliery and Cullen Valley Mine, including activities undertaken for the Modifications.

6 IMPACTS, MANAGEMENT AND MITIGATION

The potential environmental impacts of the Modifications, as identified throughout the planning and assessment process have been assessed as part of this EA. The findings of the relevant environmental assessments that were undertaken for this Modification EA and a description of the measures that will be implemented to manage and mitigate potential impacts are presented below.

6.1 AIR QUALITY

6.1.1 Introduction

An assessment has been undertaken by Pacific Environment to determine the potential impacts of the Modifications on air quality, having regard to the relevant assessment criteria for particulate matter and dust deposition. This report is summarised below and provided in **Appendix A**.

Background air quality data was provided by the existing Coalpac air quality monitoring network. The network consists of:

- One High Volume Air Sampler (HVAS) at Invincible Colliery and one HVAS at Cullen Valley Mine; and
- Five dust deposition gauges at Invincible Colliery and five dust deposition gauges at Cullen Valley Mine.

Data collected from this program includes a dust particulate contribution from both the Cullen Valley Mine and Invincible Colliery whilst operating at production rates of up to 1.8 million tonnes per annum, that is, the background dust levels discussed below include contributions from existing approved Coalpac operations. The background air quality data includes contributions from other distant operating mines within the region (i.e. Ivanhoe North Mine, Pine Dale Coal Mine – Yarraboldy Extension and Baal Bone Colliery). The activities proposed under these Modifications are a continuation of activities already captured in the background dust levels. The only significant change will be the location of some of the activities. However to be deliberately conservative, the Modifications have been assessed as an additional level of activity beyond the background levels. Clearly this is an over statement of impacts.

Data collected by the two HVASs indicate that the background annual average PM_{10} based on data collected over a six year period is approximately 10.5 $\mu g/m^3$, which is considerably below the criterion of 30 $\mu g/m^3$. During the monitoring period from February 2008 to October 2013, there were only three days where the 24-hour average PM_{10} criterion was exceeded. An analysis of the data indicates that theses elevated particulate levels were most likely the result of anomalous events such as severe dust storms and bushfires.

There is no specific $PM_{2.5}$ monitoring data for Invincible Colliery or Cullen Valley Mine. Data collected by the Upper Hunter Air Quality Monitoring Network in 2011 and 2012 indicates that $PM_{2.5}$ emissions account for up to 47% of PM_{10} emissions associated with open cut mining operations.

By applying this ratio to local PM_{10} monitoring data, the background annual average $PM_{2.5}$ is calculated to be approximately 4.9 µg/m^3. This is well below the advisory reporting standard of 8 µg/m^3.

There is no specific local monitoring data for total suspended particulates (TSP). Long term monitoring of TSP and PM_{10} associated with open cut mining in the Hunter Valley has established that PM_{10} accounts for approximately 40% of TSP. By applying this relationship to local PM_{10} monitoring data, the background annual average TSP is calculated to be approximately 26 µg/m^3. This is well below the EPA criterion of 90 µg/m^3.

With a background annual average dust deposition rate of less than 1 g/m^2/month, the annual average dust deposition levels in the vicinity of both mines is considerably below the EPA criterion of 4 g/m^2/month.

As noted above, the background air quality levels relied upon in this assessment and input into the air quality model include significant contributions from currently approved Coalpac operations at Cullen Valley Mine and Invincible Colliery. As the mining operations proposed for the Modifications are to take place following previous mining operations and not concurrently with them, the background air quality levels used in the assessment are highly conservative and include contributions that will occur as a consequence of the Modifications. The modelled results are therefore also conservative in terms of any contribution that the Modifications may have to the local air shed.

6.1.2 Methodology

An air quality impact assessment was undertaken using the Level 2 assessment methodology prescribed by the '*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales'* (EPA, 2005) (Approved Methods). This assessment utilised the CALPUFF dispersion model, using meteorological inputs generated by the TAPM and CALMET models.

Dispersion modelling was undertaken for Year 2 of the Modification. Based on coal extraction volumes (highest mining intensity in this year) and distances to private residences, it was determined that Year 2 would represent the worst-case scenario. A detailed emissions inventory was developed for Year 2. Emission factors developed by the US EPA were applied to estimate the amount of dust produced by each dust generated activity.

The effect of dust controls are reflected in the modelling results. That is, the predicted dust levels are the resulting concentrations after all management and mitigation measures have been implemented. A control factor of 80% was assumed for wheel generated dust on unsealed haul roads. This is consistent with the requirements of recent Pollution Reduction Programs (PRPs) for NSW coal mines.

The background particulate matter and dust deposition concentrations include the contributions from mining sources. The background concentrations are added to the impacts of the Modification alone to determine the cumulative impact of all local contributors, including other mines in the locality.

Given that the background concentrations also include a contribution from the open cut mining, rehabilitation, coal processing and transport operations at Cullen Valley Mine and Invincible Colliery, the addition of predicted emissions will result in "double counting" of emissions from Coalpac's operations. The methodology for the cumulative assessment is therefore highly conservative.

6.1.3 Impact Assessment

Invincible Colliery

Impacts of Modification Alone

The criteria for annual average dust deposition and 24-hour average PM10 apply to incremental dust concentrations (resulting from the Modification only). The modelling results for Year 2 predict no exceedances of the 24-hour average PM_{10} criteria at any private residences. Similarly, dust deposition levels at all private residences are predicted to be significantly below the relevant criterion.

One Coalpac owned residence (396) located on Renown Farm (which is an unoccupied residence) is predicted to experience exceedances of both the 24-hour PM_{10} criterion and the dust deposition criterion.

Cumulative Impacts

The criteria for annual average PM_{10}, annual average TSP and annual average dust deposition apply to cumulative dust concentrations. As shown in **Figure 10**, it is predicted that these criteria will not be exceeded at any residences (private or mine-owned).

Cumulative 24-hour average PM_{10} and $PM_{2.5}$ levels were assessed using a statistical approach (Monte Carlo Simulation). Seventeen representative residences were selected, composed of 10 private residences and seven mine owned residences. The results of the statistical analysis predict that there will be one exceedance of the 24-hour average PM_{10} criterion on one day due to background concentrations alone. However, the Modification is not predicted to result in additional exceedances of the 24-hour average PM_{10} criterion at private residences.

The Modifications may result in additional exceedances of this criterion at the nearest mine owned residences only (393, 394 and 396). No private residences are predicted to experience cumulative 24-hour average PM_{10} concentrations above 150 $\mu g/m^3$.

The results of the Monte Carlo analysis show that the contribution of the Modification to cumulative 24-hour average $PM_{2.5}$ concentrations is negligible. As such, the Modification is not predicted to result in any additional exceedances of the 24-hour average $PM_{2.5}$ criterion.

There is one privately owned property where greater than 25% of the property area is predicted to experience an exceedance of the air quality criteria. This industrial property (Block 395) includes a workshop and vehicle maintenance facility. The property is predicted to experience exceedances of the 24-hour average PM_{10} criterion.

Cullen Valley Mine

Impacts of Modification Alone

The criteria for annual average dust deposition and 24-hour average PM_{10} apply to incremental dust concentrations (resulting from the Modification only). The modelling results for Year 2 predict no exceedances of the 24-hour average PM_{10} criteria at all residences (private and mine owned). Similarly, dust deposition levels at all residences are predicted to be below the relevant criterion.

Cumulative Impacts

The criteria for annual average PM_{10}, annual average TSP and annual average dust deposition apply to cumulative dust concentrations. As shown in **Figure 10**, it is predicted that these criteria will not be exceeded at any residences (private or mine-owned).

Cumulative 24-hour average PM_{10} and $PM_{2.5}$ levels were assessed using a statistical approach (Monte Carlo Simulation). Seventeen representative residences were selected, comprised of 10 private residences and 7 mine owned residences. The results of the statistical analysis predict that there will be one exceedance of the 24-hour average PM_{10} criterion on one day due to background concentrations alone. However, the Modification is not predicted to result in additional exceedances of the 24-hour average PM_{10} criterion at any residences. The results of the Monte Carlo analysis show that the contribution of the Modification to cumulative 24-hour average $PM_{2.5}$ concentrations is negligible. As such, the Modification is not predicted to result in any additional exceedances of the 24-hour average $PM_{2.5}$ criterion.

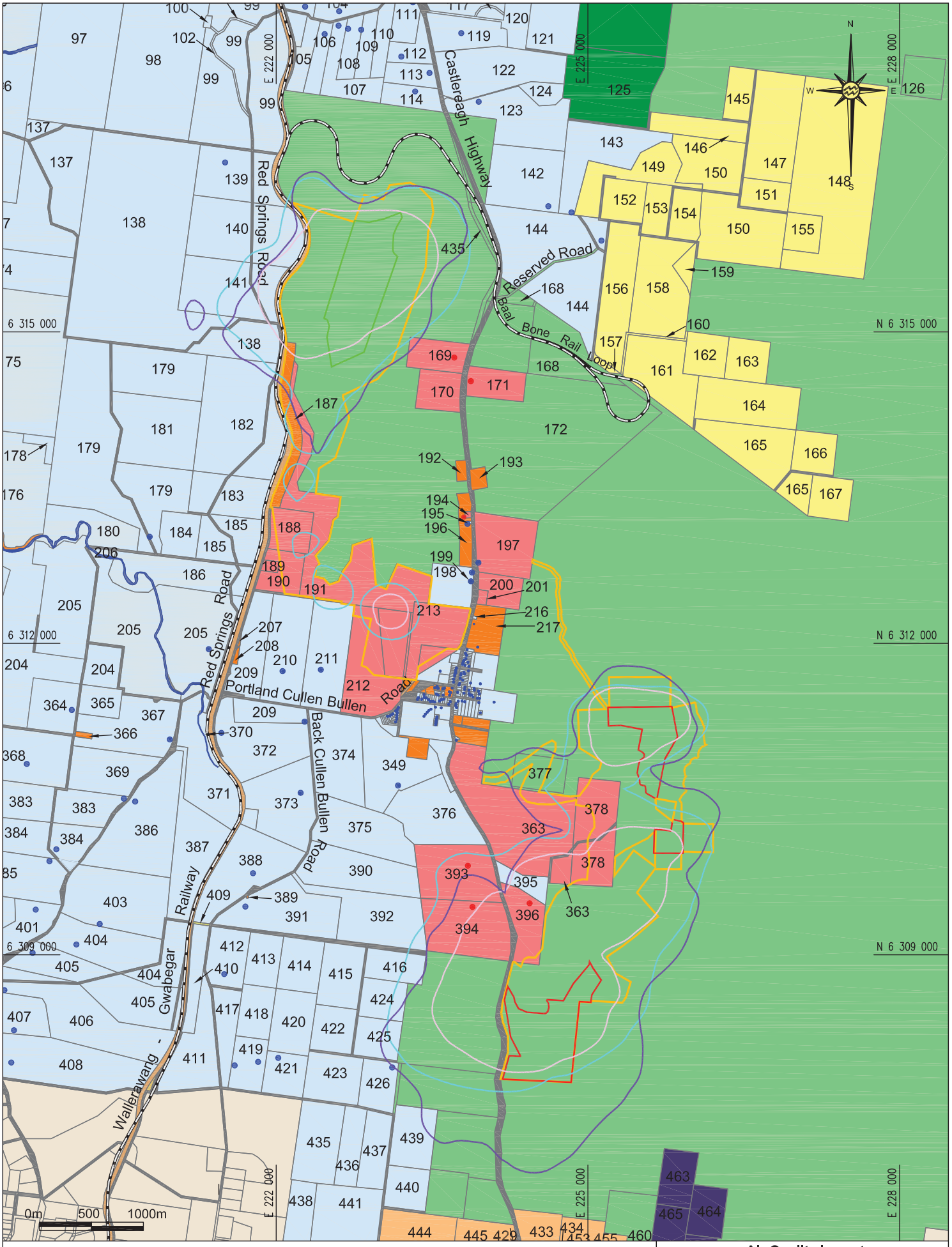
Even with the high level of conservatism in the background levels, the modelling results show that the $PM_{2.5}$, PM_{10}, TSP and dust deposition levels for the Modifications lie 38%, 65%, 71% and 75% respectively below the regulatory criterion.

6.1.4 Mitigation and Management

Both Invincible Colliery and Cullen Valley Mine will continue to implement the dust controls that are currently in place for any existing operations at these mines. These mitigation measures include:

- Minimising pre-strip areas to the extent practicable;
- Alignment of haulage routes to minimise haulage distances;
- Applying Level 1 watering to unsealed roads and other exposed areas;
- Utilising water sprays during drilling;
- Establishing wind breaks around stockpiles; and
- Modifying activities during unfavourable wind conditions.

To further reduce the impacts of the Modifications, Coalpac commits to increasing the watering rate for unsealed roads from Level 1 to Level 2, as defined in '*National Pollutant Inventory: Emission Estimation Technique for Manual for Mining'* (SEWPaC, 2012). Coalpac will also continue to implement the existing air quality monitoring program to proactively manage operations at both Invincible Colliery and Cullen Valley Mine.



LEGEND

- Modification Boundaries
- Invincible Colliery Modification Disturbance Boundary
- Cullen Valley Mine Modification Disturbance Boundary
- Private Freehold Receiver
- Coalpac Owned Receiver
- Rail
- TSP Annual (90µg/m³) Cumulative
- PM_{10} Annual Average (30µg/m³) Cumulative
- PM_{10} 24 hour Maximum (50µg/m³) Project Alone

- Crown
- Coalpac/Coalpac Shareholders
- National Park
- State Forest
- Wallerawang Collieries
- Rail Corporation NSW
- Delta Electricity
- Centennial Pty. Ltd.
- Private Freehold
- Not Searched

Air Quality Impacts (Cumulative Worst Case)

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: **10**

Drawn By:	Date:	Drawing No.:	Revision:	
D.E	14/02/14	23.4.6.9-10A	A	MGA Zone 56

6.2 GREENHOUSE GAS

6.2.1 Introduction

An assessment has been undertaken to estimate the Scope 1, 2 and 3 greenhouse gas emissions generated by the Modifications.

Scope 1 emissions refer to direct greenhouse gas emissions produced by sources owned or controlled by the proponent (Coalpac). Scope 2 and Scope 3 emissions are indirect emissions that are produced as a result of the proponent's activities, but from sources controlled by the proponent. Scope 2 emissions are associated with the use of electricity or heat generated by other parties. Scope 3 emissions are other indirect emissions produced by sources that are not owned or controlled by the proponent. The majority of Scope 3 emissions will be produced by the combustion of the product coal by end users.

6.2.2 Methodology

Greenhouse gas emissions have been calculated using the equations and emissions factors specified in the 'National Greenhouse Accounts Factors' (DCCEE, 2013). Diesel, electricity and explosives requirements for the Modifications were estimated based on usage in approved operations at the Invincible Colliery and Cullen Valley Mine as they will be a continuation of similar activities.

6.2.3 Impact Assessment

The greenhouse gas emissions for the two Modifications were calculated collectively. The key sources of Scope 1 greenhouse gas emissions are diesel use, fugitive emission, use of explosives and staff transportation. The predicted Scope 1 greenhouse gas emissions generated by the Modifications are shown in **Table 7**. The estimated Scope 1 emissions intensity of the Proposal is approximately 0.015 t CO_2-e/t saleable coal. The estimated emissions intensity of the Modifications is comparable with the emissions intensity of existing open-cut coal mines in Australia (Deslandes, 1999).

The key sources of Scope 2 and 3 emissions are onsite electricity usage, diesel combustion associated with coal transportation, and use of product coal. **Table 8** shows the predicted Scope 2 and 3 emissions for each year of the Modifications.

6.2.4 Mitigation and Management

Coalpac will continue to implement the existing Greenhouse Gas and Energy Efficiency Management Plans in place at Invincible Colliery and Cullen Valley Mine. Management and mitigation measures include:

- Monitoring and improving energy use and efficiency and reducing greenhouse gas emissions from the mining, and processing of coal;
- Considering the use of alternative fuels where economically and practically feasible;
- Review of mining practices to minimise double handling of materials and ensuring that coal and overburden haulage is undertaken using the most efficient routes;

- Ongoing scheduled and preventative maintenance to ensure that diesel and electrically powered plant operate efficiently; and
- Develop targets for greenhouse gas emissions and energy use onsite and monitor and report against these.

6.3 HISTORICAL SUBSURFACE HEATING

6.3.1 Introduction

Olsen Environmental Consulting (OEC) an independent specialist in the field, conducted an assessment of Subsurface Heating at Cullen Valley Mine in January 2013 which is contained in the approved Care and Maintenance MOP dated May 2013. This assessment included recommended management and mitigation measures which are discussed below. In accordance with the approved Care and Maintenance MOP OEC conducted an interim review of the heating area Plan of Works in February 2014 (OEC 2014).

Historical heating has been associated with the abandoned underground workings of the Tyldesley Colliery at the Cullen Valley Mine since at least the 1970s. Anecdotal evidence suggests that a fire was either deliberately started in the old workings when a vehicle was driven into the underground workings or set alight by a bushfire. Regardless of the actual cause of the subsurface heating, it should be noted that it was not caused by spontaneous combustion. There is no current or historical evidence at Cullen Valley Mine or Invincible Colliery of the occurrence of spontaneous combustion.

Table 7
Predicted Scope 1 Greenhouse Gas Emissions

Year	Scope 1 Emissions (t CO_2-e)				
	Diesel	**Fugitive Methane**	**Staff Travel**	**Blasting**	**Total**
1	25,025	1,242	43	251	*26,561*
2	30,466	1,512	43	306	*32,327*
3	30,823	1,529	43	309	*32,704*
4	33,355	1,655	43	335	*35,388*
Total	**119,670**	**5,937**	**172**	**1,201**	**126,980**

Table 8
Predicted Scope 2 & 3 Greenhouse Gas Emissions

Year	Scope 2 Emissions (t CO_2-e)	Scope 3 Emissions (t CO_2-e)			
	Electricity	**Staff Transportation**	**Diesel**	**Electricity Consumption**	**Use of Product Coal**
1	2,368	4	1,897	517	3,638,407
2	2,883	4	2,310	630	4,474,558
3	2,916	4	2,337	637	4,474,559
4	3,156	4	2,529	689	4,474,559
Total	**11,322**	**15**	**9,074**	**2,473**	**17,062,083**

The subsurface heating was relatively dormant up until the abandoned underground workings were intersected by the open cut operations in 2003. In addition to the heating in the abandoned underground workings, there are pockets of emplaced carbonaceous material in the open cut backfill that are heating at other locations in the overburden waste dumps at Cullen Valley Mine. This has been caused by excavated burning material being emplaced in open cut backfill, which has continued to smoulder over time.

6.3.2 Methodology

OEC (2013) notes that the successful and efficient management of coal fires has been achieved by the application of facts-based information in an iterative and logical manner. Fire management strategies developed from factual data maximise the likelihood of eventual success. The findings and recommendations from OEC (2013) have been incorporated into a detailed Plan of Works for the management of subsurface heating at Cullen Valley Mine which is detailed in the approved Care and Maintenance MOP.

OEC emphasise that detailed information about the fire at Cullen Valley Mine is required before any worthwhile options for extinguishment can be developed and assessed. The assessment methodology of subsurface heating at Cullen Valley Mine included the following scope of works:

- Collate all available data on the current and potential physical extent of the subsurface heating (e.g. mine plans, closure plans, anecdotal background, etc.);
- Review any previous attempts to manage and / or extinguish the subsurface heating;
- Draw on previous experiences to assist proposed actions at Cullen Valley Mine;
- Describe relevant information about the physical environment currently available (e.g. groundwater data, gaseous emissions, ground temperatures); and
- Develop management strategy options and suitable trials to ascertain likelihood of success on a larger scale and to better define likely costs.

6.3.3 Impact Assessment

The primary concerns considered during the OEC assessment in order of priority included:

- Control and minimise impacts to the community;
- Control and minimise impacts to the natural environment; and
- Avoid impacts to future coal reserves.

The assessment identified two important aspects in the Cullen Valley Mine subsurface heating matter which must be considered separately in order to minimise potential impacts and address the primary concerns noted above. These included heating in confined underground workings and heating in unconfined overburden spoil. Each of these aspects requires a different assessment approach and monitoring and management controls in order to address the primary concerns and effectively minimise potential impacts.

A comprehensive literature review identified a number of strategies that had been or could be applied to areas affected by subsurface heating. There are many variables in local conditions which need to be considered when dealing with subsurface heating such as weather patterns, material characteristics and availability, topography, site limitations and risks.

In response to the OEC review, Coalpac has developed a Plan of Works for managing subsurface heating which forms part of the approved Care and Maintenance MOP for Cullen Valley Mine. The proposed Plan of Works identifies several actions for obtaining additional local data and assessment of alternative assessment strategies to ensure the adverse impacts from the heating upon the local community and the environment will be appropriately mitigated. The plan outlines procedures required to mitigate any adverse impacts based on the recommendations by OEC (2013).

Existing assessments (RGS, 2013) of coal samples from Cullen Valley Mine and Invincible Colliery found that coal and waste overburden samples have a very low propensity for spontaneous combustion to occur. There is no historical evidence of spontaneous combustion occurring at Cullen Valley Mine or Invincible Colliery. As such, the treatment and management of subsurface heating at Cullen Valley Mine is undertaken to minimise potential impacts based on a facts based approach and the availability of local data.

6.3.4 Mitigation and Management

Should these Modifications under S75W of the EP&A Act be approved, Coalpac will continue to implement the Plan of Works for the management of the existing subsurface heating issue, as described in the approved Care and Maintenance MOP at Cullen Valley Mine for the Modification.

Key management and mitigation works described in the Plan of Works include the following:

- Ongoing monitoring and management of subsurface water levels (with the aid of the new water pipeline from Invincible Colliery) in the Old Tyldesley Colliery underground workings to control the extent of the subsurface heating;
- Ongoing monitoring of temperature in key areas within existing Overburden Emplacement Areas (OEAs) and unaffected areas of the Old Tyldesley Colliery underground workings to allow an assessment of the extent of the subsurface heating and implementation of additional management responses, if required;
- Continue and complete the emplacement and capping program to treat existing areas impacted by subsurface heating within the open cut backfill if operations recommence (as proposed by the Modifications) or in the event that Cullen Valley Mine is closed;
- Utilisation of the recommend seed mix for rehabilitation above potential heating affected areas; and
- Review the need to install barrier trenches within emplaced materials to restrict the potential risk of subsurface heating as part of the annual review of the Plan of Works.

It should be noted that if the capping works had to be completed as a result of mine closure it would further add to the difficulties in rehabilitating residual mining voids by increasing the size of one of the sinks remaining (void 104). Further the material sourced from this area for capping would be less than ideal.

OEC was engaged in January 2014 to undertake an interim review of the treatment and management of sub-surface heating at Cullen Valley Mine. OEC (2014) noted that Coalpac has progressed and completed the majority of actions generally in accordance with the Approved Plan of Works as described in the approved the Cullen Valley Mine Care and Maintenance MOP.

OEC (2014) also recommended that Coalpac continue and complete the capping programme to treat heating zones within the open cut backfill areas once operations recommence or the mine is closed and observe the performance of previously capped areas and modify treatment as required.

Any modifications required to be made to the approved Plan of Works following the review of additional data will be undertaken in consultation with DRE and to the satisfaction of DP&I.

No mitigation and management measures in addition to those included in the approved Plan of Works are considered to be required for the subsurface heating issue as a result of the Modification.

6.4 NOISE

6.4.1 Introduction

The Noise Impact Assessment for the Modifications completed by Bridges Acoustics (see **Appendix B**) was undertaken in accordance with the following guidelines and policies:

- *'NSW Industrial Noise Policy'* (INP) (EPA, 2000);
- *'Interim Construction Noise Guideline'* (DECC, 2009); and
- *'NSW Road Noise Policy'* (DECCW, 2011).

6.4.2 Methodology

Background Noise Levels

A number of attended and unattended noise surveys have previously been undertaken for Invincible Colliery and Cullen Valley Mine. The surveys have determined that the rating background level (RBL) is dependent upon distance from the Castlereagh Highway. A background level of 31 LA90 was measured during the day at Red Springs Road, approximately 550 m from the Castlereagh Highway. All locations that are closer than a distance of 500 m to the Castlereagh Highway tend to receive a background level of 32 LA90 or greater. Conversely, locations that are further from the Highway tend to experience a background level of 30 LA90 or lower. A distance of 500 m from the Highway has therefore been adopted to indicate the boundary of the higher background noise category. The adopted RBLs for this assessment are presented in **Table 9**.

Noise Assessment Criteria

The INP prescribes two criteria for assessing the impacts of a development on residences. The intrusive criteria are used to assess the impact of a development alone. The intrusive criteria are set at 5 dBA above the rating background levels for each time period. The amenity criteria apply to cumulative noise levels and are dependent on the character of the receiver and the surrounding environment. The 'rural' amenity criteria have been adopted for this assessment. The 'rural' amenity criteria are 50 dBA for the day period, 45 dBA for the evening period and 40 dBA for the night period.

Table 9
Adopted Rating Background Levels

Receiver Area	Rating Background Level, LA90,15min		
	Day	Evening	Night
Group A - within 500m of the Castlereagh Highway, including Cullen Bullen township	32	30	30
Group B - more than 500m from the Highway	30	30	30

The day, evening and night periods are defined in the INP as:

- Day period extends from 7 am to 6 pm;
- Evening period extends from 6 pm to 10 pm; and
- Night period extends from 10 pm to 7 am.

Noise Modelling

The noise levels resulting from the Modifications have been predicted using RTA Technology's Environmental Noise Model (ENM) software. ENM is a general purpose noise modelling package that combines terrain and noise source information with other input parameters, including weather conditions. The model can be used to predict noise levels at specific locations and generate noise contours over an area.

ENM is recognised in NSW as the most appropriate model for situations involving complex topography and a large number of individual noise sources, and where a detailed assessment of the effects of atmospheric conditions on noise propagation is required.

Meteorological data was sourced from the existing Cullen Valley Mine Weather Station and Invincible Colliery Weather Station. This data was analysed using DECCW's Noise Enhancement Wind Analysis program for each of the 16 compass directions.

The existing equipment fleets (or equivalents) at Invincible Colliery and Cullen Valley Mine will be used for the mining operations associated with the Modifications. Due to the relatively short duration of the Modifications, it is not economically viable to acquire new, best practice noise controlled equipment. The model has accordingly adopted noise levels produced by the respective mining equipment currently approved for use at both operations.

Sound power levels (SPLs) for the mining equipment used at Invincible Colliery and Cullen Valley Mine were measured by Global Acoustics in December 2010. For equipment where measured SPLs were not available, SPLs were obtained from either manufacturer's specifications or noise studies for other mines that used similar equipment. The model has excluded minor items of equipment that are unlikely to be audible at residences, such as light vehicles.

6.4.3 Impact Assessment

Invincible Colliery

Operational Noise

Coal mining at Invincible Colliery will be undertaken during the day period only. Coal processing and transportation will be undertaken during both the day and evening periods. Accordingly, the evening period only considers noise sources associated with coal processing and transportation. No mining, coal processing or transportation will occur during the night period.

In the unlikely event that coal processing at the ICPP is required during the evening, an assessment of noise impacts will be undertaken prior to any operations in that period to determine if additional noise controls (such as screening or cladding) are required. Any additional controls that are required will be put in place prior to the ICPP operating during the evening period.

Table 10 presents the predicted worse case noise levels at residences and properties in the vicinity of Invincible Colliery. No residences are predicted to experience exceedances of the intrusive criterion.

Table 10
Predicted Operational Noise Levels generated by Invincible Colliery

Criteria (Day / Evening)	Residence				25% of Property Area			
	Lot Ref	Day		Evening	Lot Ref	Day		Evening
		Neutral	Prevailing			Neutral	Prevailing	
40/35	-	-	-	-	387	27.5	36.1	20.5
40/35	403	25.1	35.9	21.9	403-405	25.7	36.1	22.8
	404	24.5	35.9	21.1				
40/35	406	22.2	32.6	18.7	406	23.8	36.6	21.8
40/35	408	21.4	32.6	19.6	408	22.6	36.2	20.9
40/35	349	34.0	37.6	19.3	349	33.4	35.9	19.3
40/35	391	28.7	37.4	22.0	374-376, 390, 391	33.6	38.5	21.0
40/35	373	30.5	34.5	17.3	392	33.9	39.9	24.0
40/35	388	29.5	37.2	21.0	373	30.6	35.1	17.2
40/35	-	-	-	-	388,409	29.7	37.3	20.4
40/35	412	27.4	38.5	24.9	410	27.0	36.6	18.9
40/35	419E	24.6	34.7	17.1	412-414	29.6	39.3	26.2
40/35	419W	24.6	36.6	19.2	417-419	26.7	37.1	23.1
40/35	421	24.9	33.1	15.8				
40/35	426	29.3	37.6	22.5	411, 415, 416, 420-425	31.6	40.5	25.7
40/35	-	-	-	-	426, 439, 440	25.3	34.6	16.6
					441	20.3	35.6	15.5

Green shading – a mild noise impact of 2 dBA or less above the intrusive criteria

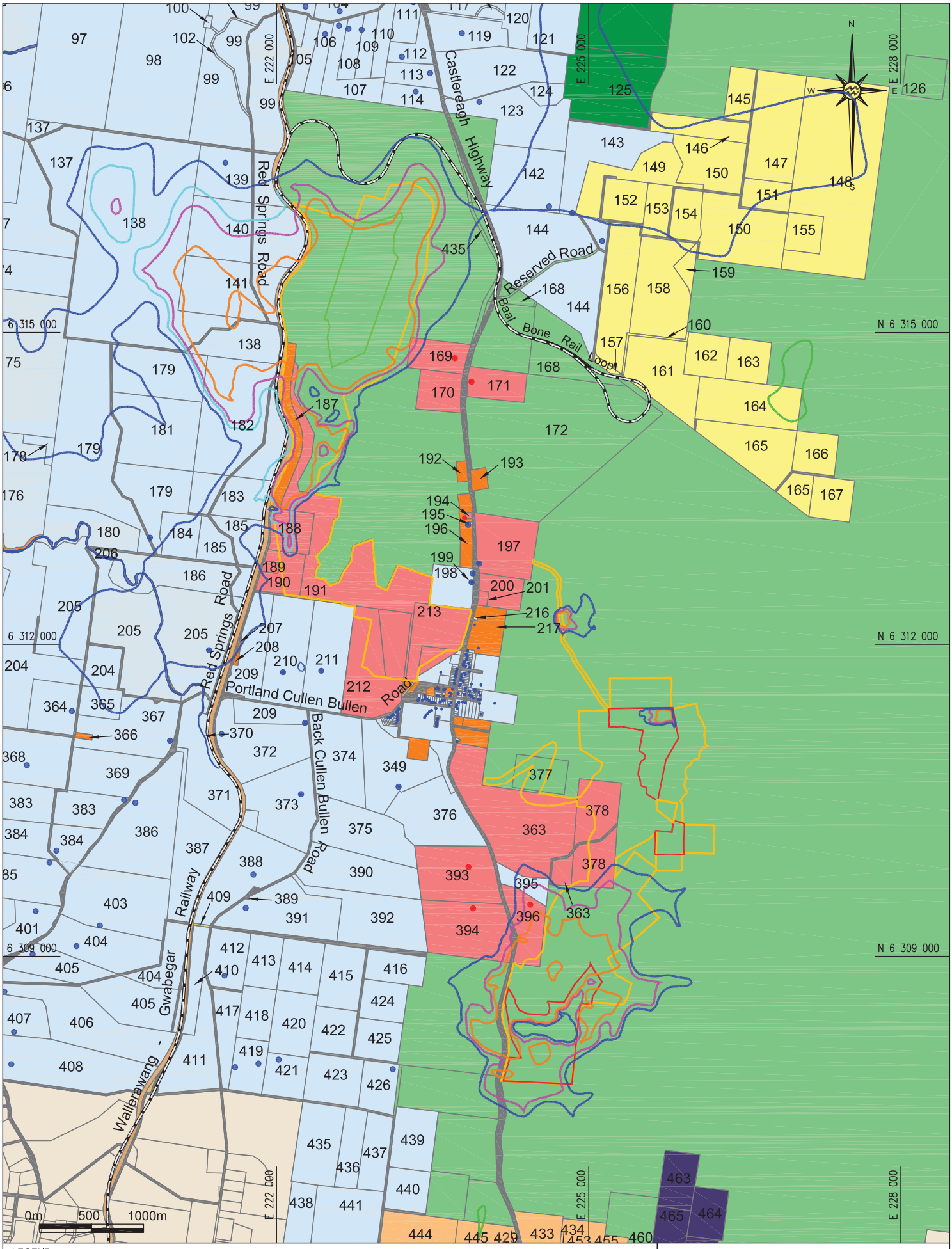
** Lot Ref 392 is shown as a property only as no residence is present on that block*

One property (lots 411/415/416/420-425) is predicted to experience exceedances of the intrusive criterion. The worst case noise level at this property is 0.5 dBA above the intrusive criterion, which represents a minor impact. The residence located on this property is not predicted to be impacted.

Noise impact contours for the day prevailing and evening prevailing scenarios are shown below on **Figure 11** and **Figure 12**, respectively.

The INP recommends an adjustment to predicted noise levels where there is a dominance of low frequency noise (20 Hz to 250 Hz). The INP recommends that 5 dBA be added to the predicted noise level if the received dBC exceeds the received dBA by more than 15 dB. At residences 403 and 404, the dBC noise level exceeds the dBA noise level by 15.1 – 15.3 dB. If a clinical interpretation of the INP is applied, the addition of 5 dBA to the predicted noise levels at residence 403 and 404 result in exceedances of the criteria at these locations. This is an anomalous outcome given that closer residences such as 388, 391 and 412 have predicted noise levels below the criteria. The application of the 5 dBA penalty for residences 403 and 404 is therefore considered neither realistic nor appropriate in this instance.

At residence 426, the dBC exceeds the dBA by 17.7 dB. The addition of 5 dBA to the predicted noise level for this residence results in a noise level of 39.7 dBA, which is below the criterion of 40 dBA.



LEGEND

- Modification Boundaries
- Invincible Colliery Modification Disturbance Boundary
- Cullen Valley Mine Modification Disturbance Boundary
- Private Freehold Receiver
- Coalpac Owned Receiver
- Rail
- 45dBA
- 40dBA
- 37dBA (Minor Contour)
- 35dBA

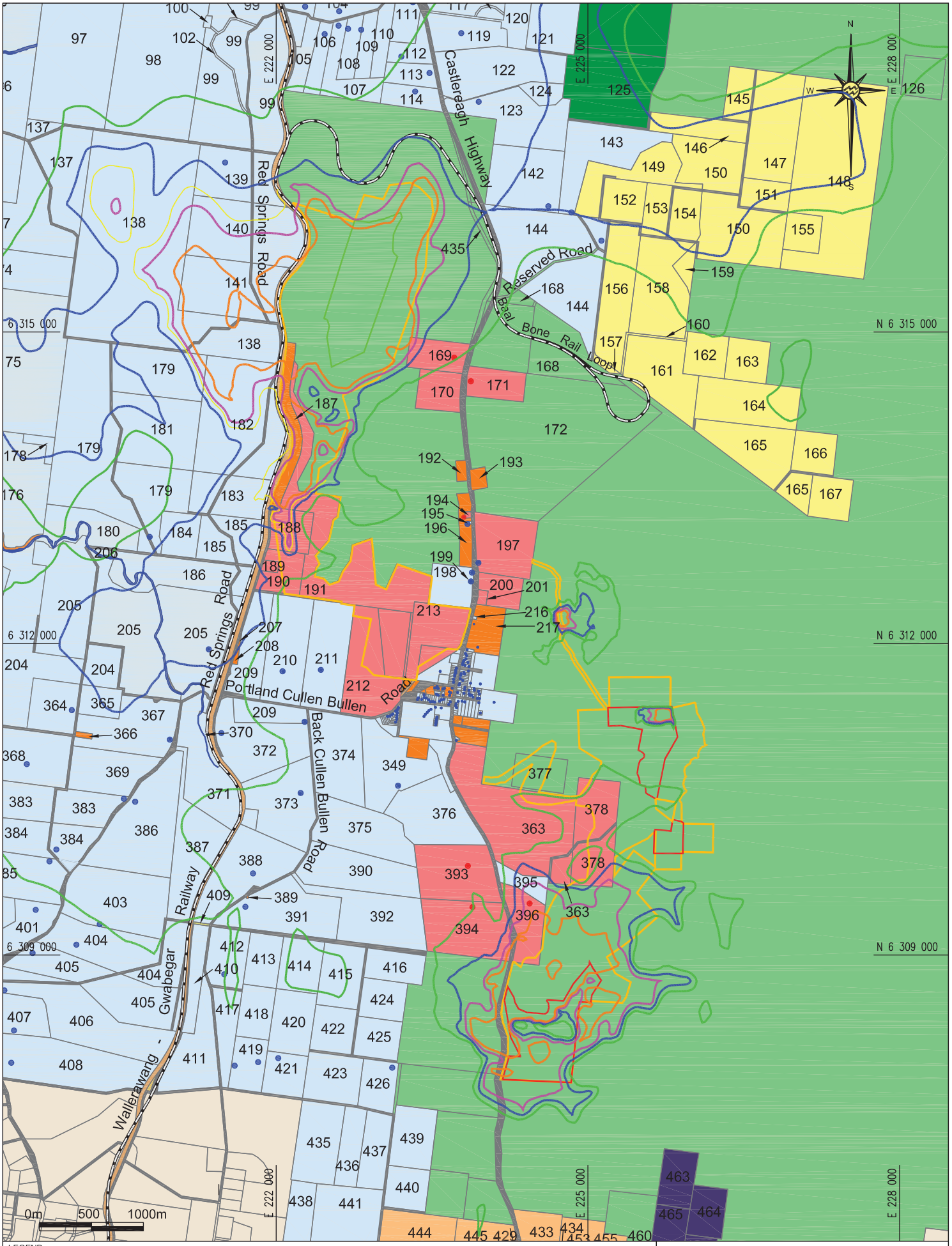
- Crown
- Coalpac/Coalpac Shareholders
- National Park
- State Forest
- Wallerawang Collieries
- Rail Corporation NSW
- Delta Electricity
- Centennial Pty. Ltd.
- Private Freehold
- Not Searched

Noise Impacts Day Prevailing

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: 11

Drawn By:	Date:	Drawing No.:	Revision:	
D.E	14/02/14	23.4.6.9-11A	A	MGA Zone 56



LEGEND

- Modification Boundary
- Invincible Colliery Total Additional Modification Disturbance
- Cullen Valley Mine Total Additional Modification Disturbance
- Private Freehold Receiver
- Coalpac Owned Receiver
- Rail
- 45dBA
- 40dBA
- 38dBA (Minor Contour)
- 35dBA
- 30dBA
- Crown
- Coalpac/Coalpac Shareholders
- National Park
- State Forest
- Wallerawang Collieries
- Rail Corporation NSW
- Delta Electricity
- Centennial Pty. Ltd.
- Private Freehold
- Not Searched

Noise Impacts Evening Prevailing

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: 12

Drawn By:	Date:	Drawing No.:	Revision:	
D.E	14/02/14	23.4.6.9-12A	A	MGA Zone 56

Construction Noise

The construction of the water transfer pipeline is the only significant construction work associated with the Modification. The earthmoving machines used in the construction are the main sources of noise. At the peak period, the construction process will utilise one backhoe, one excavator and two trucks. This equipment generates a combined SPL of 116 dBA.

The nearest receivers are located 400 m to 800 m from the proposed pipeline. Based on an SPL of 116 dBA for the construction equipment, the noise levels at distances of 400 m and 800 m are predicted to be 56 dBA and 50 dBA, respectively. These noise levels are significantly higher than the intrusive criteria. However, due to the short duration of the pipeline construction, these noise levels are only expects to be experienced for a few days. The construction of the pipeline will only take place during the day period.

Sleep Disturbance

There will be no coal mining, processing or transportation undertaken during the night period. The only noise generating activity that may be conducted at night is operation of the transfer pump and pipeline and equipment maintenance activities. This is predicted to generate noise levels of less than 30 dBA at private residences, which is well below the sleep disturbance criteria.

Road Traffic Noise

The road traffic noise criteria apply to noise generated by vehicle movements on public roads. The vehicle movements associated with the Modifications include personnel movements to and from the site, and occasional deliveries to the site.

The operational workforce will not increase as a result of the Modification. Therefore, there is not expected to be any long term increase in road traffic noise as a result of the Modification. The construction of the pipeline will generate an additional 20 movements per day for approximately 1 month. Given that the Castlereagh Highway is predicted to carry approximately 3,750 vehicles per day (as of 2014), the increase in traffic noise as a result of construction is insignificant.

Cullen Valley Mine

Operational Noise

Coal mining and processing activities will be undertaken at Cullen Valley Mine during the day and evening periods. Coal transportation will be undertaken during the day period only. Cullen Valley Mine will not conduct any mining, coal processing or transportation activities during the night period.

Table 11 presents the predicted worse case noise levels at residences and properties in the vicinity of Cullen Valley Mine. The intrusive criteria are predicted to be exceeded at three residences (142, 143 and 205). The criteria are predicted to be exceeded by less than 2 dBA, which is considered a mild impact. The properties containing these residences are also predicted to experience exceedances of the criteria on more than 25% of their area.

Table 11
Predicted Operational Noise Levels generated by Cullen Valley Mine

Criteria (Day / Evening)	Residence				25% of Property Area			
	Lot Ref	Day		Evening	Lot Ref	Day		Evening
		Neutral	Prevailing			Neutral	Prevailing	
37/35	205	24.7	36.5	36.0	205, 206	23.1	36.9	36.4
35/35	-	-	-	-	370	22.1	35.3	34.6
35/35	-	-	-	-	115, 116, 118, 120, 121	24.3	35.6	35.3
35/35	-	-	-	-	124	24.0	35.8	35.3
35/35	123	13.2	21.4	33.4	123	26.2	36.1	35.5
35/35	142	23.6	36.1	35.5	142	26.2	37.5	36.8
35/35	143	22.3	35.5	35.0	143	22.3	38.7	38.3
43/38	209	31.1	36.7	24.1	209	26.0	34.6	32.8
43/38	211	33.9	36.3	19.1	211	35.3	38.2	19.9

Blue shading – a moderate noise impact of less than 5 dBA above the intrusive criteria
Green shading – a mild noise impact of 2 dBA or less above the intrusive criteria

Four other properties (123, 134, 115/116/118/120/121 and 370) are expected to experience exceedances on more than 25% of their area, but without exceedances at the residences.

Noise impact contours for the day prevailing and evening prevailing scenarios are shown below on **Figure 11** and **Figure 12**, respectively.

The INP recommends an adjustment to predicted noise levels where there is a dominance of low frequency noise (20 Hz to 250 Hz). The INP recommends that 5 dBA be added to the predicted noise level if the received dBC exceeds the received dBA by more than 15 dB. The dBC exceeds the dBA by more than 15 dB at residences 209 and 211 during the evening period.

Adding the 5 dBA penalty results in noise levels of 29.1 dBA and 24.1 dBA for residences 209 and 211, respectively. These resultant noise levels are below the intrusive criteria of 38 dBA.

Properties 142 and 143 are predicted to experience an exceedance of between 2 – 5 dBA, which constitutes a moderate impact. Property 205/206 is predicted to experience a minor exceedance of the intrusive criteria.

Construction Noise

The Cullen Valley Modification does not involve any significant construction activities.

Sleep Disturbance

No coal mining, processing or transportation will be undertaken during the night period. Only mine equipment maintenance activities will be undertaken during the night, which will generate noise levels of less than 30 dBA at private residences, which is well below the sleep disturbance criteria.

Road Traffic Noise

The road traffic noise criteria apply to noise generated by vehicle movements on public roads. The vehicle movements associated with the Modifications include personnel movements to and from the site, and occasional deliveries to the site.

The operational workforce at Cullen Valley Mine will not change as a result of the Modification. Therefore, noise levels generated by road traffic are expected to remain similar to existing levels.

Cumulative Noise Impacts

Aside from the simultaneous operation of Invincible Colliery and Cullen Valley Mine, contributions to cumulative noise levels are expected from the MPPS and the Western Rail Coal Loader (if constructed in the future). All other industrial noise sources are too distant to contribute to cumulative noise levels. Since neither Invincible Colliery nor Cullen Valley Mine proposes to operate during the night and Invincible Colliery proposes mining activity only during the day period, cumulative impacts have not been assessed for the evening and night periods. The predicted cumulative noise levels for the most sensitive residences are presented in **Table 12**, which shows that any impacts will be below the daytime amenity criteria of 50 dBA.

6.4.4 Mitigation and Management

The likelihood of predicted exceedances of the noise criteria has been substantially reduced by limiting the operating hours of the mines as follows:

- Invincible Colliery - operations are limited to the day period, and coal transportation is restricted to the day and evening periods;
- Cullen Valley Mine - operations are restricted to the day and evening periods, and coal transportation is limited to the day period; and
- Neither mine will conduct mining related activities during the night period.

Coalpac will continue to implement the existing Noise Management Plans, including the noise controls that are currently utilised at Invincible Colliery and Cullen Valley Mine.

Due to the predicted exceedances of the intrusive criteria for construction noise, a Construction Noise Management Plan will be developed for the limited construction period required for the water transfer pipeline.

Table 12
Predicted Cumulative Noise Levels

Residence Reference	Noise Level Contribution, LAeq,11hr day				
	Cullen Valley Mine	Invincible Colliery	MPPS and MPPS Extension Project	Western Rail Coal Unloader Project	Cumulative Noise Level
403	30.0	32.9	28	<28	35.5
404	29.2	32.9	28	<28	35.3
349	23.8	34.6	28	<28	35.7
391	29.9	34.4	29	<28	36.6
412	29.0	35.5	30	<28	37.3
426	22.2	34.6	34	<28	37.5

In the unlikely event that coal processing at the ICPP is required during the evening, an assessment of noise impacts will be undertaken prior to any operations in that period to determine if additional noise controls are required. This assessment will be undertaken in consultation with EPA and to the satisfaction of DP&I prior to any operation of the ICPP during the evening.

6.5 BLASTING

6.5.1 Introduction

The Noise Impact Assessment undertaken by Bridges Acoustics included a component assessing potential blasting impacts of the Modifications. This was in undertaken accordance with the following blast assessment guidelines:

- *'Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration'* (ANZECC, 1990);
- *'Australian Standard 2187.2-2006 Explosives – Storage and use, Part 2: Use of explosives'*; and
- *'DIN 4150 Part 3 – Structural Vibration: effects of vibration on structures'* (ISO, 1999).

Blasting Criteria

The impacts of blasting are assessed according to criteria for overpressure and ground vibration (expressed in terms of Peak Particle Velocity (PPV). These criteria are prescribed by the '*Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration'* (ANZECC, 1990). The relevant criteria are:

- 115 dBL for overpressure; and
- 5 mm/s for ground vibration (PPV).

Higher limits of 120 dBL and 10 mm/s may apply to up to 5% of total blasts.

Even the higher limits for blast effects are unlikely to result in impacts to occupied structures. Most structures can withstand ground vibrations of 20 mm/s before cosmetic damage occurs and vibrations of at least 25 mm/s before structural damage will occur.

Previous experience at Invincible Colliery and Cullen Valley Mine blasting in proximity to rock structures was assessed by Terrock Consulting Engineers (2013). Blasting has occurred as close as 57 m from rock structures with PPV predicted to be in excess of 200 mm/s with no discernible impacts. Moving forward, an even more conservative limit of 100 mm/s PPV ground vibration is proposed for rock structures.

Further, a staged process with an initial limit of 50 mm/s has been recommended when the open cut approaches within 200 m of a significant rock structure, (i.e. the minimum distance proposed for the Modifications). Rock structures are not sensitive to impacts from airblast overpressure.

At Invincible Colliery the open cut mine plan proposed does not approach within 200m of any significant rock structures, however for conservatism a 50 mm/s PPV limit (at the rock structures) will be adopted for the Modification.

The open cut proposed for the Cullen Valley Mine Modification does encroach within 200m of rock structures in parts and thus the staged approach for increases in PPV proposed by Terrock Consulting Engineers (2013) will be adopted at the site. As recommended, prior to blasting within 200 m of these rock structures, a geotechnical expert will inspect the rock structures.

6.5.2 Methodology

Blast effects (overpressure and ground vibration) have been calculated using the equations in Appendix J of '*Australian Standard 2187.2-2006 Explosives – Storage and use, Part 2: Use of explosives'*. A database of previous blast events at Cullen Valley Mine and Invincible Colliery has previously been analysed. The blast data indicate the equations for vibration and overpressure prescribed in the Australian Standard are appropriate for both Modifications.

Blast effects have been calculated for different maximum instantaneous charge (MIC) weights. For all scenarios considered in the blast impact assessment, it has been assumed that there are no mitigation measures to ensure predicted results are conservative.

6.5.3 Impact Assessment

Table 13 shows the predicted blast effects for the most sensitive receivers in the vicinity of the two mines. This shows that no exceedances of the blasting criteria are predicted to occur at private residences. However, the adopted criteria for the rock structures are not predicted to be exceeded, even for blasts with larger MICs.

6.5.4 Mitigation and Management

Coalpac will continue to implement the procedures included in the approved Blast Management Plans in place for Cullen Valley Mine and Invincible Colliery, with the necessary amendments for the Modifications.

Table 13
Predicted Overpressure and Ground Vibration Levels

MIC (kg)	**75**	**150**	**300**	**600**	**75**	**150**	**300**	**600**	**Criteria (dBL, mm/s)**
Receiver (closest distance)	**Ground Vibration (mm/s)**				**Overpressure (dBL)**				
Residence 139 (1,390m)	0.4	0.6	1.1	1.9	102	105	108	111	5, 115
Residence 114 (1,510m)	0.3	0.5	0.9	1.6	101	104	107	110	5, 115
Residence 142 (1,550m)	0.3	0.5	0.9	1.5	100	103	106	109	5, 115
Residences 426 (1,450m)	0.3	0.6	1.0	1.7	101	104	107	110	5, 115
Cullen Bullen (>1,100m)	0.5	0.9	1.5	2.6	100[1]	103[1]	106[1]	108[1]	5, 115
Rock structures (> 200m)	7.5	13.1	22.8	39.6	N/A[2]	N/A[2]	N/A[2]	N/A[2]	20, N/A

1 Overpressure level reduced by 5 dBL due to significant topographical shielding.

2 Overpressure criteria are not required for the rock structures as they are not sensitive to overpressure.

The main changes required to these existing documents include additional monitoring and management procedures consistent with the recommendations of Terrock Consulting Engineers (2013) for blasting in the vicinity of potentially sensitive rock structures. These measures will be undertaken in the first year of operations for the Modifications and will include:

1. Review of the site factor (Kv) for the representative strata without impacting upon the rock structures and updating of this value if required. This Kv Exercise will involve the deployment of additional arrays of blast monitors located to the east of the mining site to measure Peak Particle Velocity (PPV) for all blasts until sufficient data is obtained. In addition strain measurements will be made to confirm the relationship between PPV and strain on the various strata horizons as operations progress southwards on a similar basis.

   Collation and analysis of data gathered from the Site Factor Kv Exercise to provide reliable site specific parameters to support predictive modelling with confidence.

2. A Non-damaging Limit Exercise, commencing with blasts at 200 m from the selected representative rock structures at Cullen Valley Mine, with an interim PPV trigger level of 50 mm/s. The Non-damaging Limit Exercise (NLE) will then move closer with successive blasts until the selected vibration trigger levels are achieved at the monitoring point and show that the rock mass is remaining stable.

   Once blasting at the interim trigger level of 50 mm/s PPV has proven to have negligible impact, the target limit will be incrementally increased in 25 mm/s steps to 75 mm/s PPV and then 100 mm/s PPV whilst continuing the monitoring program.

   Coalpac will undertake these two exercises in the first year of operations for the Modifications.

3. Predictive modelling will be carried out initially to guide blast design and limit predicted levels to 100 mm/s PPV or other agreed limit. These will be the trigger levels at which re-design or reduced design parameters will be implemented;

4. Establish the condition of the rock structures selected for the NLE and produce a Hazard Map to identify and classify zones in terms of stability; and

5. Prior to advancing blasting towards rock structures selected for the NLE, to install vibration monitors on solid rock at the top and bottom of the rock face at the nearest point to the blasting face. Install strain gauges at the base of the rock face near the vibration monitor and record the rock mass response to blasting using photogrammetric techniques. The NLE will be continued until sufficient confidence has been gained.

6.6 ECOLOGY

6.6.1 Introduction

An ecological impact assessment for the Modifications was undertaken by Cumberland Ecology. This assessment is summarised below and included in **Appendix C**.

Invincible Colliery and Cullen Valley Mine are predominantly located within the Ben Bullen State Forest. The landscape in the vicinity of the Modifications consists of forested steep slopes and gullies, woodlands on slopes and flatter topography, and sandstone outcropping and escarpment slopes with heath and woodland. Both sites are located in topographically high areas with few drainage lines. The aquatic habitats in the vicinity are limited to minor ephemeral drainage lines and farm dams.

6.6.2 Methodology

Literature Review

The literature review considered previous ecological studies undertaken in the locality and for the existing operations at Invincible Colliery and Cullen Valley Mine. The mapping in '*Vegetation of the Western Blue Mountains'* (DEC, 2006) was also used to assist in identifying and describing vegetation communities. To assist in identifying the flora and fauna that may be present in the Modification Boundary, a search of the '*Atlas of NSW Wildlife'* (OEH, 2012) database was undertaken. In addition, a search of the '*EPBC Act Protected Matters Search Tool'* (SEWPaC, 2012) was conducted to identify Commonwealth listed threatened species in the vicinity of the Modification Boundaries.

Field Surveys

A number of ecological field surveys have previously been undertaken for Invincible Colliery and Cullen Valley Mine. The surveys across the Study Area have been undertaken in Autumn and Spring between 2009 to 2013, utilising the following techniques:

- Quadrat sampling;
- Targeted searches for threatened flora surveys;
- Random meander surveys; and
- Targeted fauna surveys, including searches for amphibians, birds, reptiles, mammals and insects.

Further reptile surveys were undertaken in February 2013, targeting the Broad-headed Snake.

The Study Area for the ecology surveys encompassed an area of 2,706 ha and includes Invincible Colliery, Cullen Valley Mine and surroundings lands within the Ben Bullen State Forest. The 355 ha area of native woodland and forest within the two Modification Boundaries is located entirely within this wider Study Area.

It was identified that additional compensatory offsets would be required to offset the impacts of the Modifications on native woodlands and forests, which provide habitat for threatened flora and fauna species. Surveys of potential additional offset properties were conducted between 2010 and 2013. Based on the findings of these surveys, a biodiversity offset strategy for the Modifications was developed, as described below in **Section 6.6.4**.

6.6.3 Impact Assessment

Impacts on Vegetation Communities

Nine vegetation communities were identified within the Modification Boundaries, namely:

1. Tableland Gully Ribbon Gum Blackwood Applebox Forest;
2. Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland;
3. Capertee Rough-barked Apple - Red Gum - Yellow Box Woodland: non grassy;
4. Exposed Blue Mountains Sydney Peppermint - Silvertop Ash Shrubby Woodland;
5. Tableland Scribbly Gum - Narrow-leaved Stringybark Shrubby Open Forest;
6. Tableland Slopes Brittle Gum - Broad-leaved Peppermint Grassy Forest;
7. Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest;
8. Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest Derived Native Grassland; and
9. Cox's Permian Red Stringybark - Brittle Gum Woodland.

The extent of these vegetation communities within the Modification Boundaries is shown on **Figure 13**, which shows that some are located only within the proposed highwall mining areas, and will therefore not be subject to any disturbance.

The Capertee Rough-barked Apple Red Gum Yellow Box Grassy Woodland and Derived Native Grasslands represents a form of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Box Gum Woodland), which is listed as an Endangered Ecological Community (EEC) under the TSC Act and a Critically Endangered Ecological Community (CEEC) under the EPBC Act.

This vegetation community exists only within the proposed highwall mining areas and will not be impacted. Therefore, the Modifications will not result in any direct or indirect impacts on listed ecological communities. The Modifications will jointly disturb approximately 148 ha of native woodland and forest, and approximately 2 ha of native grassland.

Invincible Colliery

The Invincible Colliery Modification will disturb approximately 89 ha of native vegetation through open cut mining and construction of the water transfer pipeline to Cullen Valley Mine. The areas of each vegetation community located within the Modification Disturbance Boundary are presented in **Table 14**.

Table 14
Impact of Invincible Colliery Modification on Vegetation Communities

Vegetation Community	Disturbance (ha)		
	Open Cut Mining	Water Transfer Pipeline	Total
Tableland Gully Ribbon Gum Blackwood Applebox Forest	7.0	0.9	7.9
Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest	0.1	0.3	0.4
Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest	37.3	0.4	37.7
Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest	8.0	-	8.0
Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest Derived Native Grassland	2.4	-	2.4
Cox's Permian Red Stringybark - Brittle Gum Woodland	0.1	-	0.1
Exposed Blue Mountains Sydney Peppermint - Silvertop Ash Shrubby Woodland	31.6	0.6	32.2
Total	**86.5**	**2.2**	**88.7**

Cullen Valley Mine

The Cullen Valley Mine Modification will disturb approximately 62 ha of native vegetation through open cut mining. The areas of each vegetation community located within the Modification Disturbance Boundary are presented in **Table 15**.

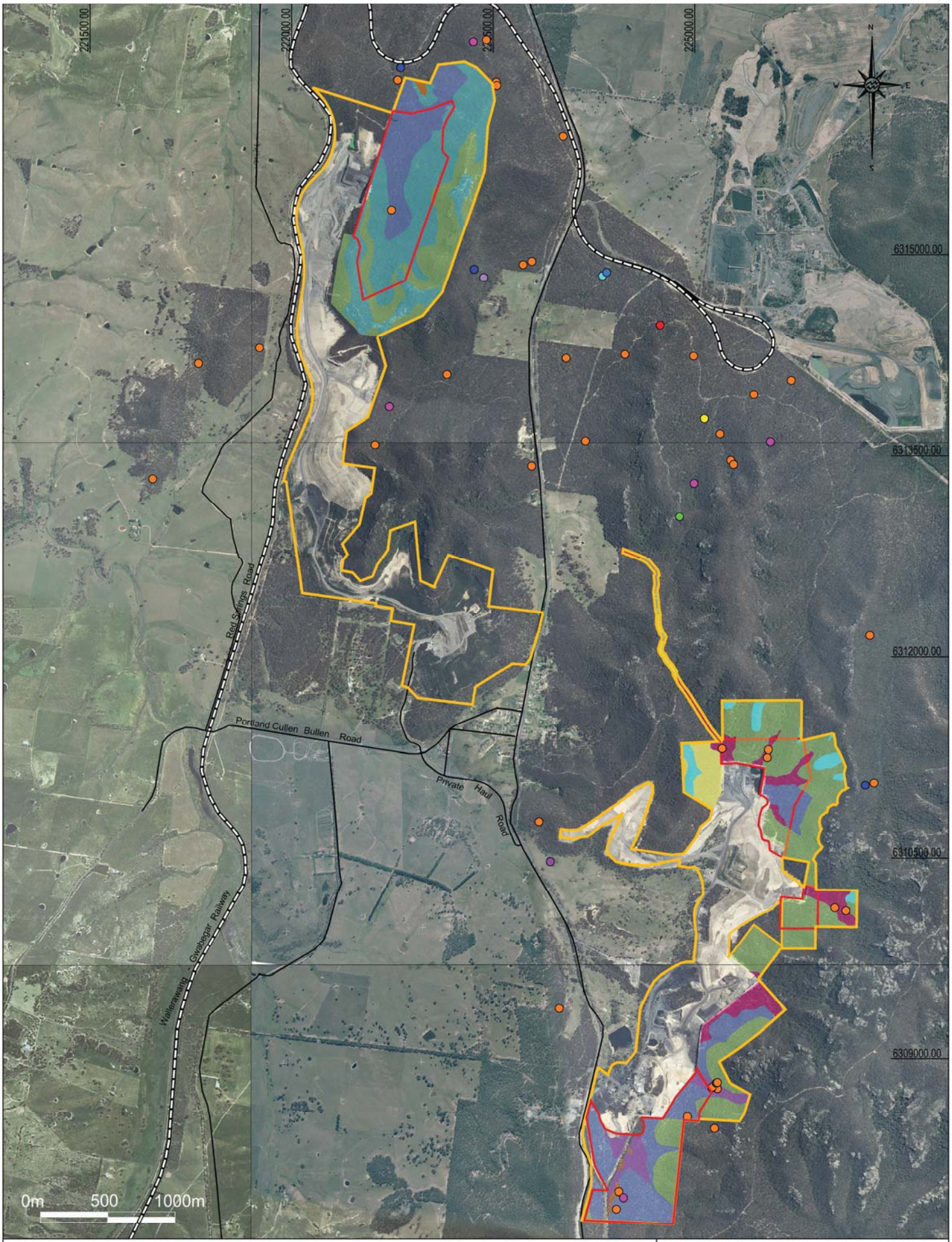
Impacts on Flora

One threatened flora species has been recorded within the Study Area and has the potential to occur within the Modification Disturbance Boundaries. Capertee Stringybark (*Eucalyptus cannonii*) is listed as threatened under the TSC Act only.

The forest and woodland communities within the Modification Boundaries are capable of providing habitat for Eucalyptus cannonii. Based on the extrapolation of densities gathered from quadrat data, a total of approximately 4,500 individual *Eucalyptus cannonii* are predicted to occur in the Modification Boundaries, with over of 16,800 predicted to be present within the Study Area.

Table 15
Impact of Cullen Valley Mine Modification on Vegetation Communities

Vegetation Community	Disturbance (ha)
Capertee Rough-barked Apple - Red Gum - Yellow Box Woodland: non grassy	0.1
Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest	34.8
Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest	21.7
Exposed Blue Mountains Sydney Peppermint - Silvertop Ash Shrubby Woodland	5.2
Total	**61.8**



LEGEND

- Modification Boundaries
- Modification Disturbance Boundary
- Road
- Rail

Threatened Fauna

- Squirrel Glider
- Gang-gang Cockatoo
- Scarlet Robin
- Eastern Bentwing Bat
- Satin Flycatcher
- Speckled Warbler
- Brown Treecreeper
- Square-Tailed Kite

Threatened Flora

- Eucalyptus Cannonii
- Eucalyptus Aggregata

Native Vegetation

- Capertee Rough-barked Apple - Red Gum Yellow Box Grassy Woodland (EEC)
- Exposed Blue Mountains Sydney Peppermint - Silvertop Ash Shrubby Woodland
- Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest
- Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest
- Tableland Gully Ribbon Gum Blackwood Applebox Forest
- Lox's Permian Red Stringbark Brittle Gum Woodland
- Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest Derived Native Grassland
- Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest

Ecological Impacts

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: 13

Drawn By:	Date:	Drawing No.:	Revision:	
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In total, the Modifications will remove approximately 148 ha of known and potential *Eucalyptus cannonii* habitat, which is estimated to sustain a population of up to 2,300 individuals. Of these, approximately 500 and 1,800 individuals are predicted to occur in the respective Modification Disturbance Boundaries of Cullen Valley Mine and Invincible Colliery.

Impacts on Fauna

Numerous bird species, several common reptile species and eight amphibian species have been recorded within the Study Area. Although macropods, microchiropteran bats and arboreal mammals were identified within the Study Area, there were few recordings of ground dwelling mammals.

Although no threatened species were recorded within the two Modification Boundaries (355 ha in total), 14 threatened species were recorded within the 2,706 ha Study Area. It has been conservatively assumed that these species have the potential to occur within the Modification Boundaries. A further 22 threatened species have been recorded in the broader Lithgow LGA. These species are also considered as having the potential to occur within the Modification Boundaries. The threatened species which have the potential to occur are listed in **Appendix C**.

The Modifications will remove approximately 148 ha of forest and woodland communities, which provide habitat for the recorded and potentially occurring fauna species.

6.6.4 Mitigation and Management

The design of the mine plans proposed for the Modifications has considered the principles of avoidance, mitigation and compensation, as described in the Draft Discussion Paper for the use of environmental offsets under the *Environment Protection and Biodiversity Conservation Act 1999*, and the NSW Offset Principles for Major Projects (State Significant Development and State Significant Infrastructure).

Avoidance

The mine planning and design undertaken for the Modifications has considered a number of alternative mine plans. Iterations have been made to the mine plan to avoid impacts on:

- All individuals, population and habitat for *Persoonia marginata* (located to the north and east of Cullen Valley Mine);
- A significant area of habitat for the *Eucalyptus cannonii*, by using highwall mining rather open cut mining methods. This has avoided impact to a large number of this species, predicted to be in the order of some 2,200 individuals;
- Pagoda and rocky escarpment, which provide potential habitat for the following threatened species:
    - Potential Brush-tailed Rock Wallaby habitat;
    - Summer and winter habitat for the Broad-headed Snake (located to the east of Invincible Colliery); and
    - Roost habitat for the Large-eared Pied Bat and Eastern Bent-wing Bat.
- Box Gum Woodland (as listed under the TSC Act and EPBC Act).

The Modifications have also adopted highwall mining methods to reduce impacts on surface vegetation. Highwall mining has no surface impact and does not result in the mine subsidence impacts associated with traditional underground mining methods.

Mitigation

Coalpac will implement the following mitigation measures for the Modifications:

- Minimise disturbance of native vegetation during construction and prior to mining operations;
- Maintain and extend successful current rehabilitation practices;
- Implement a two stage clearing protocol for all hollow-bearing trees. All hollow-bearing trees to be felled should be marked and a catalogue of their species and approximate dimensions recorded so that hollows and nest boxes can be affixed to similar standing trees located in offsets and mine rehabilitation areas;
- Prepare and implement a nest box management procedure; and
- Undertake ongoing weed management and monitoring.

Coalpac will update the existing Flora and Fauna Management Plan for Cullen Valley Mine and the Landscape Management Plan for Invincible Colliery. These management plans will be updated to include the additional disturbance areas for the Modifications. The plans will also be updated to reflect best practice guidelines and current industry standards.

Coalpac will continue to undertake the existing flora and fauna monitoring program. Monitoring will be extended to consider the additional disturbance areas proposed for the Modifications.

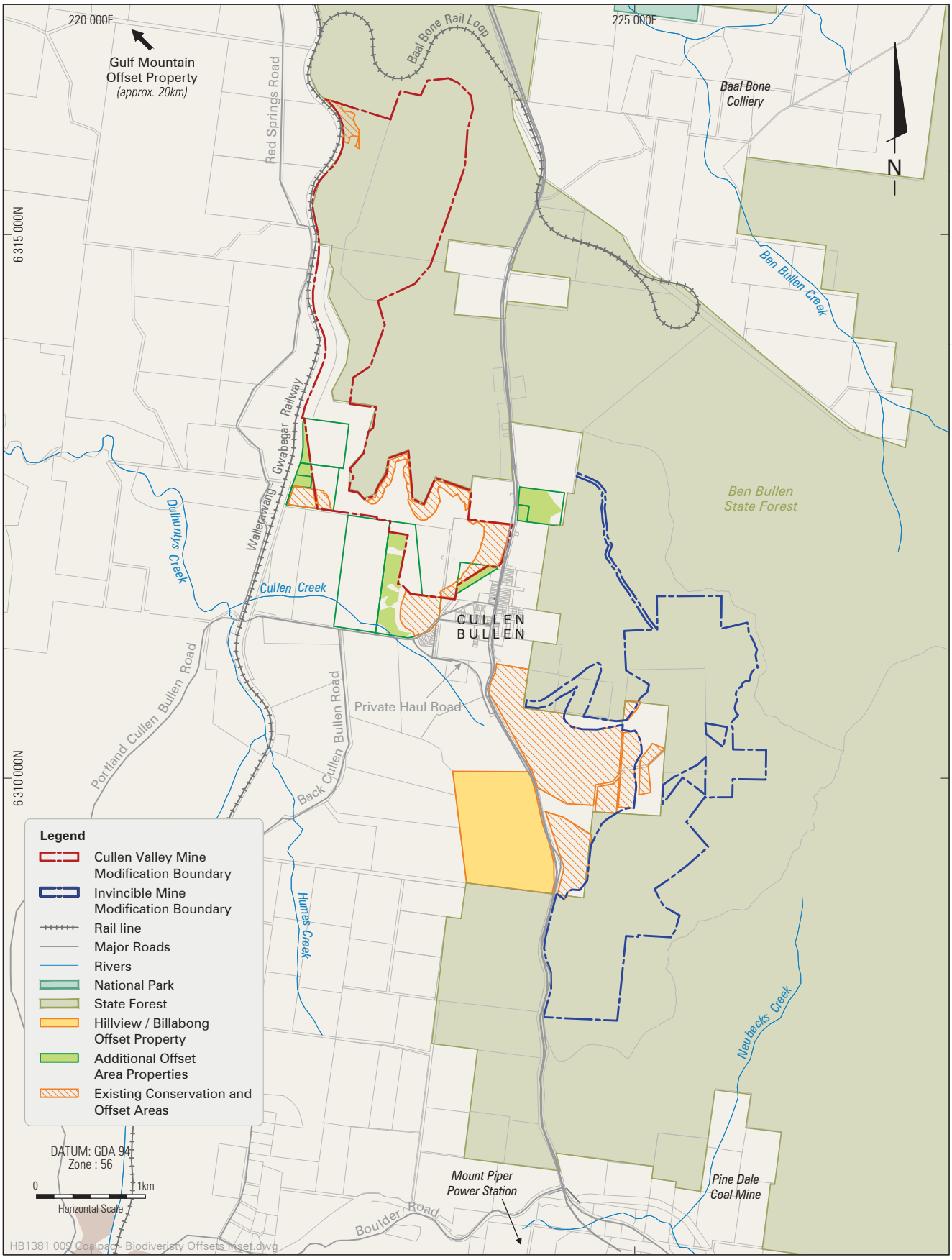
Compensation

Coalpac currently manages 166 ha of land as conservation areas to offset the impacts of the existing Invincible Colliery. Similarly, Coalpac manages 51 ha of conservation land to offset the impacts of existing operations at Cullen Valley Mine.

Coalpac has developed a Biodiversity Offset Strategy specifically for the Modifications in accordance with the current principles for offsetting set out by DoE (DEWR, 2007) and by OEH (DECC, 2008a).

To compensate for the residual impacts of the Modifications to forest and woodland vegetation communities, Coalpac will establish three new offset areas as shown on **Figure 14** and **Figure 15**. These biodiversity offset properties to be secured for the Modifications are described below and in **Appendix C** and include:

- Hillview / Billabong (83 ha);
- Gulf Mountain (532 ha); and
- Seven lots controlled by Coalpac in the vicinity of Cullen Valley Mine (referred to as the 'Additional Offset Areas'). In total, the Additional Offset Areas will conserve an area of approximately 30 ha.

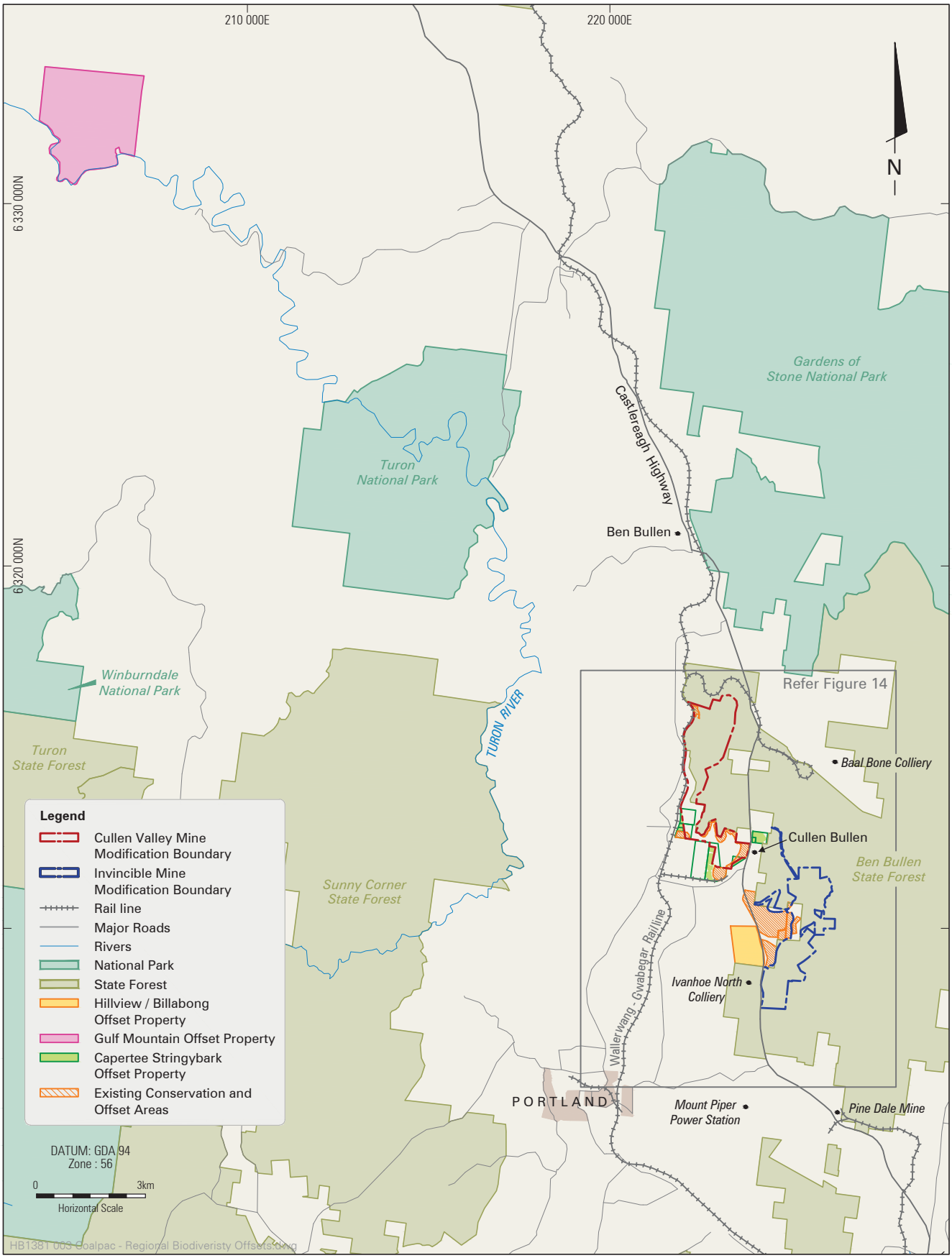


COALPAC MODIFICATIONS

Coalpac Pty Ltd | Hansen Bailey ENVIRONMENTAL CONSULTANTS

Biodiversity Offsets

FIGURE 14



COALPAC MODIFICATIONS

Coalpac Pty Ltd | Hansen Bailey ENVIRONMENTAL CONSULTANTS

Biodiversity Offsets in Regional Setting

FIGURE 15

The Biodiversity Offset Strategy (including the properties identified above) will conserve approximately 645 ha of forest and woodland with similar flora and fauna attributes to the areas proposed to be impacted for the Modifications. This provides an overall offset ratio of 4.3:1. The offset ratios for each vegetation community are presented in **Table 16**.

The Biodiversity Offset Strategy will conserve approximately 35 ha of endangered Box Gum Woodland, despite the Modifications not resulting in any disturbance to this community.

Table 16
Offset Ratios for the Modifications

Vegetation Community	Total Disturbance (ha)	Total Offset Area (ha)	Offset Ratio
Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland (EPBC C/EEC)	0	5.5	N/A
Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland Derived Native Grassland (EPBC C/EEC)	0	29.3	N/A
Capertee Rough-barked Apple - Red Gum - Yellow Box Woodland: non grassy	0.1	0	0
Tableland Gully Ribbon Gum Blackwood Applebox Forest	7.9	36.0	4.6:1
Tableland Gully Ribbon Gum Blackwood Applebox Forest Derived Native Grassland	0.0	2.0	N/A
Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest	35.2	405.3	11.5:1
Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest	59.4	130.5	2.1:1
Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest Derived Native Grassland	0	11.7	N/A
Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest	8.0	17.8	0
Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest Derived Native Grassland	2.4	0	0
Cox's Permian Red Stringybark - Brittle Gum Woodland	0.1	0	0
Exposed Blue Mountains Sydney Peppermint - Silvertop Ash Shrubby Woodland	37.5	1.2	0
Riparian River Oak Forest	0	5.6	N/A
TOTAL	**150.5**	**644.8**	**4.3:1**

Hillview / Billabong

The Hillview / Billabong properties cover a combined area of approximately 83 ha and are situated on the western side of the Castlereagh Highway, to the west of the Invincible Colliery and the existing biodiversity offsets set up for the site. The property is also located adjacent to the Ben Bullen State Forest. The primary objectives for inclusion of Hillview / Billabong in the Biodiversity Offset Strategy are to:

- Conserve and rehabilitate similar vegetation to that located within the Modification Disturbance Boundaries;
- Conserve and rehabilitate similar habitat for birds and bats to that located within the Modification Disturbance Boundaries; and
- Conserve and rehabilitate known and potential *Eucalyptus cannonii* habitat.

Due to its close proximity to the Modification Disturbance Boundaries and the similarity of flora and fauna habitats, Hillview / Billabong provides potential habitat for the majority of impacted fauna species, with the exception of the Brush-tailed Rock Wallaby and Broad-headed Snake, which utilise various habitats associated with rocky escarpments not present on the property.

Through rehabilitation of the grasslands present on the property, there is also scope for the re-introduction of approximately 37 ha of *Eucalyptus cannonii* habitat on the property, which is estimated to support a population of up to 1,900 individuals. Rehabilitation of grassland communities present on the property will also increase the extent of woodland and forest habitat adjacent to western edge of the Ben Bullen State Forest.

Gulf Mountain

Gulf Mountain is a large property approximately 17 km to the north-west of the Modifications. The property contains extensive areas of like for like vegetation, adjoins private forested land and has 5.4 km of Turon River frontage. The property also contains a suite of conglomerate, sandstone, mudstone siltstone geological units, including similar geological formations to those that occur in parts of the Modification Boundaries.

Gulf Mountain is not connected directly to any nature reserve, but links indirectly through to Winburndale Nature Reserve via a strip of uncleared forest and woodland to the south of the property. Winburndale Nature Reserve is adjacent to the Turon National Park and Sunny Corner State Forest.

The primary objectives for inclusion of Gulf Mountain in the Biodiversity Offset Strategy are to:

- Conserve a significant area of similar vegetation types and suitable habitat for threatened flora and fauna impacted by the Modifications;
- Conserve a considerable area of foraging and habitat for bird and bats; and
- Conserve a significant area of potential habitat for *Eucalyptus cannonii*.

Three vegetation communities that occur in the Modification Disturbance Boundaries are also present across large portions of Gulf Mountain, including Ribbon Gum Forest, Brittle Gum - Broad-leaved Peppermint Woodland and Scribbly Gum Woodland.

Surveys of the property have also identified a number of fauna species, including some that are predicted to be impacted by the Modifications. These include a suite of threatened fauna species listed under the TSC Act and/or EPBC Act, including the:

- Powerful Owl (*Ninox strenua*);
- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Scarlet Robin (*Petroica boodang*);
- Varied Sittella (*Daphoenositta chrysoptera*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Booroolong Frog (*Litoria booroolongensis*), listed Endangered under the EPBC Act;
- Rainbow Bee-eater (*Merops ornatus*), listed Migratory under the EPBC Act; and
- Satin Flycatcher (*Myiagra cyanoleuca*), listed Migratory under the EPBC Act.

No threatened flora species were recorded during the site investigation, however the property provides potential habitat in gullies and slopes for a number of threatened plants known in the area, including *Derwentia blakelyi* and *Eucalyptus cannonii*.

Additional Offset Areas

The Additional Offset Areas comprise of seven additional lots controlled by Coalpac that are either adjacent or near the Cullen Valley Mine and existing Compensatory Habitat Areas. In total, these offset areas will conserve an area of approximately 30 ha. The Additional Offset Areas include all or part of the following lots:

- Lot 3 DP 1148418;
- Lot 1 DP 160808;
- Lot 36 DP 755769;
- Lot 331 DP 46518;
- Lot 332 DP 46518;
- Lot 1 DP 528538; and
- Lot 4 DP 249955.

Some of these land parcels are partly located within the approved Cullen Valley Mine disturbance areas or include land that has previously been secured as a Compensatory Habitat under DA 200-5-2003. These parts of the Additional Offset Areas parcels have been excised from the Biodiversity Offset Strategy and are not considered as part of the biodiversity offsets for the Modifications.

The Additional Offset Areas will increase the extent of woodland and forest habitat under conservation immediately adjacent to the Ben Bullen State Forest and will be progressively improved.

The primary objectives for inclusion of the Additional Offset Areas are to:

- Conserve and rehabilitate similar vegetation to that located within the Modification Disturbance Boundaries; and
- Conserve and rehabilitate known and potential *Eucalyptus cannonii* habitat.

No threatened flora species have been recorded during survey of the Additional Offset Areas (to date), however potential habitat for *Eucalyptus cannonii* occurs. Rehabilitation of grasslands within these offset blocks also provides scope to re-introduce up to an estimated 800 individuals of *Eucalyptus cannonii*.

In consideration of the proximity of the Additional Offset Areas to surveyed lands and the similarity of habitats between the two areas, these properties are predicted to provide potential habitat for the majority of fauna species impacted by the Modifications. The exceptions to this are the Brush-tailed Rock Wallaby and Broad-headed Snake, which utilise various habitats associated with rocky escarpments that are not present in the Additional Offset Areas.

6.7 HIGHWALL MINING STABILITY

6.7.1 Introduction

A review of highwall mining stability was undertaken for the Modifications to assess potential surface subsidence impacts associated with this mining method. A summary of this review is provided below.

6.7.2 Methodology

Highwall mining will be performed with a continuous highwall miner driving parallel horizontal tunnels into the coal seams to a maximum penetration depth of 305 m beyond the final highwall toe position. The tunnels, known as drives, will be separated by web pillars which will provide support for the roof (section of drives and web pillars). Larger barrier pillars will be introduced to separate each panel, ensuring overall stability.

A key design criterion for highwall mining will be the Factor of Safety (FoS) of the pillar design (web and barrier). By designing with an adequate FoS the stability of the surface over highwall mining areas over the long term is ensured. Unlike other forms of underground mining, maintaining the stability of panel and the overlying surface is critical to the success of the highwall mining process during mining.

An Assessment of Stability and Subsidence was undertaken for the previously-exhibited Coalpac Consolidation Project (CCP) by Geonet Consulting Group (Geonet) and included as Appendix F in the CCP Exhibited EA.

This assessment was undertaken in accordance with the DRE '*Guideline for Applications for Subsidence Management Approvals'* (DMR, 2003), and '*Mine Safety Operations Guideline, Coal Technical Reference CTR-001*' (DPI, 2008). It investigated the potential subsidence and stability impacts associated with the highwall mining component proposed for the Exhibited Project to enable the extraction of selective coal reserves from the target coal seams.

6.7.3 Impact Assessment

The Geonet (2011) study for the CCP analysed a worst case scenario, where highwall mining was carried out in multiple seams, above old underground mine workings where mining-induced stress conditions were increased, and under the greatest amount of overburden load of the entire CCP area. This was done to provide a highly conservative highwall mining geomechanical design able to accommodate these conditions in order to ensure an adequate FoS such that the potential for surface subsidence to occur as a result of highwall mining is negligible (i.e. less than 20 mm).

Several peer reviews of the methodology, input parameters and design outcomes were conducted for the CCP (Boyd Mining, 2011, Geonet 2013a, 2013b, and Hebblewhite, 2013). These concluded the following:

- The mass coal strength used for the analyses was appropriate and conservative, and as such, it conservatively assessed the predicted subsidence impacts associated with that mining method;
- An appropriate FoS of 1.3 has been applied for web pillar designs (i.e. no pillars have a FoS below 1.3);
- The three stage pillar design approach employed (using empirical, 2D and 3D numerical design) is considered to be a very comprehensive and appropriate design methodology;
- The design principle used for the critical span between barrier pillars to ensure that intervening web pillars are not overloaded is geotechnically appropriate; and
- The FoS of the barrier pillars (being the larger squat pillars that separate individual panels or groups of parallel highwall mining drives), was calculated under worst case load conditions (i.e. with no contribution from the intervening web pillars) and was still found to the adequate.

The Modifications propose to apply the same conservative design inputs and assessment and design methodology as used in the CCP. In all cases the overburden load in the highwall mining areas proposed in the Modifications will be considerably less than that of the Geonet study area.

6.7.4 Mitigation and Management

Coalpac will prepare detailed Subsidence Management Plans (SMPs) for the Modifications in consultation with DRE and to the satisfaction of DP&I. The SMPs will contain information to address the requirement for specific design reports or an extraction plan giving scheduling for each area prior to mining and geotechnical assessment of the highwall stability.

This information will be supplied for DRE approval before the highwall mining operations in each area commences.

In addition, Coalpac will implement a number of mitigation and management measures to minimise the potential for any surface subsidence associated with the Modifications. These shall be incorporated into a Highwall Mining Management Plan for the Modifications, which will include detail on the following procedures:

- Final highwall position and orientation assessment to take structural geology into account to promote stability in the exposed jointed highwalls;

- Limiting designed surface subsidence to below the relevant criteria;
- Designing highwall mining panels to minimise the potential impact upon any nearby rock formations;
- Designing of pillars to take into account the likely entry azimuth deviations based on Original Equipment Manufacturer's advice;
- Conduct gas measurements from exploration bore cores prior to highwall mining to establish the background levels of gas and to confirm negligible risk;
- Locate long term stable barrier pillars to minimise subsidence of the surface strata as part of the overall design methodology; and
- Conduct and document regular surveys and inspections associated with the highwall joint condition, joint orientations and overall stability of the exposed highwalls, to be undertaken by appropriately qualified geotechnical specialists.

6.8 OPEN CUT MINING STABILITY

6.8.1 Introduction

A review of open cut mining stability was undertaken for the Modifications to assess potential surface subsidence impacts associated with this mining method. A summary of this review is provided below.

6.8.2 Methodology

A desktop review of the topographic slope types at key rock shelter sites within the CCP Project Boundary was undertaken by SCT Operations (SCT, 2012) to assess the risks to these areas that may be associated with the mining operations under that proposal. In particular, the review considered potential impacts that may result to the sandstone pagoda and escarpment features that are such a distinctive characteristic of the region.

For the Modifications, the proposed final highwall positions are now significantly further away from the sensitive rock formations than that proposed for the CCP.

6.8.3 Impact Assessment

Subsequent to the study of slope stability for the Exhibited Project, specialist consultant GeoTek Solutions reviewed the slope stability of the proposed open cut highwalls for the CCP (GeoTek Solutions, 2013). Slope stability analyses considered potential failure mechanisms based on the known geology of the site, and the geometry of the excavation of highwalls proposed in the CCP mine plan.

A representative site was selected from within the mine footprint on the basis it would be a near-worst case scenario highwall (i.e. highest highwall adjacent to a pagoda landform of near-maximum height within the CCP Project Boundary). In this location, the highwall crest was positioned 60 m from the base of the cliff face of the pagoda landform.

The analyses showed that the minimum global FoS for the profile assessed was 1.36. GeoTek Solutions noted that the normally accepted FoS for a short-term mining slope under which people will work is 1.2 and for a slope carrying critical infrastructure required for the life of mine the design FoS would be about 1.3.

It can therefore be concluded that under the proposed final highwall position for the Modifications the FoS on the stability of any cliffs or pagoda landforms will be much greater than 1.3 and will not be impacted by any highwalls created for the Modifications.

For the Modifications the closest crest is greater than 200m away from any pagoda landform, which further reduces the risk of any stability impact.

6.8.4 Mitigation and Management

To ensure slope stability for the Modifications, Coalpac's Slope Stability Management Plans for the Invincible Colliery and Cullen Valley Mine will be updated. This plan will regular slope stability visual inspections and annual inspections by an appropriately qualified geotechnical practitioner.

6.9 SURFACE WATER

6.9.1 Background

A surface water impact assessment for the Modifications was undertaken by WRM Water and Environment (WRM). This assessment is summarised below and included in **Appendix D**.

Invincible Colliery

Invincible Colliery is located within the upper catchment of Cullen Creek. The mine overlies an extensive network of abandoned underground workings associated with several abandoned underground mines, including Old Invincible Colliery, Invincible Colliery, Renown Colliery and Ivanhoe Colliery. Surface runoff from natural forested catchments and open cut mining areas including sumps, fine reject dams, coal stockpiles and some rehabilitation areas tends to seep into the underground workings via backfilled entries, subsidence induced cracks and channelling. The licensed discharge point for the operation is the Invincible Main Colliery Dam as indicated on **Figure 3**.

Cullen Valley Mine

Cullen Valley Mine is located within the catchments of Jews Creek, Cullen Creek and Red Springs Creek. Jews Creek and Cullen Creek are tributaries of Dulhunty's Creek. Parts of previous open cut mining areas intersect an extensive network of abandoned underground workings. In these areas, surface runoff collected in sumps and coal stockpile areas tends to seep into the underground workings via backfilled entries and subsidence induced cracks. In areas where the open cut mining area does not intersect abandoned underground workings, the water is collected in sediment dams, and predominantly re-used for dust suppression.

The licensed discharge points for Cullen Valley Mine are Dam 1 and Dam 4 as indicated on **Figure 3**.

6.9.2 Methodology

Detailed water balance modelling was conducted as part of the Surface Water Impact Assessment for the previous Coalpac Consolidation Project (WRM, 2011) which included the area within the proposed Modification Boundary.

For these Modifications, WRM conducted a further desktop analysis to determine the impacts of the Modification on the surrounding catchments. WRM has then recommended additional water management measures, as required, to minimise any such impacts.

6.9.3 Impact Assessment

Invincible Colliery

Reduction in Catchment Area

The Modification will result in surface disturbance of an additional 88 ha within the Cullen Creek catchment. However, these additional disturbance areas are within the catchment of the existing water management system. Therefore, the Modification to the Invincible Colliery does not result in any further reduction in catchment area.

Impacts on Water Quality

The water management system has been designed to prevent uncontrolled offsite discharges of mine water and sediment laden water. All coal affected water is captured in active mining sumps. All other runoff from disturbed areas (i.e. not coal affected) is captured and treated using a series of sediment dams.

Mine water collected in sumps is reused for site activities, with the surplus being allowed to evaporate or seep into the underground workings. If dewatering is required, at any time in the future, water from the sumps is pumped to the Invincible Main Colliery Dam. Water quality monitoring data indicates that water which accumulates in the Main Colliery Dam is generally suitable for release in accordance with EPL 1095.

The need for any release of surface water from the Main Colliery Dam could be further reduced as a result of the Modifications due to the proposed construction of the water transfer pipeline from Invincible Colliery to Cullen Valley Mine. As described in Section 3.3.3, any water transferred would be used at Cullen Valley Mine for operational purposes.

It is concluded that the impact of the Modification on downstream water quality will continue to be negligible.

Cullen Valley Mine

Reduction in Catchment Area

The Modification to Cullen Valley Mine is located entirely within the catchment of Jews Creek. The Modification will reduce the catchment area of Jews Creek by approximately 85 ha. This represents approximately 1.4% of the Jews Creek catchment area upstream of the Turon River.

Impacts on Water Quality

The water management system has been designed to prevent uncontrolled offsite discharges of mine water and sediment laden water. Sediment laden water from OEAs and haul roads will be captured and treated in sediment dams. Water transferred to Cullen Valley Mine via the proposed pipeline from Invincible Colliery would be used for operational purposes, including dust suppression and to assist in managing the pre-existing subsurface heating.

Coal affected water is captured and stored in active mining sumps or directed to the old underground workings and can be transferred to Dam 1 or Dam 4 as required (licensed discharge points). Mine water collected in sumps, Dam 1 or Dam 4 is typically reused for operational activities. Water quality monitoring data indicates that water collected in Dam 1 and Dam 4 is generally suitable for release in accordance with EPL 10341 criteria. Any release of surface water from the site would need to comply with the requirements of EPL 10341. Therefore, the Modification is predicted to have no significant impacts on downstream water quality.

6.9.4 Mitigation and Management

Invincible Colliery

The existing and proposed mining areas at Invincible Colliery will be rehabilitated following mining. The final landform for the mine will drain towards Cullen Creek, restoring the catchment area of the creek consistent with pre-mining conditions.

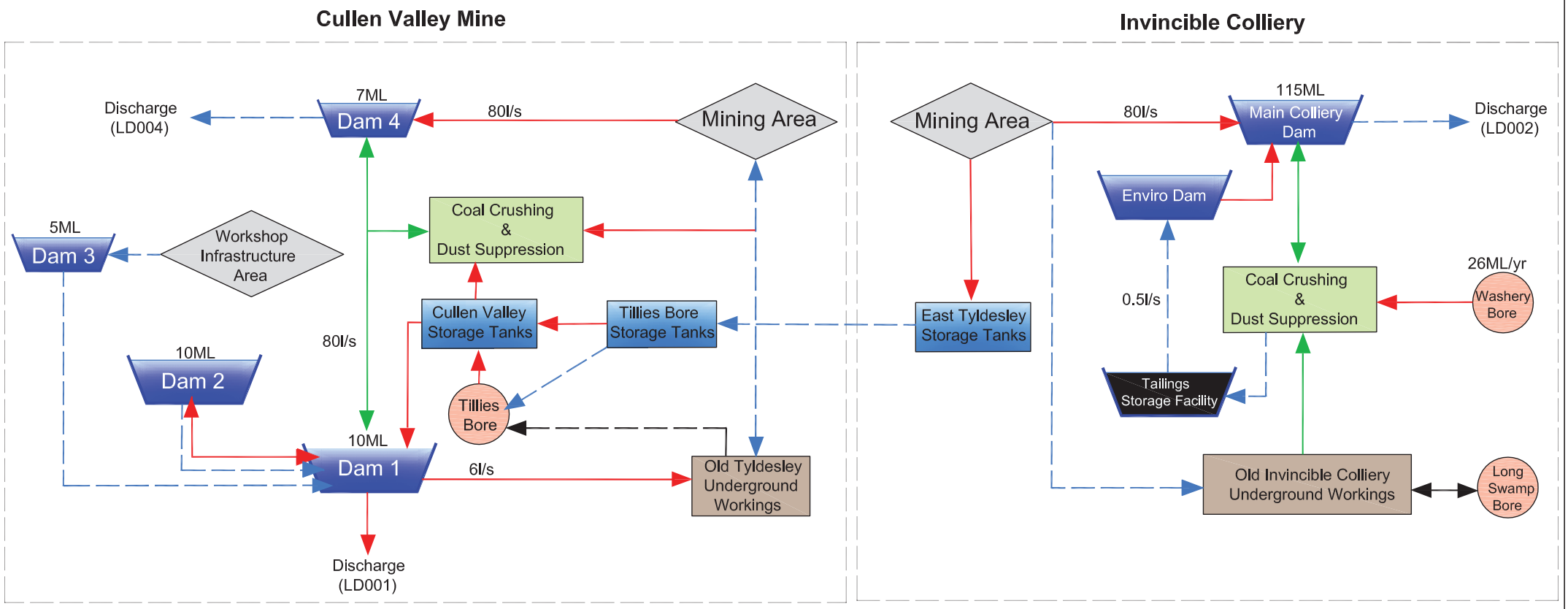
The existing Water Management Plan and Landscape Management Plan for Invincible Colliery will also be revised to incorporate the activities proposed for the Modification, as shown conceptually on **Figure 16**.

Cullen Valley Mine

The existing and proposed mining areas at Cullen Valley Mine will be rehabilitated following mining. Rehabilitation will progressively restore the catchment area of Jews Creek. The final landform will be free draining and the catchment area of Jews Creek will be consistent with pre-mining conditions.

In the post-mining landform, the drainage contour at the southern side of the Cullen Valley bund (which is located at the northern end of the mining area) will accumulate with water and overflow to Jews Creek. Again, the eventual reinstatement of the catchment area will ultimately have a net benefit on the Jews Creek Catchment.

The surface water management component of the existing Environmental Management Plan for Cullen Valley Mine will be revised to reflect the activities proposed for the Modification, as shown conceptually on **Figure 16**.



LEGEND

- Mine Water Storage
- Demand
- Gravity Flows
- Reuse Flows
- Water Transfer Pipeline
- Reuse Flows From Underground Bores

Water Management System

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: 16

Drawn By:	Date:	Drawing No.:	Revision:	
D.E	19/02/14	23.4.6.9 - 16A	B	MGA Zone 56

6.10 GROUNDWATER

6.10.1 Background

A groundwater impact assessment for the Modifications was undertaken by Australasian Groundwater and Environmental Consultants (AGE). This assessment is summarised below and included in **Appendix E**.

Hydrogeological Regime

The hydrogeological regime at Invincible Colliery and Cullen Valley Mine comprises the following:

- Overburden sediments of the Triassic Narrabeen Group;
- The Permian Illawarra Coal Measures; and
- The Marrangaroo Formation.

The sediments within the Triassic Narrabeen Group are characterised by low matrix permeabilities, with greater secondary permeability provided by fractures, fissures and bedding partings. Groundwater systems within the Narrabeen Group exist as perched aquifers and semi-confined leaky aquifers separated by relatively impermeable claystone.

The Illawarra Coal Measures consist of coal seams separated by sandstone, siltstone and mudstone. The interburden materials possess very low hydraulic conductivities, and are generally low yielding to dry. As a result, the coal seams act as the primary water bearing strata, despite also possessing low hydraulic conductivities.

The underlying Marrangaroo Formation consists of sandstones and conglomerates. The permeability of the formation is regionally variable. In some locations, the formation is sufficiently permeable to act as a productive aquifer.

The water table is located at a significant depth below the natural surface. At Cullen Valley Mine, only the deepest of the seven target coal seams, the Lithgow Seam, has the potential to be saturated. Furthermore, saturation of the Lithgow Seam is only predicted to occur in the southern portion of the proposed Modification Disturbance Boundary at Cullen Valley Mine.

At Invincible Colliery, all of the coal seams in the Illawarra Coal Measures are located above the water table. Therefore, the Modification will not intercept any formation groundwater. It should be noted that the Lithgow Seam in the Northern Mining Area is predicted to be partially saturated with surface water run-off stored in the abandoned underground mine workings. This water differs from formation groundwater, and is referred to hereafter as “subsurface water”.

6.10.2 Methodology

Due to the depth of the regional water table, the potential interactions with groundwater systems are expected to be limited. Accordingly, potential groundwater impacts were assessed using a conceptual analytical groundwater model based on Darcy’s Law. In the absence of significant interaction with groundwater systems, a conceptual model is likely to be as accurate as a numerical model.

6.10.3 Impact Assessment

Invincible Colliery

Groundwater Seepage

Within the Invincible Colliery Modification Disturbance Boundary, the Illawarra Coal Measures are unsaturated due to historic underground mining activity. Therefore, open cut and highwall mining associated with the Modification will not result in any groundwater inflows.

Impacts of Aquifer Depressurisation

Given that there is not predicted to be any groundwater seepage generated by the Modification, depressurisation of aquifers is not anticipated to occur. As such, the Modification is not predicted to have any impacts on Groundwater Dependent Ecosystems (GDEs) or registered groundwater bores.

Impacts on Abandoned Mine Workings

A portion of the flooded mine workings associated with the now abandoned Old Invincible Colliery is located within the proposed Northern Mining Area. Based on previous experience and current conditions, there is expected to be a low volume of seepage (up to 125 ML) of subsurface water from the flooded workings to the Northern Mining Area.

Consideration has been given to potential increase in subsurface water seepage due to changes in water levels in the abandoned underground mine workings. Extraordinary rainfall events may cause significant volumes of water to infiltrate into the abandoned underground mine workings. This may raise the water level within the mine workings, translating into greater saturation of the Lithgow Seam within the Modification Disturbance Boundary. As a result, significant rainfall events may cause more substantial subsurface water seepage into open cut mining areas.

If the neighbouring Baal Bone Colliery ceases dewatering of its underground workings, the potentiometric surface within the Old Invincible Colliery workings may rise. This may cause some water from the abandoned underground workings to seep into the Northern Mining Area.

In the event that this occurs, seepage will be pumped from the active mining area either into the Main Colliery Dam for use in the coal preparation plant or, transferred via the pipeline to Cullen Valley Mine to be utilised elsewhere for dust suppression and to assist in managing the pre-existing subsurface heating. Additional water may also be released downstream via the licensed discharge point at the Main Colliery Dam if water quality criteria specified by EPL 1095 are achieved.

Impacts on Water Quality

The overburden materials at Invincible Colliery have been determined to be non-acid forming (NAF). Seepage generated by overburden materials is expected to possess neutral pH and low salinity. Concentrations of metals in the overburden materials are not expected to present any significant environmental issues.

Most coal reject materials have been determined to be NAF. Seepage generated by these materials is likely to be of neutral pH and low salinity. Concentrations of metals in the NAF reject materials are below the thresholds that may cause environmental issues.

Some coarse reject materials associated with the Lithgow Seam are potentially acid forming (PAF). If exposed to oxidising conditions, the seepage generated by these materials may be acidic and more saline than seepage from the NAF materials. The dissolved metal concentrations in seepage from PAF materials may increase over time. Monitoring will be undertaken in reject emplacement areas to ensure there are no adverse impacts on groundwater quality.

Cullen Valley Mine

Groundwater Seepage

The Illawarra Coal Measures located above the Lithgow Seam are unsaturated. Therefore, mining of the seams above the Lithgow Seam will not result in any groundwater seepage. The Lithgow Seam may be saturated within the proposed open cut and highwall mining areas. Open cut mining will expose a 1.5 km length of the Lithgow Seam, of which, approximately 750 m is expected to be saturated. Therefore, the seepage face is approximately 750 m long and 2.5 m high (equivalent to seam thickness).

The rate of groundwater seepage into open cut mining areas is dependent upon the hydraulic conductivity of the coal seam. The conceptual model adopted hydraulic conductivity values ranging from 0.07 m/day to 0.2 m/day, which are representative of regional coal seam permeability. Using these hydraulic conductivities, the steady-state seepage rate for the entire open cut mining area was determined to range from 0.4 ML/year to 1.2 ML/year. When evaporation from the seepage face is taken into account, it is likely that there will be minimal accumulation of groundwater in open cut mining areas.

Highwall mining will generate voids in the coal seam, which will ultimately fill with groundwater. Based on the geometry of the highwall drives, approximately 125 drives will be developed in the saturated extent of the Lithgow Seam. Each drive will generate a storage volume of approximately 2.25 ML, resulting in a total increase in void space of 281 ML.

Using the adopted hydraulic conductivities, the rate of groundwater seepage into the highwall drives is predicted to range from 0.75 ML/year to 2.1 ML/year. Based on these seepage rates, the time required for the voids to fill is predicted to range from 376 years to 132 years.

The total volume of water inflows due to open cut and highwall mining is predicted to range from 1.2 ML/year to 3.3 ML/year.

Impacts of Aquifer Depressurisation

Due to the limited saturation of the coal measures and the moderately low permeability of the Lithgow Seam, the zone of depressurisation is expected to be limited to the extent of the saturated Lithgow Seam. The zone of depressurisation is predicted to extend to approximately 500 m down-dip of the Cullen Valley Modification Boundary.

No registered bores are located within the zone of depressurisation.

There are no GDEs located within the Modification Boundary or the zone of depressurisation. The nearest GDEs are Jews Creek Swamp and Coxs River Swamp. These GDEs rely on perched aquifers and are therefore not affected by depressurisation of the Lithgow Seam. Accordingly, the Modification will not have any impacts on GDEs.

Impacts on Abandoned Mine Workings

The flooded mine workings associated with the abandoned Old Tyldesley Colliery and Great Western Mine are located 1 km to the south of the proposed open cut and highwall mining areas. The zone of depressurisation is not predicted to extend to these mine workings. Therefore, the Modification is not expected to alter the levels of water stored within the flooded mine workings.

Impacts on Water Quality

The overburden materials at Cullen Valley Mine have been determined to be non-acid forming (NAF). Seepage generated by overburden materials is expected to possess neutral pH and low salinity. Concentrations of metals in the overburden materials are not expected to present any significant environmental issues.

No reject material generated from coal processing is emplaced at Cullen Valley Mine, therefore there is no potential for environmental impacts as a result of acid-forming material.

6.10.4 Mitigation and Management

Invincible Colliery

Water Licensing

Since there is expected to be no groundwater seepage into mining areas, a WAL is not required for Invincible Colliery. Coalpac holds groundwater licence 10AL118580 which has a capacity of 26 ML for use in the ICPP in the event of extreme dry conditions. In addition Coalpac holds WAL 27898 with a share component of 80 ML which could be transferred to licence 10AL118580 if required. As such, Coalpac already holds more than sufficient licence allocation for the incidental flow of any groundwater into active mining areas.

There are expected to be inflows of subsurface water when the Northern Mining area encounters the abandoned mine workings to the east of Invincible Colliery. All surface water and groundwater taken by the mine is derived from water sources outside a Water Sharing Plan.

All water taken by the mine is from dirty water runoff from disturbed areas (retained in sedimentation dams and mine water management systems) or from old underground workings which receive dirty water from the mine. The taking of these waters does not require licensing.

Groundwater Monitoring

Coalpac will continue to operate the existing groundwater monitoring network. Given that the Modification is not predicted to result in any depressurisation, the existing monitoring network is considered sufficient for future monitoring. The monitoring program includes the assessment of standing water levels, and annual sampling of bores for water quality analyses.

Cullen Valley Mine

Water Licensing

The groundwater seepage induced by open cut and highwall mining is predicted to reach a peak rate of 3.3 ML/year. This water will be taken from the porous rocks of the Permian Coal Measures. This water source is subject to the Porous Rock WSP and therefore triggers the requirement for a WAL.

Coalpac and its affiliates currently hold WAL 27898 and 10AL118580 with a share component of 80 units and 26 units respectively in the SBMDB Groundwater Source. The seepage rate after the cessation of mining is not predicted to be greater than the peak rate during mining (3.3 ML/year). Therefore, Coalpac holds a sufficient share component to authorise the taking of water during and after mining.

All surface water and groundwater (other than that described above) taken by the mine is derived from water sources outside a Water Sharing Plan.

All water taken by the mine is from dirty water runoff from disturbed areas (retained in sedimentation dams and mine water management systems) or from old underground workings which receive dirty water from the mine. The taking of these waters does not require licensing.

Groundwater Monitoring

Coalpac will continue to operate the existing groundwater monitoring network as shown on **Figure 17**. Given that the Modification is not predicted to result in extensive depressurisation of aquifers, the existing monitoring network is considered sufficient for future monitoring. The monitoring program includes the assessment of standing water levels, and annual sampling of bores for water quality analyses.

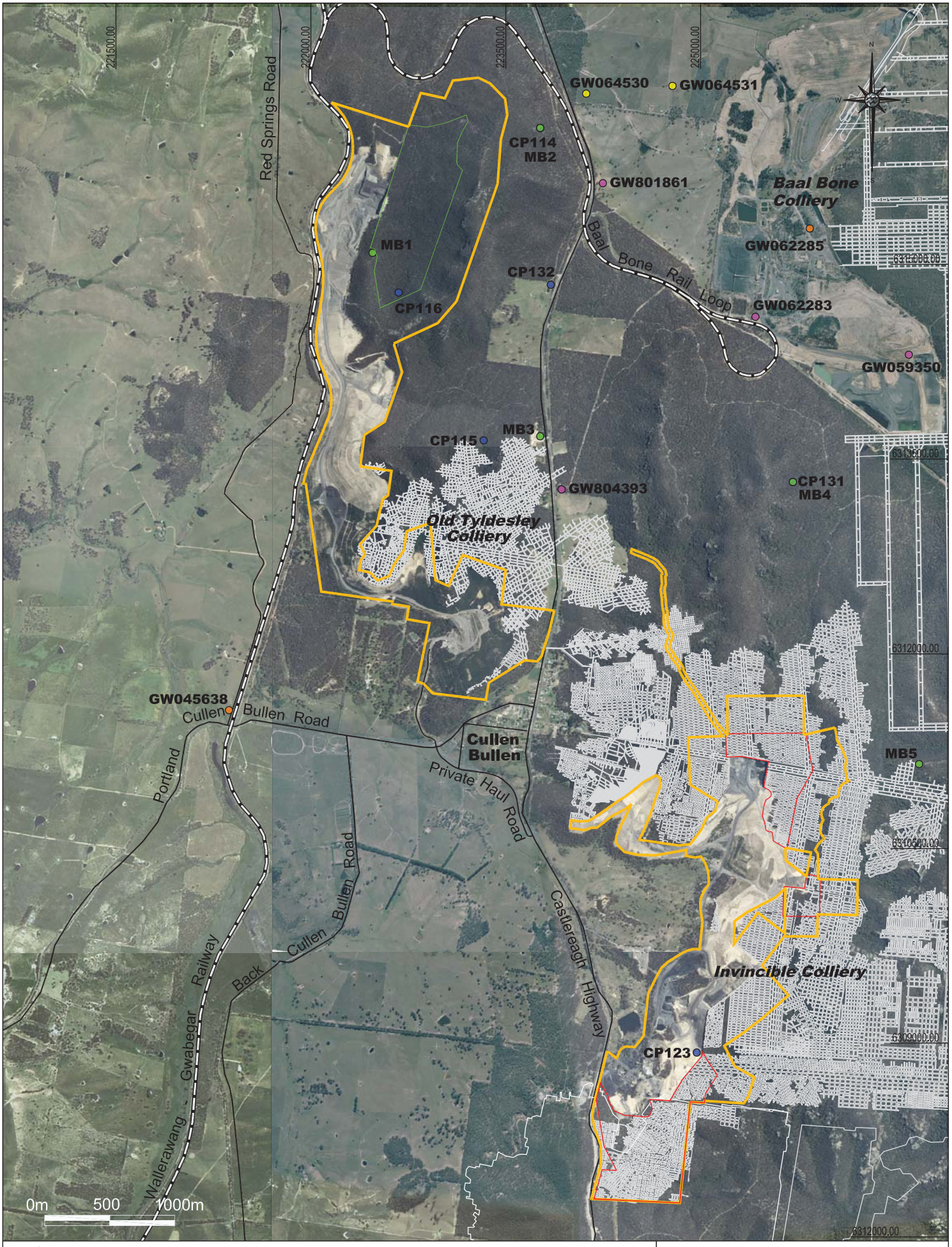
6.11 ECONOMICS

6.11.1 Introduction

Gillespie Economics completed an economic assessment of the Modifications, which is provided in full in **Appendix F**. This assessment noted that from an economic perspective, there are two important aspects of the Modifications:

- Their economic efficiency (i.e. consideration of the economic costs and benefits of the Modifications); and
- Their economic activity impacts (i.e. the economic activity that the Modifications will provide to the regional and NSW economy).

The Draft Guideline for Economic Effects and Evaluation in EIA (James and Gillespie, 2002) has been adopted by DP&I as the relevant guideline for economic analyses. The economic efficiency of a proposal is the key consideration, although economic impact assessment may provide additional information as an adjunct to the economic efficiency analysis. The economic efficiency of the Modifications was assessed using Benefit Cost Analysis (BCA) method. The economic impacts were assessed using input-output (IO) analysis method.



LEGEND

- Modification Boundaries
- Invincible Colliery Modification Disturbance Boundary
- Cullen Valley Mine Modification Disturbance Boundary
- Road
- Rail
- Existing Underground Workings
- Groundwater Monitoring Location
- NOW Registered Bores
- Private Bores
- Mining Bores
- Proposed Water Management Bores

Groundwater Management

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: 17

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6.11.2 Methodology

Benefit Cost Analysis

BCA provides a comparison of the present value of aggregate benefits to society, as a result of a development, with the present value of the aggregate costs. BCA includes the consideration of costs and benefits to all members of society, including consumers, producers and the broader society as represented by the government. BCA of mining proposals invariably involves a comparison of:

- The net production benefits of a development; and
- The environmental, social and cultural impacts (which are generally costs, but may be benefits).

Net production benefits can be estimated based on market data on the projected economic value of coal minus the capital and operating costs of projects, including opportunity costs of capital and land already in the ownership of mining companies. The estimates of net production benefits generally includes accounting for costs aimed at mitigating, offsetting or compensating for the main environmental, social and cultural impacts. Production costs and benefits over time are discounted to a present value. A discount rate of 7% has been used in the analysis, with rates of 4% and 10% used for sensitivity testing.

Environmental, social and cultural impacts that can be readily identified and measured can potentially be valued in monetary terms. Impacts can be valued using benefit transfer or primary non-market valuation methods. The principle of materiality applies to the valuation of the impacts of a project on the well-being of people. Only those impacts which are likely to have a material bearing on the decision need to be considered in BCA (NSW Government, 2012).

Economic Impact Assessment

The economic impact of a development on the regional economy is assessed using indicators of economic activity, namely:

- Gross regional output (gross value of business turnover);
- Value Added (gross regional output minus the costs of the raw materials, components and services used to produce the gross regional output);
- Income paid to employees (including imputed wages for self-employed persons and business owners); and
- Employment.

For the Modifications, the regional economy comprises the Lithgow and Bathurst LGAs.

6.11.3 Impact Assessment

Benefit Cost Analysis

The Modifications are estimated to have total net production benefits of $219M, with all of these benefits accruing to Australia. If employment benefits are considered, the net production benefits increase to $227M. Most of the environmental and social impacts of the Modifications are immaterial from an aggregate economic efficiency perspective.

Since the economic values of these impacts are very low compared to the total net production benefit, the principle of immateriality is applied. The only environmental impacts which have the potential to be material from an economic efficiency perspective are the clearing of native vegetation in the Ben Bullen State Forest and the impacts of blasting on pagoda landforms. Blasting in close proximity to the rock structures will be managed to ensure that there are no impacts, thereby avoiding any economic costs. Coalpac has committed to establishing biodiversity offset areas to compensate for the loss of biodiversity values due to vegetation clearing. The cost of these offset areas is included in the operating costs for the Modifications. Therefore, the ecological costs have been internalised into the net production benefits.

Due to the immateriality of most environmental impacts, the measures to avoid indirect impacts on pagoda landforms, and the internalisation of ecological costs into operating costs, the net production benefits of the Modifications are not encumbered by environmental, cultural and social costs. Accordingly, the Modifications are estimated to provide net social benefits of between $219M and $227M.

The Modifications are therefore justifiable from an economic efficiency perspective.

The net production benefit will be distributed amongst a range of stakeholders including:

- The Commonwealth Government in the form of Company tax payable ($11M present value) which is subsequently used to fund provision of government infrastructure and services across Australia and NSW, including the local and regional area;
- The NSW Government in the form of royalties ($29M present value) which are subsequently used to fund provision of government infrastructure and services across NSW, including the regional area;
- Coalpac and its shareholders in the form of after tax (and after voluntary contributions) profits ($25M present value); and
- The operator of the MPPS ($155M present value) in the form of lower cost coal, which ultimately benefits electricity consumers in NSW in the form of lower electricity prices; and
- The local community in the form of any voluntary contributions to community infrastructure and services.

The residual environmental and social impacts of the Modification, while considered immaterial from an aggregate economic efficiency perspective, may accrue to a number of different stakeholder groups at the local, state, national and global level.

Economic Impact Assessment

It has been conservatively assumed that Invincible Colliery and Cullen Valley Mine will operate at maximum production for 3 years of the Modifications. The Modifications are predicted to provide the following economic benefits in each of these years:

- $149M in annual direct and indirect gross regional output;
- $46M in annual direct and indirect regional value added;
- $19M in annual direct and indirect household income; and
- 245 direct and indirect jobs.

The quantum of benefits will be lower for the year where production is less than the maximum. The flow-on benefits of the Modifications may accrue to various sectors in the regional economy including:

- Exploration and Mining Support Services;
- Road Transport;
- Professional, Scientific and Technical Services;
- Ownership of Dwellings;
- Retail Trade;
- Food and Beverage Services;
- Electricity Transmission, Distribution, On Selling and Electricity Market Operation;
- Wholesale Trade; and
- Education and Training.

These are the sectors in which the Modifications may generate additional employment opportunities.

6.11.4 Mitigation and Management

For the Modifications to be questionable from an economic efficiency perspective, all incremental residual environmental impacts from the Modifications, that impact Australia, would need to be valued by the community at greater than the estimate of the Australian net production benefits i.e. greater than $219M.

The BCA demonstrates that the Modifications are economically desirable and justifiable. The costs of residual environmental and social impacts were found to be immaterial, owing to the effectiveness of mitigation and management measures for potential environmental issues.

These mitigation and management measures and commitments are described through this EA and summarised in **Section 7**.

6.12 TRAFFIC & TRANSPORT

6.12.1 Background

A Traffic Impact Assessment (Hyder Consulting, 2010) was undertaken for Invincible Colliery Modification 3 (MOD 3) in 2010. MOD 3 involved the transportation of an additional 0.3 Mtpa of coal to Mt Piper Power Station and other domestic consumers. The Traffic Impact Assessment assessed the impacts of the increased coal transportation on three key intersections, namely:

- Castlereagh Highway / Invincible Colliery Access;
- Castlereagh Highway / Boulder Road; and
- Boulder Road / Mt Piper Power Station Access.

Based on the results of SIDRA modelling, Hyder Consulting determined that the increased coal transportation did not significantly alter the performance of the key intersections.

The Modification does not entail any increase in the coal production or workforces of the Invincible Colliery and Cullen Valley Mines. Consequently, the traffic volumes associated with coal transportation and personnel movements are expected to remain at existing levels.

6.12.2 Methodology

Given that the Modification is not expected to alter the traffic volumes generated by Invincible Colliery and Cullen Valley Mine, additional SIDRA modelling was not necessary. The only increases in traffic volumes on the local road network will be through growth in background traffic (i.e. independent of the Modification).

The potential impact of the Modification was assessed by examining the results of the Traffic Impact Assessment (Hyder Consulting, 2010) and applying a rate of background growth for the additional four years of operations at Invincible Colliery. The Traffic Impact Assessment (Hyder Consulting, 2010) determined that the average annual increase in background traffic was approximately 2%.

6.12.3 Impact Assessment

Invincible Colliery

Given that the maximum coal production at Invincible Colliery will remain unchanged, there is not expected to be any change in the traffic volumes associated with the operation. Increases in traffic volumes on the surrounding road network will primarily be due to growth in background traffic.

The SIDRA modelling undertaken for the Traffic Impact Assessment predicted that the three key intersections would exhibit good performance, with an average delay of less than 6 seconds per vehicle and a queue length of less than one vehicle. As such, there is sufficient spare capacity in the road network to accommodate the 2% growth in background traffic during the additional four years of production at Invincible Colliery (DC Traffic Engineering, 2013).

Cullen Valley Mine

The Modification does not entail any changes to the maximum production, transportation arrangements or operational period for Cullen Valley Mine. Therefore, the traffic volumes generated by the mine are not expected to be altered by the Modification.

6.12.4 Mitigation and Management

Since the Modification is not predicted to have a significant impact on the performance of the road network, no additional management or mitigation measures are necessary. Coalpac will continue to implement the existing management measures for Invincible Colliery and Cullen Valley Mine coal haulage traffic, including:

- Haulage of product coal by road will be undertaken using covered trucks within daily timeframes currently approved for each site;
- Monitoring of all product coal haulage to record product volumes and the number of movements, with data reported in the Annual Review;

- Use of the truck wheel wash at Invincible Colliery for haulage vehicles leaving site to reduce potential for tracking of dust onto the Castlereagh Highway; and
- Regular training of workforce and contractors in relation to road safety practises for interactions with the local community;

6.13 SOILS AND LAND CAPABILITY

6.13.1 Introduction

A Soil and Land Capability Impact Assessment has been undertaken by Ecobiological Pty Ltd (Ecobiological) in 2011 for the areas adjacent to the existing Cullen Valley Mine and Invincible Colliery. The land contained within the Modification Disturbance Boundaries formed part of this assessment and included a review of existing information, definition of soil types, description of land classifications, pre and post-mining land and agricultural capability, quantification of available topsoil and subsoil resources and identification of appropriate management measures.

6.13.2 Methodology

The methodology used by Ecobiological (2011) to assess soil and land capability of land adjacent to the Cullen Valley Mine and Invincible Colliery, including the Modification Boundary, involved:

- A broad scale review of the '*Atlas of Australian Soils'*;
- A soil and land capability survey of the land which included soil mapping and profiling, a soil field assessment and soil laboratory testing;
- Land capability was determined in accordance with OEH (formerly the NSW Soil Conservation Service) '*Systems Used to Classify Rural Lands in New South Wales'* (Cunningham et al 1988) which is comprised of eight classes, classified on the basis of an increasing soil erosion hazard and decreasing versatility of use; and
- Agricultural suitability was also determined in accordance with DRE's (formerly NSW Agriculture) '*Agricultural Land Classification'* (Agfact AC.25) which consists of five classes, providing a ranking of lands according to their productivity for a wide range of agricultural activities with the objective of determining the potential for crop growth within certain limits.

6.13.3 Impact Assessment

Four soil types were identified within the Modification Boundaries. **Table 17** identifies these soil types and presents the quantitative distribution of each within the Modification Boundaries at Cullen Valley Mine and Invincible Colliery. These soil types are described further below, with the mapping of each within the Modification Boundaries shown on **Figure 18**.

Soil Type 1

Soil type 1 is a deep dark sandy loam and covers approximately 3.6 ha (4%) of the land within the Modification Disturbance Boundary at Invincible Colliery. They occur in a transferral landscape generally within valley flats and along drainage lines (alluvial / colluvial). The topsoil associated with this soil type is approximately 50 cm in depth, non-saline, slightly dispersive and slightly acidic. The subsoil extends to a depth of up to 250 cm and is non-saline, moderately dispersive and acidic. The topsoil is suitable for stripping and reuse as topdressing in rehabilitation.

Table 17
Modification Boundary Soil Types and Area

		Area within Modification Disturbance Boundary (%)		Area within Modification Disturbance Boundary (ha)	
Soil Type	**Soil Unit**	**Cullen Valley Mine**	**Invincible Colliery**	**Cullen Valley Mine**	**Invincible Colliery**
1	Deep dark sandy loam	0	4.0	0	4.0
2	Deep orange clay loam	93.5	82.9	57.8	72.7
3	Shallow brown clay loam	5.5	10.0	3.0	9.0
4	Skeletal sandy loam	1.0	3.1	1.0	3.0
Total		100.0	100.0	61.8	88.7

The subsoil has similar textural and chemical properties to the topsoil and therefore stripping to depths lower than 50 cm may be achieved in some areas depending on profile characteristics.

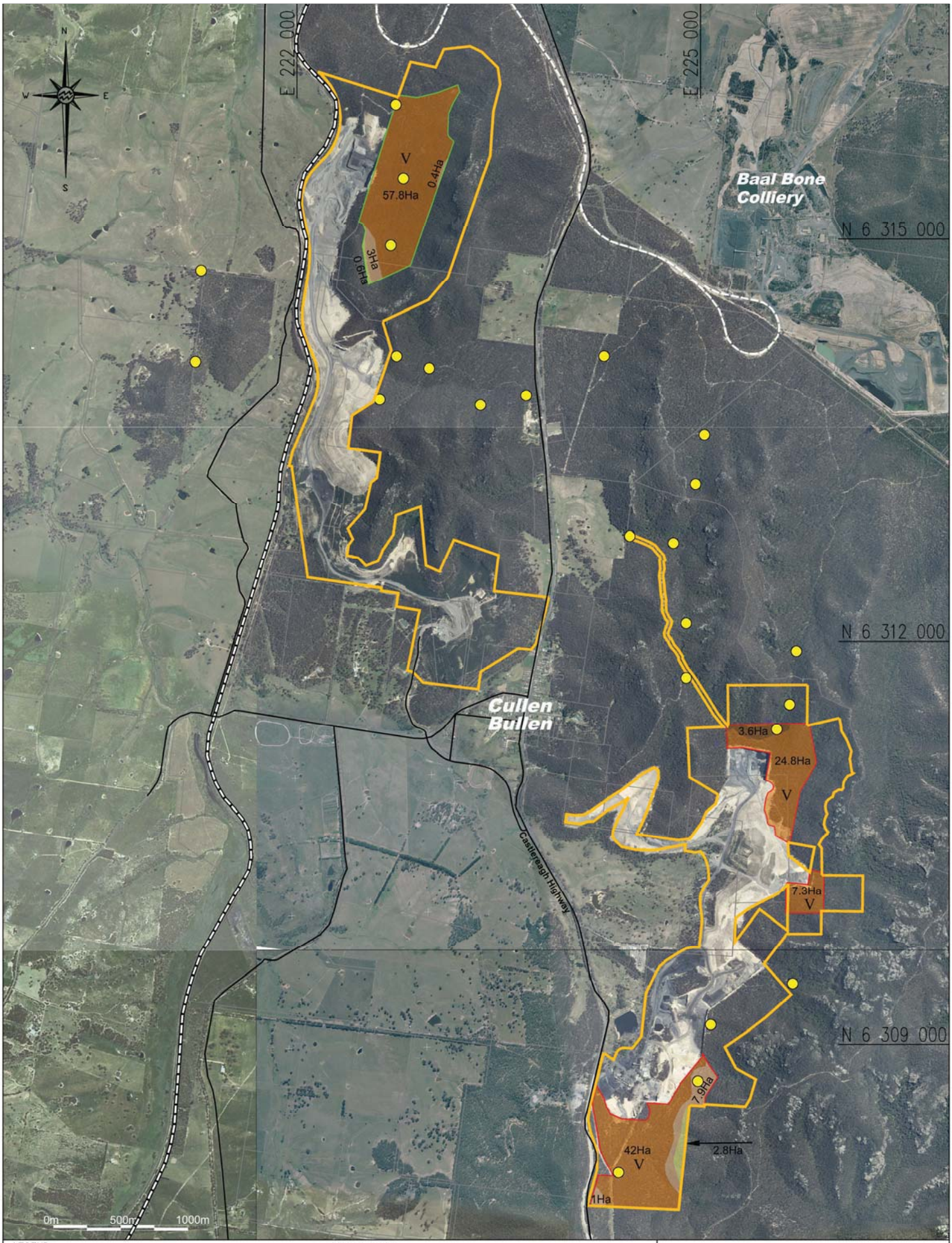
Soil Type 2

Soil type 2 is a deep orange clay loam and covers approximately 57.8 ha (93.5%) of the land within the Modification Disturbance Boundary at Cullen Valley Mine and 74.1 ha (82.9%) of the land within the Modification Disturbance Boundary at Invincible Colliery. This soil type occurs in a residual soil landscape and primarily on lower gradual slopes. The topsoil associated with the soil is approximately 20 cm in depth, and is non-saline, slightly dispersive and slightly acidic. The subsoil extends to a depth of up to 240 cm and is non-saline, moderately dispersive and acidic.

The topsoil is suitable for stripping to a depth of 15 – 20 cm and reuse as topdressing in rehabilitation. The subsoil however is texturally and structurally unsuitable for stripping, due to high clay content and massive structure, and should not be retained for topsoil respreading. Salinity levels and acidity are not suitable for supporting vegetation growth.

Soil Type 3

Soil type 3 is a shallow brown sandy loam and covers approximately 3.4 ha (5.5%) of the land within the Modification Boundary at Cullen Valley Mine and 8.9 ha (10.0%) of the land within the Modification Boundary at Invincible Colliery. This soil type occurs in residual soil landscapes located primarily on the upper gradual slopes.



LEGEND

- Modification Boundaries
- Invincible Colliery Modification Disturbance Boundary
- Cullen Valley Mine Modification Disturbance Boundary
- VIII Land Capability Classes
- Soil Test Pits
- Road
- Rail

Soil Categories

- Deep Dark Sandy Loam
- Deep Orange Clay Loam
- Shallow Brown Sandy Loam
- Skeletal Sandy Loam

Soils Land Capability

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: 18

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The topsoil associated with the soil is approximately 15 cm in depth and is non-saline, slightly dispersive and slightly acidic. The subsoil extends to a depth of up to 114 cm and is non-saline, moderately dispersive and acidic.

The topsoil is suitable for stripping to a depth of 10 – 15 cm and reuse as topdressing in rehabilitation. The subsoil however is texturally and structurally unsuitable for stripping, due to high clay content, and should not be retained for topsoil respreading. Further, the salinity levels and acidity of the subsoil material are not suitable for supporting vegetation growth.

Soil Type 4

Soil type 4 is a Skeletal sandy loam and covers approximately 0.6 ha (1.0%) of the land within the Modification Boundary at Cullen Valley Mine and 2.8 ha (3.1%) of the land within the Modification Boundary at Invincible Colliery. This soil type occurs in a residual soil landscapes located primarily on crests and upper steep slopes.

The topsoil associated with the soil is approximately 2 cm in depth and is non-saline, slightly dispersive and slightly acidic. The subsoil is limited to a depth of only 2 cm and is non-saline, moderately dispersive and generally slightly acidic.

Given that the topsoil is extremely shallow and the subsoil contains high density of parent rock material, the soil is texturally and structurally unsuitable for stripping and both the topsoil and subsoil should not be retained for respreading.

Topsoil Availability and Suitability

The estimated total volume of suitable topdressing materials available from areas proposed to be disturbed within the Modification Boundary at Invincible Colliery is up to 172,000 cubic metres. When a handling loss of 10% is allowed, the quantity decreases to approximately 155,000 cubic metres, which will be adequate for the Modification requirements (**Table 18**).

Table 18
Topsoil Stripping Depths Invincible Colliery

Soil Type	Stripping Depth (m)	Disturbed Area (ha)	Volume within Modification Disturbance Boundary (m^3)	Maximum Volume (10% Handling Loss) (m^3)
1	0.30	3.6	10,800	9,720
2	0.20	74.1	148,200	133,380
3	0.15	8.9	13,350	12,015
4	Stripping not to be undertaken	2.8	0	0
Total		**89.4**	**172,350**	**155,115**

The estimated total volume of suitable topdressing materials available from areas proposed to be disturbed within the Modification Boundary at Cullen Valley Mine is up to 120,000 cubic metres. When a handling loss of 10% is allowed, the quantity decreases to approximately 108,000 cubic metres, which will be adequate for the Modification requirements (**Table 19**).

Land Capability

The majority of the Modification Boundary is considered Class V land suited for grazing activities (as defined in Cunningham et al 1988). This is consistent with neighbouring agricultural land outside the Modification Boundary.

The majority of the disturbed post-mining landform consists of slopes of 10 degrees and will be covered in low to moderate quality topdressing materials.

The aim of these rehabilitation activities will aim at restoring the land back to the pre-mining land capability of Class V land. The flatter slopes of rehabilitation will enable the land capability to be generated back to Class V land which will continue to dominate the site after cessation of mining.

Agricultural Suitability

The land within the Modification Disturbance Boundary is currently vegetated with native forest associated with the Ben Bullen State Forest. Adjacent farmland is predominantly used for low intensity cattle and sheep grazing.

With respect to cropping, the land within the Modification Boundary was identified as Class 5. This indicates that the land is unsuitable for cropping which was mainly due to the inaccessibility of the undulating terrain and a lack of available topsoil for most soil units.

Table 19
Topsoil Stripping Depths Cullen Valley Mine

Soil Type	Stripping Depth (m)	Disturbed Area (ha)	Volume within Modification Disturbance Boundary (m^3)	Maximum Volume (10% Handling Loss) (m^3)
1	0.30	0.0	0	0
2	0.20	57.8	115,600	104,040
3	0.15	3.4	5,100	4,590
4	Stripping not to be undertaken	0.6	0	0
Total		**61.8**	**120,700**	**108,630**

With respect to grazing, the majority of the site is identified as Class 4 land which indicates that the land is suited to support native pastures and / or improved pastures using minimum tillage techniques.

The overall level of production for this land would however be comparatively low due to environmental constraints such as low topsoil availability and undulating terrain. Skeletal Soils were identified as Class 5 (unsuitable for grazing) due to their low topsoil availability, higher erosion potential and inaccessibility. Overall, the percentage area of each class of agricultural suitability will remain relatively similar to that of the existing environment.

6.13.4 Mitigation and Management

In order to reduce the potential for degradation of soil and land capability within the Modification Disturbance Boundary and adjoining lands, existing topsoil management and rehabilitation strategies at Invincible Colliery and Cullen Valley Mine will continue to be implemented during the mining process to achieve the desired post-mining land capability. These management strategies include:

- Stripping materials to indicated levels. Where possible, materials will not be stripped in excessively dry or wet conditions;
- Topsoil materials will be spread directly onto reshaped areas to a minimum depth of 0.1 m where practical to avoid stockpiling;
- Where topsoil must be stockpiled, efforts will be made to reduce compaction by keeping soil in as coarsely textured a condition as possible in order to promote infiltration and minimise erosion until vegetation is established and to prevent anaerobic zones forming; stockpiles will be a maximum of 3 m in height and if stored for greater than 12 months seeded and fertilised and treated for weeds prior to respreading;
- An inventory of designated areas and available soil will be maintained to ensure adequate topsoil materials are available for planned rehabilitation activities;
- Thorough seedbed preparation will be undertaken to ensure optimum establishment and growth of vegetation with all topsoiled areas lightly contour ripped to create a “key” between the soil and the spoil. Ripping will be undertaken on the contour, preferably when soil is moist;
- Re-grading will be undertaken where required to produce slope angles, lengths and shapes that are compatible with the proposed land use and not prone to an unacceptable rate of erosion. This will be done in integration with drainage structures and dams capable of conveying runoff from the newly created catchments whilst minimising the risk of erosion and sedimentation (including contour furrows or contour banks at intervals down the slope, contour ripping across the grade, and graded banks where required); and
- Engineered waterways, spillways and sediment control dams (using erosion blankets, ground cover vegetation and / or rip rap) will also be implemented to capture sediment laden runoff prior to offsite release and designed and located so as to safely convey the maximum anticipated discharge.

Coalpac will update existing site procedures and relevant environmental management procedures as required to reflect the management of lands within the Modification Boundary.

6.14 VISUAL AND LIGHTING

6.14.1 Introduction

A visual and lighting impact assessment was undertaken to identify the character of the existing landscape surrounding Invincible Colliery and Cullen Valley Mine, consider visual impacts and determine management and mitigation measures for the Modifications.

6.14.2 Methodology

Existing Visual Landscape

Invincible Colliery and Cullen Valley Mine are located approximately 25 km north-west of Lithgow on lands surrounding the township of Cullen Bullen. Invincible Colliery is located directly to the east and Cullen Valley Mine to the west of the Castlereagh Highway, which is the main road link between Lithgow and Mudgee.

The visual setting of each site is created by a combination of different landscapes which vary as a result of topography, vegetation cover and land use types. This variation can create screening and visual buffers or alternatively, provide viewing corridors to specific areas proposed to be impacted by the Modifications.

Invincible Colliery

The visual landscape surrounding Invincible Colliery is generally defined by the steep, forested lands and escarpments within the Ben Bullen State Forest to the north, east and south of the site, with the Castlereagh Highway located immediately to the west. The visual catchment for existing Invincible Colliery operations also includes several rural residences to the west and in proximity of the township of Portland, located approximately 8 km to the south-west of the site.

Cullen Valley Mine

The visual landscape surrounding Cullen Valley Mine is generally defined by the steep, forested lands and escarpments within the Ben Bullen State Forest to the north and east of the site, with the Wallerawang – Gwabegar Rail Line located immediately to the west and the Baal Bone Colliery rail loop to the north. The visual catchment also includes undulating rural grazing lands and a number of residences located to the west and south of the site off Red Springs Road and Cullen Bullen – Portland Road that have views of existing approved operations.

Visual Impact Evaluation

The evaluation of visual impact was undertaken by considering the existing visual landscape setting, including how it is seen from various viewing locations to establish the predicted visual character of the Modifications. The visual impacts were then determined by considering the visual characteristics of each Modification in the context of the landscape in which it is located.

The overall visual impact of each Modification was then determined by assessing the relationship between visual sensitivity and visual effect (and the interaction between these factors as shown in **Table 20**) to direct any required mitigation and management strategies for key viewing locations.

Visual effect relates to the level of visual contrast and integration of the Modifications within the existing landscape. The magnitude of the visual effect was determined by a balanced analysis of the contrast and integration of the Modifications (such as form, shape, pattern, line, colour and texture) and the proportion of the view that includes Modification elements.

The continuation of a mining development as that proposed by the Modifications creates different visual characteristics within the existing landscape. Visual effects were assessed by considering the context of the Modifications landscape within the landscape and how these changes will impact on existing views.

Visual sensitivity is a measure of how critically a change to the existing landscape is viewed by people from different land uses in the vicinity of a development. In this regard, residential, tourist and / or recreation areas are typically ascribed a higher visual sensitivity than industrial areas, agricultural lands and transport corridors, as lands used as part of a leisure experience make use of the scenic amenity values of the surrounding landscape and are often utilised in this way over extended viewing periods.

The visual sensitivity of individual receivers may range from high to low, depending on additional factors which are particularly relevant to this Project given the diverse viewing locations and complex topography. These factors include:

- Screening effects of topography, buildings or vegetation;
- Viewing distance from the receiver to visible areas of the Modifications; and
- General orientation of receivers to landscape areas affected by the Modifications (for example those with verandas, decks or living room windows overlooking the Modifications).

Table 20
Visual Impact Assessment Matrix

		Visual Effect			
		High	**Moderate**	**Low**	**Very Low**
Visual Sensitivity	**High**	High Impact	High Impact	Moderate Impact	Low Impact
	Mod	High Impact	Moderate Impact	Low Impact	Low Impact
	Low	Moderate Impact	Low Impact	Low Impact	Low Impact

Lighting Impact

Mining operations associated with the Modifications have the potential to result in lighting impacts to surrounding receivers in addition to those from the existing Invincible Colliery and Cullen Valley Mine sites. These impacts will be influenced by the scale and location of operations during the night within the Modification Boundaries, the relative level at which the viewing locations are situated and the presence of any offsite barriers such as topographic features and / or screening vegetation. Lighting impacts were evaluated qualitatively and considered both direct and indirect lighting effects of the Modifications. It should be noted that that no night time (i.e. between 10 pm and 7 am) mining, coal processing or transport operations are proposed as part of the Modifications.

6.14.3 Impact Assessment

Invincible Colliery

The visual impacts of the Invincible Colliery Modification will include a range of viewing locations, primarily to the south and west of the Modification Disturbance Boundary. Views to residential receptors to the north of the site (including Cullen Bullen) will be screened from visual impacts by existing topography and woodland vegetation in the Ben Bullen State Forest.

Views for receptors located to the south and west of the site include low sensitivity rural land owners, road users of the Castlereagh Highway and several local roads. The primary visual effects of the Modification are related to the open cut mining activities proposed for the Southern and Eastern Mining Areas. This effect will be high for road users travelling on the Castlereagh Highway in close proximity to the Southern Mining Area, creating a high visual impact for limited sections of the road that have views to active mining operations in this area. These impacts will be minimised by retaining a buffer of existing native vegetation between the Southern Mining Area and the Castlereagh Highway and the progressive rehabilitation of active mining areas to forest and woodland communities (see **Section 6.17**).

Receptors on the Castlereagh Highway will also continue to have views to areas disturbed by approved existing mining activities at Invincible Colliery. The visual effect of these views is experienced predominantly by northbound traffic; however any impact on existing views will continue to be reduced through the ongoing successful growth of rehabilitation in these areas (see **Section 6.17**).

Receptors using local roads or at rural residences with views of the Modification to the west of Invincible Colliery are likely to have a low visual sensitivity and effect due to the viewing distances to the proposed mining areas and the limited proportion of the total view that active mining activities will occupy.

The visual impacts created by the contrast of the more elevated open cut mining activities within the Eastern Mining Area to surrounding forest and woodland will be reduced to low over a period of approximately five years as rehabilitation vegetation communities are developed.

Views of the Modification Boundary to the east and north of the site will be available from a number of locations in the Ben Bullen State Forest. While views in these areas are generally screened by existing forest and woodland vegetation, some elevated areas within the Ben Bullen State Forest to the east and north of the site provide views to the Invincible Colliery and to the proposed Northern, Eastern and Southern Mining Areas. The views from the north are dominated by the successful rehabilitation. Receptors viewing Invincible Colliery from the east and north would be limited to occasional recreational users of the Ben Bullen State Forest.

The visual effect of these existing mining areas will be further reduced by Year 2 as rehabilitation of existing disturbance areas is undertaken as part of the Modification activities. However as open cut mining is carried out, views to active mining in the Northern, Eastern and Southern areas will continue, maintaining a localised high visual effect. Over time, visual effect levels will decrease as the Modification Disturbance Boundary and existing disturbance areas are progressively rehabilitated and develop into forest communities, reducing impacts due to the contrast created with the existing forested environment (see **Figure 19**).

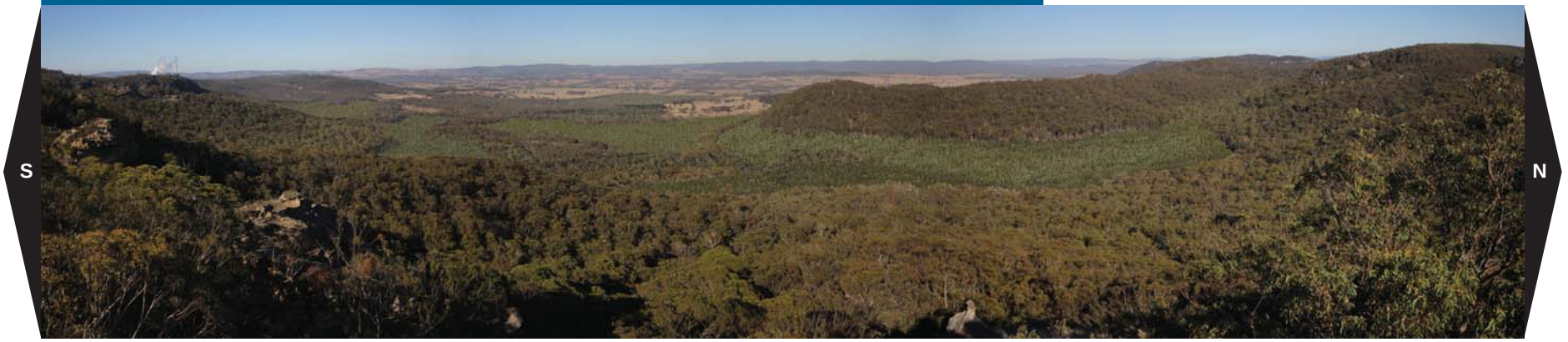
Cullen Valley Mine

The visual impacts of the Cullen Valley Modification will be restricted to those receptors to the north of the site with views of the proposed open cut mining area. In order to minimise the potential impacts, a bund will be constructed at the northern extent of the Modification Disturbance Boundary as shown on **Figure 5**. There will be high visual effects to those northern receptors for a period of approximately two years from commencement of the Modification, after which the rehabilitation of the bund in this area will reduce the high / moderate visual effects to low. Some mining areas will remain periodically exposed over the top of the noise bund at some viewing locations from time to time, however these will be less than 2.5% of a Primary Viewing Zone (PVZ) and will create a moderate to low visual effect.

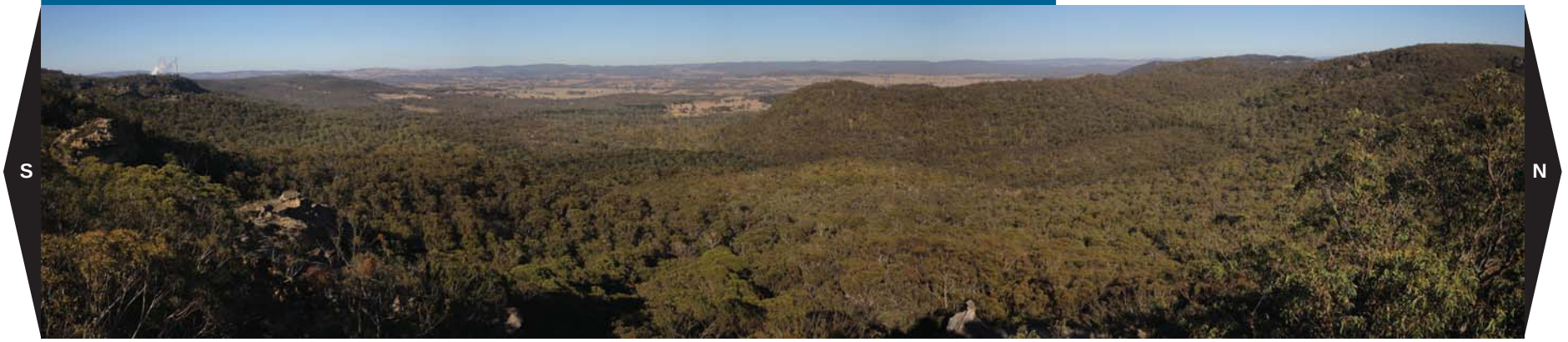
The residences to the north of Cullen Valley Mine (most of which are accessed via the Red Springs Road from the Castlereagh Highway) have been ascribed a high visual sensitivity. Most residences have open views of surrounding areas, which increases the likelihood of open views to the Modification. The roads in the locality are minor roads but have been ascribed a moderate visual sensitivity, being located within 2.5 km of the Modification. On the basis of land use, all rural lands in this sector will have a low sensitivity.

Operations proposed for the Modification will therefore have a high visual effect for a one to two year period from commencement, which when combined with the high sensitivity of the rural residences in this sector will create a high visual impact. This impact will be minimised through early, progressive rehabilitation of the noise bund required to be constructed in this area (see **Figure 20**). Due to the forested setting surrounding these operational areas, rehabilitation activities will require the establishment of forest and woodland plantings to reduce visual effects and impacts to low.

CONCEPTUAL REHABILITATION – 7 YEARS POST-MINING VIEW LOOKING WEST



CONCEPTUAL REHABILITATION – 20 YEARS POST-MINING VIEW LOOKING WEST



COALPAC MODIFICATIONS

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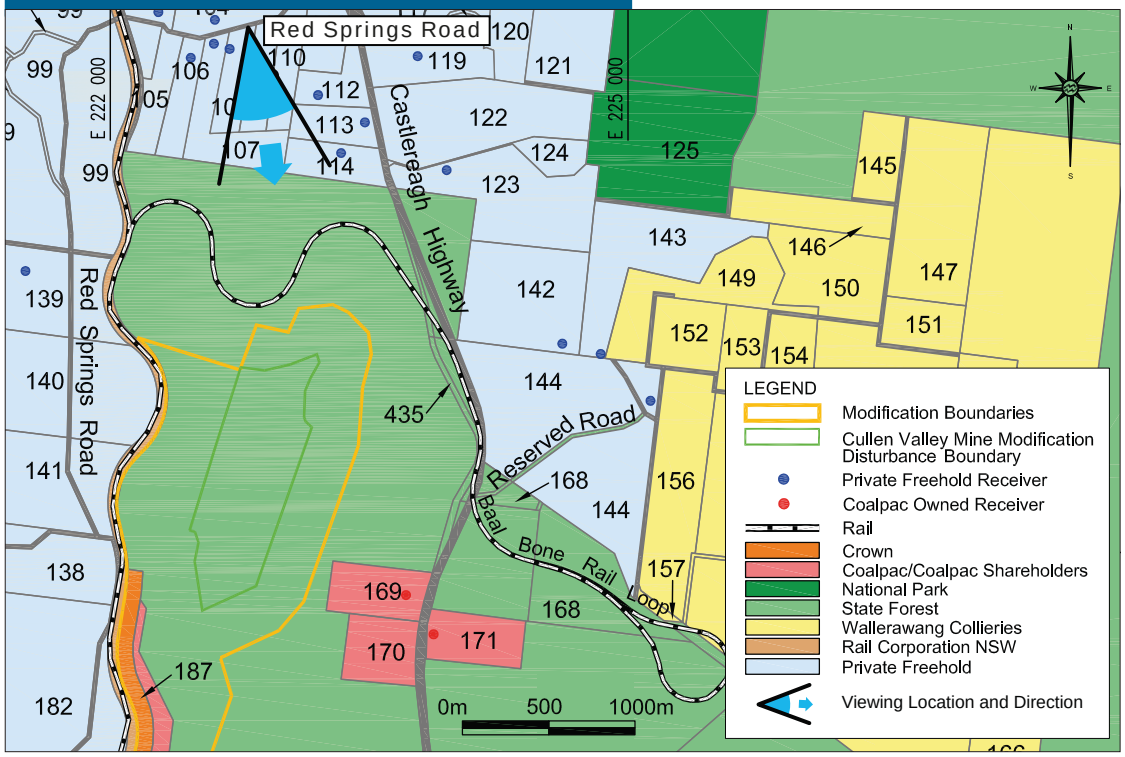
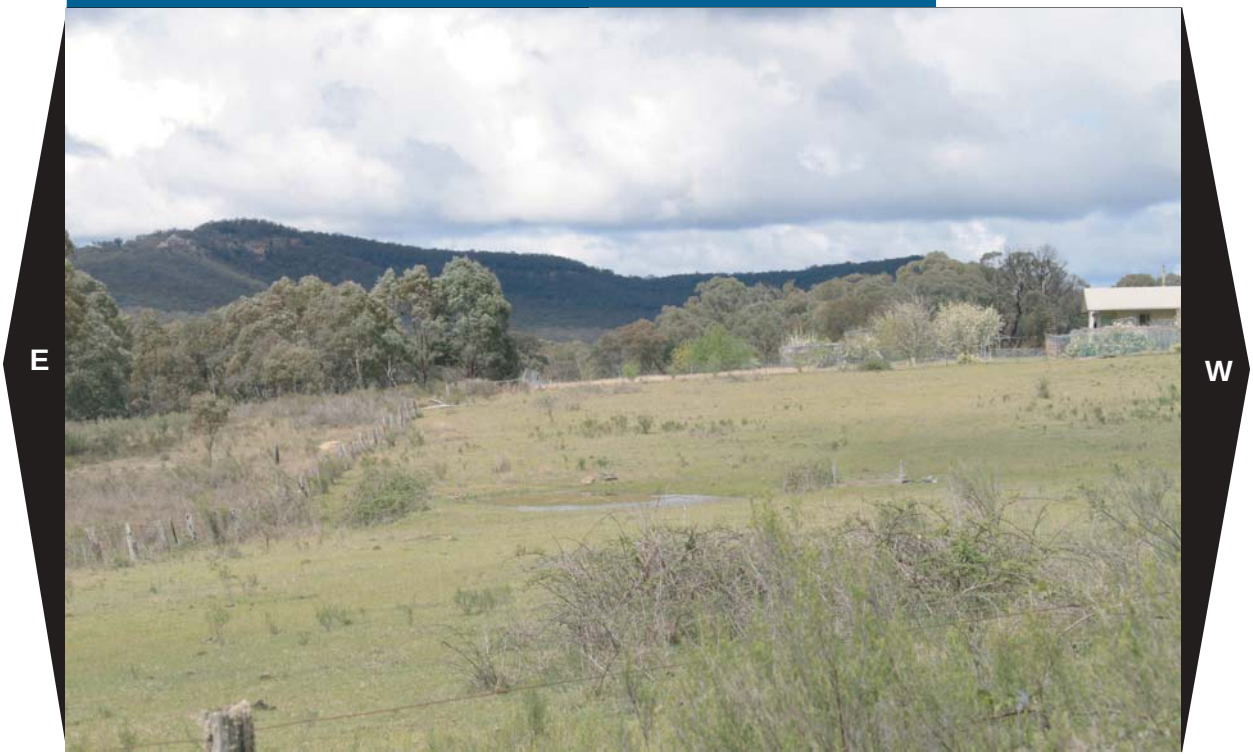
Invincible Colliery Conceptual Long Term Rehabilitation
(See Figure 6 for Viewing Location)

FIGURE 19

RED SPRINGS ROAD - LOCATION PLAN



RED SPRINGS ROAD - EXISTING VIEW LOOKING SOUTH



COALPAC MODIFICATIONS

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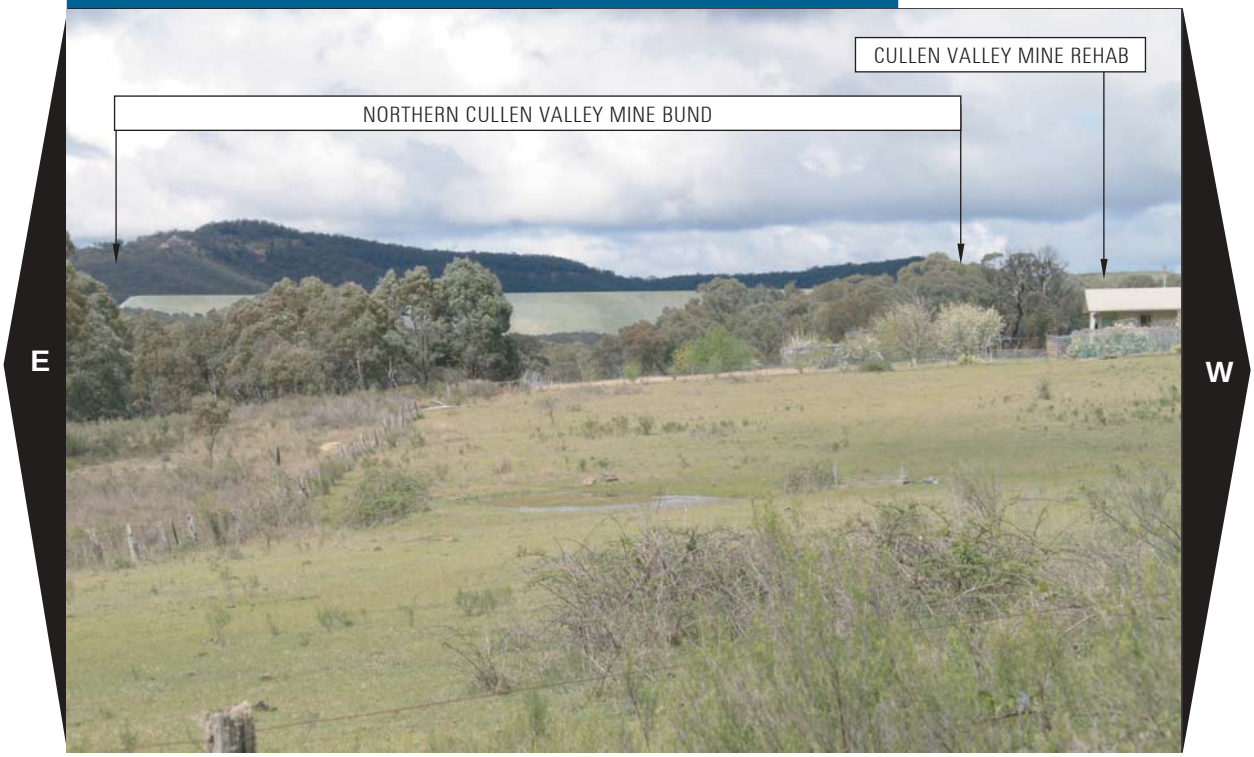
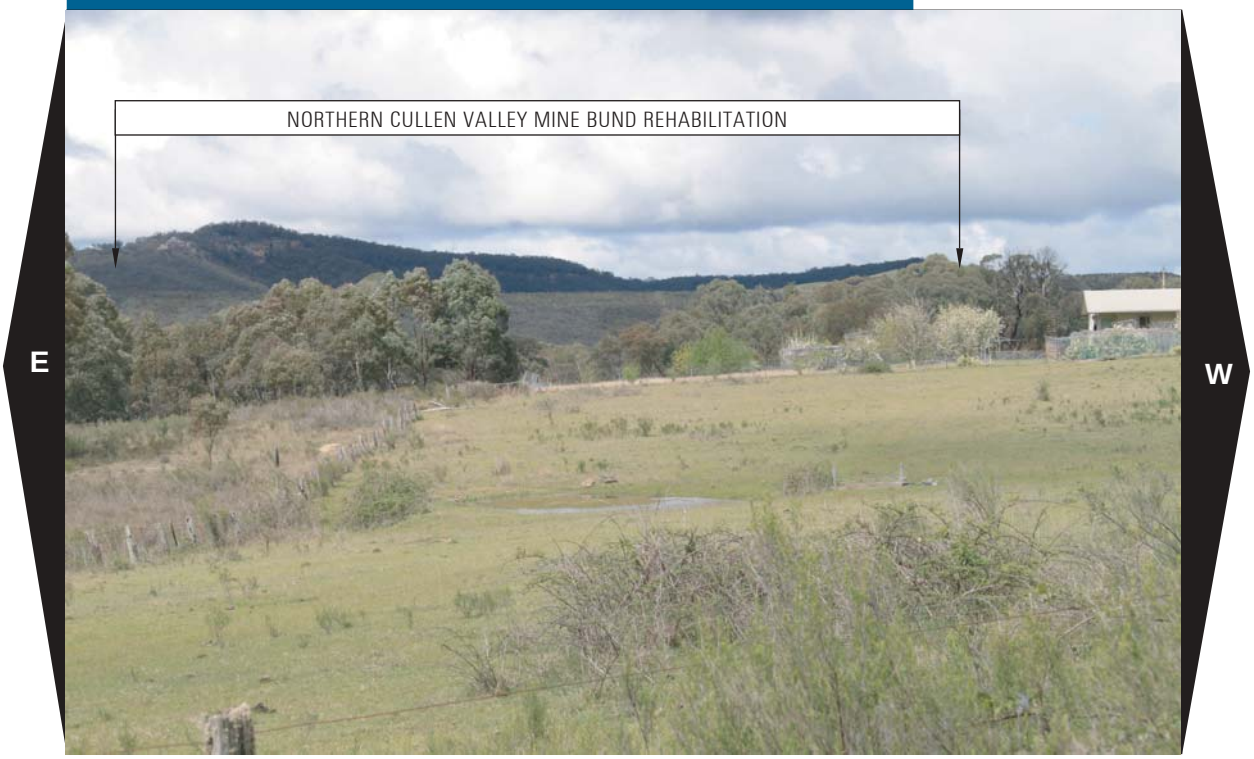
Photomontage Location 1
Red Springs Road (Location Plan and Existing)

FIGURE 20a

RED SPRINGS ROAD - YEAR 2 VIEW LOOKING SOUTH



RED SPRINGS ROAD - YEAR 20 VIEW LOOKING SOUTH



COALPAC MODIFICATIONS

Coalpac Pty Ltd | Hansen Bailey ENVIRONMENTAL CONSULTANTS

Photomontage Location 1
Red Springs Road (Year 2 and Year 20)

FIGURE 20b

Some rural receptors of low visual sensitivity will continue to have views to existing disturbance areas of Cullen Valley Mine located to the west of the Wallerawang – Gwabegar Rail Line. The visual effect of existing views varies between receptors as a function of viewing distance, orientation and elevation. However any impact of such views will continue to be reduced through the progressive rehabilitation of the existing disturbance areas as part of activities under the Modification (see **Section 6.17**).

Lighting Impacts

The potential for direct lighting impacts for the Modification will be minimal as a result of there being no night time (i.e. between 10 pm and 7 am) mining, processing or coal transport operations at either Invincible Colliery or Cullen Valley Mine. As noted in **Section 6.4**, only coal haulage, coal processing and equipment maintenance activities will be undertaken during the evening period at Invincible Colliery. Night lighting at both sites will be restricted to infrastructure and active areas to a level required to maintain safety and security.

6.14.4 Mitigation and Management

Mitigation measures proposed to reduce visual impacts for the Modification were considered in the proposed mine plans for both sites with a focus on onsite treatments to reduce visual effects. Generally, these treatments relate to the progressive development of OEAs and the continued successful rehabilitation of the Modification Disturbance Boundary at both Invincible Colliery and Cullen Valley Mine to ensure that the period at which active mining operations are visible to sensitive receptors. The rehabilitation of the landform at the conclusion of mining will also provide a landscape that is consistent with the surrounding forested slopes of the Ben Bullen State Forest (see **Section 6.17**).

Specific onsite treatments to reduce impacts to sensitive receptors will include:

- Retaining an area of existing native vegetation on the eastern side of the Castlereagh Highway adjacent to the Southern Mining Area proposed for Invincible Colliery to provide visual screening of that area. This screening will be enhanced by the establishment and maintenance of additional plantings by Coalpac;
- The continued successful progressive rehabilitation of existing disturbance areas as part of the Modifications;
- The early establishment and progressive development of rehabilitation within additional areas disturbed by open cut mining at Invincible Colliery and Cullen Valley Mine due to the Modifications; and
- Development and rehabilitation of the bund on the northern side of the Cullen Valley Mine Modification Disturbance Boundary to provide screening of active mining operations in this area (see **Figure 5**).

6.15 ABORIGINAL HERITAGE

6.15.1 Introduction

A number of Aboriginal Archaeological and Cultural Heritage Assessments have been prepared in and around Cullen Valley Mine and Invincible Colliery, including the areas proposed to be developed for the Modifications. These studies provide a comprehensive basis for Aboriginal archaeology and cultural heritage for the Modifications.

The aim of this section is to review previous studies and assess the nature of the archaeological landscape of the Invincible Colliery and Cullen Valley Mine and assess the potential impacts that the Modifications may have on Aboriginal cultural heritage values.

6.15.2 Methodology

A number of previous reports were identified as relevant to the local area in terms of assessing the current status of Aboriginal archaeology and cultural heritage. Those previous studies that had been undertaken either wholly or partially within the Modification Boundaries include:

- Haglund (1982) – surveyed the Cullen Main Colliery (Cullen Main West and East). Two artefact scatters were recorded, both of which were found to be in disturbed contexts. Quartz dominant raw material was found in both sites, with minor quartzite and chert / tuff component. Recorded artefact types included flakes, cores and a single concave scraper (quartz);
- Hagland (1985) – surveyed the proposed rail spur and loop for the Invincible Colliery. No sites were identified during survey;
- Mills (1996) – surveyed the Feldmast Coal Project. Three sites were recorded: one artefact scatter (RSC-OS-1), one isolated find (CC-IF-1) and one axe grinding groove site (FL-GG-1). All three were found in association with drainage lines. Artefacts recorded at RSC-OS-1 included one chert / tuff flake, one chert / tuff scraper and one quartzite millstone. CC-IF-1 comprises a brown, quartzite hammerstone. FL-GG-1 was located on the property 'Forest Lodge' to the west of the Wallerawang-Gwabegar Railway. The site consists of 12 axe grinding grooves on sandstone exposure (3.8 m^2) within an ephemeral drainage line;
- Silcox (1997) – surveyed the Invincible ML 68 Open Cut Coal Mine and Haulage Road. No sites were identified during survey;
- Kelton (2002a) – surveyed the Extension to Cullen Valley Mine. Two sites were recorded: one artefact scatter (C-OS-1) and one potential rock shelter with PAD (C-S-1). C-OS-1 was recorded on the eastern bank and adjacent alluvial / colluvial terrace of an unnamed second order creekline, 50 m south of the Baal Bone Rail Loop. Recorded artefacts comprised four chert / tuff flakes, one quartzite flake, two 'block-fractured' chert / tuff fragments, a chert / tuff core and chert / tuff flake fragment;

- Kelton (2002b) – surveyed the Boulder Road Coal Mine. Two sites were recorded: one isolated find (BPIF-1) on spur overlooking an unnamed tributary of Neubecks Creek, and one open artefact scatter (BP-OS-1) in transmission line easement to immediate east of the Castlereagh Highway;
- OzArk (2006) – surveyed the Extension to Invincible Colliery Open Cut Coal Mine (Project Application 05_0065). No sites were identified during survey;
- OzArk (2008) – surveyed the Extension to Invincible Colliery Open Cut Coal Mine. One site was recorded: a large, open artefact scatter (Invincible OS1) adjacent to the third order tributary of Cullen Creek. Recorded artefacts included cores, flakes, blades, non-flake debitage, an edge-ground axe and a broken, but complete portable sandstone grindstone with use-wear on both faces; and
- AECOM (2011) – Coalpac Consolidation Project, Aboriginal Archaeology and Cultural Heritage Impact Assessment. The study area for this assessment covered all the land subject to the sought Modifications and beyond. This assessment included a review of the AHIMS database records, a comprehensive field survey, significance assessment and consultation with local aboriginal stakeholder groups. A number of sites were recorded including: Four open artefact scatters (CV-AS1-10; CV-AS2-10; CV-AS3-10 and CV-AS4-10), One isolated find (CV-IF1-10), One rock shelter with deposit (CV-RCK1-10), One potential Aboriginal rock shelter site (CV-RCK2-10), and Two rock shelters with PAD (CV-RCKPAD1-10 and CV-RCKPAD2-10).

All sites recorded from the detailed filed surveys undertaken for the above assessments have been registered on the AHIMS database. Coalpac was also notified in 2012 of a further indigenous cave painting site located within their mining authorities some distance to the east of the Invincible Colliery and Modification Boundary. Coalpac inspected this site with the traditional owners and Forest Corporation NSW in 2012. During the site inspection, the traditional owners requested, that the location of the site be not made public in relevant approval documents. As such, this site is not indicated on **Figure 21**.

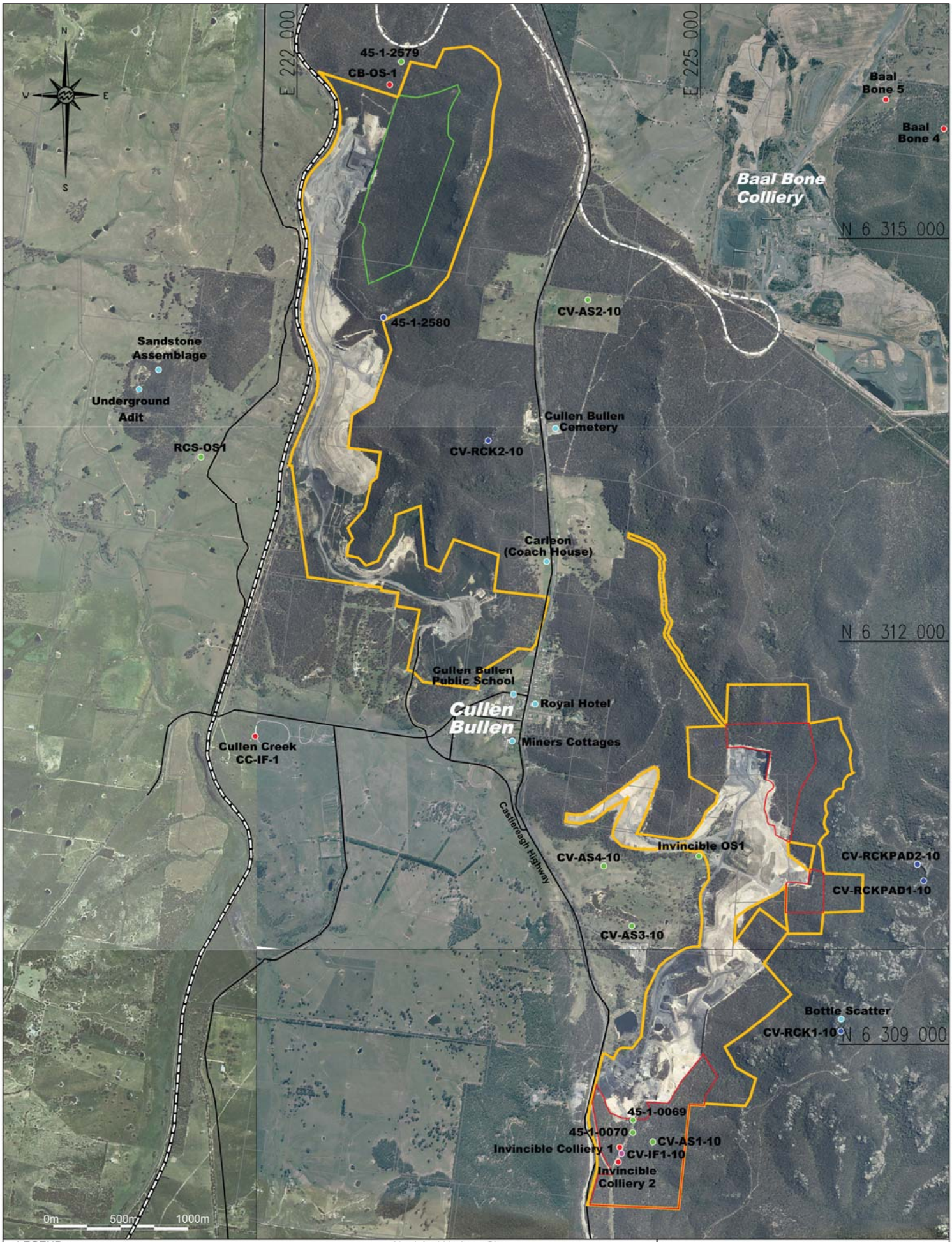
6.15.3 Impact Assessment

Archaeological Resource

The archaeological resources known within the Modification Boundary are composed of sites previously identified by Haglund (1982), Kelton (2002a), OzArk (2008) and AECOM (2011) that have not been subject to salvage.

A total of 15 Aboriginal archaeological sites are known to occur in the vicinity of Cullen Valley Mine and Invincible Colliery. Of these sites, four occur within the Modification Disturbance Boundary at Invincible Colliery and will be directly impacted by this Modification; no sites have been found in the Modification Disturbance Boundary at Cullen Valley Mine.

The locations of all Aboriginal sites identified within the Modification Boundaries and in proximity to the existing Invincible Colliery and Cullen Valley Mine are presented on **Figure 21** and summarised in **Table 21**.



LEGEND

- Modification Boundaries
- Invincible Colliery Modification Disturbance Boundary
- Cullen Valley Mine Modification Disturbance Boundary
- Road
- Rail

Aboriginal Heritage Site

- Open Camp Site
- Shelter with Deposit
- Isolated Find
- Artefact Scatter

- Non Indigenous Heritage Site

Heritage Impacts

Coalpac Pty. Ltd.
Proprietors of Invincible Colliery and Cullen Valley Mine

Figure: **21**

Drawn By:	Date:	Drawing No.:	Revision:	
D.E	04/03/14	23.4.6 .9 -21B	B	MGA Zone 56

Table 21
Impacts on Aboriginal Heritage Sites

Site Type	Site Name	Scientific Significance	Project Impact	Management
Isolated find	CV-IF-1-10	Low	Open Cut Mining Direct Impact	Surface collection of artefacts
Open Artefact Scatter	Invincible Colliery Site 1	Low	Open Cut Mining Direct Impact	Surface collection of artefacts
	Invincible Colliery Site 2	Low	Open Cut Mining Direct Impact	Surface collection of artefacts
	CV-AS1-10	Low	Open Cut Mining Direct Impact	Surface collection of artefacts
Potential Aboriginal rock shelter site	CB-S-1	Low	Indirect, Potential Vibration Impact	Monitoring and reporting, Blast protocol as per **Section 6.5.4**

Cullen Valley Mine

As noted above, no Aboriginal archaeological sites or artefacts have been located in the Modification Disturbance Boundary at Cullen Valley Mine. An artefact scatter (C-OS-1) and open campsite (CB-OS-1) are known to exist to the north of the existing Cullen Valley Mine, and a potential rock shelter site (CB-S-1). These sites will continue to be monitored for potential vibration impacts from blasting in accordance with the approved Cullen Valley Mine Blast Management Plan.

All other previously identified archaeological sites in the area surrounding Cullen Valley Mine will continue to be managed as required in accordance with the relevant approved Environmental Management Plan.

Invincible Colliery

The four Aboriginal Archaeological sites identified in the Southern Mining Area at Invincible Colliery include three artefact scatters and one isolated find.

It is proposed that the artefacts identified at these sites will be salvaged prior to the commencement of mining activities. The salvage, handling and keeping of these artefacts will be undertaken in consultation with the relevant Aboriginal stakeholders and OEH, to the satisfaction of DP&I.

All other previously identified archaeological sites in the area surrounding Invincible Colliery will continue to be managed as required in accordance with the relevant approved Environmental Management Plan.

Statement of Significance

The significance assessment undertaken by AECOM (2011) was based on the relevant criteria from the Burra Charter which was adopted by the Australian International Council on Monuments and sites for the conservation of places of cultural significance in 1979 (ICOMOS, 1979). A significance assessment attempts to ascertain a relative value of heritage sites. The appropriate criteria to determine significance included cultural / social (importance to Aboriginal people) and scientific (archaeological value) significance.

The cultural significance determined by the Aboriginal stakeholders is reflected in their responses to the Aboriginal Archaeological and Cultural Heritage Impact Assessment undertaken by AECOM (2011).

Overall, only one site of high scientific significance has been identified adjacent to the Invincible Colliery, the previously recorded open artefact scatter Invincible OS1. This site will not be disturbed by the Modification and is protected within an existing biodiversity offset area. All four sites that are located within the Southern Mining Area at Invincible Colliery proposed for the Modification are of 'low' scientific significance.

6.15.4 Mitigation and Management

Coalpac will update the approved Aboriginal Heritage Management Plan (AHMP) for Invincible Colliery in consultation with Aboriginal community stakeholders and OEH and to the satisfaction of DP&I. The revision of the AHMP will be guided by current regulatory policies and procedures for the management of Aboriginal archaeological sites and will include those within the Modification Disturbance Boundary.

The revised AHMP will be updated to reflect the predicted impacts and management commitments included in **Table 21** and would be periodically reviewed in consultation with Aboriginal stakeholders and OEH. The AHMP will include provisions for at least the following:

- Protection of known sites prior to salvage;
- Protection of known sites prior to direct impacts or indirect predicted impacts, including development of appropriate monitoring strategies for vibration and to confirm no subsidence impacts occur;
- Detailed salvage methodologies to be carried out prior to the sites being impacted by the Modification;
- Development of protocols for the monitoring of earth works for the Modification, as required; and

- Identification of an appropriate storage location and procedure for the care and control of salvaged artefacts in consultation with Aboriginal stakeholders and in accordance with the OEH '*Aboriginal cultural heritage consultation requirements for proponents'* (DECCW, 2010).

The Cullen Valley Mine and Invincible Colliery Blast Management Plans will be updated to ensure that the potential for impacts to known or potential Aboriginal rock shelter sites are minimised.

6.16 NON-ABORIGINAL HERITAGE

6.16.1 Introduction

The area within the Modification Boundaries has been the subject of an extensive non-Aboriginal heritage assessment undertaken by AECOM in November 2011. A summary of the assessment in relation to the Modifications is provided below.

Non-Aboriginal settlement at Cullen Bullen commenced following the construction of Coxs Road across the Blue Mountains in 1815 to make the rich fertile country west of the Great Dividing Range accessible. The development of this road subsequently stimulated non-Aboriginal settlement in areas such as Cullen Bullen and the Capertee Valley.

There has been a long history of open cut mining operations in the district, with operations in the local area dating from 1946 including Ben Bullen Colliery, Cullen Main Open Cut, Red Springs Open Cut, Renown Colliery and Beaumaris Colliery. Ben Bullen Colliery open cut was extended to become Baal Bone Colliery open cut. Cullen Main Open Cut and Renown Colliery open cut have been extended to become part of the Invincible Colliery open cut and Ivanhoe North Colliery open cut. Beaumaris Colliery open cut was extended as part the Cullen Valley Mine.

6.16.2 Methodology

A search of relevant historic registers and inventories was undertaken to identify historic heritage items in the local area. These searches included a review of the:

- World Heritage List;
- Commonwealth Heritage List;
- National Heritage List;
- Register of the National Estate;
- State Heritage Inventory; and
- Lithgow City LEP.

Several field studies have also been prepared for Coalpac that identified additional non-Aboriginal heritage items in the areas surrounding the Modification Boundaries. These reports, including AECOM (2011), were also reviewed to confirm any additional sites not listed on the registers listed above.

6.16.3 Impact Assessment

The location of the non-Aboriginal heritage items identified within and surrounding the Modification Boundaries are shown on **Figure 21**.

The Cullen Valley Mine Modification will not impact on any known items of non-Aboriginal heritage significance. The closest known non-Aboriginal heritage item to the Cullen Valley Mine Modification Boundary is a Sandstone Assemblage located approximately 1.5 km to the south-west. The Cullen Bullen Cemetery is located approximately 1.5 km to the south-east of the Cullen Valley Mine Modification Boundary.

The closest known non-Aboriginal heritage item to the Invincible Colliery Modification Boundary is a bottle scatter located approximately 1 km to the east. An assemblage of sandstone footings are located approximately 1.5 km to the south of the Modification Boundary. The Invincible Colliery Modification will not impact on these non-Aboriginal heritage items.

6.16.4 Mitigation and Management

No impacts to known items of non-Aboriginal heritage significance will occur as a result of the Modifications. In the unlikely event that additional non-Aboriginal heritage items are identified or impacts from the Modifications occur to known heritage items, Coalpac will consult with relevant authorities and implement appropriate management and mitigation actions to the satisfaction of DP&I.

6.17 REHABILITATION AND FINAL LANDFORM

6.17.1 Introduction

There are more than six and twelve year's history of undertaking successful rehabilitation at the Invincible Colliery and Cullen Valley Mine, respectively. This long history is evidenced by the results achieved to date in the rehabilitation of approximately 193 ha of bushland. Rehabilitation is undertaken in accordance with a series of approved management plans that include strategies for each site based on current research, expert advice and practical experience gained over the past 12 years in establishing stable landforms which is compatible with the surrounding landscape. Coalpac's progressive rehabilitation strategy minimises its impact by filling the open cut void immediately behind mining, avoids the use of an out of pit OEA which would create additional disturbance, and can be scheduled to ensure that a final void does not occur at either site at the completion of mining.

6.17.2 Existing Coalpac Rehabilitation

Progressive rehabilitation has been undertaken on a regular basis since 2002 at Cullen Valley Mine and from 2008 at Invincible Colliery. Rehabilitation is undertaken as soon as practicable following the completion of mining and landform establishment in accordance with the respective MOP and other relevant approval authorities for both sites.

The benefits of progressive rehabilitation are clearly evident at both Cullen Valley Mine and Invincible Colliery (see **Plate 1** and **Plate 2**) and include:

- The early establishment of native vegetation while mining is continuing in adjacent areas;
- Establishment of a mosaic of vegetation, with different age class and species composition that improves biodiversity of rehabilitated areas;
- Re-colonisation and use of previously mined areas by native fauna;
- Agreed rehabilitation performance criteria can be monitored and measured to ensure appropriateness and to identify areas for improved management;
- Minimisation of erosion and potential air pollution from dust emissions from exposed areas following the completion of mining; and
- Early establishment of a stable formal landform.

The rehabilitation performance at Cullen Valley Mine and Invincible Colliery has been independently reviewed by external ecologists as part of the annual biodiversity monitoring program. The annual monitoring surveys seek to quantify and measure the performance of rehabilitated areas to ensure they are progressing towards achieving the final landform goals and agreed rehabilitation completion criteria. Ecological surveys undertaken by independent ecologists have confirmed that rehabilitated areas at both sites are generally of good quality (Ecobiological 2012).

Plate 1
Progressive Rehabilitation at Cullen Valley Mine

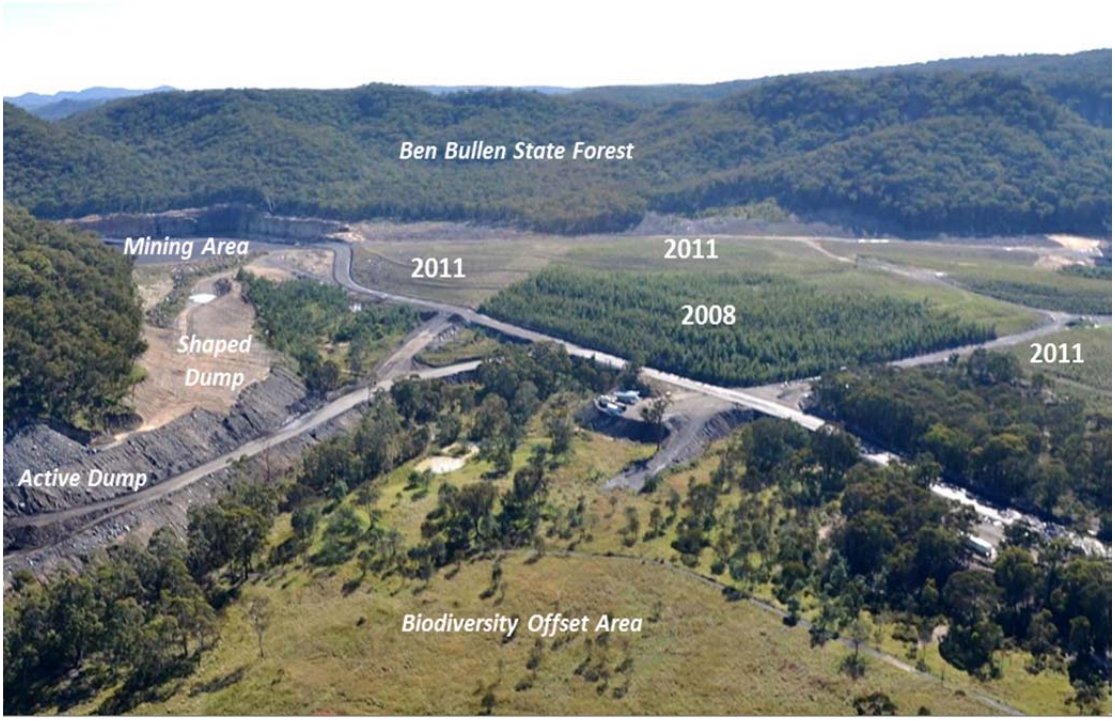


Plate 2
Progressive Rehabilitation at Invincible Colliery

The annual ecological surveys collect data against a series of nominated performance criteria to review rehabilitation performance in key areas such as vegetation diversity, density, complexity, growth development and foliage cover against those from surrounding native vegetation communities. The integration and importance of connectivity between rehabilitation and adjacent biodiversity offsets and forestry areas is shown in **Plate 2**.

Overall, the reviews undertaken by Ecobiological (2011 and 2012) and Kleinfelder (2013) noted that the rehabilitation areas are progressing well towards achieving the final landform outcomes. In terms of performance against the specific criteria developed for rehabilitation areas, it was noted that species diversity is high and close to target values, with plant density also increasing with the age of each rehabilitation area.

A breakdown of the vegetation stratum was also assessed to determine the proportion of species in each vegetation type for each area (i.e. ground, shrub, midstorey and overstorey species). This found that the stratum proportions are strongly dominated by shrub, midstorey and overstorey layers in all areas assessed. Given the progress of rehabilitation areas recorded to date, it is estimated that the overstorey species would meet the desired height criteria within a period of 20 – 30 years post-establishment. The ongoing review against the target levels of weed foliage showed that coverage and diversity of weed species across the rehabilitation was low, even in more newly established areas.

In addition to the management procedures utilised for the progressive establishment and development of rehabilitation areas, Coalpac has also undertaken a number of rehabilitation trials and research programs with the objective of increasing the effectiveness of rehabilitation at both Invincible Colliery and Cullen Valley Mine. This has included the ongoing review and assessment of what management practices promote successful rehabilitation outcomes and the findings of the rehabilitation trials are also used to provide important information that is used to improve the quality of existing and future rehabilitation areas.

6.17.3 Methodology

The performance of progressive rehabilitation efforts has led to modified practices in some areas such as spreading native timber over the surface which helps retain soil moisture and provides micro habitats for emerging seedlings. Other improvements in rehabilitation establishment include reducing slope angle where practical, hydro-mulching as required, installing rock lined drop structures, reinforcing contour drainage lines with excess native timber and refining the rehabilitation seed mix.

Key Findings

The modification of rehabilitation methods by the process of continual review and improvement has produced some very successful rehabilitation outcomes. Monitoring over time has identified improvements in the stability of the final landform and increased diversity of native flora which in turn increases the overall biodiversity and general health of rehabilitated areas. The diversity of native vegetation and progressive succession of native species can be seen in rehabilitated areas at Cullen Valley Mine (see **Plate 3**).

With the diversity and density of local providence species recorded in rehabilitated areas, there is strong evidence to support that these areas will achieve biodiversity outcomes comparable to adjacent native woodland communities.

The density and diversity of mid story and over-storey species has the benefit of adding organic material via leaf and bark drop to create ground mulch below. This supports the development of ground cover which further improves the stability and diversity of understory species and soil developments (see **Plate 4** to **Plate 6**). In some of the older rehabilitation areas, there is now little evidence remaining of previous disturbance.

The success of rehabilitation and the methods used in reconstructing the landscape has allowed a number of other native flora to recolonise rehabilitated areas. These species were not included in the initial rehabilitation seed mix and have developed in these areas either within the seed bank in the topsoil which is spread over the area or via wind dispersal, the birds and mammals which frequent rehabilitated areas or other natural processes. Such species that commonly occur throughout rehabilitated areas at Cullen Valley Mine and Invincible Colliery are shown on **Plate 7**.

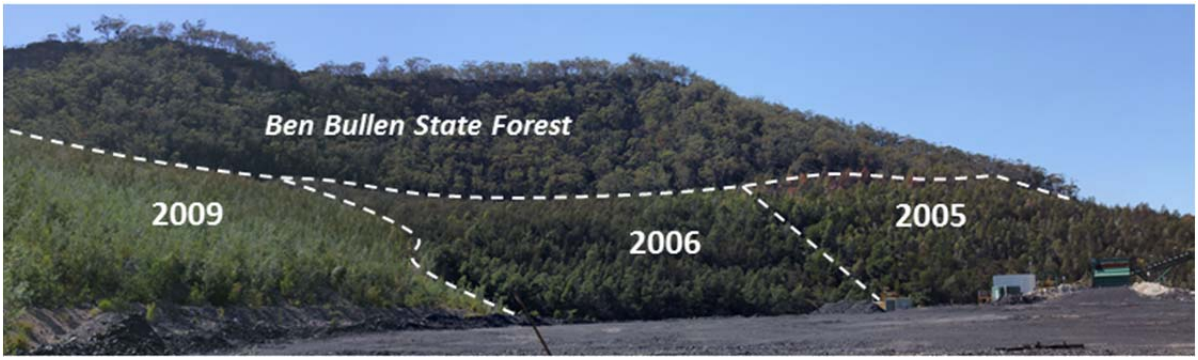


Plate 3
Succession of species emerging in rehabilitation areas
Plate provides good example of succession of species in rehabilitated areas adjacent existing native bushland

Plate 4
Ground cover in ten year old rehabilitation at Cullen Valley Mine
There is little evidence of previous mining activity

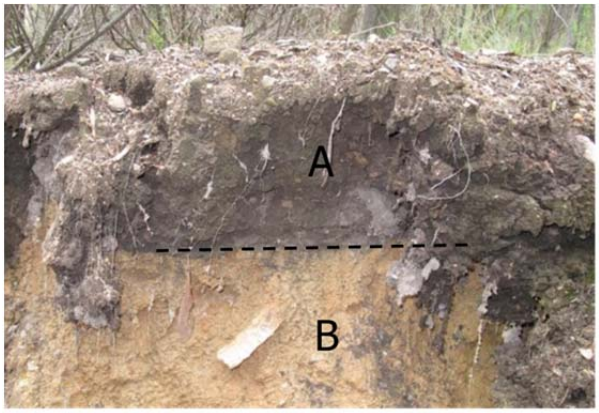


Plate 5 Development of the soil profile in a rehabilitated area at Cullen Valley Mine

Plate 6 Evidence of invertebrate species which assist soil development over time

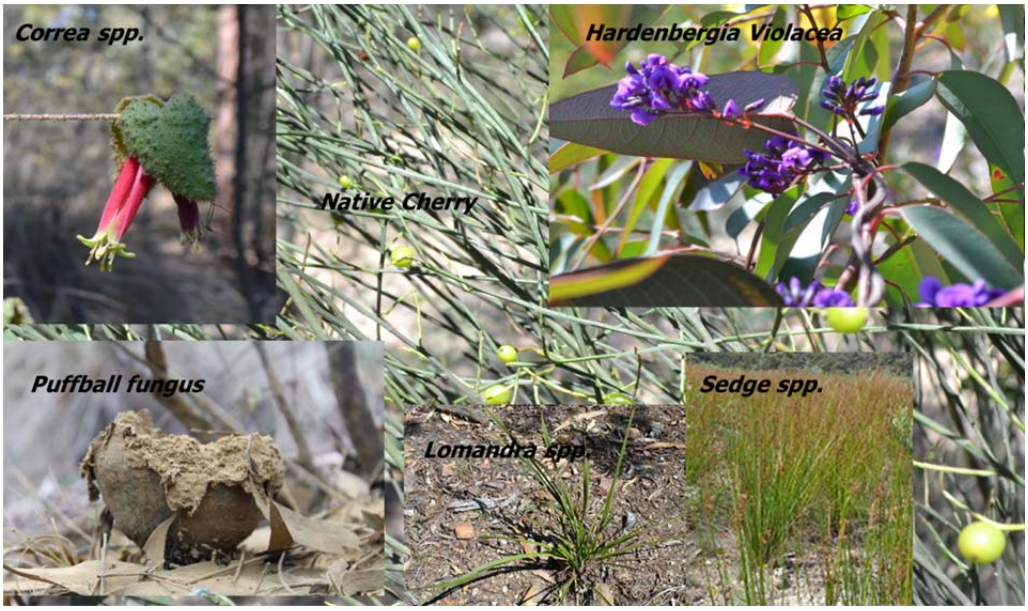


Plate 7
Native plant species in Cullen Valley Mine rehabilitation
These species are native to the area and were not included in the rehabilitation seed mix

Fauna

The successful rehabilitation strategy and mosaic of different vegetation communities and plant diversity at Invincible Colliery and Cullen Valley Mine has also provided the opportunity for native fauna to recolonise areas disturbed by previous mining operations. A range of native fauna including woodland birds, mammals, reptiles and frogs have all be observed in rehabilitated areas.

During the 2012 biodiversity monitoring surveys, 15 woodland bird species were observed to be using the rehabilitated areas for foraging and/or nesting purposes.

Three reptile species and the Eastern Grey Kangaroo were also observed in these areas. The species observed during the 2012 biodiversity monitoring surveys are listed in **Table 22**. It should be noted that there is evidence of additional species utilising rehabilitated areas, as such **Table 22** does not represent the entire list of species understood to utilise the area. Additional species such as the common Red-bellied Black Snake, Lyre Bird, Gang-gang Cockatoo and Echidna have been regularly sighted in rehabilitated areas by Coalpac operational staff outside of annual survey periods.

As noted previously, a number of woodland bird species have been observed foraging and nesting in existing rehabilitated areas. A number of nesting sites have been discovered in the more mature rehabilitated areas at Cullen Valley Mine during the annual biodiversity monitoring surveys (see **Plate 8**).

Supplementary Habitat Features

Coalpac is currently undertaking a trial to assess the effectiveness of supplementary habitat features for native hollow nesting birds and mammals. Coalpac installed six nesting boxes in each plot at four locations in May 2013.

Table 22
Rehabilitation area survey native fauna species list

Common name	Scientific Name
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Brown Pigeon	*Macropygia amboinensis*
Brown Thornbill	*Acanthiza pusilla*
Common Bronzewing	*Phaps chalcoptera*
Crimson Rosella	*Platycercus elegans*
Grey Fantail	*Rhipidura albiscapa*
Grey Shrike-thrush	*Colluricincla harmonica*
Laughing Kookaburra	*Dacelo novaeguineae*
Noisy Friarbird	*Philemon corniculatus*
Red Wattlebird	*Anthochaera carunculata*
Rufous Whistler	*Pachycephala rufiventris*
Silver Eye	*Zosterops lateralis*
White-browed Scrubwren	*Sericornis frontalis*
White-eared Honeyeater	*Lichenostomus leucotis*
White-throated Treecreeper	*Cormobates leucophaea*
Eastern Grey Kangaroo	*Macropus giganteus*
Common Garden Skink	*Lampropholis guichenoti*
Mountain Heath Dragon	*Rankinia diemensis*
Nobby Dragon	*Amphibolurus nobbi*

Two plots (12 nesting boxes) were located in 12 month and five year old rehabilitated areas at Invincible Colliery. A further two plots (12 nesting boxes) were installed at Cullen Valley Mine in 10 year old rehabilitation area and the second control plot was installed in the adjacent mature native woodland (see **Plate 9**). Preliminary results indicate that nesting boxes at all sites are being utilised by native bird and mammal species.

Further monitoring and assessment is required to determine their effectiveness in providing habitat in rehabilitation areas.

Plate 8 Grey fan tail nest in rehabilitation area at Cullen Valley Mine (2011)

Plate 9 Bird nesting box in five year old rehabilitation at Invincible Colliery

6.17.4 Landscape Integration

A principle rehabilitation objective is the development of stable and safe landforms that are well integrated with the surrounding landscape and environment. Coalpac has rehabilitated approximately 193 ha of previously mined land which has been integrated into the local landscape.

Monitoring indicates that rehabilitated areas are moving towards achieving the rehabilitation targets in the establishment of native forest communities. By providing the fundamental components for a native woodland community in its early stages of development will more likely lead to a successful outcome and achieve the agreed rehabilitation outcomes. The fundamental components and methods included in Coalpac's successful rehabilitation strategy are discussed below.

Getting the fundamental components correct provides the opportunity for the establishment of a self-sustaining landscape. The establishment of a self-sustaining landscape will ensure the rehabilitated area can to be successfully integrated into the surrounding landscape as it transitions into a mature woodland forest through natural selection process. As such the long term objective of integrating the rehabilitated area with the adjacent landscape based on scientifically sound and proven strategies will have a high likelihood of success.

Examples of rehabilitated areas in their early stages of development being integrated into the sounding landscape are shown in **Plate 10** and **Plate 11**.

Plate 10
Mining area in 2008 and final landform and rehabilitation in 2012

Plate 11
Mining area in 2011 and final landform and rehabilitation in 2012

6.17.5 Modification Rehabilitation

Rehabilitation Objectives

Coalpac's primary rehabilitation objectives are to create a stable and sustainable final landform and return the post-mining landscapes of Cullen Valley Mine and Invincible Colliery to pre-mining land capability and vegetation communities.

The rehabilitation program at both sites also aims to enhance local and regional ecological linkages across the site and with adjacent areas of the Ben Bullen State Forest. The key objectives and management measures for site rehabilitation will continue to be followed for the Modifications, with the long term aim of providing connectivity to native forest vegetation.

Revegetation will continue to be undertaken to develop forest and woodland communities that are generally consistent with the surrounding landscape and provide connectivity to remnant native vegetation communities with re-established habitat areas. The rehabilitation strategy for the Modifications will also continue to focus on promoting biodiversity and the establishment of habitat for local threatened flora and fauna species, where practical (see **Section 6.6**).

Strategic Framework

Rehabilitation processes implemented for the Modifications will continue to be undertaken generally in accordance with the '*Strategic Framework for Mine Closure*' (ANZMEC MCA 2000) and the '*Mine Rehabilitation*' and '*Mine Closure and Completion*' handbooks developed as part of the Leading Practice Sustainable Development Program by the Department of Industry, Tourism and Resources.

The planning for and implementation of rehabilitation activities for the Modifications will be based on the existing management measures already in place and proven to be effective at Invincible Colliery and Cullen Valley Mine.

These measures will include:

- Updating the currently approved rehabilitation management documents for Invincible Colliery and Cullen Valley Mine as required to reflect the activities proposed for the Modifications;
- Continuation of existing management practices and Coalpac's extensive knowledge of developing effective rehabilitation in the local area gathered during rehabilitation already undertaken at Cullen Valley Mine and Invincible Colliery; and
- Early characterisation of topsoil and overburden to avoid any potential issues associated with the use of materials used in rehabilitation.

Objectives for the environmental management of the Modifications to promote rehabilitation development will continue to include the:

- Management of site water to reduce potential erosion or pollution;
- Development of stable and safe landforms that are well integrated with the surrounding environment;
- Establishment of effective covers for stability and hazardous material containment within landforms where required;
- Management of topsoil to conserve nutrients and encourage native seed and micro-organisms; and
- Establishment of dynamic and resilient flora and fauna communities in the long term.

Land Disturbance Protocol

Prior to the clearing of any native vegetation, in particular pre-strip clearing activities in advance of mining, the existing Land Disturbance Protocol will continue to be used at both sites. This protocol includes:

- Due diligence field inspection prior to disturbance by an appropriately qualified person to ensure no impacts to threatened ecology and archaeology;
- Progressively clearing of vegetation in advance of mining and blasting operations to minimise cleared areas to as small an area as practical;
- Establishing erosion and sediment controls appropriate for the area to be disturbed;
- Stockpiling of cleared trees adjacent to cleared areas or near existing shaped areas to include in rehabilitation;
- Stripping of topsoil and subsoil material in advance of overburden removal and immediate use in available reshaped areas where possible. Volumes of topsoil material required to be stockpiled for later use will be minimised, where possible; and
- Overburden material will be stockpiled in nominated areas adjacent to existing overburden emplacements or near shaped rehabilitation for use in rehabilitation. Overburden material will be spread over the shaped and contoured area with dozers and allowed to settle, forming a crust. Once crusting has occurred, available subsoil and topsoil will be applied.

6.17.6 Conceptual Final Landform

Coalpac will maximise opportunities for the development of a post-mining landscape that is generally consistent with pre-mining land use and biodiversity. All disturbed areas for the Modifications will be shaped prior to topsoil spreading and seeding to promote this outcome.

Project Disturbance Areas

The indicative final landform for the Project has been developed to promote visual characteristics and biodiversity outcomes that generally conform to the existing landscape of the Ben Bullen State Forest. To ensure long term stability and sustainability, the slopes of the final landform within the Modification Boundaries will generally have a maximum slope of 18 degrees, consistent with the surrounding topography.

The conceptual final landform for the Modifications will be free draining and designed to integrate with the surrounding catchments by channelling water towards natural drainage lines of the Cullen, Dulhunty's and Jews Creeks. The final landform will contain some more gentle slopes to allow drainage to form preferential paths on the rehabilitated slopes.

The rehabilitation of the final landform would predominantly focus on the re-establishment of native vegetation. The OEAs will be progressively rehabilitated throughout the Modification as soon as is practical following the completion of mining disturbance.

This process will be in accordance with DRE requirements for Rehabilitation Completion Criteria as described in the approved MOPs for Invincible Colliery and Cullen Valley Mine.

The continuation of this progressive approach to rehabilitation development will minimise disturbed areas at any one time and reduce the environmental impacts from the open cut operations. The rehabilitation strategy and the development of rehabilitation areas will continue to be reviewed by Coalpac on a regular basis to ensure disturbed areas are kept to a minimum and that rehabilitation areas are performing appropriately. The conceptual final landform for the Modifications is described in **Section 3**.

6.17.7 Completion of Approved Mining Areas

There are currently three open cut mining voids at Invincible Colliery and a further three open cut mining voids at Cullen Valley Mine. These voids were left open to facilitate the continuation of future mining activities and will assist the recommencement of mining under this Modification. Material from these current voids has been used in the rehabilitation of adjacent mining areas as per the mining schedule at the time. As such, there are now insufficient volumes of material available (including topsoil and bulk overburden) to fully infill these voids and achieve the desired long term outcomes of a stable and free-draining landform.

If these existing voids were to be in-filled under existing approvals, additional disturbance of forested areas adjacent the voids and of rehabilitation areas would be required to treat the existing open cut highwalls. The final landform under this scenario would contain large depressions or sinks and would not be free draining. As such, the final landform would also not be consistent with the surrounding landscape.

The Modifications will provide access to additional fill to ensure that no final voids would remain in the final landform at either site at the completion of mining operations under these Modifications (see **Appendix H)**. The need for additional disturbance of forest and woodland vegetation from highwall treatment in existing Invincible Colliery and Cullen Valley Mine approval areas to rehabilitate the existing voids would also be minimised.

As noted above, Coalpac are committed to develop a stable, free-draining final landform to ensure that the landscape is representative of pre-mining conditions and is compatible with the surrounding landscapes of the Ben Bullen State Forest. The mining activities proposed for the Modifications will promote a stable and free-draining final landform and a higher quality rehabilitation outcome in the long term. This will be achieved through having access to a suitable quality and quantity of overburden and topsoil materials to allow the infilling of proposed and existing mining voids at Invincible Colliery and Cullen Valley Mine at the completion of mining operations under these Modifications.

A detailed description of the existing mining voids at Invincible Colliery and Cullen Valley Mine and the details over the proposed development of the final landform is included in **Appendix H**.

6.17.8 Mitigation and Management

Existing rehabilitation completion criteria for Invincible Colliery and Cullen Valley Mine will be reviewed in consultation with the relevant government agencies and community and included in the Rehabilitation Management Plan.

These criteria will continue to be revised to demonstrate that the rehabilitation objectives have been achieved. Progress against the completion criteria will be regularly monitored and reported to relevant stakeholders.

Coalpac is committed to the development of sustainable rehabilitation and the achievement of leading practice completion criteria, as this will provide the best framework for the long term protection and management of the post-mining landscape and its biodiversity conservation values. With its extensive rehabilitation experiences, Coalpac has developed a robust rehabilitation methodology that ensures the final land use and completion criteria are achievable.

To provide a contemporary framework for the Modifications, Coalpac will revise the existing approved Landscape Management Plan for Invincible Colliery and Flora and Fauna Management Plan for consistency with the Modifications, in consultation with relevant regulatory authorities.

These documents will include procedures for the management and monitoring of rehabilitated lands to ensure that rehabilitation at Invincible Colliery and Cullen Valley Mine is moving towards achieving the agreed objectives and targets are achieved in the long term. Rehabilitation monitoring will includes annual inspections of rehabilitated areas to assess:

- Structural stability;
- The effectiveness of erosion and sediment control measures;
- Vegetation species development and revegetation success and fauna habitat; and
- The effectiveness of weed and pest management measures.

Maintenance works in existing and future rehabilitation areas will be completed as required to address any issues of concern identified during monitoring reviews. Maintenance activities may include a range of management responses, including:

- Supplementary seeding of vegetated areas;
- Weed and pest control;
- The application of fertiliser to selected areas;
- De-silting or repairing drainage structures and sedimentation dams; and
- The infill and regrading of any eroded areas.

Coalpac will continue to undertake ongoing rehabilitation maintenance works as required. The results of rehabilitation and landform monitoring and the effectiveness of any maintenance activities required for the Modifications will be assessed and utilised in the continual refinement of rehabilitation techniques and reported against in the Annual Review.

7 STATEMENT OF COMMITMENTS

Additional commitments for the operation and management of Invincible Colliery and Cullen Valley Mine to those attached to PA 07_1027 and DA 200-5-2003 are required as a result of the Modifications proposed. Commitments from the Modifications specific to each operation are outlined in **Table 23** and **Table 24**.

Table 23
Invincible Colliery Statement of Commitments

Ref	Description	Section(s)
1.	The water transfer pipeline and pumping infrastructure will be constructed on the alignment shown on **Figure 4**, being placed on existing access tracks to limit surface disturbance, wherever practical. Construction of the water transfer pipeline will occur during the day period only.	**3.3.3**
2.	Site operations during the evening period will be restricted to the crushing and haulage of product coal. No coal mining activities, coal processing or haulage will be undertaken during the night period.	**6.4**
3.	In the event that coal processing at the ICPP is required during the evening period, an assessment of noise impacts will be undertaken prior to any operations in that period to determine if additional noise controls are required. This assessment will be undertaken in consultation with EPA and to the satisfaction of DP&I prior to any operation of the ICPP during the evening.	**6.4.4**
4.	Open cut and highwall mining operations will be undertaken within the areas as discussed in **Section 3**, with the conceptual final landform shown on **Figure 6** to be reinstated at the conclusion of the Modification.	**3.3.1 and 6.17**
5.	A Highwall Mining Management Plan will be prepared to the satisfaction of DRE prior to the commencement of highwall mining operations, detailing highwall design, monitoring and management measures.	**6.7.4**
6.	Coalpac will prepare an SMP in consultation with DRE and to the satisfaction of DP&I prior to the commencement of highwall mining in each distinct mining area.	**6.7.4**
7.	EPL 1095 will be amended to include the transfer of water between Invincible Colliery and Cullen Valley Mine, if required.	**4.3.2**
8.	Coalpac will develop a Construction Noise Management Plan for the limited construction period required for the water transfer pipeline.	**6.4.4**
9.	Coalpac will implement the additional blast monitoring and management procedures described in **Section 6.5.4**.	**6.5.4**
10.	Coalpac will implement the revised Biodiversity Offset Strategy as described in this EA, including the dedication of the additional biodiversity offset properties required.	**6.6.4**

Ref	Description	Section(s)
11.	Coalpac will increase the watering rate for unsealed roads from Level 1 to Level 2, as defined in '*National Pollutant Inventory: Emission Estimation Technique for Manual for Mining'* (SEWPaC, 2012).	**6.1.4**
12.	Coalpac will implement the visual impact treatments as described in **Section 6.14.4**.	**6.14.4**
13.	Coalpac will update the existing AHMP for Invincible Colliery to reflect the predicted impacts of the Modifications, in consultation with relevant regulators and the local Aboriginal community.	**6.15**
14.	Coalpac will review and submit an updated EMP and EMS to DP&I for approval, which will include a consideration of the activities described in the Invincible Colliery Modification.	**2.1.6**

Table 24
Cullen Valley Mine Statement of Commitments

Ref	Description	Section
1.	Coal mining and processing activities will be undertaken at Cullen Valley Mine during the day and evening periods. Coal transportation will be undertaken during the day period only. Cullen Valley Mine will not conduct any activities during the night period.	**6.4**
2.	Open cut and highwall mining operations will be undertaken within the areas as discussed in **Section 3**, with the conceptual final landform shown on **Figure 8** to be reinstated at the conclusion of the Modification.	**3.4.1 and 6.17**
3.	A Highwall Mining Management Plan will be prepared to the satisfaction of DRE prior to the commencement of highwall mining operations, detailing highwall design, monitoring and management measures.	**6.7.4**
4.	Coalpac will prepare an SMP in consultation with DRE and to the satisfaction of DP&I prior to the commencement of highwall mining.	**6.7.4**
5.	Coalpac will review and submit an updated EMP and EMS to DP&I for approval, which will include a consideration of the activities described in the Cullen Valley Mine Modification.	**2.2**
6.	EPL 10341 will be amended to include the transfer of water between Cullen Valley Mine and Invincible Colliery, if required.	**4.3.2**
7.	Coalpac will increase the watering rate for unsealed roads from Level 1 to Level 2, as defined in '*National Pollutant Inventory: Emission Estimation Technique for Manual for Mining'* (SEWPaC, 2012).	**6.1.4**

Ref	Description	Section
8.	Coalpac will implement the additional blast monitoring and management procedures described in **Section 6.5.4**.	**6.5.4**
9.	Coalpac will implement the revised Biodiversity Offset Strategy as described in this EA, including the dedication of the additional biodiversity offset properties required.	**6.6.4**
10.	Coalpac will implement the visual impact treatments as described in **Section 6.14.4**, including the construction of the bund located to the north of the proposed open cut mining area.	**6.14.4**

8 CONCLUSION

This section provides conclusions with regard to the Modification applications and the environmental assessments.

8.1 REASON FOR THE APPLICATIONS

The Modifications to PA 07_0127 and DA 200-5-2003 are required to provide a competitively priced, short term fuel supply to MPPS whilst an alternative cost effective long term fuel supply strategy is secured for the facility.

The combined Modifications to mining operations at both sites (and the approved life of Invincible Colliery) are required to provide a suitable quality and quantity of coal supply for the domestic power generating facilities at the nearby MPPS.

Further to the above, the Modifications have been specifically designed to enable the development of a stable, free-draining final landform and a higher quality rehabilitation outcome for Invincible Colliery and Cullen Valley Mine. The open cut and highwall mining methods proposed will create sufficient surplus overburden material to enable the six mine voids currently present (three at Invincible Colliery and a further three at Cullen Valley Mine) to be rehabilitated and incorporated into a free draining final landform at the completion of mining operations under these Modifications. This landform will be consistent with the surrounding landscape and capable of sustaining a native forest vegetative cover of similar composition to that in existence prior to mining.

The Modifications also seek approval to share water via a pipeline connecting both sites for operational use and to assist in the management of an historic subsurface heating area present at Cullen Valley Mine.

8.2 THE APPLICATIONS

The Modifications to PA 07_0127 and DA 200-5-2003 as described and assessed in this EA are sought to enable mining and related activities to continue generally in accordance with the Invincible Colliery and Cullen Valley Mine environmental assessment documents that support PA 07_0127 and DA 200-5-2003 (as modified).

The main essential elements of the operation of Invincible Colliery and Cullen Valley Mine (following any approval of the Modifications) would remain unaltered from existing approvals, as outlined in **Section 3**.

8.3 POWER TO MODIFY

The components sought to be approved by the Modifications do not constitute a "*radical transformation*" of what has been approved under PA 07_0127 or DA 200-5-2003. The following essential elements of Invincible Colliery and Cullen Valley Mine operations will remain unaltered by the Modifications:

- Mining and other equipment,
- Mining methodology,
- Hours of operation,
- Manning levels,
- Coal handling and processing,
- Coal transport and access to site,
- Water management (apart from the introduction of the new proposed inter-mine pipeline),
- Reject handling,
- Total annual output of ROM and product coal; and
- Total duration of mining (in the case of Cullen Valley Mine. It should be noted that the Modification sought in respect of the Invincible Colliery PA 07_0127 seeks to extend the duration of mining by 4 years.

The developments approved by PA 07_0127 and DA 200-5-2003 will remain in the same locality, mining coal from the same seams, using the same mining methodology.

The developments sought to be approved by the Modifications falls within the term 'modify' in Section 75W of the EP&A Act and there is the power and it is appropriate for the Minister as the approval body to approve the Modification applications.

8.4 ENVIRONMENTAL ASSESSMENTS

The extension of mining proposed by the Modifications will require an additional disturbance area of 88 ha and 62 ha of native vegetation to that approved under PA 07_0127 and DA 200-5-2003, respectively. None of the vegetation communities present in the proposed extension areas of either site are listed as an EEC under the EPBC Act or TSC Act.

It was identified that compensatory offsets would be required to offset the impacts of the Modifications on native forest and woodlands, which are known to or have some potential to provide habitat for threatened flora and fauna species. A Biodiversity Offset Strategy for the Modifications has therefore been developed by Coalpac as a compensatory measure for predicted ecological impacts.

The Modification will not result in air quality impacts above the relevant assessment criteria for dust deposition, TSP, PM_{10} and $PM_{2.5}$ at private residences due to the proposed extension of mining. The proposed extensions to mining areas will also occur at a greater distance from the township of Cullen Bullen than is currently approved under PA 07_0127 and DA 200-5-2003.

No material noise impacts to private receivers in addition to those previously described within the PA 07_0127 or DA 200-5-2003 are likely to occur as a result of the Modifications.

The noise associated with the extension of mining operations proposed will be mitigated by the continuation of existing noise management controls and modification of operating hours which will be maintained to ensure that any noise impacts are minimised.

Noise impacts during the short construction period of the water transfer pipeline will also be minimised through the implementation of additional management controls.

The extension of approved transport arrangements for the haulage of product coal by road for an additional four years will not significantly impact on the performance of key intersections between Cullen Valley Mine and MPPS as the Modification traffic will not represent a significant increase in existing traffic volumes on the Castlereagh Highway.

The construction of the proposed pipeline will also provide greater flexibility for the management of water on site and provide an additional source of water for operational use and in the management of the historic subsurface heating at Cullen Valley Mine.

The proposed extension to the open cut and highwall mining operations will also allow for the extraction of additional volumes of overburden and topsoil materials that were identified as being required to complete the development of a stable, free-draining final landform and the higher quality rehabilitation of the existing disturbance areas at both mine sites at the completion of mining operations under these Modifications.

The proposed extension of mining operations will result in a post-mining landform option that will be more stable and sustainable in the long term, than if the mining areas currently approved under PA 07_0127 and DA 200-5-2004 were to be rehabilitated with the currently available materials.

8.5 ENVIRONMENTAL PLANNING AND SOCIAL CONTEXT

The approval of the applications for Modification will enable Invincible Colliery and Cullen Valley Mine to operate in an efficient manner for a further period of four years under the conditions of PA 07_0127 and DA 200-5-2003 and will provide for a more sustainable rehabilitation and final landform outcome for the proposed and existing mining areas.

This additional period of operations will also secure the short term supply of competitively priced coal for the domestic power generating facilities at the nearby MPPS.

This Modification EA provides a balanced consideration of all potential environmental, social and economic impacts associated with the continuation of operations at Invincible Colliery and Cullen Valley Mine, consistent with the principles of Ecologically Sustainable Development. Detailed engineering investigations and environmental studies have assessed the proposed developments and identified the need for revised mine plans that are required to ensure the advancement of the interests of all stakeholders in accordance with the objects of the EP&A Act.

8.6 JUSTIFICATION

The operations proposed for the Modifications are generally consistent with those previously assessed and approved under PA 07_0127 and DA 200-5-2003. The main elements of Invincible Colliery and Cullen Valley Mine operations, including coal extraction methodology, processing arrangements and rates, product coal transportation and employment levels, will remain unaltered.

The timely approval of the Modifications will allow the extension of Invincible Colliery and Cullen Valley Mine to commence and to be undertaken in an efficient manner, averting a major disruption to competitively priced fuel supply to MPPS and the subsequent impost of increased electricity prices in NSW.

At full production the combined operations proposed for the Modifications will provide the following economic benefits:

- $149M in annual direct and indirect gross regional output;
- $46M in annual direct and indirect regional value added;
- $19M in annual direct and indirect household income; and
- 245 direct and indirect jobs.

The quantum of benefits will be lower for the start–up and final years, where production levels are less, however these will still be material. Further, the combined flow-on benefits of the Modifications will accrue to various sectors in the local and regional economy and generate significant additional employment.

If approved, the Modifications will enable the orderly cessation of mining within the locality of the existing open cut mining areas and a higher quality rehabilitation outcome for both sites whilst delivering economic welfare through the provision of lower electricity costs to the people of NSW and material regional economic stimulus.

9 ABBREVIATIONS

Abbreviation	Description
A	Authorisation
CCP	Coalpac Consolidation Project (now withdrawn)
CEEC	Critically Endangered Ecological Community
CHPP	Coal Handling and Preparation Plant
CL	Coal Lease
Coalpac	Coalpac Pty Limited
Cullen Valley Mine EIS	*Cullen Valley Open Cut Extension EIS* (IEC, 2004)
DA	Development Approval
DP&I	NSW Department of Planning and Infrastructure
DoE	Department of Environment
DRE	Department of Trade and Investment, Regional Infrastructure and Services – Division of Resources and Energy
EA	Environmental Assessment
EEC	Endangered Ecological Community
EMP	Environmental Management Plan
EMS	Environmental Management Strategy
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPL	Environmental Protection Licence
ESD	Ecologically Sustainable Development
Feldmast EIS	*Feldmast Coal Project EIS* (IEC, 1997)
ha	Hectare
Hansen Bailey	Hansen Bailey Environmental Consultants
ICPP	Invincible Coal Preparation Plant
INP	NSW Industrial Noise Policy
Interim Protocol	Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land (NSW Government, 2013)
LGA	Local Government Area
Lithgow LEP	Draft *Lithgow City Local Environment Plan 2013*
Mining Act	*Mining Act 1992*
ML	Mining Lease
MLA	Mining Lease Application
MOP	Mining Operations Plan
Mtpa	Million tonnes per annum

Abbreviation	Description
MPPS	Mount Piper Power Station
NOW	NSW Office of Water
NPW Act	*National Parks and Wildlife Act 1974*
OEA	Overburden Emplacement Area
OEH	Office of Environment and Heritage
PA	Project Approval
POEO Act	*Protection of the Environment Operations Act 1997*
ROM	Run of Mine
TSC Act	*Threatened Species Conservation Act 1995*
WAL	Water Access Licence
WPS	Wallerawang Power Station

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11 MODIFICATION EA STUDY TEAM

Section	Title / Modification EA Component	Team Member and Company	
Project Management			
	Chief Executive Officer	Ian Follington	Coalpac
	Chief Development Officer	Bret Leisemann	
	Environmental Manager	Ben Eastwood	
Modification EA Management			
	Project Director	James Bailey	Hansen Bailey
	Project Manager	Dorian Walsh	
Modification EA Sections			
1	Overview	Dorian Walsh	Hansen Bailey
2	Approved Operations	Dorian Walsh	
3	Modifications Description	Dorian Walsh	
4	Regulatory Framework	James Bailey, Andrew Wu	
5	Stakeholder Engagement	Dorian Walsh	
6	Impacts, Management and Mitigation	Dorian Walsh, Andrew Wu	
7	Statement of Commitments	Dorian Walsh	
8	Abbreviations		
9	References		
10	Modification EA Study Team		
Appendix A	Air Quality and Greenhouse Gas Impact Assessment	Jane Barnett	Pacific Environment
Appendix B	Acoustic Impact Assessment	Mark Bridges	Bridges Acoustics
Appendix C	Ecological Impact Assessment	David Robertson	Cumberland Ecology
Appendix D	Surface Water Impact Assessment	Rhys Cullen	WRM Water & Environment
Appendix E	Groundwater Impact Assessment	Tim Armstrong	Australasian Groundwater and Environmental Consultants
Appendix F	Traffic and Transport Impact Review	Damien Chee	DC Traffic Engineering