

	NARRABRI MINE ENVIRONMENTAL MANAGEMENT SYSTEM	Document owner:	Environmental Superintendent
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NARRABRI MINE



REHABILITATION MANAGEMENT PLAN

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Prepared by:

Title	Name	Signature	Date
Senior Environmental Project Manager	Callum Gawne Onward Consulting		16 November 2023
Director	Mark Vile Onward Consulting		16 November 2023

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Summary Table

Name of mine	Narrabri Colliery
Rehabilitation management plan commencement date	16 November 2023
Rehabilitation management plan revision dates and version numbers	Revision 2A, 16 November 2023
Mining leases (lease number(s)) and expiry date(s)	ML1609
Name of lease holder(s)	Narrabri Coal Pty Ltd
Date of publication	30 November 2023

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1. Introduction to mining project

1.1 History of operations

The Narrabri Mine is an existing underground coal mining operation situated in the Gunnedah Coalfield. It is located approximately 25 kilometres (km) south-east of Narrabri and approximately 60 km north-west of Gunnedah, within the Narrabri Shire Council (NSC) Local Government Area in New South Wales (NSW). The Narrabri Mine includes an underground coal mine, a coal handling and preparation plant and associated rail siding and surface infrastructure.

The Narrabri Mine is operated by Narrabri Coal Operations Pty Ltd (NCOPL), on behalf of the Narrabri Mine Joint Venture, which consists of two Whitehaven Coal Limited (WHC) wholly owned subsidiaries, and other joint-venture partners¹. The underground mine is covered by Mining Lease (ML) 1609 which covers an area of 5,298 hectares (ha) for the predominant purpose of mining for coal from the Hoskissons Coal Seam.

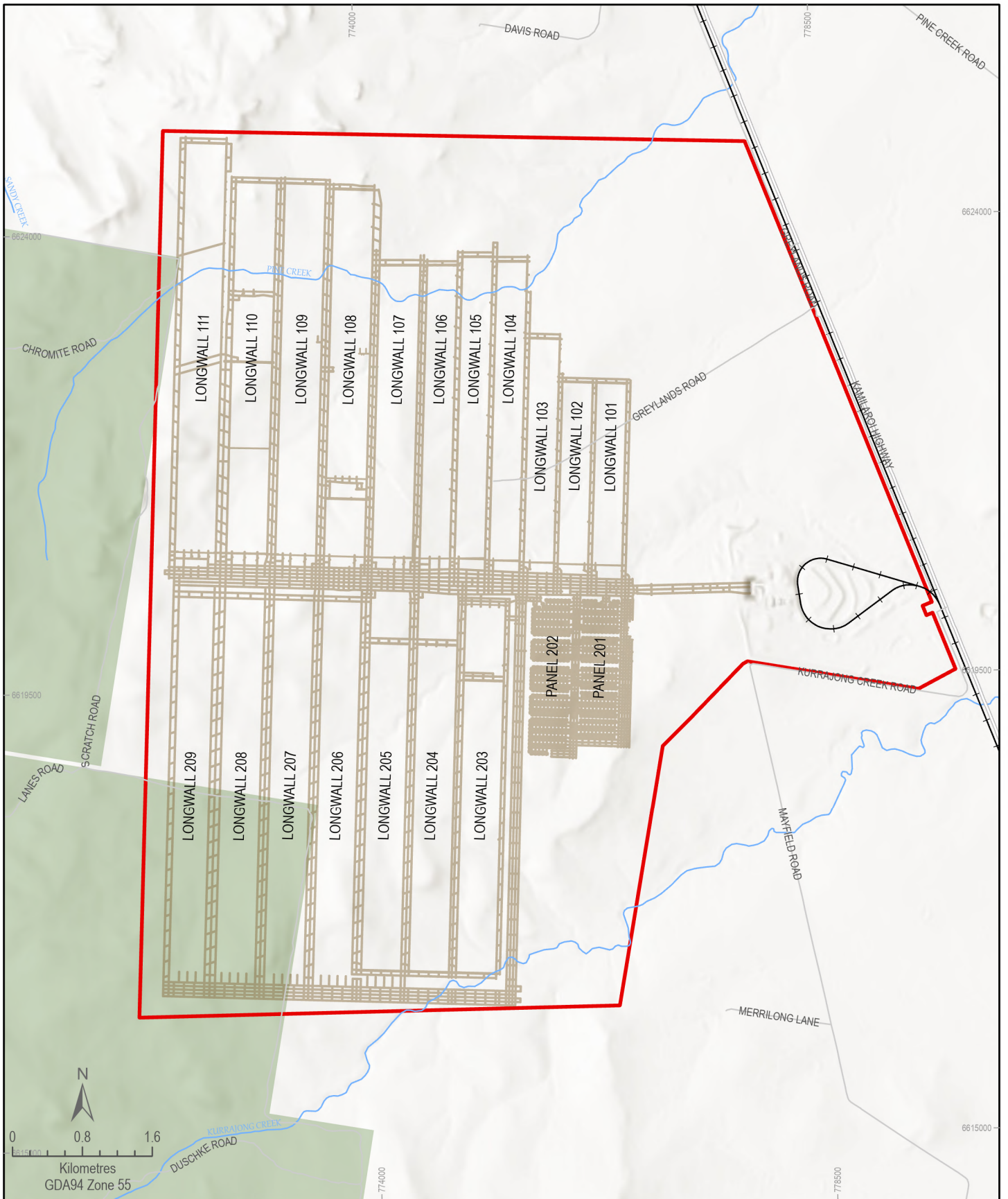
Stage 1 of the Narrabri Mine was approved in November 2007 under Part 3A of the *Environmental Planning and Assessment Act 1979 (EP&A Act)*. Construction of the mine and supporting infrastructure commenced in 2008, with production using a continuous miner commencing in 2010. Following the approval of the Stage 2 Environmental Assessment (R.W Corkery & Co., 2009) (the **EA**), the issue of the Stage 2 Project Approval 08_0144 (**Project Approval**) in July 2010, and *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* approval (**2009/5003**) on 17 August 2009, the Narrabri Mine was converted to an 8 million tonnes per annum (Mtpa) run of mine (ROM) longwall mining operation, which commenced in 2012.

The Project Approval has subsequently been modified on multiple occasions. The environmental assessment for Modification 5 (Resource Strategies, 2015) (**MOD 5**), approved in December 2015, changed the mine geometry by reducing the number of longwall (LW) panels from 26 to 20, increased some LW panel widths and increased the production to 11 Mtpa of ROM coal until July 2031.

Modification 7, the most recent modification of the Project Approval, was approved on 23 November 2021. The environmental assessment for Modification 7 (Resource Strategies, 2021) (**MOD 7**) describes the change in mining method within the extent of the previously approved LW 201 and LW 202 and allows for up to 0.7 Mtpa via bord and pillar extraction at pillar reduction panels Cut and Flit (CF) 201 to CF 205. The bord and pillar mining will occur concurrently with existing longwall operations for a period of approximately five years, with the maximum ROM coal production rate remaining within the approved limit of 11 Mtpa.

The Narrabri Mine underground mining layout is shown in Figure 1-1 and surface development footprint is shown in Figure 1-2.

¹ Please refer to the Environmental Management Strategy for further detail on the joint venture.

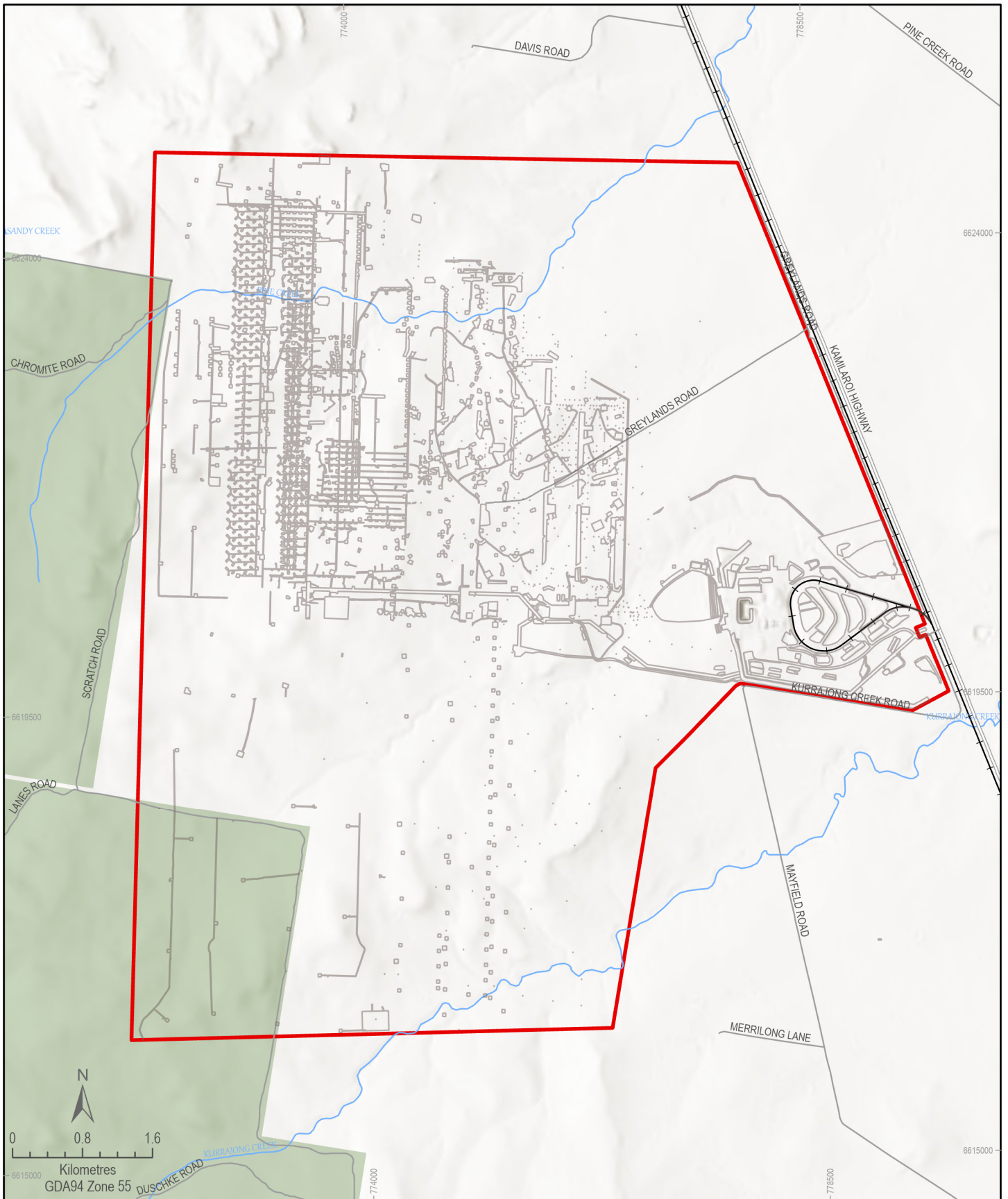


LEGEND

- ML1609
- Stage 2 underground longwall panels
- Highway
- Roads
- Railway
- Named watercourse
- StateForest

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Figure 1.1
Narrabri Mine Underground Mining Layout



LEGEND

- ML1609
- Stage 2 surface footprint
- Highway
- Roads
- Railway
- Named watercourse
- StateForest

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Figure 1.2
Narrabri Mine Surface Footprint

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1.1.1 Surface disturbance activities

Significant surface disturbance activities carried out at the Narrabri Mine include:

- vegetation clearance to support longwall and bord and pillar mining;
- development of services corridors and access tracks for surface infrastructure;
- development of gas management and services infrastructure;
- development of exploration and service boreholes;
- development of pre-conditioning areas; and
- development of brine storage ponds and the Reject Emplacement Area (REA).

The existing disturbance footprint also incorporates the Narrabri Mine surface and underground infrastructure, including the box cut, coal handling and preparation plant (CHPP), ROM and product stockpiles, rail loop, product coal load-out infrastructure, water management infrastructure and mine ventilation infrastructure.

1.1.2 Rehabilitation activities

Rehabilitation at the Narrabri Mine has been undertaken progressively since 2008. Rehabilitation is conducted as soon as reasonably practicable as areas become available following longwall mining operations. Progressive rehabilitation activities include:

- decommissioning boreholes and reclaiming gas drainage infrastructure for reuse;
- borehole sealing;
- filling of sumps associated with drilling activities;
- grading landforms and re-spreading topsoil/subsoil;
- fertilising and seeding topsoiled areas (where required);
- subsidence remediation;
- inspections of roads and creeks, water management structures, soil stockpiles and seeded areas for erosion;
- inspections of progressively rehabilitated areas to assess germination rates; and
- weed and feral pest monitoring and management.

Since 2008, NCOPL have progressively rehabilitated 169.2 ha (Annual Rehabilitation Report 2022);

- 27.71 ha prepared for rehabilitation; and
- 141.49 ha in land use establishment phase.

Gas drainage infrastructure and mine safety pre-conditioning drill pads are progressively decommissioned and rehabilitated following undermining when the infrastructure is no longer required for operational purposes.

The above processes will continue over the life of mine, with the extent and nature of activities undertaken being consistent with this Rehabilitation Management Plan (RMP or Plan), and other relevant plans such as the Extraction plans. Rehabilitation activities and inspections are currently documented utilising checklists and the collection of spatial data.

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1.2 Current development consents, leases, and licences

Table 1-1 summarises the Narrabri Mine development consents, leases, and licences.

Table 1-1 Narrabri Mine Project Approval

Authority	Reference	Grant date	End date
<i>Environmental Planning and Assessment Act 1979</i>	PA 08_0144 MOD 7	July 2010	July 2031
<i>Mining Act 1992</i>	EL 6243	21/05/2004	21/05/2029
	EL 9455	6/09/2022	6/09/2028
	EL 9456	6/09/2022	6/09/2028
	ML 1609	18/01/2008	18/01/2029
	ML 1839*	13/09/2022	13/09/2043
<i>Environmental Protection and Biodiversity Conservation Act 1999</i>	EPBC 2009/5003	17/08/2009	N/A
<i>Protection of the Environment Operations Act 1997</i>	EPL 12789	20/02/2008	N/A
<i>NSW Murray-Darling Basin Porous Rock Groundwater Sources Order 2020</i>	WAL 29549	09/02/2015	N/A
	WAL 43017	11/11/2019	N/A
<i>NSW Great Artesian Basin Groundwater Sources 2020</i>	WAL 15922	30/04/2009	N/A
<i>Namoi Alluvial Groundwater Sources Order 2020</i>	WAL 12833	08/09/2011	N/A
	WAL 20131	15/01/2010	N/A
	WAL 12822	25/11/2020	N/A
<i>Upper Namoi and Lower Namoi Regulated Water Sources 2016</i>	WAL 6762	11/12/2009	N/A
	WAL 2671	02/07/2010	N/A
	WAL 2728	06/01/2010	N/A
	WAL 20152	22/2/2010	N/A

*ML 1839 covers the area proposed to be mined by the Stage 3 Extension Project that is yet to receive EPBC approval.

1.3 Land ownership and land use

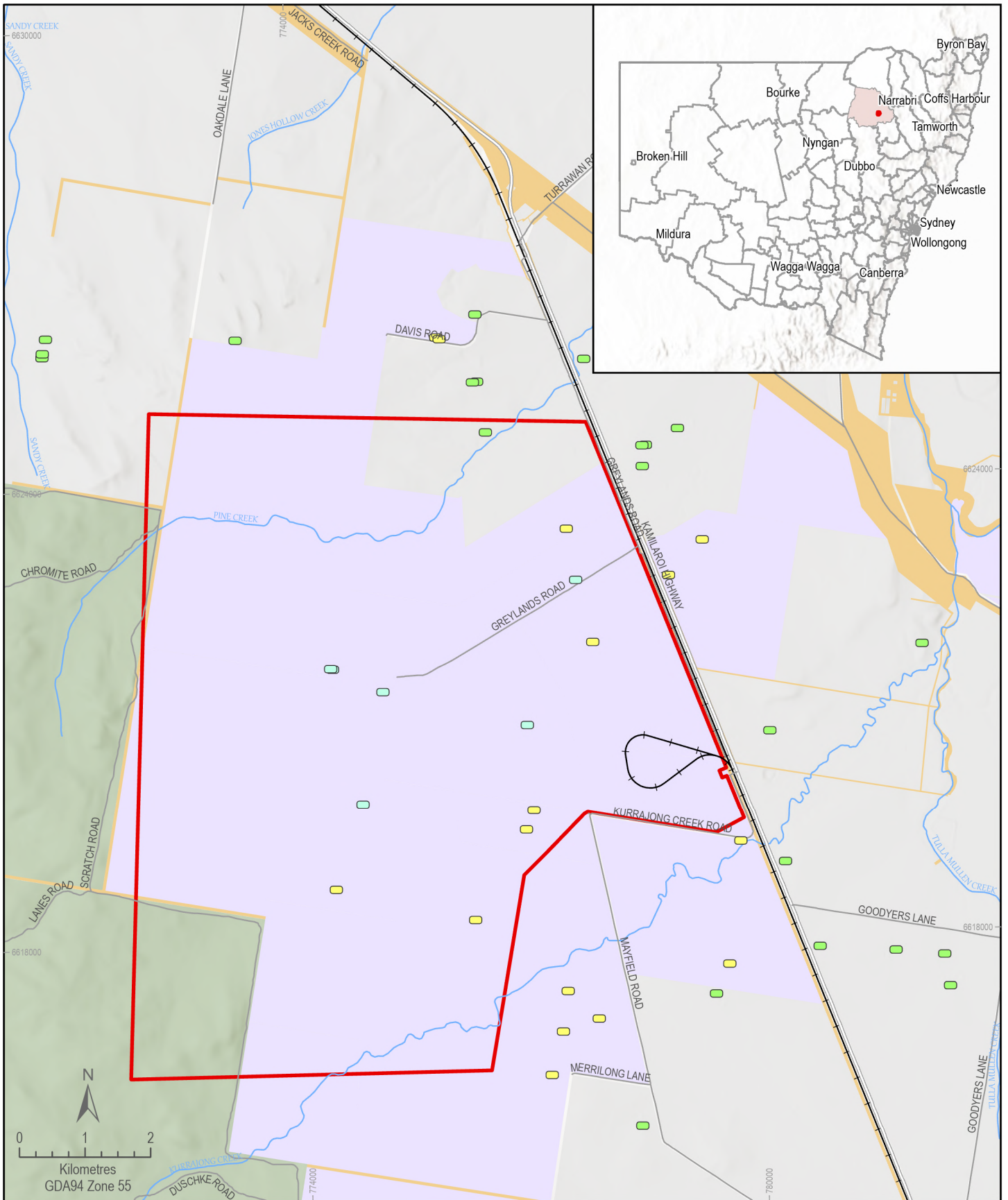
1.3.1 Land ownership

ML 1609 covers an area of approximately 5,298 ha within the Parishes of Milner, Turrawan, and Gorman, in the County of White and within the Narrabri Local Government Area. The Narrabri Mine site comprises of a number of land parcels, including freehold land owned by NCOPL, land owned by the NSW Government (managed by the Forestry Corporation of NSW) and Crown Land (road reserves). Land ownership within and surrounding the Narrabri Mine is summarised in Table 1-2 and shown on Figures 1-3a-e.

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Table 1-2 Narrabri Mine land ownership

Tenure	Lot number	Deposited plan number	Ownership
Freehold	1	254523	NCOPL
Freehold	1	659899	NCOPL
Freehold	3	757104	NCOPL
Freehold	7	757104	NCOPL
Freehold	8	757104	NCOPL
Freehold	10	757104	NCOPL
Freehold	25	757104	NCOPL
Freehold	67	757104	NCOPL
Freehold	68	757104	NCOPL
Freehold	57	757114	Privately owned
Freehold	58	757114	Privately owned
Freehold	63	757114	NCOPL
Freehold	64	757114	NCOPL
Freehold	65	757114	NCOPL
Freehold	60	757124	NCOPL
Freehold	61	757124	NCOPL
Freehold	81	757124	Privately owned
Freehold	83	757124	NCOPL
Freehold	115	757124	NCOPL
Freehold	1	798487	Privately owned
Freehold	1	811171	NCOPL
Freehold	2	811171	NCOPL
Freehold	151	816020	NCOPL
Freehold	152	816020	NCOPL
Freehold	3	1005608	NCOPL
Freehold	381	1028753	NCOPL
Freehold	382	1028753	NCOPL
Freehold	1	1124652	Privately owned
Freehold	2	1124652	NCOPL
Freehold	841	1134385	NCOPL
Freehold	842	1134385	NCOPL
Freehold	1	1206684	NCOPL
Freehold	2	1206684	NCOPL
Freehold	1	1210797	NCOPL

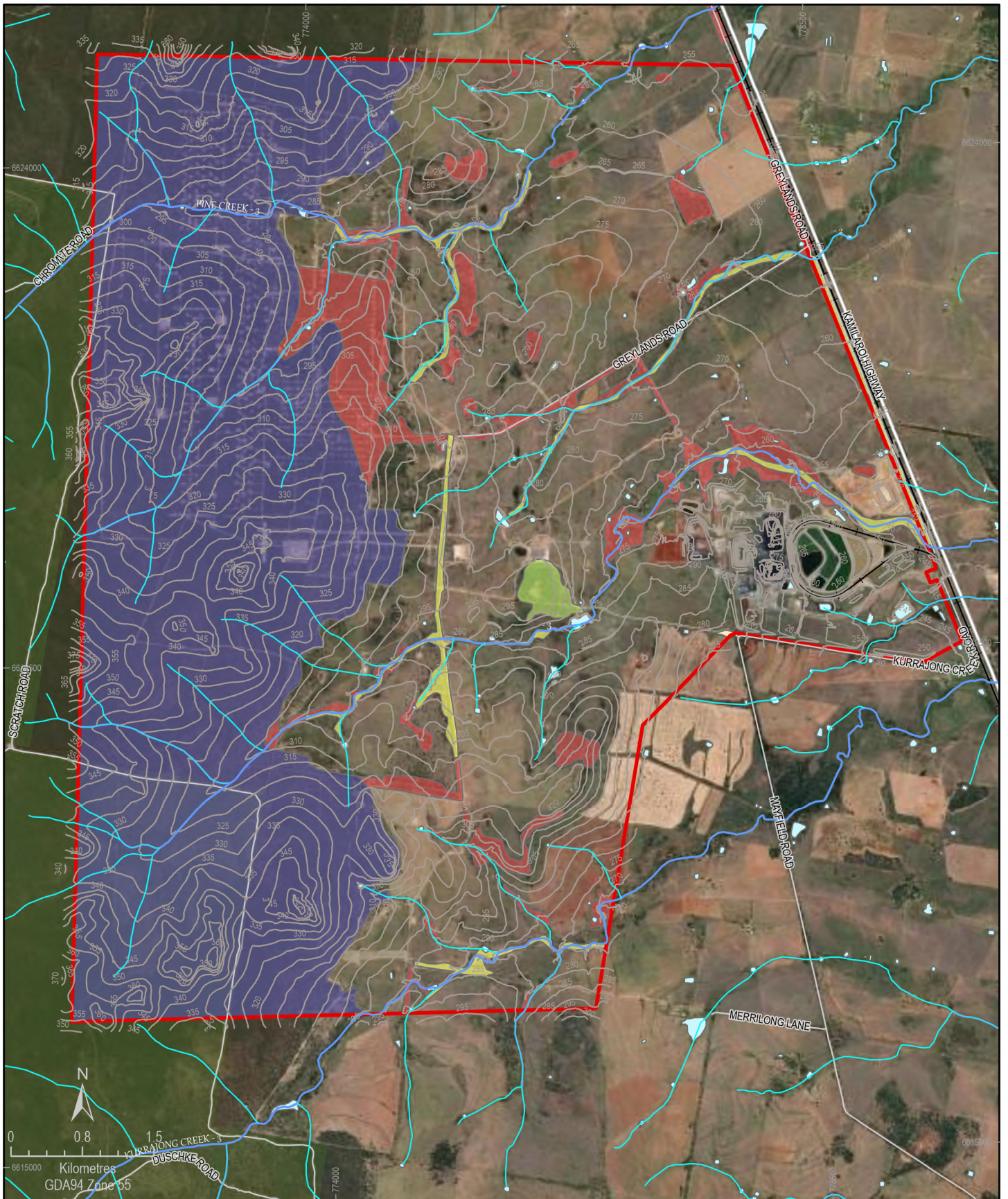


LEGEND

- | | | |
|--------------------------------|---------------------------------------|-------------------|
| ML1609 | Dwellings | Highway |
| Whitehaven owned land | Privately Owned Land | Roads |
| Privately owned land | Whitehaven Owned Land | Railway |
| Crown land | Whitehaven Owned Land (Uninhabitable) | Named watercourse |
| Local government area | | StateForest |
| Narrabri local government area | | |

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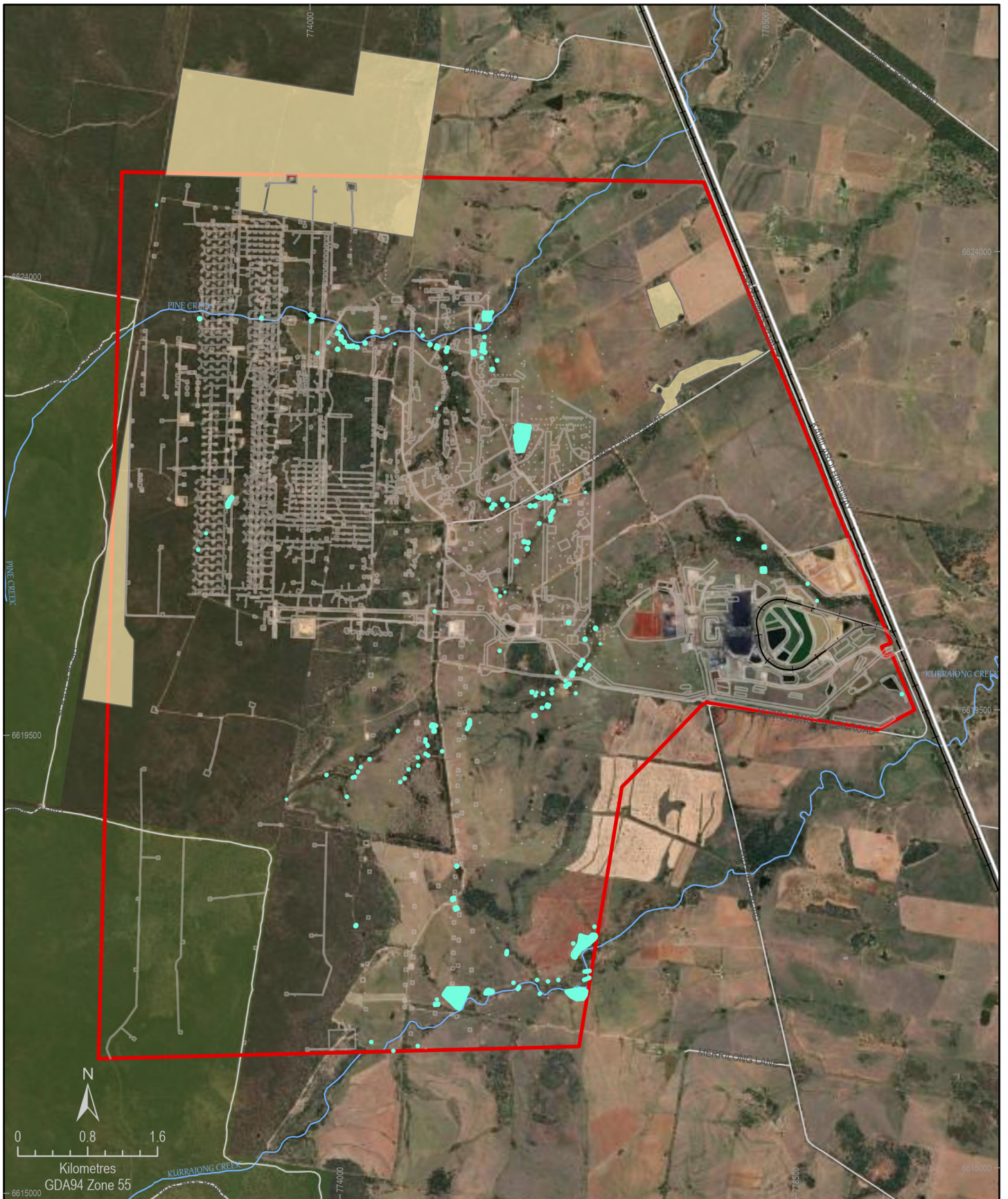
Figure 1.3a
Land Ownership



LEGEND

- | | | |
|------------------|--------------------------------------|------------------------------|
| ML1609 | Vegetation communities | Strahler stream order |
| Current contours | Brown Bloodwood/Pilliga Box Woodland | 1 |
| Highway | Callitris Forest | 2 |
| Roads | Inland Grey Box Woodland | 3 |
| Railway | Riparian Forest | |
| Waterbody | Weeping Myall | |
| StateForest | | |

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 Figure 1.3b
 Vegetation and Landform Characteristics

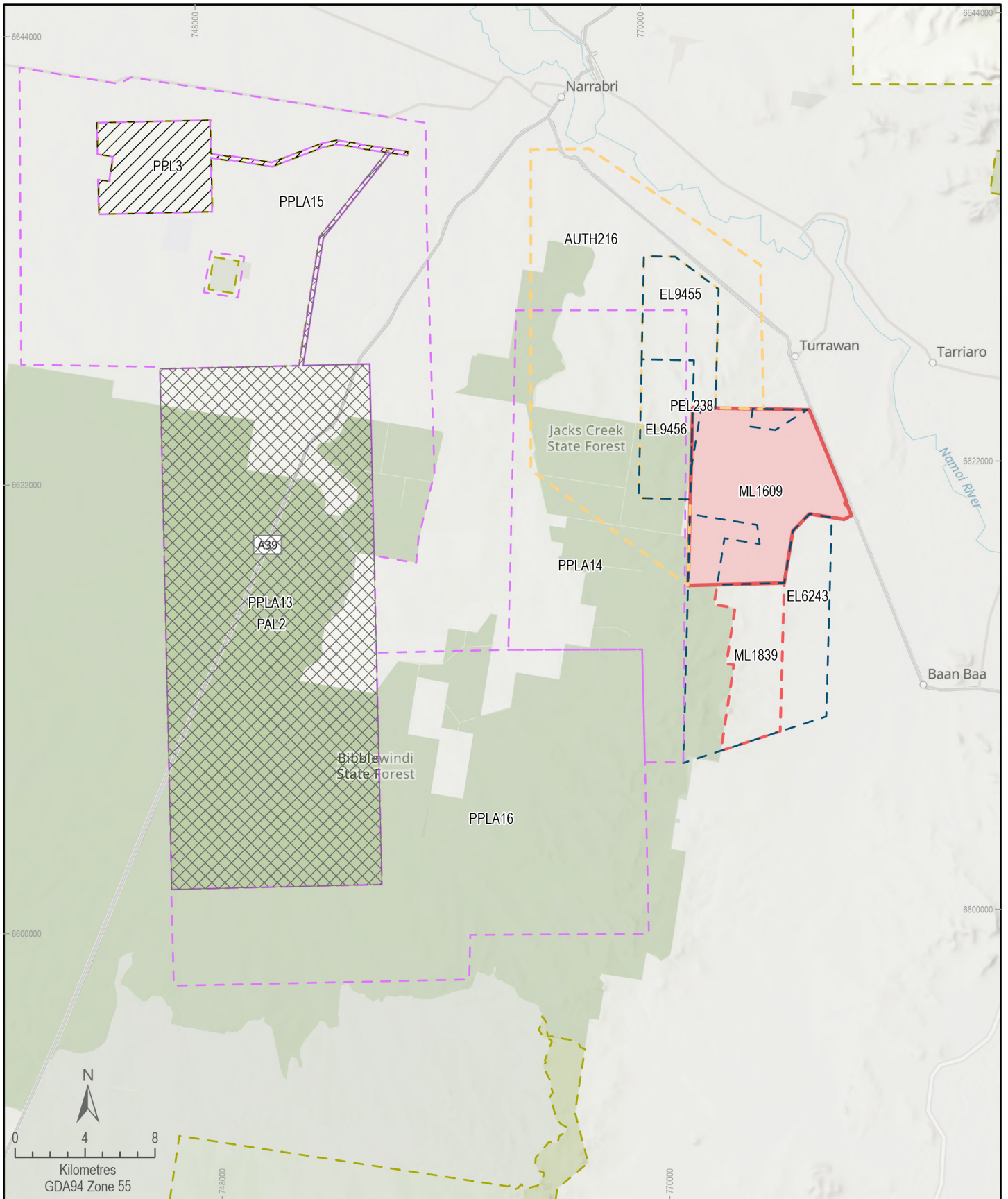


LEGEND

- ML1609
- Biodiversity offset area
- Aboriginal heritage site extent
- Stage 2 surface footprint
- Highway
- Roads
- Railway
- Named watercourse
- StateForest

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Figure 1.3c
Sensitive Areas

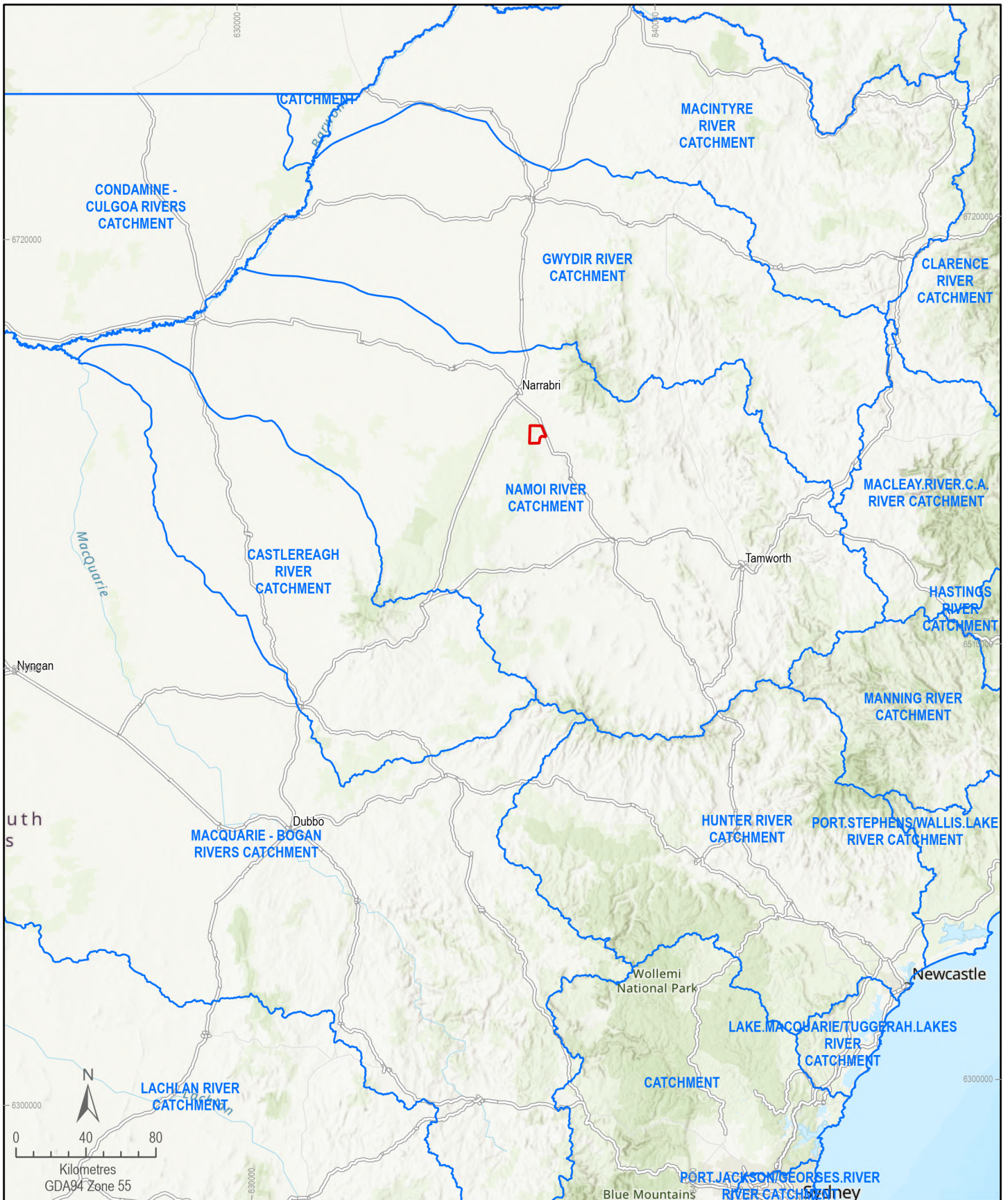


LEGEND

- ML1609
- Mining lease
- Exploration licence
- Petroleum assessment lease
- Petroleum exploration licence
- Petroleum pipeline licence
- Petroleum production lease application
- Authorisation
- Highway
- State Forest

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Figure 1.3d
Mining Tenements



LEGEND

- ML1609
- Water catchment area
- Highway

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Figure 1.3e
Catchment Areas

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1.3.2 Historic and current use

Narrabri Mine is located in a rural environment away from urban centres and has a relatively low density of surrounding residences. Prior to commencement of mining operations, the historic land use within ML1609 was predominantly agriculture and forestry. Current surrounding land uses include:

- mining (Maules Creek Coal Mine, Boggabri Coal Mine and Tarrawonga Coal Mine);
- commercial forestry (Pilliga East, Leard, and Jacks Creek State Forests);
- biodiversity conservation (Leard State Conservation Area and Mount Kaputar National Park);
- quarrying activities undertaken by NSC;
- transport corridors including the Kamilaroi Highway and adjacent rail line;
- coal seam gas activities (Santos); and
- traditional agriculture (cropping and grazing) on privately held freehold land.

1.3.3 Final land use

Final land use will include a combination of native woodland vegetation, biodiversity offset areas (BOA), agriculture, and forestry. The approved final land use will include agricultural land comparable to that of the pre-mining environment. Woodland areas which have been subject to subsidence impacts or clearance for infrastructure will be rehabilitated with native vegetation species endemic to the surrounding vegetation communities. Rehabilitated landforms will also integrate with the adjoining State Forests to enhance regional biodiversity and conservation outcomes. The final land use of the REA will be a mix of native and introduced grasses (pastures) with native woodland overstorey communities across the plateau surface and batters to reflect the surrounding areas, with grazing discouraged.

Detailed mine closure planning will identify infrastructure that is to be decommissioned and removed as well as infrastructure that will be retained to support the final land use.

1.3.4 Agreements specific to mining lease areas

In accordance with the approved Biodiversity Offset Strategy, approximately 431 ha of native woodland vegetation adjacent to the mining operation has been conserved for biodiversity offset.

Following the cessation of mining, a further 1,168 ha of native woodland within ML 1609 will be conserved for biodiversity offset in accordance with EPBC 2009/5003. In addition, an offsite biodiversity offset area (the “Kenna” property) has been established which covers an area of 1,244 ha. This results in a total of 2,843 ha in offsets.

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Table 1-3 Biodiversity properties relevant to PA08_0144 and EPBC 2009/5003 offset requirements

Property name	Area (ha)	Securement	Date executed	Lot number	Deposited plan number
Kenna (Offsite)	1244.1	VCA0486	27 June 2019	73	754924
				94	754924
				95	754924
				111	754924
				112	754924
				113	754924
				602	854685
				3	1210577
				2	1210578
Greylands (Onsite)	15.1	VCA0528	07 June 2021	841	1134385
Omeo (Onsite)	10.8	VCA0495	07 June 2021	83	757124
Rosevale (Onsite)	337.1	VCA0529	07 June 2021	63	757114
				1	1210797
West Haven (Onsite)	42.5	VCA0531	07 June 2021	67	757104
Greylands Road (Onsite)	5.7	VCA0496	07 June 2021	1	1210797
				65	757114
Kurrajong Park (Onsite)	20.0	VCA0530	07 June 2021	1	811171

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2. Final land use

2.1 Regulatory requirements for rehabilitation

Table 2-1 outlines the regulatory requirements for rehabilitation that apply to the Narrabri Mine.

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Table 2-1 Regulatory requirements for rehabilitation

Condition	Requirement	Final land use domain	Timing	Section										
Project Approval PA 08_0144														
Schedule 5, Condition 1	<p>The Proponent shall rehabilitate the site to the satisfaction of the Secretary and Resources Regulator in accordance with the rehabilitation objectives in Table 1.</p> <p>Table 1: Rehabilitation Objectives</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #0056b3; color: white;"> <th>Domain</th> <th>Objective</th> </tr> </thead> <tbody> <tr> <td>Surface Facilities Area</td> <td>Set through Condition 4 below</td> </tr> <tr> <td>Other land affected by the project</td> <td>Restore ecosystem function, including maintaining or establishing self-sustaining native ecosystems: comprised of local native plant species; with a landform consistent with the surrounding environment.</td> </tr> <tr> <td>Built features</td> <td>Repair/restore to pre-mining condition or equivalent.</td> </tr> <tr> <td>Community</td> <td>Minimise the adverse socio-economic effects associated with mine closure including the reduction in local and regional employment. Ensure public safety.</td> </tr> </tbody> </table>	Domain	Objective	Surface Facilities Area	Set through Condition 4 below	Other land affected by the project	Restore ecosystem function, including maintaining or establishing self-sustaining native ecosystems: comprised of local native plant species; with a landform consistent with the surrounding environment.	Built features	Repair/restore to pre-mining condition or equivalent.	Community	Minimise the adverse socio-economic effects associated with mine closure including the reduction in local and regional employment. Ensure public safety.	All	Ongoing	Section 4 Section 5 Section 6
Domain	Objective													
Surface Facilities Area	Set through Condition 4 below													
Other land affected by the project	Restore ecosystem function, including maintaining or establishing self-sustaining native ecosystems: comprised of local native plant species; with a landform consistent with the surrounding environment.													
Built features	Repair/restore to pre-mining condition or equivalent.													
Community	Minimise the adverse socio-economic effects associated with mine closure including the reduction in local and regional employment. Ensure public safety.													
Schedule 5, Condition 2	To the extent that mining operations permit, the Proponent shall carry out rehabilitation progressively, that is, as soon as reasonably practicable following the disturbance.	Native Ecosystem, Rehabilitation Biodiversity Offset Area, Agricultural – grazing	Ongoing	Section 6										
Schedule 5, Condition 4	<p>Rehabilitation Management Plan</p> <p>The Rehabilitation Management Plan must include:</p> <p>(a) the rehabilitation objectives for the site;</p> <p>(b) a strategic description of how the rehabilitation of the site would be integrated with surrounding land use;</p>	All	Life of mine (revised throughout)	This RMP										

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Condition	Requirement	Final land use domain	Timing	Section
	<p>(c) a general description of the short and long term measures that would be implemented to rehabilitate the site;</p> <p>(d) a detailed description of the measures that would be implemented to remediate predicted subsidence impacts under individual Extraction Plans;</p> <p>(e) a detailed description of the measures that would be implemented to minimise environmental impacts of mining operations and to rehabilitate the site, including measures to be implemented for:</p> <ul style="list-style-type: none"> • managing remnant vegetation and habitat on site; • minimising impacts on fauna; • minimising visual impacts; • conserving and reusing topsoil; • controlling weeds, feral pests, and access; • managing bushfires; and • managing any potential conflicts between rehabilitation works and Aboriginal cultural heritage. <p>(f) detailed performance and completion criteria for the rehabilitation of the site;</p> <p>(g) a detailed description of how the performance of the rehabilitation works would be monitored over time to achieve the stated objectives and against the relevant performance and completion criteria; and</p> <p>(h) details of who is responsible for monitoring, reviewing and implementing the plan.</p> <p><i>Note: In accordance with condition 11 of schedule 2, the preparation and implementation of Rehabilitation Management Plans is likely to be staged, with each plan covering a defined area (or domain) for rehabilitation. In addition, while mining operations are being carried out, some of the proposed remediation or rehabilitation measures may be included in the detailed management plans that form part of the Extraction Plan. If this is the case, however, then the Proponent will be required to ensure that there is good cross-referencing between the various management plans.</i></p>			

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Condition	Requirement	Final land use domain	Timing	Section
Statement of Commitments (SoC) (Appendix 3 to the Project Approval)				
SoC 4.1	Confirm the proposed final land use of the Mine Site lands and identify the infrastructure and services to be retained to support this land use.	All	Prior to closure	Section 2.3 Section 6.2.2
SoC 4.2	Demolish or deconstruct and remove infrastructure and services not required by the confirmed future land use.	Native Ecosystem, Rehabilitation Biodiversity Offset Area, Agricultural – grazing	Ongoing	Section 6.2.2
SoC 4.3	Stabilise all earthworks, drainage lines and disturbed areas no longer required for mine-related activities in order to minimise erosion and sedimentation, and to reduce the visibility of the activities from adjacent properties and the local road network.	All	Ongoing	Section 6.2.3
SoC 4.4	Provide a low maintenance, stable and safe landform that blends with the surrounding topography and which is commensurate with re-established agricultural land uses.	Agricultural - grazing	Ongoing	Section 2.3
SoC 4.5	Ensure any areas of disturbance that require profiling meet the requirements of the final landform.	All	Prior to relinquishment	Section 6.2.3
SoC 4.6	Replace subsoil and topsoil over areas of disturbance in the same order and approximately same depths as it was removed.	Native Ecosystem, Rehabilitation Biodiversity Offset Area, Agricultural - Grazing	Ongoing	Section 6.2.4
SoC 4.7	Ensure the most appropriate crop / pasture species are planted in areas returned for agricultural use.	Agricultural - Grazing	Ongoing	Section 6.2.5
SoC 4.8	Conduct ongoing rehabilitation monitoring and maintenance throughout and beyond the operation.	All	Ongoing to relinquishment	Section 8
SoC 4.9	Restrict areas of disturbance to the areas identified and marked in accordance with Commitments 1.1 to 1.5.	All	Ongoing	Section 6.2.1
SoC 4.10	Remove gas drainage equipment and backfill and cap each remaining bore hole in accordance with the former NSW Department of Primary Industries – Mineral Resources EDG01 guideline “Borehole Sealing Requirements on Land: Coal Exploration”.	Native Ecosystem, Rehabilitation Biodiversity Offset Area, Agricultural - Grazing	Ongoing	Section 6.2.2 and Section 6.2.3

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Condition	Requirement	Final land use domain	Timing	Section
SoC 4.11	Allow water retained within the sump(s) to evaporate, excavate any consolidated drill cuttings and fines, remove the plastic liner and backfill each sump.	Native Ecosystem, Rehabilitation Biodiversity Offset Area, Agricultural - Grazing	Post closure	Section 6.2.3
SoC 4.12	Respread previously stripped and stockpiled topsoil and vegetation over the backfilled sumps and other cleared areas.	Native Ecosystem, Rehabilitation Biodiversity Offset Area, Agricultural - Grazing	Post closure	Section 6.2.4
SoC 4.13	Complete periodic inspections of the rehabilitated sites to confirm a return to the vegetation of the surrounding landform	Native Ecosystem, Rehabilitation Biodiversity Offset Area, Agricultural - Grazing	Ongoing to relinquishment	Section 8
SoC 4.14	(Unless required for future access to monitor or manage subsidence related impacts), close, cross-rip and respread previously cleared vegetation over access tracks.	Native Ecosystem, Rehabilitation Biodiversity Offset Area, Agricultural - Grazing	Progressively as needed	Section 6.2.5
SoC 4.15	Obtain certification from plant supplier/ contractor that equipment imported to the Mine Site has been cleaned and is free of soil and vegetation.	All	Ongoing	Section 6.2.1
SoC 4.16	Undertake campaign weed spraying over the Pit Top Area and areas of surface disturbance of the Mining Area in consultation with DII-Agriculture and/or the local Noxious Weeds Inspector.	All	Ongoing	Section 6.2.1
SoC 11.12	Progressively rehabilitate areas of disturbance including gas drainage areas.	All	Ongoing	Section 6
SoC 11.13	Progressively rehabilitate areas no longer required for operational purposes.	All	Ongoing	Section 6
SoC 12.11	Retain soil conservation structures, or if disturbed, reinstate these structures to maintain pre-mining soil and water management on the Mine Site.	All	Ongoing	Section 6.2.1
SoC 12.13	Undertake remedial actions on areas of accelerated erosion, eg. reinstatement or realignment of contour banks, regrading of channels, sowing of cover crops, etc.	All	Ongoing and as required	Section 6.2.3
SoC 12.15	Excavate and remove soils contaminated with hydrocarbons or saline water.	All	Within one month of contamination occurring.	Section 6.2.1 Section 6.2.2

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Condition	Requirement	Final land use domain	Timing	Section
Environmental Assessment (R.W. Corkery & Co 2009)				
Section 4B.3.4.2.4	Vegetation and soil would be cleared and stripped and stockpiled away from natural drainage lines for future use in rehabilitation of the site.	Native Ecosystem, Rehabilitation Biodiversity Offset Area, Agricultural - grazing	Ongoing	Section 6.2.1
Section 4B.3.7.2	The final landform created following the completion of the Longwall Project and rehabilitation of the Mine Site would be equivalent in topography and vegetation to that of the pre-mining landform.	All	Post closure	Section 6.2.3
Section 4B.4.6.1	The facilities within the Pit Top Area and the Reject Emplacement Area would be decommissioned and the area rehabilitated on completion of the Longwall Project to re-instate a final land use of agriculture and native vegetation in accordance with that detailed in Section 2.13.2.	Agricultural – grazing	Post closure	Section 6.2.2 Section 6.2.3
Section 4B.4.6.5	It is noted that a number of access tracks, pre-drainage and goaf boreholes and gas production sites would be located within the Biodiversity Offset Area. The areas that would be disturbed by each of these have not been incorporated within the area calculation for the Biodiversity Offset Area and would be rehabilitated as soon as practicable once they are no longer required for gas drainage and production purposes.	Rehabilitation Biodiversity Offset Area	Ongoing	Section 6
Section 4B.4.7.1	Given the loss of approximately 210.5ha of native vegetation would be offset by the conservation of 547.3ha of equivalent vegetation, with all disturbance to be rehabilitated to re-establish the original vegetation community, the Longwall Project would maintain overall biodiversity values.	Native Ecosystem, Rehabilitation Biodiversity Offset Area	Ongoing	Section 6
Section 4B.8.5.3 (Table 4B.39)	Progressive rehabilitation of areas of disturbance including topsoil and subsoil stockpiles.	All	Ongoing	Section 6
Section 4B.9.2.4	Topsoil would be stripped to a depth of 150 mm and stockpiled separately from the remaining profile to be excavated. The subsoil would only be removed from the trench after completion of excavation of the topsoil. This will ensure that more fertile topsoil material with its accumulated seed bank will be readily available for replacement over the trench to ensure rapid rehabilitation.	All	Ongoing	Section 6.2.1

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Condition	Requirement	Final land use domain	Timing	Section
Section 4B.9.3.4	Disturbance associated with the progressive development of gas drainage and ventilation over the Mine Site would be progressively rehabilitated by replacing the soil stripped from these areas of disturbance and stockpiled as nominated in Section 4B.9.2.4.	All	Ongoing	Section 6.2.1
Section 4B.11.3	Gas drainage sites would be rehabilitated to re-establish the pre-existing vegetation.	Native Ecosystem, Rehabilitation Biodiversity Offset Area, Agricultural - grazing	Ongoing	Section 6.2.1 Section 6.2.5
Section 4B.13.4.5	The Proponent is committed to rehabilitate the mine following its closure, to a standard which would allow agricultural production to be resumed at an equivalent level to that prior to mining.	Agricultural - grazing	Post closure	Section 6.2.5
Section 4B.13.5.5	Many of the areas of native vegetation to be disturbed would be rehabilitated back to native vegetation comparable to the pre-mining status.	Native Ecosystem, Rehabilitation Biodiversity Offset Area	Post closure	Section 6.2.5
Standard mining lease conditions				
Division 1 (4)	Must prevent or minimise harm to environment	All	Ongoing	Sections 3, 9 and 10
Division 1 (5)	Rehabilitation to occur as soon as reasonably practicable after disturbance	All	Ongoing	Section 6.2.5
Division 1 (6)	Rehabilitation must achieve final land use	All	Ongoing	Section 2.3
Division 2 (7)	Rehabilitation risk assessment	All	Complete	Section 3
Division 3 (10)	Rehabilitation management plans for large mines	All	Ongoing	This RMP
Division 3 (12)	Rehabilitation outcome documents	All	Ongoing	Section 4.2 Section 5
EPBC 2009/5003				
Condition 5	In order to minimise potential impacts on EPBC Act listed threatened species and communities within the mine site, the person undertaking the action must actively manage progressive disturbance of the mine site in accordance with a Rehabilitation Management Plan for the life of the mine. The Rehabilitation Management Plan must be developed and implemented prior to any Works commencing and in accordance with the NSW Director General's Assessment	All	Life of mine	This Plan

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Condition	Requirement	Final land use domain	Timing	Section
	Report and approval conditions (26 July 2010). The final version of this plan must be submitted to the Department.			

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2.2 Final land use options assessment

The Narrabri Mine Mining Operations Plan (MOP)² defines the final land use previously approved by the Resources Regulator. The final land use goal is to create a physically and chemically stable mine landform that is adequately drained and integrates with the surrounding landform with all mine-induced subsidence remediated and rehabilitated.

The rehabilitation of mining disturbed areas will be planned to deliver final land uses that achieve biodiversity and agricultural outcomes. Rehabilitated landforms will also integrate with the adjoining State Forests to enhance regional biodiversity and conservation outcomes.

Previously approved final land use domains are summarised in Table 2-2. In accordance with the *Form and Way – Rehabilitation Management Plan for Large Mines* (Resources Regulator, 2021), NCOPL are not required to undertake a further land use options assessment.

Table 2-2 Narrabri Mine final land use domains as approved in the MOP

Domain	Description
Water Management Area	Includes all water management structures and dams retained in the final landform.
Rehabilitation Area – Pasture	Landholdings that were previously used for agriculture and have been impacted by mining, such as subsidence areas and some infrastructure areas will be rehabilitated to Class III agricultural suitability land, capable of pasture production and occasional cropping.
Rehabilitation Area – Woodland (existing)	Woodland areas that have been impacted by mining, such as subsidence areas and some infrastructure areas will be rehabilitated to woodland. This domain will cover approximately 443 ha.
Rehabilitation Area – State Forest (existing)	The areas of the Jacks Creek and Pilliga East State Forests are within ML and are impacted by mining, such as subsidence areas will continue to be used for forestry post-mining. This domain will cover approximately 367 ha.
Conservation and Biodiversity Offset Area	Area that will be conserved for biodiversity offset following the cessation of mining (approximately 1,590 ha). In accordance with the EPBC approval, a legally binding conservation covenant will be placed on the title of this domain following the cessation of mining.

2.3 Final land use statement

As discussed in section 2.2, the final land use goal is to create a physically and chemically stable landform that is adequately drained and integrates with the surrounding landform with all mine-induced subsidence remediated and rehabilitated.

The rehabilitation of mining disturbed areas will be planned to deliver final land uses that achieve biodiversity and agricultural outcomes. Rehabilitated landforms will also integrate with the adjoining State Forests to enhance regional biodiversity and conservation outcomes.

Final land use themes will include native ecosystem, agricultural grazing, rehabilitation biodiversity offset areas, and water management areas. The rehabilitation objectives statement is detailed in section 4.2, with

² Whitehaven Coal Narrabri Coal Operations Pty Ltd (29 November 2021). Narrabri Mine Mining Operations Plan (MOP) / Landscape Management Plan 1 December 2020 – 31 December 2023 Amendment B

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the final land use for the Narrabri Mine spatially depicted on the Final Landform and Rehabilitation Plan (Refer to Figure 5-1).

2.4 Final land use and mining domains

2.4.1 Final land use domains

Final land use domains are defined as areas of land characterised by the same final land use objective. Each final land use unit represents a separate final land use domain which require specific rehabilitation objectives.

The final land use domains relevant to the Narrabri Mine are presented in Table 2-3 and are depicted on the Final Landform and Rehabilitation Plan (Figure 5-1).

Table 2-3 Narrabri Mine final land use domains

Code	Final land use domain	Description
A	Native ecosystem	Woodland areas that have been impacted by mining such as underground mining areas and infrastructure areas. This includes areas of the Jacks Creek and Pilliga East State Forests. These areas will be rehabilitated to restore ecosystem function, including maintaining or establishing self-sustaining native ecosystems comprised of local native plant species.
B	Agricultural – grazing	Landholdings that were previously used for agriculture and have been impacted by mining such as underground mining areas and infrastructure areas will be rehabilitated to pre-mining agricultural land capable of pasture production and occasional cropping.
D	Rehabilitation Biodiversity Offset Area	Areas of woodland vegetation within the onsite BOA that that have been impacted by mining such as underground mining areas and infrastructure areas will be rehabilitated and maintained in accordance with the Biodiversity Offset Management Plans.
G	Water Storage	Water management structures including drainage.

2.4.2 Mining domains

Mining domains are defined as the footprint of areas disturbed for discrete mining-related activities. They have discrete geophysical and geochemical characteristics that will require specific rehabilitation treatments to achieve the final land use.

The mining domains relevant to the Narrabri Mine are presented in Table 2-4.

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Table 2-4 Narrabri Mine mining domains

Code	Mining Domain	Description
1	Infrastructure area	<p>This domain incorporates all surface infrastructure, including:</p> <ul style="list-style-type: none"> • site access road and internal access tracks; • office and administration buildings; • light vehicle carpark, and equipment laydown areas; • workshop and stores buildings; • electrical sub-station and associated electricity infrastructure; • rail loop and train loadout bin and train loader; • sewage treatment plant; • box cut and mine portals; • drift and skyline conveyors; • explosives magazine; • ventilation fans and shafts, gas drainage and mine safety pre-conditioning infrastructure, and water pipelines; and • stockpiled topsoil, as well as the material stockpiled in the visual amenity bund.
3	Water management area	Incorporates the network of dams, lined evaporation ponds, brine storage ponds, water diversion bunds and associated water management infrastructure.
4	Overburden emplacement area	Reject Emplacement Area
6	Underground mining area	The area to be managed for subsidence impacts, for example subsidence management area in accordance with an extraction plan. Excludes 'Infrastructure areas' such as ventilation shafts and other surface infrastructure associated with underground mining
7	Beneficiation facility	Coal crushing station, Coal Handling and Preparation Plant (CHPP), ROM and product coal pad hardstand areas.

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3. Rehabilitation risk assessment

3.1 Summary of historic risk assessments

Multiple risk assessments have been completed for rehabilitation works associated with the Narrabri Mine. Table 3-1 summarises the completed rehabilitation risk assessments to date.

Table 3-1 Rehabilitation risk assessments

Date	Risk Assessment	Details
10 August 2015	Risk Assessment workshop	A risk assessment was undertaken during the preparation of the 2015 MOP to address all risks to rehabilitation. The risk assessment was undertaken in accordance with <i>AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines</i> , along with the Whitehaven risk assessment process.
5 August 2020	Broad Brush Risk Assessment - Narrabri Mine MOP Amendment B Rehabilitation Risk Assessment	The rehabilitation risk assessment was reviewed and updated during the preparation of the 2020 MOP (v2, 29 November 2021). The review included consideration of Whitehaven’s latest risk matrix and incorporated consideration of the DRAFT <i>Guideline 1 - Rehabilitation Risk Assessment</i> (DPIE-RR 2018). The workshop assessed 43 rehabilitation risks, all of which were identified as low or moderate risk, given the existing controls in place. No elements were categorised as being a high or critical risk.
10 to 15 January 2021	Bow Tie Risk Assessment	The Bow Tie risk assessment was undertaken to identify critical controls required to be implemented onsite to prevent non-compliances with the Project Approval, mining lease and relevant licenses, and to manage environmental obligations.
11 May 2022 and 18 May 2022	Risk Assessment workshop	The workshop was used to identify key issues that may present a risk to achieving the rehabilitation objectives, completion criteria, and final landform and rehabilitation plan documented in this RMP and to align with the requirements of the <i>Mining Amendment (Standard Conditions of Mining Leases—Rehabilitation) Regulation 2021</i> and the <i>Guideline: Rehabilitation Risk Assessment</i> ³ .

3.2 Current rehabilitation risk assessment

Conditions of a mining lease granted under the *Mining Act 1992* require the lease holder to conduct a rehabilitation risk assessment and implement measures to eliminate, minimise or mitigate the risks in accordance with the *Guideline: Rehabilitation risk assessment*.

A risk assessment workshop was undertaken on 11 and 18 May 2022. The workshop was used to identify the key issues that presented a risk to achieving rehabilitation at the Narrabri Mine.

³ NSW Resources Regulator (2021) *Guideline: Rehabilitation Risk Assessment*

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The risk assessment included key WHC personnel and was conducted in accordance with the *AS/NZS ISO 31000:2018 Risk Management – Guidelines* and the *Risk Management Handbook for the Mining Industry (MDG1010)*. The WHC Risk Matrix was used to calculate the consequence and likelihood of an event and to evaluate the subsequent risk level (risk rank).

The risk assessment has been used to inform the preparation of this RMP. The objectives of the risk assessment were to:

- identify the risks associated with rehabilitation and closure of Narrabri to achieve the approved post mining land uses;
- identify knowledge gaps in Whitehaven's current understanding of the risks to rehabilitation;
- identify the investigations/controls/action plans necessary to effectively mitigate risks and/or realise opportunities and to close any identified knowledge gaps;
- inform the development of this RMP, to provide a basis to determine additional investigations and/or project works to be undertaken; and
- provide the framework to satisfy relevant internal and government guidelines, requiring implementation of a risk-based approach to closure.

The risk workshop assessed a total of 53 key rehabilitation risks, which were ranked as follows:

- 10 risks were ranked as not applicable;
- 30 risks were ranked as low;
- 13 risks were ranked as moderate;
- 0 risks were ranked as high; and
- 0 risks were ranked as critical.

All risks rated as 'moderate' have been adopted as the key risks to rehabilitation. These key risks, associated risk controls and a cross reference to where these controls have been captured in the RMP (or other management plans) are summarised in Appendix A Risk assessment summary. A copy of the full risk assessment is maintained on the NCOPL server and will be available as a record in accordance with Schedule 8A, Clause 17 of the Mining Regulation 2016. Rehabilitation risks, controls and proposed controls will regularly be reviewed and revised (as required).

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4. Rehabilitation objectives and rehabilitation completion criteria

4.1 Rehabilitation objectives and completion criteria

Table 4-1 lists the rehabilitation objectives and rehabilitation completion criteria associated with each final land use domain and specific mining domains. The rehabilitation objectives were approved by the Resources Regulator on 18 October 2023. The rehabilitation completion criteria are proposed criteria subject to approval by the Resources Regulator.

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Table 4-1 Rehabilitation domain objectives and completion criteria

Final land use domain	Mining domain	Spatial reference	Rehabilitation objective	Indicator	Proposed completion criteria	Validation method
Native Ecosystem	Infrastructure Area	A1	Removal of infrastructure: All surface infrastructure that is not to be used as part of the final land use is removed to ensure the site is safe and free of hazardous materials.	Removal of all services (power, water, communications) that have been connected on site as part of operation.	All utility infrastructure removed.	<ul style="list-style-type: none"> Statement provided. Utility services disconnection records/notification.
				Heritage obligations (e.g. development consent under the <i>Environmental Protection and Assessment Act 1979</i> , approvals under the <i>Heritage Act 1977</i>) have been met (e.g. archival recording).	All archival reports required are complete and submitted.	<ul style="list-style-type: none"> Close out report. Archival reports/records.
Rehabilitation Biodiversity Offset Area	Infrastructure Area	D1	Removal of infrastructure: All surface infrastructure that is not to be used as part of the final land use is removed to ensure the site is safe and free of hazardous materials.	Removal of all plant, equipment and associated infrastructure including processing facilities, stockpile areas, rail infrastructure and loading facilities, office complex, portable offices, storage racks, geological samples, maintenance sheds.	Infrastructure removed.	<ul style="list-style-type: none"> As-constructed final landform plan. Photos. Decommissioning reports. Site inspection records.
				Removal of all footings to a certain depth.	Footings removed to 1 m below surface to avoid exposure pathways to subsequent final land use.	Surveyed and marked on the as-constructed final landform plan.
Agricultural – Grazing	Infrastructure Area	B1	Removal of infrastructure: All surface infrastructure that is not to be used as part of the final land use is removed to ensure the site is safe and free of hazardous materials.	Surveying and sealing of all drill holes, boreholes, preconditioning areas and gas wells in accordance with department guidelines and relevant standards.	Sealing completed and verified.	<ul style="list-style-type: none"> Engineering report/statement. Plug and abandonment log. Photos. As-constructed drawings. Records of fill materials and concrete plugs. Filling methods.
				Surveying and sealing of all underground mine entries in accordance with the department guidelines and relevant standards.	Sealing completed and verified by suitably qualified engineer.	<ul style="list-style-type: none"> Engineering report/statement. Plug and abandonment log. Photos. As-constructed drawings. Records of fill materials and concrete plugs. Filling methods.
	Overburden emplacement area	B4				
	Beneficiation facility	B7				



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Final land use domain	Mining domain	Spatial reference	Rehabilitation objective	Indicator	Proposed completion criteria	Validation method	
Agricultural - grazing	Infrastructure Area	B1	Removal of infrastructure: All water management infrastructure that is not to be used as part of the final land use is removed to ensure the site is safe and free of hazardous materials.	Removal of all water management infrastructure such as pumps, pipes and power.	Water infrastructure removed.	<ul style="list-style-type: none"> Statement provided. Before/after photos. 	
	Water Management Area	B3			Removal of the Namoi River pump station, alluvial production bore and pipeline.		
Water Storage	Water Management Area	G3	Retention of infrastructure: All infrastructure that is to remain as part of the final land use is safe and does not pose any hazard to the community.	The structural integrity of the infrastructure is suitable and safe for use as part of the intended final land use.	The structural integrity of the infrastructure has been inspected by a suitably qualified engineer and determined to be suitable and safe as part of the intended final land use.	<ul style="list-style-type: none"> Engineering report/statement. Photos. 	
				Infrastructure is in a condition (e.g. structural, other hazards) that is suitable for the intended final land use.	Formal acceptance from the subsequent landowner that infrastructure is in a condition that is suitable for the intended final land use in accordance with formal agreement.		<ul style="list-style-type: none"> Formal acceptance from Landowner.
				Water quality in sediment dams is non-polluting.	Sediment accumulated in sediment dams is appropriately removed or remediated. Water quality within the dams meet specifications in Environment Protection License.		<ul style="list-style-type: none"> Water quality monitoring reports. Environment Protection Licence relinquished by Environment Protection Authority.
Native Ecosystem	Infrastructure Area	A1	Land contamination: There is no residual soil contamination on site that is incompatible with the final land use or that poses a threat of environmental harm.	Waste material and/or visible contamination areas on site surface.	There are no visible signs of contamination following the removal of plant, equipment, and materials. All rubbish/ waste materials removed from site.	<ul style="list-style-type: none"> Statement provided. Before/after photos. 	
Agricultural - grazing	Infrastructure Area	B1		Soil testing for contaminants of concern as listed by the Health Investigation Level of the <i>National Environment Protection (Assessment of Site Contamination) Measure (1999)</i> applicable to the land use type.	Contamination will be appropriately remediated so that appropriate guidelines for land use are met, e.g. Health Investigation Level of the <i>National Environment Protection (Assessment of Site Contamination) Measure (1999)</i> . Excess sludge/material has been removed from surface water dams.		<ul style="list-style-type: none"> Contamination Remediation Report prepared by Land Contamination Consultant. Site Contamination Audit Report and Site Audit Statement prepared by EPA Accredited Auditor (where required).
	Water Management Area	B3					
	Overburden emplacement area	B4					
	Beneficiation facility	B7					
Rehabilitation Biodiversity Offset Area	Infrastructure Area	D1					
Water Storage	Water Management Area	G3					

Final land use domain	Mining domain	Spatial reference	Rehabilitation objective	Indicator	Proposed completion criteria	Validation method
Agricultural - grazing	Overburden emplacement area	B4	<p>Management of waste and process materials:</p> <p>Residual waste materials stored on site (e.g. coarse rejects and other wastes) will be appropriately contained/encapsulated so it does not pose any hazards or constraints for intended land use.</p>	<ul style="list-style-type: none"> Visual - capping material placement, type across emplacement Visual – indication of capping performance on final landform – vegetation health Visual – emplacement seepage and other indicators of groundwater issues (e.g. wet spots) Measured - survey of emplacement capping to verify construction and to monitor settlement. Quality assurance records for the construction of the emplacement material including (where relevant) capping material, liner system, seepage control. Measured- surface and groundwater levels to verify water balance modeling and capping function Measured – contamination levels in surface and groundwater surrounding emplacement for contaminants of concern associated with waste material emplaced. 	<ul style="list-style-type: none"> Visual – verification that capping, type and placement consistent with design (REA Closure Design Report ⁴). Visual – no signs of compromised capping performance indicated by vegetation health – such as tree death (deeper root systems) Visual – no areas of unexpected seepage Survey verifies that capping placement consistent with design (REA Closure Design Report) and settlement and/or material loss is within predicted limits and will not compromise final landform drainage via differential settlement. Quality assurance records verify capping constructed and in accordance with design specifications relevant to site risks and target final land use (REA Closure Design Report). Groundwater and surface water monitoring verify adequate containment of waste materials and seepage/leachate is not contributing to land/groundwater contamination. 	<ul style="list-style-type: none"> Photos. Rehabilitation monitoring reports As constructed surveys. Quality assurance records for construction Erosion surveys. Independent geotechnical reports (where required), groundwater/surface water monitoring reports. <p>The structural integrity of the infrastructure and capping has been inspected by a suitably qualified engineer and determined to be suitable and safe as part of the intended final land use and water material adequately contained.</p>
Native Ecosystem	Infrastructure Area	A1	<p>Landform stability:</p> <p>The final landform is stable for the long-term and does not present a risk of environmental harm downstream/downslope of the site or a safety risk to the public/stock/native fauna. Landform that is commensurate with surrounding natural landform and where appropriate, incorporates geomorphic design principles.</p>	<ul style="list-style-type: none"> Visual - indicators of erosion and land instability. Visual - indicators that surface water management structures are functioning as designed. Measured - Survey of rehabilitated landform to verify final landform construction in accordance with Final Landform and Rehabilitation Plan. Measured - survey of rehabilitated landform to specifically monitor settlement and/or material loss via erosion at the REA. 	<ul style="list-style-type: none"> Visual – minimal erosion that would not require moderate to significant ongoing management and maintenance works (i.e. no active gully or rill erosion >200 mm in depth). Visual – no signs of land instability such as mass movement. Visual - no evidence of tunnel erosion. Visual - no evidence of active scour likely to compromise surface water management structure. Survey verifies final landform complies with final landform construction in accordance with Final Landform and Rehabilitation Plan. <p>Survey verifies that settlement and/or material loss at the REA is within predicted limits and will not compromise final landform drainage via differential settlement.</p> <p>Significant surface water management structures (e.g. spillways, drop structures, major drains and</p>	<ul style="list-style-type: none"> Before and after photos. Rehabilitation monitoring reports. As-constructed surveys. Erosion surveys. Independent geotechnical reports (where required) and/or erosion modelling reports (where required) that indicate long-term stability of rehabilitated landform.
	Underground Mining Area	A6				
Agricultural – grazing	Infrastructure Area	B1				
	Water Management Area	B3				
	Overburden emplacement area	B4				
	Underground Mining Area	B6				
Rehabilitation Biodiversity Offset Area	Beneficiation facility	B7				
	Infrastructure Area	D1				
	Underground Mining Area	D6				

⁴ ATC Williams (January 2022). Narrabri Mine Rejects Emplacement Area Capping Assessment and Closure Design. Prepared for Narrabri Coal Operations Pty Ltd.

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Final land use domain	Mining domain	Spatial reference	Rehabilitation objective	Indicator	Proposed completion criteria	Validation method
Water Storage	Water Management Area	G3			creek diversions) have been constructed in accordance with hydrological design.	structures (e.g. spillways, drop structures, major drains and creek diversions) have been constructed in accordance with hydrological design.
Native Ecosystem	Infrastructure Area	A1	Bushfire: The risk of bushfire and impacts to the community, environment and infrastructure has been addressed as part of rehabilitation.	Appropriate bushfire hazard controls (where required) have been implemented on the advice from the NSW Rural Fire Service.	Bushfire controls implemented.	<ul style="list-style-type: none"> Statement provided. Before/after photos.
Agricultural – grazing	Infrastructure Area	B1				
	Water Management Area	B3				
	Overburden emplacement area	B4				
	Beneficiation facility	B7				
Rehabilitation Biodiversity Offset Area	Infrastructure Area	D1				
Water Storage	Water Management Area	G3				
Native Ecosystem	Infrastructure Area	A1	Surface Water: Runoff water quality from mine site is similar to, or better than the pre-disturbance runoff water quality.	Water quality parameters selected from the Environment Protection Licence or the site-specific trigger values documented in the Surface Water Management Plan.	Water quality discharged from rehabilitated mining operation meet specifications in Environment Protection License or meet the site-specific triggers values.	<ul style="list-style-type: none"> Water quality monitoring reports. Environment Protection Licence relinquished by Environment Protection Authority.
	Underground Mining Area	A6				
Agricultural – grazing	Infrastructure Area	B1				
	Water Management Area	B3				
	Overburden emplacement area	B4				
	Underground Mining Area	B6				
	Beneficiation facility	B7				
Rehabilitation Biodiversity Offset Area	Infrastructure Area	D1				
	Underground Mining Area	D6				
Water Storage		G3				

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Final land use domain	Mining domain	Spatial reference	Rehabilitation objective	Indicator	Proposed completion criteria	Validation method
	Water Management Area					
Water Storage	Water Management Area	G3	Water Approvals: Structures that take or divert water such as dams or levees are appropriately licensed (e.g. under the <i>Water Management Act 2000</i>) and where required, ensure sufficient licence shares are held in the water source(s) to account for water take.	Final landform considers advice from relevant Government Agency whether sufficient licence shares are available in the water source to account for water stored in dams in the proposed final landform.	Water approvals / licences are granted by relevant NSW Government Agency (if required).	Confirmation from relevant Government Agency that relevant water approvals/licences are able to be granted.
Native Ecosystem	Infrastructure Area	A1	Groundwater Quality: Groundwater quality is similar to, or better than the pre-disturbance groundwater quality.	Water quality parameters selected from site-specific trigger values documented in the Water Management Plan.	Ground water quality meets specifications in the Water Management Plan.	Independent hydrogeological assessment report.
		Underground Mining Area				
Agricultural – grazing	Infrastructure Area	B1				
	Water Management Area	B3				
	Overburden emplacement area	B4				
	Underground Mining Area	B6				
	Beneficiation facility	B7				
Rehabilitation Biodiversity Offset Area	Infrastructure Area	D1				
	Underground Mining Area	D6				
Native Ecosystem	Underground Mining Area	A6				
Agricultural – grazing	Water Management Area	B3				
	Overburden emplacement area	B4				
	Underground Mining Area	B6				
	Beneficiation facility	B7				



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Final land use domain	Mining domain	Spatial reference	Rehabilitation objective	Indicator	Proposed completion criteria	Validation method
Rehabilitation Biodiversity Offset Area	Underground Mining Area	D6				
Native Ecosystem	Infrastructure Area	A1	The vegetation composition of the rehabilitation contains species that are commensurate with native vegetation communities of Brown Bloodwood/Pilliga Box Woodland found in the local area.	Native plant species recorded from 0.04 hectare fixed monitoring plots are characteristic of the target vegetation community.	Native plant species are characteristic of the target vegetation community(s) when compared to analogue sites.	<ul style="list-style-type: none"> Rehabilitation monitoring reports. Independent ecological reports (where required) that validate rehabilitation completion criteria have been met.
Rehabilitation Biodiversity Offset Area	Infrastructure Area	D1				
	Underground Mining Area	D6				
Native Ecosystem	Infrastructure Area	A1	The vegetation composition of the rehabilitation contains species that are commensurate with native vegetation communities of Inland Grey Box Woodland found in the local area.			
	Underground Mining Area	A6				
Rehabilitation Biodiversity Offset Area	Infrastructure Area	D1				
	Underground Mining Area	D6				
Native Ecosystem	Infrastructure Area	A1	The vegetation composition of the rehabilitation contains species that are commensurate with native vegetation communities of Riparian Forest found in the local area.			
	Underground Mining Area	A6				
Rehabilitation Biodiversity Offset Area	Infrastructure Area	D1				
	Underground Mining Area	D6				
Native Ecosystem	Infrastructure Area	A1	The vegetation composition of the rehabilitation contains species that are commensurate with native vegetation communities of Callitris Forest found in the local area.			
Native Ecosystem	Infrastructure Area	A1	The vegetation structure of the rehabilitation is similar to that of native vegetation communities of Brown Bloodwood/Pilliga Box Woodland found in the local area.	Cover and abundance of plant growth forms recorded from 0.04 hectare fixed monitoring plots are characteristic of the target vegetation community, or an ongoing trend toward becoming characteristic is evident from the monitoring data.	Cover, abundance and height range of native plant growth forms are characteristic of, or trending towards, the target vegetation community type(s).	
Rehabilitation Biodiversity Offset Area	Infrastructure Area	D1				
	Underground Mining Area	D6				
Native Ecosystem	Infrastructure Area	A1	The vegetation structure of the rehabilitation is similar to that of native vegetation communities of Inland Grey Box Woodland found in the local area.			
	Underground Mining Area	A6				
	Infrastructure Area	D1				



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Final land use domain	Mining domain	Spatial reference	Rehabilitation objective	Indicator	Proposed completion criteria	Validation method	
Rehabilitation Biodiversity Offset Area	Underground Mining Area	D6	The vegetation structure of the rehabilitation is similar to that of native vegetation communities of Riparian Forest found in the local area.				
Native Ecosystem	Infrastructure Area	A1					
	Underground Mining Area	A6					
Rehabilitation Biodiversity Offset Area	Infrastructure Area	D1					
	Underground Mining Area	D6					
Native Ecosystem	Infrastructure Area	A1	The vegetation structure of the rehabilitation is similar to that of native vegetation communities of Callitris Forest found in the local area.				
Native Ecosystem	Infrastructure Area	A1	Levels of ecosystem function have been established that demonstrate the rehabilitation is self-sustainable.	Indicators of nutrient cycling are suitable for sustaining the target vegetation community.	Litter cover is within the 10 th – 90 th percentile variation range of analogue sites/data	Rehabilitation monitoring reports.	
	Underground Mining Area	A6					
Rehabilitation Biodiversity Offset Area	Infrastructure Area	D1		Evidence of plant regeneration from 0.04 hectare fixed monitoring plots.	Second generation individuals of trees are within the 10 th - 90 th percentile variation range of analogue sites/data.	<ul style="list-style-type: none"> Rehabilitation monitoring reports. Independent ecological reports (where required) that validate rehabilitation completion criteria have been met. 	
		Underground Mining Area		D6	Cover of exotic species within 0.04 hectare fixed monitoring plots is low.	Foliage cover of 'high threat exotic' (HTE) weeds is within the 10 th - 90 th percentile variation range of analogue sites/data.	<ul style="list-style-type: none"> Rehabilitation monitoring reports. Independent ecological reports (where required) that validate rehabilitation completion criteria have been met.
					Soil health is suitable to sustain the target vegetation community(s).	Total organic carbon is within 10 th - 90 th percentile variation range of analogue sites/data.	<ul style="list-style-type: none"> Rehabilitation monitoring reports. Independent soil reports (where required) that demonstrate long-term function of rehabilitated landform.
					Threats to rehabilitation.	Vertebrate pest species – no increase in pest animal populations. Domesticated stock – presence and damage are recorded and controlled.	Rehabilitation monitoring reports.
Agricultural - grazing	Infrastructure Area	B1	Agricultural Revegetation: Revegetation is sustainable for the long-term and only requires maintenance that is consistent with the intended final land use. Land use capability is capable of supporting the target agricultural land use.	Routine Soil Test (bulk soil cores 0-10 cm) – Includes: Total Carbon (TC), Total Nitrogen (TN), Organic Matter, TC/TN Ratio; Bray Land II Phosphorus; Colwell Phosphorus; Available cations (Calcium, Magnesium, Potassium, Ammonium, Nitrate, Phosphate, Sulfur); Available Micronutrients (Zinc, Manganese, Iron, Copper, Boron, Silicon); Exchangeable (Sodium, Potassium, Calcium, Magnesium, Hydrogen, Aluminium, Cation Exchange Capacity); pH and EC (1:5 water); Basic Colour, Basic Texture.	Land and Soil Capability classification or Agricultural Land Classification criteria met.	<ul style="list-style-type: none"> Rehabilitation monitoring reports. Independent soil reports or independent agronomist reports. 	
	Water Management Area	B3					

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Final land use domain	Mining domain	Spatial reference	Rehabilitation objective	Indicator	Proposed completion criteria	Validation method
	Overburden emplacement area	B4		Commodity data (stocking rates, pasture composition).	The re-established topsoil / subsoil substrate is capable of supporting the targeted pasture / cropping regime on a sustained basis.	
	Underground Mining Area	B6			Pasture establishment is consistent with the range of species utilized within the region.	
					Pasture establishment is in good health and provides adequate cover.	
	Beneficiation facility	B7			Appropriate and reliable access to water for livestock.	

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4.2 Rehabilitation objectives and rehabilitation completion criteria - stakeholder consultation

Rehabilitation stakeholder consultation undertaken to date is summarised in Table 4-2.

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Table 4-2 Rehabilitation stakeholder consultation

Stakeholder	Date	Method of consultation	Matters raised	Actions taken by NCOPL
Narrabri Coal Stage 1 and Stage 2				
Various	2004	Various	During the scoping phase of Narrabri Coal Stage 1 Project, consultation was conducted with statutory regulators, other stakeholders and community members. During the assessment phase, the issues raised included all potential impacts of the project to the surrounding environment including discussions around how the project would be rehabilitated and closed.	Address any issues raised during the approval process.
Various	September 2008	Planning Focus Meeting	A Planning Focus Meeting was held for the proposed Longwall Project on 2 September 2008. The meeting was attended by representatives from all relevant government agencies and included a site visit and a presentation about the project. Issues raised included all potential impacts of the project to the surrounding environment including discussions around the proposed rehabilitation strategy and final landform.	Address any issues raised during the approval process and reflect in the Statement of Commitments (Appendix 3 of PA 08_0144)
Owners, residents or leaseholders of properties within and adjacent to (within 2km) the mine	2009	Preliminary Environmental Assessment Report for Stage 2	Once the decision to progress the mining operations to the Stage 2 Longwall Project was made, a Preliminary Environmental Assessment for the proposed Longwall Project was prepared and a copy provided to the owners, residents or leaseholders of properties within and adjacent to (within 2km) the Mine Site to inform them of the Proponent's intention to develop the longwall mine. Along with the Preliminary Environmental Assessment, an invitation was provided to the landowners/ residents to comment on the proposal.	Address any issues raised during the approval process and reflect in the Statement of Commitments (Appendix 3 of PA 08_0144)
Consultation during Preparation of MOD 5 Environmental Assessment				
NSW Department of Planning, Industry and Environment (now DPE)	May 2015	Meetings relating to the Modification of PA 08_0144 (MOD 5) and associated Environmental Assessment.	An overview of MOD 5 key assessment requirements, preliminary environmental assessment outcomes and the proposed timing for EA lodgment.	Review and update the MOP (Revision B approved on 30 September 2015)

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Stakeholder	Date	Method of consultation	Matters raised	Actions taken by NCOPL
NSW Office of Environment and Heritage (now NSW Department of Environment and Heritage)	August 2015	Meeting relating to the Modification of PA 08_0144 (MOD 5) and associated Environmental Assessment.	An overview of Modification 5 and a summary of preliminary Aboriginal cultural heritage and biodiversity impacts were provided.	
NSW Office of Water (now DPE Water)	July 2015 August 2015	Provided briefing package relating to the Modification of PA 08_0144 (MOD 5) and associated Environmental Assessment with a follow up briefing package.	An overview of Modification 5 key assessment requirements, preliminary environmental assessment outcomes and the proposed timing for EA lodgment. A summary of surface and groundwater assessment outcomes and water licensing.	
NSW Division of Resources and Energy (now NSW Mining, Exploration and Geoscience [Resources Regulator])	July 2015 August 2015	Provided briefing package relating to the Modification of PA 08_0144 (MOD 5) and associated Environmental Assessment with a follow up meeting.	An overview of Modification 5 key assessment requirements, preliminary environmental assessment outcomes including resource recovery outcomes and the proposed timing for EA lodgment. It was noted that the existing mining tenement sufficient to cater for the Project.	
NSW Roads and Maritime Service (now Transport for NSW)	July 2015	Provided briefing package relating to the Modification of PA 08_0144 (MOD 5) and associated Environmental Assessment.	An overview of Modification 5 and potential road transport impacts, and proposed timing for EA lodgment.	
Environment Protection Authority (EPA)	July 2015	Meeting relating to the Modification of PA 08_0144 (MOD 5) and associated Environmental Assessment.	An overview of Modification 5, preliminary noise, air quality and water quality assessment outcomes were provided. Environment Protection Licence (EPL) 12798 variation requirements were also discussed. Items discussed included recent noise monitoring outcomes and noise movement responses by NCOPL.	
North-West Local Land Service (LLS)	July 2015	Provided briefing package relating to the Modification of PA 08_0144 (MOD 5) and associated Environmental Assessment.	An overview of Modification 5 key assessment requirements, preliminary environmental assessment outcomes and the proposed timing for EA lodgment.	
Forestry Corporation of NSW	August 2015	Provided briefing package relating to the Modification of PA 08_0144 (MOD 5) and associated Environmental Assessment.	A description of the small changes to the modified underground mine layout proposed.	

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Stakeholder	Date	Method of consultation	Matters raised	Actions taken by NCOPL
Narrabri Shire Council (NSC)	July 2015	Meeting via the CCC relating to the Modification of PA 08_0144 (MOD 5) and associated Environmental Assessment.	NSC were updated on Modification 5 through its involvement in the CCC.	
Gunnedah Shire Council (GSC)	July 2015	Meeting relating to the Modification of PA 08_0144 (MOD 5) and associated Environmental Assessment.	An overview of Modification 5 and the key environmental assessment issues related to the GSC were discussed during the meeting.	
Rail and port operators	No date provided	Previous consultation	Consulted with the Australian Rail Track Corporation regarding an increase in rail movements dispatched from the mine as a result of Modification 5.	
Registered Aboriginal Parties	July 2015	Site surveys	The Registered Aboriginal Parties were invited to participate in site surveys in July 2015. Details of site surveys are provided in Section 4.9 of the Environmental Assessment (Resource Strategies, 2015).	
CCC and affected landowners.	June 2015	Meeting and community newsletter relating to the Modification of PA 08_0144 (MOD 5) and associated Environmental Assessment.	An overview of Modification 5. Landholders in the vicinity of the mine were also provided information on the Modification in the Narrabri Mine Community Newsletter in August 2015.	
2016 MOP consultation				
NSW Division of Resources and Energy (now NSW Mining, Exploration and Geoscience)	January 2016 August 2016	Meeting	<p>Consultation undertaken regarding the requirements for MOP development. It was confirmed that following approval of MOD 5, a new MOP would be required that aligned with the requirements of <i>ESG3 - Mining Operations Plan (MOP) Guidelines, September 2013</i>. Aspects discussed at the meeting included:</p> <ul style="list-style-type: none"> Infrastructure remaining in the final landform (however for the purposes of this MOP it has been assumed all infrastructure will be removed); Tree deaths and ponding; 	Review and update the MOP (Revision C approved on 4 October 2016)

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Stakeholder	Date	Method of consultation	Matters raised	Actions taken by NCOPL
			<ul style="list-style-type: none"> The use of analogue sites in rehabilitation monitoring; Capping and monitoring of the REA; Consultation; and Exploration. <p>In response to consultation feedback, NCOPL undertook additional capping studies. The preliminary capping assessment report was issued to DRG in 2017. It was recommended that NCOPL conduct further assessment of some key aspects of the proposed capping and closure concepts.</p>	
NSW Resources Regulator	July 2019 April 2020	Submission of report	NCOPL submitted the REA Closure Design Report (ATC Williams, 2019). In April 2020, the Resources Regulator advised that the REA Capping Assessment & Closure Design Report was suitable for use and that the full report including recommendations and design criteria should be included in the next revision of the MOP for submission in 2020.	Revise MOP 2020
Secretary's endorsement for suitably qualified person				
DPE	July 2020	Letter	<p>Narrabri issued a letter to DPE on 17 July 2020 seeking the Secretary's endorsement of a suitably qualified expert to review the Landscape Management Plan for the Narrabri Coal Mine (PA 08_0144) and approval to incorporate this plan into the MOP.</p> <p>Narrabri received DPE endorsement and approval to combine the Plans "provided that all the requirements of the conditions of PA 08_0144 are adequately addressed in the MOP and that this information is presented in a clear and distinguishable format for the Department's review".</p> <p>To satisfy the requirements of Schedule 5, Condition 3 of PA 08_0144, consultation with key government departments was required for the revision of the Landscape Management Plan to encompass Stage 2</p>	Revision of the 2020 MOP (Approved on 26 November 2020)

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Stakeholder	Date	Method of consultation	Matters raised	Actions taken by NCOPL
			mining activities. All previously received feedback was considered in the revised MOP.	
Narrabri Mine Stage 3 Extension Project				
Resources Regulator	April 2019	Consultation response on the Stage 3 Environmental Impact Statement (EIS)	<p>During consultation for the Narrabri Mine Stage 3 Extension Major Project application, the Resources Regulator requested additional information to assess the suitability of geomorphic design principles for the final landform of the REA and assessment of the adequacy of the design for long term stability associated with erosion impacts, as follows:</p> <p>“As outlined in the letter from the Resources Regulator to DPIE dated 12 April 2019... the Regulator specified a requirement to evaluate geomorphological landform design characteristics. It is noted that the EIS does not include an evaluation of this issue, specifically in respect to the existing REA that is proposed to be utilised until the end of mine life in 2044.”</p> <p>“Section A5.2.2 of Attachment 5 (Rehabilitation & Mine Closure) of the Stage 3 EIS describes a conventional final landform design for the REA with limited detail in regard to final surface water drainage. While this section of the EIS references the ATC Williams 2019 review of the REA, which indicates the emplacement design has a very low risk of global batter failure or displacement, further information is required to assess the adequacy of the design for long term stability associated with erosion impacts. This is required to determine its capability to support the final land use outcomes of pastures for light grazing.”</p>	Revision to the REA Closure Design Report (ATC Williams, 2022)
Rehabilitation Objectives Statement (ROBJ)				
Resources Regulator	October 2022	Letter	The Rehabilitation Objectives Statement (ROBJ) (ROBJ0001146) for the Narrabri Colliery submitted on 9 September 2022 was assessed and refusal of the ROBJ provided to NCOPL.	Revision of the ROBJ and Final Landform and Rehabilitation Plan to address the Notice of Refusal reasons.

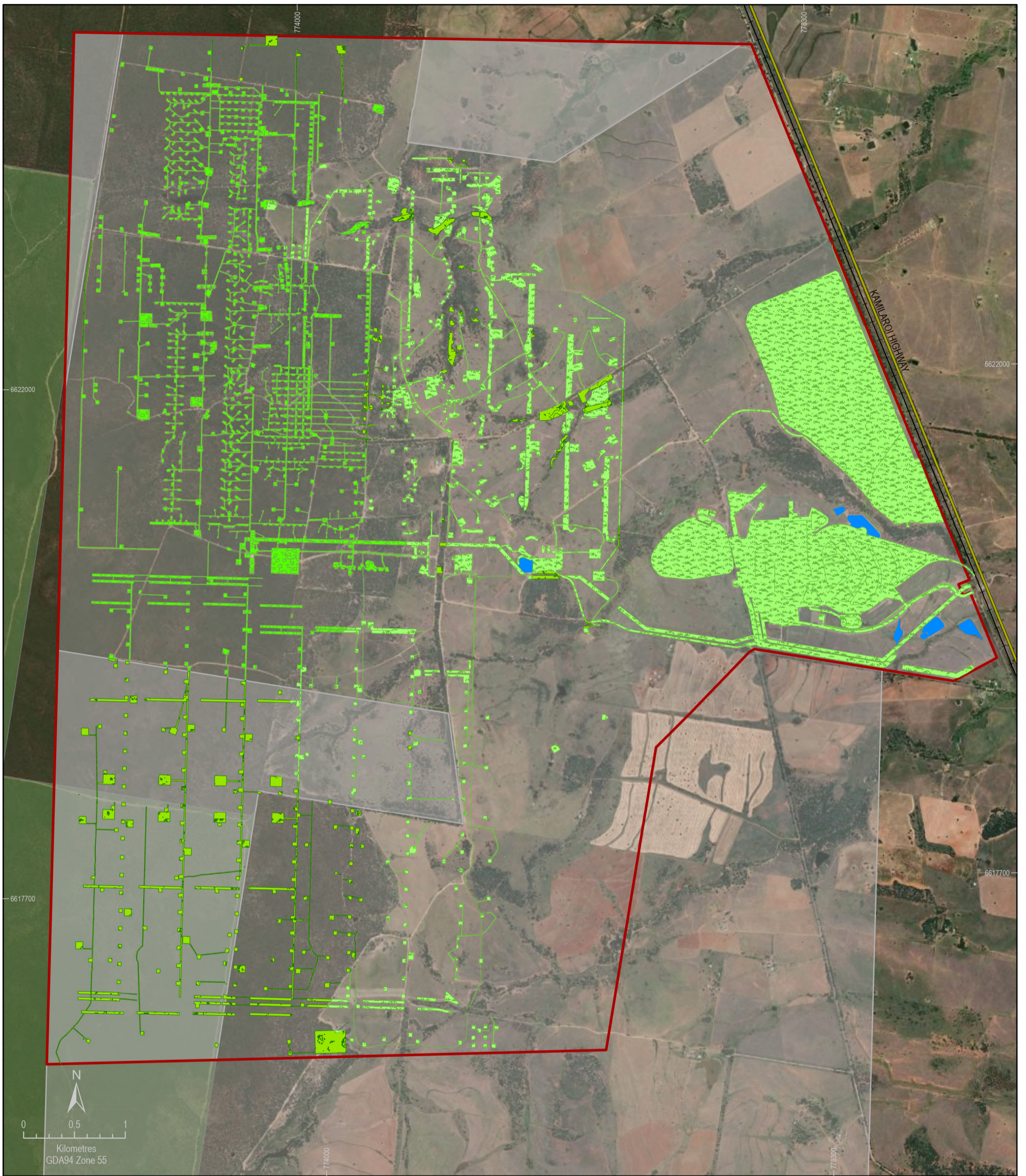
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Stakeholder	Date	Method of consultation	Matters raised	Actions taken by NCOPL
Resources Regulator	18 October 2023	Submission	The Rehabilitation Objectives Statement (ROBJ) and Final Landform and Rehabilitation Spatial Plan (FLRP) was assessed and approved.	Revision of RMP and submission of proposed rehabilitation completion criteria to the Resources Regulator.

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5. Final landform and rehabilitation plan

5.1 Final landform and rehabilitation plan – electronic copy



LEGEND

- Project Approval Boundary
- Coal - Current Titles
- Highway
- Railway
- State forest
- FnLndDom**
- Agricultural - Grazing
- Native Ecosystem
- Rehabilitation Biodiversity Offset Area
- Water storage



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Figure 5.1a

FLRP Plan 1: Final Landform Features
Surface Disturbance

Map created: 29 September 2023
Portal submission ID # 6220




- LEGEND**
- Project Approval Boundary
 - Final Landform Contours
 - Highway
 - Roads
 - Railway
 - State forest



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Figure 5.1b
FLRP Plan 2: Final Landform Contours

Map created: 29 September 2023
Portal submission ID # 6219

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6. Rehabilitation implementation

6.1 Life of mine rehabilitation schedule

Key infrastructure associated with the Pit Top Area (e.g. CHPP, brine storage ponds, REA, box cut, rail etc.) and ventilation shaft areas that will be in place for the life of mine have already been constructed and are planned to be decommissioned on cessation of mining and processing activities (i.e. 2031). Progressive decommissioning and rehabilitation will continue to occur for areas temporarily disturbed during the progressive development of the mine such as access roads, service and gas drainage boreholes, pre-conditioning areas, and subsidence cracks.

Detailed mine closure planning will commence a minimum of five years from the cessation of mining, in consultation with DPE, the Resources Regulator, NSC and the Community Consultative Committee (CCC). Detailed mine closure planning will further identify key actions, assessments, studies, detailed designs, and regulatory approvals required to decommission and/or demolish built infrastructure.

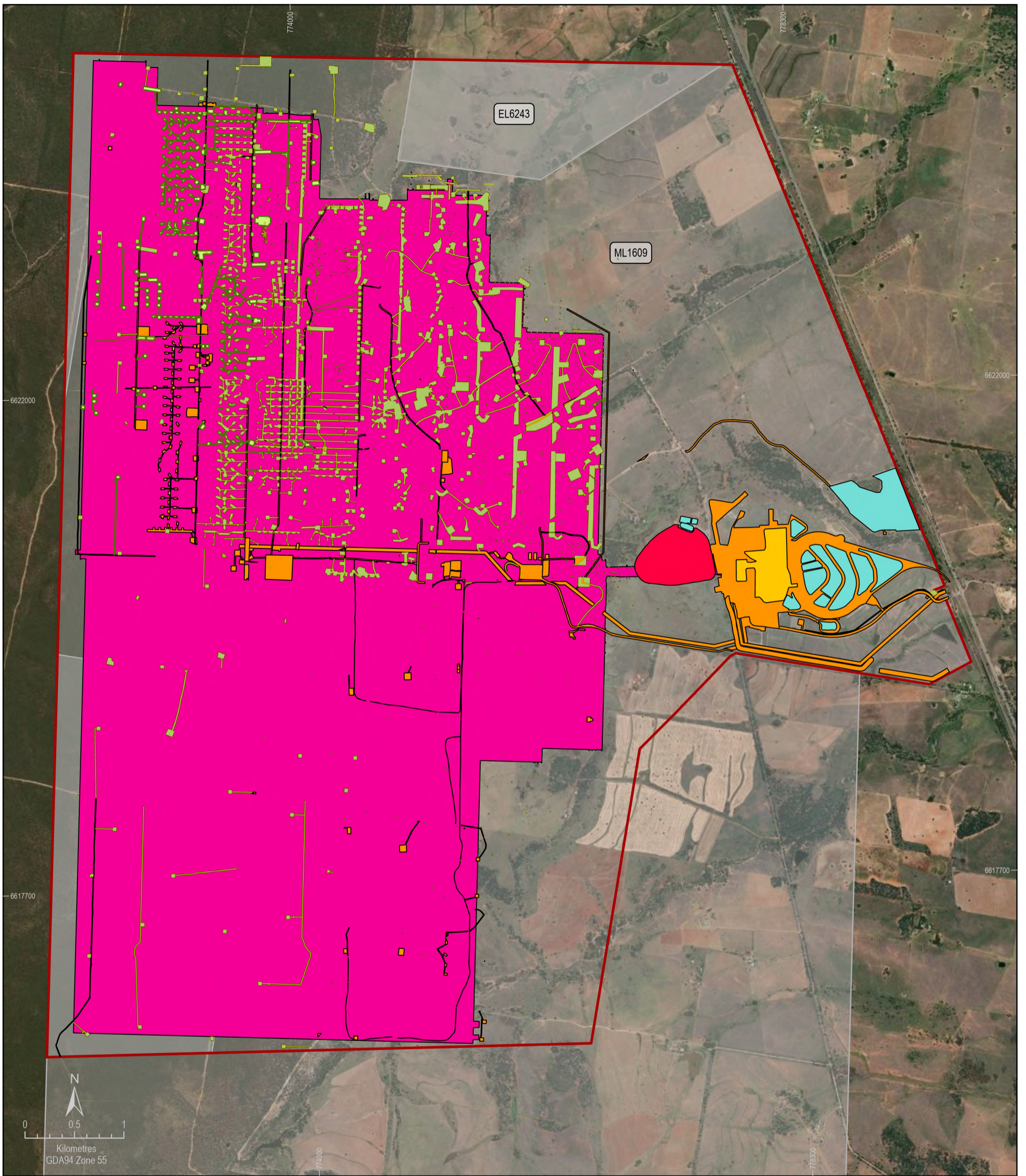
With cessation of mining activities in 2031, decommissioning and final rehabilitation activities will be completed. Ongoing environmental monitoring of surface water, groundwater, rehabilitation and biodiversity are expected to continue for at least five years post mining.

Construction and development activities that will progressively occur to support normal mining activities during the life of mine include:

- mining approved under PA 08_0144 until 2031 with a production rate of up to 11.0 Mtpa;
- goaf gas drainage behind the progressing longwall;
- clearing and maintenance of access tracks for as long as the goaf gas drainage is required to be maintained;
- drilling of service bores for the installation of services (i.e. compressed air, water, power or monitoring) or for gas extraction from underground to in-seam (UIS) gas drainage;
- mine safety pre-conditioning;
- construction of a number of brine storage ponds to the north of the Pit Top Area (as required) (Figure 1-2); and
- exploration activities within ML 1609.

Production milestones and resulting reject material volumes are the key assumptions that are relied on for the development of the life of mine rehabilitation schedule. Importantly, the staging of mining operations will be determined by the requirements of the coal market, product specification and/or blending requirements. As these requirements are likely to vary over the life of mine, the development sequence of the underground mine, coal extraction rates, gas drainage requirements and rehabilitation areas may vary accordingly. Changes to the life of mine rehabilitation schedule will be reflected in the Annual Rehabilitation Report and Forward Program. Subsequently, this RMP will be revised accordingly.

The current rehabilitation and disturbance to date is provided in Figure 6-1 Rehabilitation and disturbance to date and the current rehabilitation schedule is provided in Figures 6-1a-c.



LEGEND

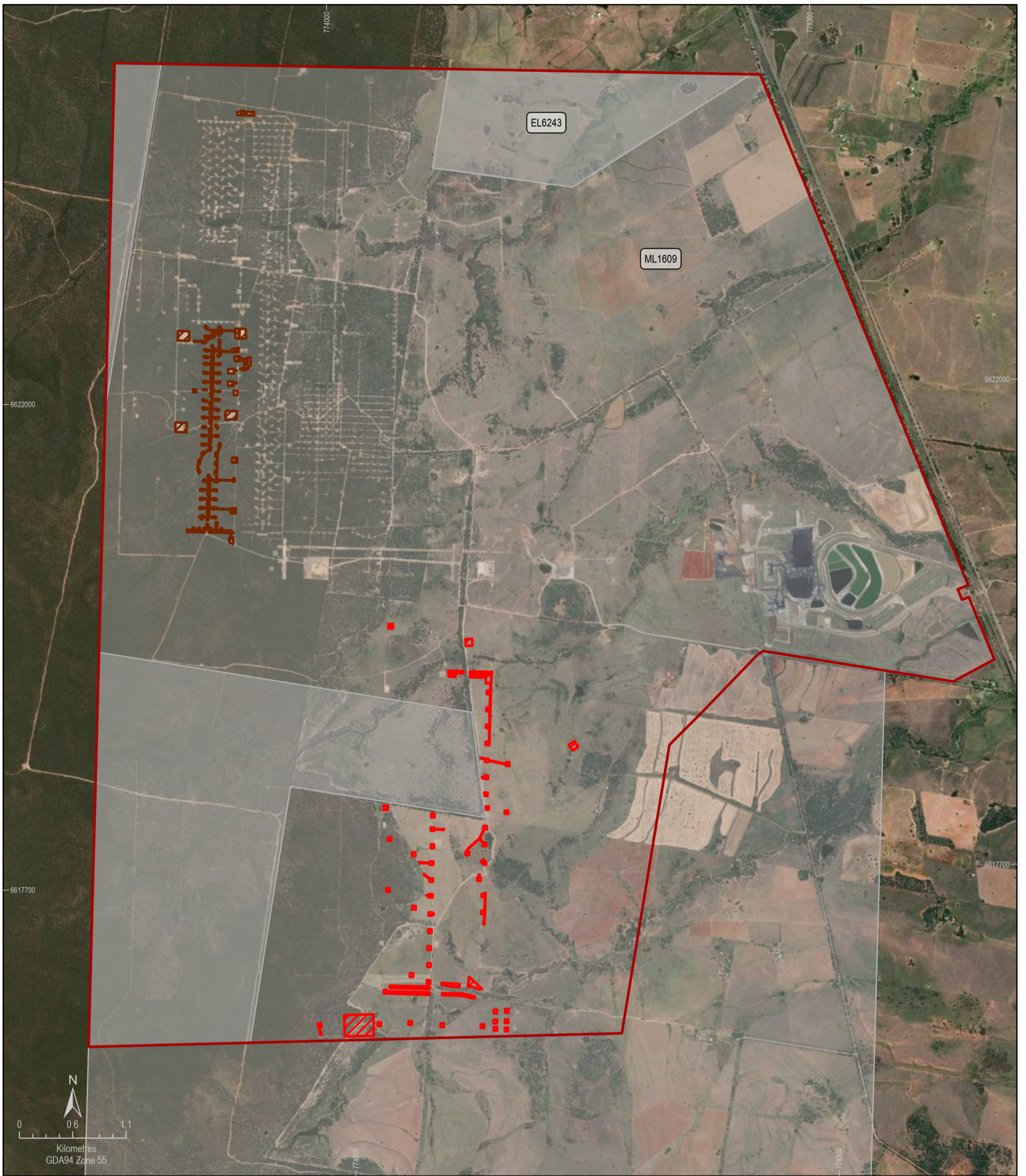
- | | |
|---|---|
|  Project Approval Boundary |  MineDomT Infrastructure Area |
|  Coal - Current Titles |  Beneficiation Facility |
| Rehabilitation preparation | |
|  Ecosystem and land use establishment |  Other |
|  Growth media development |  Overburden Emplacement Area |
| |  Underground mining area (SMP) |
| |  Water Management Area |



NARRABRI MINE

Figure 6.1

Status of mining and rehabilitation at completion of annual reporting period



LEGEND

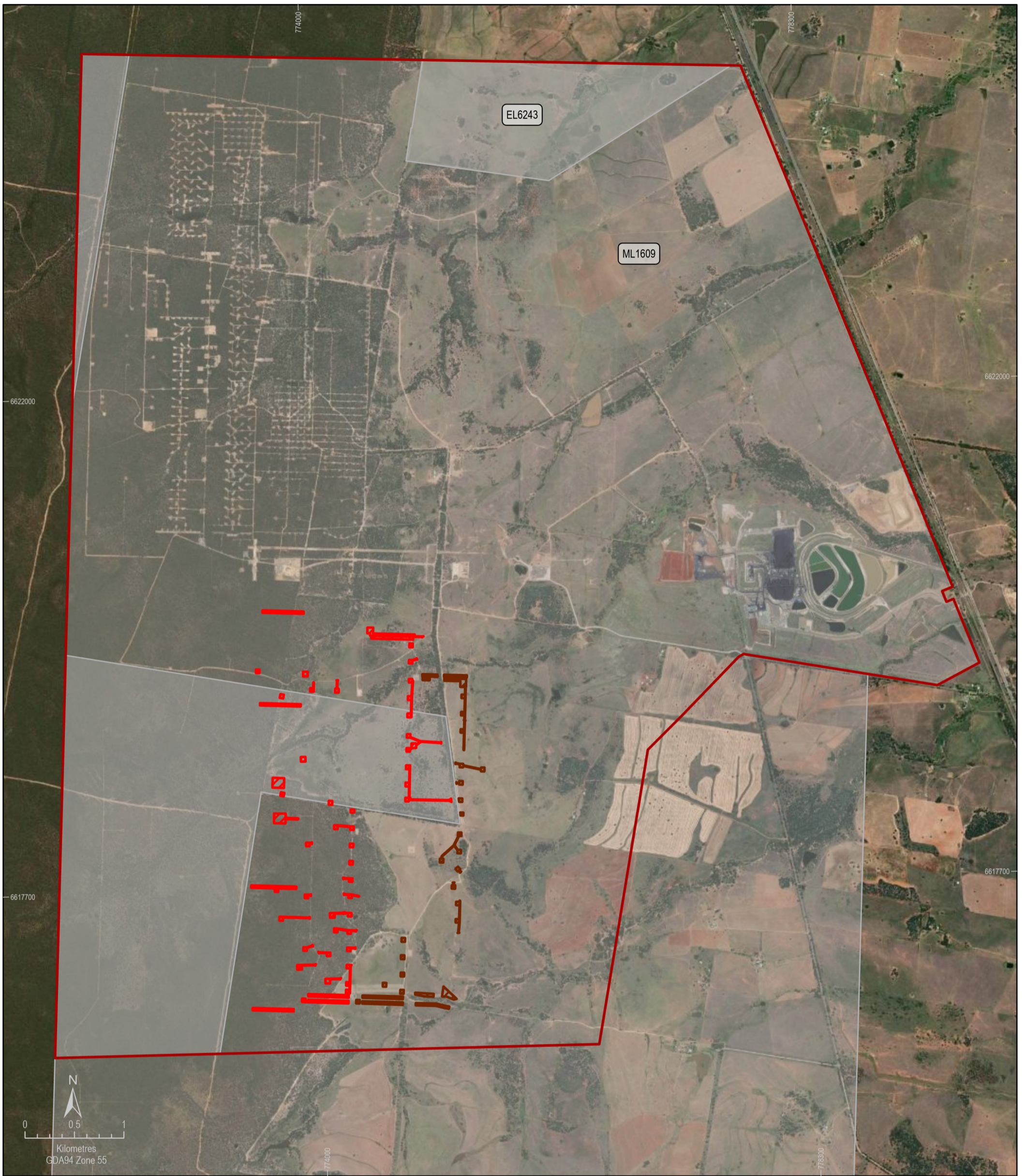
- Project Approval Boundary
- Coal - Current Titles
- Forecast Area**
- Forecast disturbance
- Forecast land prepared for rehabilitation



NARRABRI MINE

Figure 6.2a
Mining and Rehabilitation - Year 1 (2023)

Map created: 3 April 2023
Portal submission ID # 4583



LEGEND

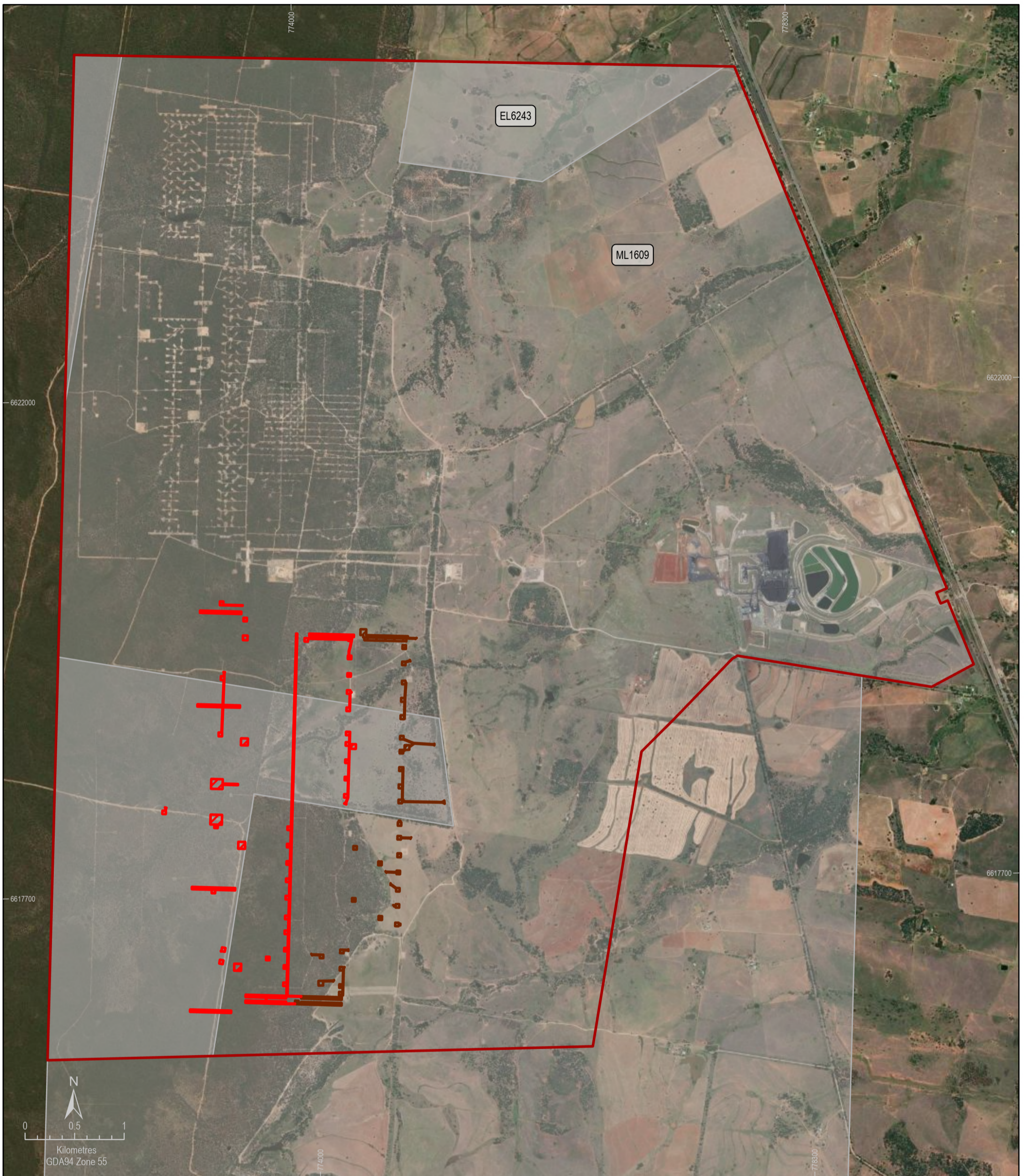
- Project Approval Boundary
- Coal - Current Titles
- Forecast Area**
- Forecast disturbance
- Forecast land prepared for rehabilitation



NARRABRI MINE

Figure 6.2b
Mining and Rehabilitation - Year 2 (2024)

Map created: 3 April 2023
Portal submission ID # 4584



LEGEND

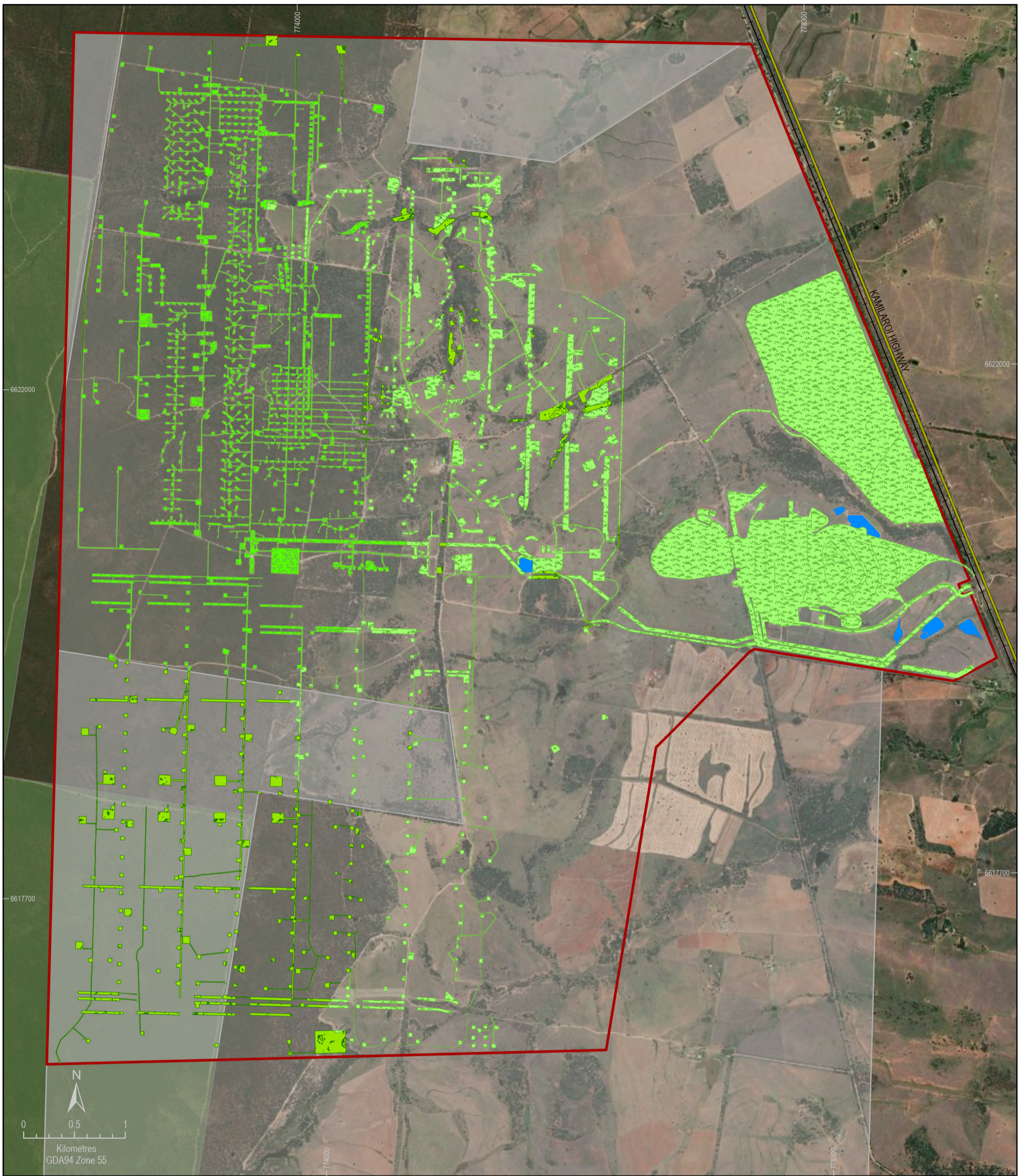
- Project Approval Boundary
- Coal - Current Titles
- Forecast Area**
- Forecast disturbance
- Forecast land prepared for rehabilitation



NARRABRI MINE

Figure 6.2c
Mining and Rehabilitation - Year 3 (2025)

Map created: 3 April 2023
Portal submission ID # 4585



LEGEND

- Project Approval Boundary
- Coal - Current Titles
- Highway
- Railway
- State forest
- FnLndDom**
- Agricultural - Grazing
- Native Ecosystem
- Rehabilitation Biodiversity Offset Area
- Water storage



NARRABRI MINE

Figure 6.3
FLRP Plan 1: Final Landform Features
Surface Disturbance

Map created: 29 September 2023
Portal submission ID # 6220


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6.2 Phases of rehabilitation and general methodologies

Rehabilitation phases are defined in Table 6-1, and discussed in detail in the following sections.

Table 6-1 Rehabilitation phases

Rehabilitation Phase	Description
Phase 1: Active mining	This phase is associated with active mining operations across the mining domains.
Phase 2: Decommissioning	This phase includes activities associated with the removal of mining infrastructure, unless agreed to be retained, and the removal, remediation, or management of contaminated and hazardous materials.
Phase 3: Landform establishment	This phase consists of the processes and activities required to construct the approved final landform. In addition to profiling the surface of rehabilitation areas to the approved final landform, this phase may include works to construct surface water drainage features, encapsulate problematic materials such as rejects, and prepare a substrate with the desired physical and chemical characteristics (i.e. rock raking or ameliorating sodic materials).
Phase 4: Growth medium development	This phase consists of activities required to establish the physical, chemical and biological components of the substrate required to establish the desired vegetation community (including short-lived pioneer species). This phase may include spreading the prepared landform with topsoil and/or subsoil and/or soil substitutes, applying soil ameliorants to enhance the physical, chemical and biological characteristics of the growth media, and actions to minimise loss of growth media due to erosion.
Phase 5: Ecosystem and land use establishment	This phase consists of the processes to establish the final land use following construction and preparation of the final landform and growth media. For vegetated land uses, this phase includes establishing the desired vegetation community and implementing land management activities such as weed control.
Phase 6: Ecosystem and land use development	This phase consists of the activities to manage maturing rehabilitation areas on a trajectory to achieving the proposed rehabilitation objectives; For vegetated land uses, this phase may include processes to develop characteristics of functioning self-sustaining ecosystems, such as nutrient recycling, vegetation flowering and reproduction, increasing habitat complexity, and development of a productive, self-sustaining soil profile. This phase may include specific vegetation management strategies and maintenance such as tree thinning, supplementary plantings and weed management.
Phase 7: Rehabilitation completion (sign-off)	The final phase is when a rehabilitated area has achieved the final land use. Rehabilitation areas may be classified as complete when the Resources Regulator has determined in writing that rehabilitation has achieved the final land use following submission of the relevant application.

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6.2.1 Active mining phase

a. Soil and materials

Mine site

The Stage 2 EA identified a variety of soil types across the Narrabri Mine. Some of the soil types, particularly those derived from the Purlawaugh Formation, were identified as being moderately to highly dispersive, erodible, and saline, and management of these soils is required where subsidence results in cracking, slope increases, or occurs within drainage lines. The Stage 2 EA details the soil attributes and limitations for the identified geological formations and is summarised in Table 6-2, Table 6-3, and Table 6-4.

Once the soils are replaced as part of the progressive rehabilitation of the site, they will provide a suitable substrate for revegetation. As such, the impact to the soils within the disturbance area is considered temporary and manageable.

REA

The general soil profile within the footprint of the REA was assessed as part of the Stage 2 EA which identified topsoil to 25 cm depth comprising brown to reddish brown, light to heavy clays; with some angular gravel to 1 cm to 3 cm. Subsoil was identified as and comprising up to four layers consisting of brown, reddish brown or yellowish brown, light to heavy clays; with stones and gravel absent or some-to-much gravel present; some large stones and floaters present in some profiles. The measured dispersibility values for topsoils and subsoils were found to be generally low and pH and salinity levels within the soils were found to be within acceptable values for stockpiling and future use in rehabilitation.

The REA Closure Design Report (ATC Williams, 2022) found that soils available for use were categorised as either 'Silty Clay' (insitu or stockpiled) or 'Sandy Gravel' (some clay/silt). Both soil types had relatively high plasticity, and clay soils indicate non-dispersive behaviour. Potential capping materials were summarised as being typically non-sodic and alkaline, with the REA footprint materials slightly acidic to neutral. Based on the erosional stability documented in the REA Closure Design Report, the soil is considered likely to be susceptible to erosion.

Materials deficit

The current soil mass balance estimate (2022) indicates that there will be sufficient resource available for rehabilitation activities. Approximately 80,510 m³ of topsoil and 226,110 m³ of subsoil is available for rehabilitation activities. This will continue to be recorded in future, along with future demand.

A capping materials balance was undertaken for the REA by ATC Williams (2022) which concluded that a sufficient volume of topsoil and subsoils exists to achieve the proposed capping design. Measures for stripping and stockpiling of soils for the REA will follow the general measures as described in the following section.

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Table 6-2 Topsoil and subsoil attributes and limitations

Soil attribute	Surface geology								
	Purlawaugh formation			Pilliga sandstone			Garrawilla volcanics		
Soil depth	Usually very deep profiles on the crests where profiles tend to be shallower			Generally less than 0.25 m; shallower on crests and slopes			Deep profiles on slopes, floodplains and in drainage lines. More likely to be shallower on upper slopes and crests.		
	<i>Not limiting</i>			<i>Not limiting</i>			<i>Not limiting</i>		
Typical soil depths	Drainage lines	Floodplains	Slopes	Upper slopes	Upper slopes	Mid slopes	Drainage lines	Floodplain	Crests
Topsoil	0<1.0 m	0~0.35 m	0~0.30 m	0 ~0.35 m	0~0.15 m	0~0.40 m	0-0.30 m	0~0.40 m	0~0.25 m
Subsoil	1.0-3.0 m	0.35-2.5 m	0.30-2.6 m	0.35-2.5 m	0.15-1.38 m	0.40~2.20 m	0.30-2.5 m	0.4-2.50 m	0.25-1.30 m
Soil texture	A mix of often coarse textured topsoil and more clayey subsoils			Generally the most sandy soils across the mine site			Usually finer textured (more clayey).		
	<i>Not limiting</i>			<i>Not limiting</i>			<i>Not limiting</i>		
Soil surface characteristics	Surface stone often absent but noted on slopes; surface sometimes self-mulching; not hydrophobic			Surface stone usually absent but noted on upper slopes; surface sometimes self-mulching; often hydrophobic			Surface stone usually absent, but noted on upper slopes; surface sometimes self-mulching; not hydrophobic		
	<i>Not limiting</i>			<i>Not limiting</i>			<i>Not limiting</i>		
pH	Generally favourable to plant growth; usually increasing with depth but some lower horizons quite acidic			Generally lower than in the other Geological Formations and not increasing much with depth			Generally favourable to plant growth; usually increasing with depth		
	<i>Not limiting</i>			<i>Not limiting</i>			<i>Not limiting</i>		

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Soil attribute	Surface geology		
	Purlawaugh formation	Pilliga sandstone	Garrawilla volcanics
Erodibility	May be some limitations where subsidence results in slope increases and in drainage lines	May be some limitations where subsidence results in slope increases and in drainage lines	Some limitations where subsidence results in slope increases
	<i>Low to moderate limitations</i>	<i>Low limitations</i>	<i>Low to moderate limitations</i>
Topsoil dispersibility	Topsoils usually slightly dispersible	Topsoils usually slightly or moderately dispersible; may be limiting near subsidence cracks or where slope gradient increases following subsidence	Topsoils generally not or only slightly dispersible
	<i>Usually not limiting</i>	<i>Usually not limiting</i>	<i>Not limiting</i>
Subsoil dispersibility	Often moderately to highly dispersible	Slight to very highly dispersible, particularly in drainage lines	Variable but often moderate to high
	<i>May be limiting near subsidence cracks or where slope gradient increases following subsidence but may be an advantage in filling in cracks</i>	<i>May be limiting near subsidence cracks or where slope gradient increases following subsidence but may be an advantage in filling in cracks</i>	<i>Limitation in vicinity of subsidence cracks</i>
Salinity	Slight to moderate salinity detected in drainage line, floodplain and some slopes areas	Salinity not recorded	Salinity not recorded
	<i>Limitation in areas associated with subsidence cracks where down slope saline areas may develop after erosion</i>	<i>Not limiting</i>	<i>Not limiting</i>

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Table 6-3 Soil attributes of Purlawaugh Formation and Piliga Sandstone

Geological formation	Purlawaugh Formation				Piliga Sandstone	
Landform	Major drainage line	Crests	Floodplains	Lower slopes	Midslopes	Upper slopes
Surface condition	Loose, soft or firm, surface stone absent	Loose to firm, surface stone absent or low to medium amounts of rounded angular surface stone (to 15 centimetres [cm])	Loose to firm or hard setting, surface stone absent	Loose, surface stone absent or some rounded surface stone (1-2 cm)	Firm, sometimes self-mulching and cracked, surface stone absent or some angular surface stone (<1 cm) and some flat sandstone to 15 cm present	Firm, surface stone absent
Topsoil	<ul style="list-style-type: none"> • Up to 103 cm deep • Sand, clayey sand to sandy light clay • pH 6.0 - 7.5 • Poorly structured (massive/single-grained), although sometimes well structured • Slight dispersibility (D% and EAT) • Non-saline 	<ul style="list-style-type: none"> • Up to 27 cm deep • Clayey sand or sandy medium clay • pH 5.0 - 5.5 • Moderately to well structured • Moderate dispersibility (D%) • Slight dispersibility (EAT) • Non-saline 	<ul style="list-style-type: none"> • Up to 39 cm deep • Sandy loam to medium clay • pH 6.0 - 6.5 • Well structured • Slight dispersibility (D% and EAT) • Non-saline 	<ul style="list-style-type: none"> • Up to 25 cm deep • Sandy clay loam to light clay • Well structured • Slight dispersibility (D% and EAT) • Non-saline 	<ul style="list-style-type: none"> • Up to 37 cm deep • Silty clay to medium clay • pH 6.0 - 7.5 • Well structured • Slight dispersibility (D% and EAT) • Non-saline 	<ul style="list-style-type: none"> • Up to 21 cm deep • Clayey sand to light to medium clay • pH 4.5 - 6.5 • Moderately to well structured • Slight dispersibility (D%) • Not or slightly dispersible (EAT) • Non-saline

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Geological formation	Purlawaugh Formation			Pilliga Sandstone		
Landform	Major drainage line	Crests	Floodplains	Lower slopes	Midslopes	Upper slopes
Subsoil	<ul style="list-style-type: none"> Up to 3 horizons (to 300 cm) Sand to medium to heavy clay (sometimes sandy) pH 5.5 - 7.0, although sometimes pH 9.0-10 at depth Poorly structured (massive) or well-structured in more clayey horizons Very highly dispersible (D%) Slightly to high to moderately dispersible (EAT) Lowest horizon sometimes slightly saline 	<ul style="list-style-type: none"> 2 horizons (to 127 cm) Medium clay (sometimes sandy) pH 5.5 - 8.5 Well structured, although sometimes poorly structured Moderate dispersibility (D%) Slight dispersibility (EAT) Non-saline 	<ul style="list-style-type: none"> Up to 4 horizons (to 255 cm) Sandy loam to medium (gritty) clay pH 6.5 - 7.54 sometimes pH 8.0-9.0 Well structured, occasionally massive Slight to very high dispersibility (D%) High to moderate and very high dispersibility (EAT) Lowest horizon slightly saline 	<ul style="list-style-type: none"> Up to 4 horizons (to 260 cm) Clay loam to heavy clay pH 6.5 - 7.5, sometimes pH 8.0 - 9.0 (pH 4.0 recorded at lowest horizon) Well structured Negligible to very high dispersibility (D%) Very high dispersibility (EAT) Most subsoil horizons slightly to moderately saline 	<ul style="list-style-type: none"> Up to 5 horizons (to 270 cm) Light to medium clay to heavy clay pH 7.5 - 9.9 (pH 4.5 in some lowest horizons) Usually well structured, sometimes massive Slight to moderate dispersibility (D%) High to moderate or very high dispersibility (EAT) Lower horizons slightly to moderately saline 	<ul style="list-style-type: none"> Up to 4 horizons (to 230 cm) Sandy clay loam to medium to heavy clay pH 4.5 - 6.5, up to pH 9.5 at depth Poorly structured (massive), at times well structured Slight dispersibility (D% and EAT) Non-saline

Note:

D% - dispersion percentage

EAT - Emerson Aggregate Test

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Table 6-4 Soil attributes of Garrawilla Volcanics

Geological formation	Garrawilla Volcanics		
Landform	Drainage line	Floodplain	Upper slopes
Surface condition	Firm, surface stone absent	Loose to firm, surface stone absent or sometimes medium amounts (angular) to 15 cm	Loose or self-mulching, some angular surface gravel and stone (1-15 cm) in upper layers
Topsoil	<ul style="list-style-type: none"> Up to 30 cm Medium to heavy clay pH 6.5 Well structured Slightly dispersible (D% and EAT) Non-saline 	<ul style="list-style-type: none"> Up to 46 cm Light sandy clay loam to sandy clay loam pH 5.5 - 6.0 Well structured Slightly dispersible (D% and EAT) Non-saline 	<ul style="list-style-type: none"> Up to 36 cm Medium to heavy clay or heavy clay pH 6.0 - 9.0 Well structured Slightly dispersible (D%) Not or slightly dispersible (EAT) Non-saline
Subsoil	<ul style="list-style-type: none"> 3 horizons (to 250 cm) Medium clay or medium to heavy clay pH 8.0 - 9.0 Well structured Very high dispersibility (D%) High or high to moderate dispersibility (EAT) Non-saline 	<ul style="list-style-type: none"> 3 horizons (to 250 cm) Light to medium clay to heavy clay pH 6.0 - 7.5 (sometimes pH 8.0 - 9.0 at depth) Well structured Slight to moderate dispersibility (D%) Slight to very high dispersibility (EAT) Non-saline 	<ul style="list-style-type: none"> Up to 4 horizons (to 250 cm) Light to medium clay to heavy clay pH 7.0 - 9.0 Well structured Slight dispersibility (D%) Not or slightly dispersible (EAT) Non-saline

Note:

D% - dispersion percentage

EAT - Emerson Aggregate Test

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Management


Subsoil and topsoil resources available for rehabilitation activities is considered a ‘moderate’ risk to achieving successful rehabilitation and completion criteria. Risks assessed during the risk assessment workshop included:

- salvage and maintenance of biological resources;
- volumes of pre-existing biological resources such as topsoil;
- establishment of vegetation from the geochemical/chemical composition of topsoils, subsoils, capping or imported materials;
- physical and structural properties of the substrate; and
- volumes of topsoil and subsoil available for rehabilitation.

NCOPL will supervise all stripping activities to ensure that topsoil and subsoil can be re-used in site rehabilitation, with the stripping and use of soils restricted to those soils identified as amenable for this purpose. NCOPL will develop the optimal approach to stripping and salvaging (including timing) topsoils and subsoils to ensure materials are handled as little as possible.

The current controls in place to ensure growth media resources are retained and managed to retain structure, chemical and biological properties are as follows:

- all equipment imported to site is to be cleaned and free of soil and vegetation;
- ensure the area to be stripped and the area of stockpiling are clearly identified prior to disturbance;
- conduct disturbance works in accordance with the ‘Permit to Work’ procedure;
- informed by a test pit, strip topsoil to a depth of at least 150 mm, where possible;
- soils will be stockpiled in wind rows immediately adjacent to the area of disturbance;
- stockpiles are to be created no higher than 2 m and with slopes no greater than 2:1 (H:V) with a roughened surface to minimise soil erosion;
- stockpiles retained for more than three months that do not have a naturally established vegetation cover will be seeded with a selection of pasture species such as triticale, ryecorn or millet and perennial species such as phalaris, cocksfoot, perennial rye and sub clover;
- sedimentation controls including catchment banks, silt-stop fencing, or straw bales will be placed immediately down slope of any stockpiles and will be maintained until such time as a stable vegetation cover is achieved in accordance with the Erosion and Sediment Control Plan;
- if unacceptable weed generation is observed on stockpiles, a weed control program will be implemented;
- operation of machinery on stockpiles will be avoided in order to prevent compaction and maintain soil aggregation;
- maintain a record of the location and volume of stockpiled soils;
- monitor stockpiled material as part of the ongoing soil assessment program (including the REA);

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b. Flora

Preclearance surveys prior to disturbance are conducted to identify if any threatened species or ecological communities are present within the proposed disturbance boundary. Risks of impacts to vegetation are avoided, mitigated, and managed through the implementation of the ‘Permit to Work’ procedure.

Progressive rehabilitation measures for impacts on native vegetation include revegetation via natural regeneration (through seed bank in the topsoil or seed from surrounding vegetation), the implementation of weed and pest control, and the dispersal of cleared native vegetation to provide habitat, increase the seed bank and to provide a mulch material for nutrient cycling and water retention. The soil resources stockpiled within woodland areas will be reapplied in the same order as they were stripped to ensure the seed bank of the target vegetation community remains viable.

If revegetation is not achieved via natural regeneration, NCOPL will use a mix of native tube stock planting and seeding. Active planting will use flora species characteristic of the surrounding vegetation community and will be of regional provenance. Planting will be undertaken by suitably experienced personnel.

Weed and pest management

All weeds are regulated under the NSW *Biosecurity Act 2015* with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant has a duty to prevent, eliminate or minimise the risk, so far as is reasonably practicable. General measures for managing weeds onsite include:


- during introduction to site, all vehicles and mechanical equipment that will be working within native vegetation areas will be subject to a clean down to minimise seed transportation; and
- implementation of the weed monitoring and control program as describe below.

Weed monitoring will occur biannually, primarily within disturbed areas and areas undergoing active regeneration/rehabilitation. Weed control will focus on the eradication of High Threat Weeds with timing, frequency, and method of control as recommended by a suitably qualified person. Qualified and experienced weed management contractors will be engaged over the life of mine to undertake weed control activities. Weed control may include a combination of herbicide application, biological controls, and manual weeding. Where possible, weed control will consider seasonal variations in rainfall and weed growth, botanical flowering times and treatment affectivity.

c. Fauna

As previously stated, preclearance surveys are conducted prior to disturbance to identify if any threatened fauna species may be present within the proposed disturbance boundary.

A suitably trained and qualified ecologist or wildlife handler will be present during clearing to manage fauna that may be encountered. Options to minimise harm to fauna by modifying the clearance method is to be evaluated by the suitably trained and qualified ecologist or wildlife handler (e.g., shaking or nudging tree trunks to evacuate mobile fauna, retaining trees with suspected active nests until the nest is disused, or controlled lowering of trees with suspected tree hollows being used by fauna with the hollow facing upwards to enable fauna to exit). In the unlikely event that a Koala is identified in a tree marked to be cleared, the tree will be retained (allowing a 200m avoidance zone) until the individual has self-relocated. The management of fauna may include relocating the

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individual to adjacent habitat or treating injuries (the nearest veterinary clinic, wildlife carer and/or appropriately trained ecologist contact information will be on hand in case any fauna are injured).

Pest animals

Pest animal identification and control will be conducted over the life of mine to detect and control pest animals that may be impacting on rehabilitation and revegetation areas. Pest animals will be identified as part of the biannual monitoring program and will be controlled with timing, frequency and techniques such as baiting, trapping, mustering, or shooting (as appropriate) as recommended by a suitably qualified person. The management of pest animals will consider the relevant threat abatement plans for Feral pig, European rabbit, Goat, Red fox and Feral cat.

NCOPL will engage qualified and experienced contractors that hold appropriate pesticide accreditation in accordance with the *Pesticides Act 1999* or Firearm Licence under the *Firearms Act 1996*. NCOPL will also ensure the contractors provide copies of their accreditation and will retain records of pest species, control techniques and location.

d. Rock/overburden emplacement

Narrabri is an underground coal mine, subsequently there is no overburden generated at the site.

Rock and drill cuttings from gas drainage and service boreholes will be either consolidated with excavated soil to backfill sumps at the drill pad site or disposed of in the REA.


e. Waste management

Waste generation can be categorised as production and non-production wastes. The principal wastes that will be generated include:

- production wastes:
 - mined rock from development of ventilation shafts;
 - drill cuttings (e.g. from development of gas management infrastructure, exploration boreholes and service boreholes);
 - reject generated by the CHPP and underground areas; and
 - brine.
- non-production wastes:
 - general waste;
 - hydrocarbons;
 - treated sewage and effluent; and
- minor quantities of other waste from mining and workshop activities (e.g., worn tyres and used oil filters) as well as hazardous wastes.

Wastes generated at the Narrabri Mine are managed in accordance with the Waste Management Plan.

Contaminated soils

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The greatest risk for the contamination or pollution of land as a result of mine operations is associated with the potential for contaminated water and/or hydrocarbon spills/leaks. The following hydrocarbon management controls will be implemented:

- all water from wash areas and workshops is directed to oil water separators and containment systems;
- all storage tanks are either self-bunded or partitioned with an impermeable bund with capacity to contain a minimum 110 % of the largest storage tank capacity;
- all hydrocarbon products are securely stored; and
- most equipment is refuelled at the bunded fuel farm in the Pit Top Area and any refuelling activities in the field are undertaken in accordance with site procedures and following the implementation of adequate controls to minimise the risk of spills.
- Internal audits and spot checks of hydrocarbon storage and waste management areas.

In the event of an internally reportable hydrocarbon spill, an Incident Report Form will be completed and the Pollution Incident Response Management Plan will be implemented where necessary. The affected area will be inspected after rectification to ensure there is no ongoing effect on the land that could prevent it from being successfully rehabilitated.

Investigations will be undertaken at mine closure to identify and remediate any contaminated soil that may exist (e.g. within infrastructure areas), in accordance with the requirements of the NSW *Contaminated Land Management Act 1997*. At mine closure, a preliminary contaminated site analysis will be implemented to determine whether an assessment should be conducted. Where required, an assessment of contamination in the area will be undertaken by a suitably qualified consultant. This would quantify the amount of contaminated material that would need to be bio-remediated on site.

f. Geology and geochemistry

A range of parameters were tested for the environmental geochemical assessment of reject material, sampled from both the REA and the ROM stockpile (ATC Williams, 2022). The objectives of the geochemical test work program were to support the assessment of salinity, sodicity, acid forming potential and metals enrichment, and solubility. A summary of the outcomes from the geochemical test work are provided in Table 6-5 and Table 6-6.

Table 6-5 Summary of geochemical characteristics for reject material

Characteristic	Summary
pH	Typically alkaline with median values of 9.3 and 9.4 for placed and fresh rejects respectively.
Salinity	Placed rejects typically range from slightly to highly saline. Fresh rejects typically slightly saline.
Sodicity	Stockpiled and REA footprint capping materials typically non-sodic (one sample slightly sodic)
Acid Forming Potential	Total sulfur content low All samples classified as non-acid forming (NAF) and barren in terms of acid generation and neutralisation

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Characteristic	Summary
Metal Enrichment	Selenium concentration significantly enriched in all samples. Arsenic and antimony concentrations slightly enriched in some samples.
Solubility (Leaching)	Initial results indicate neutral pH and high salinity.

Table 6-6 Summary of geochemical characteristics for potential capping materials

Characteristic	Summary
pH	Stockpiled and placed REA capping materials typically alkaline. REA footprint materials slightly acidic to neutral.
Salinity	Stockpiled capping materials non-saline to slightly saline. Placed REA capping materials highly saline. REA footprint materials non-saline.
Acid Forming Potential	Total sulfur content relatively low, with majority of contained sulfur occurring as reactive sulphide. All samples classified as non-acid forming (NAF).
Metal Enrichment	Selenium (Se) concentration significantly enriched in all samples, compared to average crustal abundance. Arsenic (As) and antimony (Sb) concentrations slightly enriched in some samples. Relative enrichment described above is a typical feature of strata in this region.
Solubility (Leaching)	Initial results indicate leachate with alkaline pH, with high to very high salinity (primarily due to significant sulfate salts).

The final REA closure design (ATC Williams, 2022) was informed by a series of studies including geotechnical and geochemical characterisation of coarse reject and capping materials. The findings of the materials testing program are discussed throughout this section, as well as in 6.2.3 (c).

g. Material prone to spontaneous combustion

Spontaneous combustion within coal stockpiles

The Hoskissons coal seam has a high intrinsic spontaneous combustion propensity. Therefore, spontaneous combustion represents a potential hazard within the coal stockpiles and the goaf during operation and requires ongoing monitoring for evidence of self-heating. Spontaneous combustion events within stockpiles are recorded in accordance with the Spontaneous Combustion Management Plan and managed through a TARP. In 2022, 13 events were recorded and actively managed.

At the cessation of mining, the coal stockpiles will be removed and the area will be rehabilitated to a grazing final land use.

Spontaneous combustion within the REA

The test results from the REA Closure Design Report (ATC Williams, 2022) indicate that the reject material is classified as a having a propensity rating of low and the risk of spontaneous combustion, in the form of fires or

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heating within the REA, is also low. As such, it is considered that specific measures in relation to placement and encapsulation are not necessarily required. Notwithstanding, the adopted capping construction approach should consider measures to minimise potential for oxygen diffusion into the rejects mass, which would be a key trigger for spontaneous combustion.

h. Material prone to generating acid mine drainage

Geochemistry testing was undertaken during the preparation of the REA Closure Design Report (ATC Williams, 2022). The testing of acid forming potential of reject material indicates that:

- the total sulphur content is relatively low, with the majority of contained sulphur occurring as reactive sulphide; and
- all samples were classified as non-acid forming.

In addition, assessments undertaken for the Stage 2 EA identified low sulphate concentrations in groundwater suggesting that there is little concern for acid producing potential from groundwater inflows.

Therefore, acid mine drainage is considered a low risk to rehabilitation at the Narrabri Mine. Notwithstanding, analysis of coal and reject material will continue to occur throughout the mine life (and when conditions change). If in the event acid mine drainage is identified, a works program for the identification of any potentially acid forming material would be conducted and specific controls implemented.

i. Ore beneficiation waste management (reject disposal)

Coal from the underground workings is sent to the CHPP which produces a combined (part washed) (thermal) coal product and a washed (pulverised coal injection) coal product.


The coal preparation process removes approximately 2% of the total ROM feed as reject, which is predominantly rock from the floor of the mine workings. Currently, coarse rejects are unloaded onto a reject stockpile before being transferred via truck to the REA. Fine rejects are mechanically dewatered and blended with the unwashed (thermal) product coal.

j. Erosion and sediment control

Given the Narrabri Mine is an underground mine, there are relatively few areas of exposed ground with the potential for erosion and sedimentation. Notwithstanding, the risk assessment identified erosion and sedimentation to be a moderate risk during the active mining phase. Erosion and sedimentation can result directly or indirectly from:

- vegetation clearing, topsoil stripping and soil stockpiles;
- surface runoff from the construction and maintenance of unsealed roads and newly constructed embankments and drains;
- erosion of drainage channels;
- disturbed areas not yet rehabilitated; and/or
- operation of the REA.

Erosion and sediment control is managed in accordance with the Erosion and Sediment Control Plan.

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Erosion potential for the REA

As identified in the REA Closure Design Report (ATC Williams, 2022), erosion is a primary issue of concern for rehabilitation of the REA. Landform evolution modelling was conducted to assess the performance of the modified landform as a basis for supporting the application of geomorphic design principles. The results indicate that an 80% vegetation cover scenario achieves the target erosion rate of 5 tonnes per hectare per year (t/ha/year), and that gully depths developed within the capping layer are unlikely to expose emplaced coarse reject within the 1,000-year model period. These results highlight the critical role that vegetation establishment plays in erosion management for the REA.

The appropriate final land use includes the establishment of mixed native and introduced grasses (pastures) with native woodland overstorey communities across the plateau surface and batters to reflect the surrounding areas, with grazing discouraged.

A summary of the ongoing erosion and sediment control measures for the REA are provided in Table 6-7.

Table 6-7 REA erosion and sediment control measures


Measure	Application	Affected area
Check dams	The installation of check dams allows for collection of the sediment along the drainage line minimising its offsite transport	Perimeter drains
Silt fences	Minimises the potential for erosion by reducing the velocity of stormwater sheet flow.	Capped REA surface prior to revegetation and during establishment of vegetation
Bare earth stabilisation	Use of soil stabiliser during construction and prior to revegetation to reduce rill formation.	Capped REA surface following compaction and prior to revegetation
Revegetation (hydromulching with tackifier)	Long term stability by reinforcing the soil with vegetation. Use of tackifier also increases stability during establishment phase.	Capped REA surface

k. Ongoing management of biological resources for use in rehabilitation

Biological resources such as topsoil seedbanks will be effectively managed during operations. Stockpiles will be created no higher than 2 m to maintain seed viability. A weed monitoring and control program will be implemented to mitigate adverse impacts to the seedbank from weeds. Topsoil will be spread at a depth of 150 mm for optimal germination, growth, and survival of emerging vegetation. If sufficient topsoil is unavailable, NCOPL will source appropriate materials from offsite.

Key habitat features will be salvaged during and/or following vegetation clearance activities and stockpiled for use in rehabilitation areas. The habitat features will be respread over the disturbed areas during progressive rehabilitation to provide habitat resources for a range of invertebrate and ground-dwelling fauna.

NCOPL will provide for the reasonable and feasible salvage, transplanting and/or propagation of threatened flora found during pre-clearance surveys, including Coolabah bertya, in accordance with the *Guidelines for the Translocation of Threatened Plants in Australia Third Edition* (Commander et al., 2018).

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I. Mine subsidence

Mining activities are conducted using both the longwall retreat and bord and pillar methods. Due to the underground nature of mining operations, the proposed mining method is not considered a significant risk to rehabilitation. Previous subsidence impacts on natural features include surface cracking and ponding. Surface cracking > 50mm width will generally be remediated. Surface cracking < 50mm will likely self-correct over time. Ponding is remediated only if significant impacts to vegetation or downstream water quality is identified.

A multi-scale, multi-data monitoring approach has been developed to monitor the environmental consequences of subsidence effects. Whole-of-site monitoring includes remote sensing data (multi-spectral imaging and LiDAR), while field surveys focus on native vegetation, agricultural areas, watercourses, and surface cracking and erosion.

Impacts related to subsidence may include:

- surface cracking and shearing;
- general and localised slope instability;
- surface gradient increase/decrease; and
- additional ponded areas.

Current measures for managing surface cracks include:

- visual inspections of the surface during active subsidence behind the retreating longwall face;
- larger surface cracks (more than 50 mm) will be remediated following active subsidence (rip or grade where necessary);
- surface cracks that cannot be filled by surface ripping or grading will be filled using subsoil stockpile material from stockpiles maintained at nearby gas drainage or ventilation sites, or material from within the footprint of the REA; or
- leave a barrier pillar or increase set-back distances from a sensitive area or restrict mining.

The risk assessment identified that ponding may pose a moderate risk to rehabilitation success. The relevant Extraction Plan – Water Management Plan includes a trigger action response plan (TARP) to manage impacts to vegetation health or downstream water quality. If ponding impacts are observed, NCOPL will investigate options to dewater the ponded area to limit further impacts on and implement any identified adaptive management measures. Adaptive measures may include conducting a geomorphological assessment to determine options to have the subsidence ponded area freely drain.

Subsidence monitoring, remediation and rehabilitation will be on-going throughout the life of the mine.

m. Management of potential cultural and heritage issues

Aboriginal heritage is managed in accordance with the Aboriginal Cultural Heritage Management Plan (ACHMP) which was developed in consultation with Registered Aboriginal Parties (RAPs) and Heritage NSW.

The ACHMP documents the outcomes of all Aboriginal cultural heritage assessments conducted to date, along with management and mitigation measures to protect, monitor and manage Aboriginal cultural heritage sites and values within the approved disturbance area.

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Engagement with the RAPs and Heritage NSW will be undertaken as part of detailed mine closure planning, and all archival reports will be completed and submitted to the relevant departmental agencies.

n. Exploration activities

Exploration activities will be undertaken in accordance with the requirements of the *Exploration Code of Practice: Rehabilitation*⁵. Disturbance from exploration will be rehabilitated as soon as reasonably practicable following the completion of exploration activities. Surveying and sealing of all drill holes will be conducted in accordance with relevant Government department guidelines and standards.

6.2.2 Decommissioning

a. Site security

Site security measures will be implemented during and following the decommissioning phase to prevent access by members of the public and secure rehabilitation areas, including any heritage places or objects and any retained infrastructure items.

Site security measures will include:

- site sign-in and induction processes;
- fencing and signage;
- logs placed over rehabilitated areas in woodland to prevent vehicle access;
- routine scheduled inspections of fences; and
- maintenance of existing security fences and signage, including fencing for Aboriginal cultural heritage sites.


b. Infrastructure to be removed or demolished

Site features, services, and structures to be decommissioned and demolished to achieve the final land use are described in Table 6-8.

Table 6-8 Infrastructure to be decommissioned

Code	Mining domain	Description
1	Infrastructure area	Site access road and internal access tracks, office and administration buildings, light vehicle carpark, workshop and stores buildings, electrical sub-station and associated electricity infrastructure, equipment laydown areas, rail loop and train loadout bin and train loader, sewage treatment plant, box cut and mine portals, explosives magazine, ventilation fans and shafts, gas drainage infrastructure and water pipelines.
3	Water management area	Network of dams, lined evaporation ponds, brine storage ponds, water diversion bunds and associated water management infrastructure.

⁵ NSW Resources Regulator (June 2021), Exploration Code of Practice: Rehabilitation

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4	Overburden emplacement area	Signage, access roads, storage areas.
7	Beneficiation facility	Drift and skyline conveyors, coal crushing station, CHPP, ROM and product coal pad hardstand areas

As required under PA 08_0144, all demolition work on site is to be undertaken in accordance with Australian Standard *AS 2601-2001: The Demolition of Structures*, or its latest version.

As part of the detailed mine closure planning, NCOPL will assess if surface infrastructure (e.g. conveyor belt, building materials, cement pads/footings, poly pipe) could be disposed of on-site (e.g. in backfilled box cut or underground).

Gas drainage infrastructure and mine safety pre-conditioning drill pads will be progressively decommissioned and rehabilitated following undermining when the infrastructure is no longer required for operational purposes.

Mine entrances will be sealed in accordance with the relevant Government department guidelines. Boreholes will be capped in accordance with the *Exploration Code of Practice: Rehabilitation* and the Guideline for mineral exploration drilling; drilling and integrity of petroleum exploration and production wells⁶ or the latest versions.

c. Buildings, structures and fixed plant to be retained

Infrastructure associated with the water storage final land use domain will include contour banks and drainage structures with appropriate erosion and sediment controls implemented to ensure water is adequately managed during closure and beyond. The structural integrity of the infrastructure will be determined as part of the detailed mine closure planning.

The detailed mine closure planning process will:

- determine the structural integrity of the infrastructure to be retained;
- identify the associated short-term and long-term risks to public safety and the environment from the structures remaining in place, which should identify potential modes of failure;
- address any potential residual risks such as potential for structures to fail; and
- engage a suitably qualified engineer to verify that any risks have been satisfactorily addressed (if required).


d. Management of carbonaceous/contaminated material

Carbonaceous material

During decommissioning, detailed inspections or audits will be undertaken within the footprint of surface infrastructure area including the REA, coal stockpile areas, access roads, and haul roads to identify remaining sources of carbonaceous material.

Following the inspections or audits, all carbonaceous material will be removed from the surface of the site and will be disposed of in the box cut with at least 5 m of inert cover.

⁶ Department of Industry – Resources and Energy, (August 2016) Guideline for mineral exploration drilling; drilling and integrity of petroleum exploration and production wells

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Contaminated material

NCOPL will conduct the ongoing management of contaminated materials to allow for the completion of remedial works prior to progressive rehabilitation within the relevant domains. Contaminated material will be managed in accordance with relevant guidelines under the *Contaminated Land Management Act 1997*. NCOPL will engage a suitably qualified contamination expert to assist with the management of contaminated materials when required.

Contamination assessments will be completed as part of the detailed mine closure planning. The scope for these assessments will include:

- engaging a suitably qualified contamination expert to conduct contamination and remediation assessments;
- conduct a Phase 1 assessment for all features, services and structures within the Infrastructure domain;
- subject to the findings and recommendations of the Phase 1 assessment, a targeted Phase 2 assessment may be required;
- if contamination is identified, a Remedial Action Plan will be developed, detailing remediation strategies for potential contamination.

e. Hazardous materials management

During decommissioning, hazardous materials (e.g. hydrocarbons and chemicals) will be managed and stored in accordance with the Waste Management Plan. Removal of hazardous materials will be undertaken by a licenced waste disposal contractor and disposed of/recycled at a licenced waste facility.


Accumulated salt in the evaporation/storage ponds will be excavated and either placed within the drifts of the box-cut prior to backfilling or reinjected back into the goaf, supported by records.

f. Underground infrastructure

Following completion of underground mining activities, infrastructure associated with the box cut, drifts, shafts and boreholes will be decommissioned and removed. All remaining entries, shafts, adits, drifts and boreholes will be backfilled, capped and/or sealed in accordance with relevant Government department guidelines and standards.

Detailed mine closure planning will identify and describe how underground mining infrastructure will be decommissioned to achieve the final land use. The detailed planning will include details for the following aspects:

- detailed design for sealing and decommissioning entries, shafts, adits and drifts which will be supervised and subsequently validated by a suitably qualified engineer to ensure that any risks associated with achieving the final land use outcome have been adequately addressed;
- procedure for the salvage of underground mining equipment and materials;
- the sealing and decommissioning of any remaining boreholes including services, gas wells, and dewatering;
- implementation of any specific measures required for the future management of groundwater accumulation in the underground workings, which may include measures to be implemented to minimise any environmental or community impacts associated with potential future discharges from the underground workings; and

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- details of any consultation with Government agencies and any subsequent approvals that may be required to allow for any ongoing discharges.

Security measures will be implemented for public safety purposes whilst sealing and decommissioning works are being conducted. These will include exclusion zones demarcated by fencing and signage.

Subsidence monitoring pegs will be removed following cessation of monitoring as outlined in the relevant Extraction Plan/s.

6.2.3 Landform establishment

a. Water management infrastructure

Water management structures such as contour banks, diversion drains, or re-established drainage lines will be constructed with longitudinal gradients which permit the transfer of water at non-erosive velocities (e.g., 1:200 (V:H)) (where practicable). Consequently, specialised rehabilitation treatments will generally not be required. No flumes are required due to limited heights of any embankments constructed. However, in the event that unacceptable levels of erosion are observed, specialised treatments such as jute meshing, or rock lining will be implemented.

Sedimentation dams will be constructed and retained during rehabilitation to collect runoff from rehabilitated areas until discharge water quality meets the relevant assessment criteria and dams can be decommissioned. Sediment accumulated in sediment dams will be appropriately removed or remediated.

The brine storage pond walls will be pushed in and re-profiled to be consistent with the surrounding landscape.

b. Final landform construction: general requirements

The final landform will be designed to be stable, adequately drained, and consistent with the surrounding natural and modified landforms using a geomorphic engineered design. Final landform drainage will be designed and constructed to achieve long term stability and to minimise erosion.

General landform construction activities will include:

- removal of water retained within the sump(s) adjacent to each borehole/drill site by pump truck for reuse or disposal, or allow to evaporate over time;
- consolidated drill cuttings and fines will be excavated, and the sump backfilled using consolidated drilling spoil stockpiled during the bore construction phase;
- any upstream diversion banks or downstream catch banks will be pushed over and profiled to natural surface level;
- where cut and fill works were required, these areas will be re-excavated to return the site to its natural slope;
- access tracks will be progressively closed and rehabilitated (unless required for future access to monitor or manage subsidence-related impacts) and ripped using the tynes of a bulldozer (or similar) and regraded and trimmed to make a landform that is consistent with the surrounding topography; and
- regrading will be such that it will enable the free drainage of surface runoff from the site.

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Remediation of subsidence effects such as surface cracking, ponding, and erosion will be conducted in accordance with the relevant Extraction Plan/s. Final subsidence inspections and rehabilitation will be conducted as part of the detailed mine closure planning.

The final landform design will be confirmed by survey of slopes and elevations upon completion.

c. Final landform construction: reject emplacement area

A final landform design has been developed based on material characterisation and modelling outcomes (ATC Williams, 2022) and is summarised below. The REA will be progressively capped as external batters are formed using the overall capping philosophy stated in the REA Closure Design Report.

Final landform comprising:

- maximum height of 15m above natural surface level;
- a plateau area separated from external batters by a perimeter crest bund;
- the plateau will be partitioned into a series of flat internal ‘cells’ through incorporation of internal cross-bunding over the plateau surface; and
- permanent batters with concave slopes (14° transitioning to 11°).


The base case capping layer will be formed using topsoil and subsoil stripped from the REA footprint (nominal total thickness of 400mm). An alternative case comprising ameliorated capping soil using rock is also to be considered. Revegetation will include a fast-growing cover crop, with species ultimately sown to establish a suitable vegetation cover to achieve erosional stability.

The completed landform design forms the basis for the closure and capping works to be undertaken progressively as each ‘cell’ is formed and reaches capacity. The final REA landform design will be confirmed by survey of slopes and elevations upon completion.

Key closure design criteria are summarised in Table 6-9 with the proposed capping configuration presented in Figure 6-3.

Table 6-9 REA closure design criteria summary

Design aspect	Criteria / Features
Landform attributes	<ul style="list-style-type: none"> • Maximum height 15 m • Footprint area 25 ha • Concave batters (transitioning from upper 7.5 m at 4H:1V to 5H:1V) • Plateau perimeter bund and internal cross-bunding to form cells • Internal (operational) batters 2H:1V
Capacity	<ul style="list-style-type: none"> • Design airspace capacity 1.9 million m³ (based on revised design landform) • Existing rejects disposal 577,000 m³ (estimated from survey)
Capping configuration	<ul style="list-style-type: none"> • 400mm thick soil layer using CLAY capping material borrowed from topsoil and subsoil stripping from the REA development area • Revegetation by hydromulch (with tackifier) grass cover; species selection appropriate for soil properties and local climate conditions

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Stormwater management	<ul style="list-style-type: none"> • External perimeter drain (clean water diverted around REA for release) • Internal perimeter drain (site water directed to sediment basin SB3 during operations; offsite release post-closure) • Flat cross-bunded cells on plateau to retain all runoff water on top of the landform
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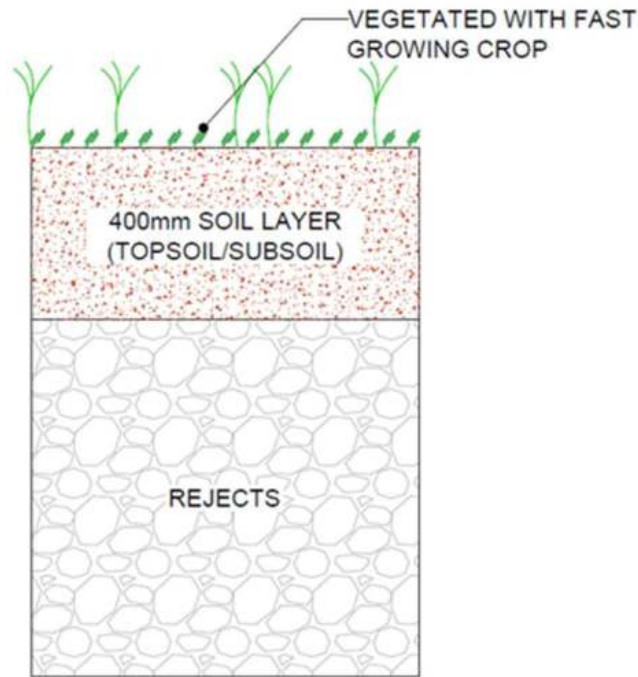


Figure 6-3 Proposed capping configuration for REA landform

d. Final landform construction: final voids, highwalls and low walls

There will be no final voids, highwalls and/or low walls in the final landform.

e. Construction of creek/river diversion works

There will be no creek or river diversion works as part of the final landform.


6.2.4 Growth Medium Development

This section outlines how rehabilitation areas will be prepared with growth media (e.g. vegetation substrate) suitable for establishing vegetation in accordance with the approved final land use.

Soil characterisation

Characterisation of soil has previously been conducted (refer to section 6.2.1.). Additional sampling may be used to determine if the topsoil and subsoil requires amelioration or selective handling and placement.

Soil respreading and amelioration

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Prior to the re-spreading of stockpiled topsoil and subsoil, an assessment of weed infestation and amelioration requirements will be undertaken. For all suitable stockpiled material, the following re-spreading measures will be applied where appropriate:

- prior to re-spreading, NCOPL will consider the information contained in the stockpile inventory (i.e. volume, age, type), climatic conditions, the location and distance of the stockpile from the area to be rehabilitated, the pre-mining vegetation communities (i.e. what communities were growing in the area prior to stripping), and the vegetation communities and final land use proposed for the rehabilitated area;
- prior to re-spreading, the ground will be scarified along the contour to a depth of 50-100 mm to break up any hard setting surfaces and to provide a good bond between the re-spread material and sub-soil;
- topsoil will be spread to a minimum depth of 150 mm and will consider the soil depth information obtained through the pre-stripping soil sampling;
- when the topsoil is replaced it will be replaced such that it resembles the surrounding landscape;
- fertiliser application will be considered prior to seeding (agricultural grazing only) while the surface is being lightly scarified to create an optimal seed bed; and
- any soil testing results will be used to determine if physical and/or chemical amelioration is required, and the rates and method of application applied.

Where necessary, soil will typically be ameliorated using one or more of the following methods:

- mulching to increase organic carbon and improve the soils water holding capacity and soil biota levels;
- fertiliser applied to increase nutrient levels where possible, or as a slow-release formula applied directly beneath hand planted tree seedlings; and/or
- gypsum to treat dispersion, calcium to magnesium ratio, and improve structure and water holding capacity.

In addition to the above, the respreading of woody debris (logs, hollows etc.) to improve habitat value will also be conducted within rehabilitated woodland areas.

If the growth medium cannot be effectively ameliorated, the unsuitable subsoil and spoil will be buried and capped where fill is required (such as in backfilling the box cut). Capping spoil will be ameliorated if required, and contour ripped prior to the placement of the topsoil.


Reject emplacement area

The recovered topsoil and subsoil will be placed over the developing/completed landform to provide a growth medium (ATC Williams, 2022). Revegetation of this profile will be via hydromulching to establish a fast-growing cover crop to achieve erosional stability. It is critical that selection of the cover crop species be appropriate for the soil properties and local climate conditions, with modelling suggesting that some perennial and drought tolerant species would be best suited to this application.

Weed control techniques

Weed control techniques will follow the process outlined in section 6.2.1.

Erosion

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Erosion will be managed in accordance with the Erosion and Sediment Control Plan and as summarised in section 6.2.1.

6.2.5 Ecosystem and land use establishment

This section describes how the target vegetation associated with the final land use will be established and subsequently managed to progress to the ecosystem and land use development phase (section 6.2.6). Revegetation activities are undertaken progressively and will be planned to occur after the completion of reshaping, topdressing with growth media and construction of drainage structures.

Domain A – Native Ecosystems and Domain D – Rehabilitation Biodiversity Offset Area

The majority of the rehabilitated sites located within native woodland areas will be left to self-regenerate following reinstatement with topsoil and the spreading of habitat features. In some instances, if regeneration is not self-sustaining, infill planting may be required using endemic species commensurate with the surrounding vegetation communities. These sites will be revegetated with canopy, mid-storey, shrub, and groundcover species as specified in Table 6-10.

At a minimum, rehabilitation of canopy species should reflect the number of trees identified during pre-clearance surveys or count per m² as follows:

- canopy – 1 canopy planting per 10 m²
- mid-storey – 1 mid-storey planting per 5 m²
- shrub – 1 shrub planting per 1 m²
- groundcover – 4 groundcover plantings per 1 m²

All plants will be planted as tube stock. The use of tree guards will be determined at the time of planting depending upon the predicted level of grazing and/or weather conditions. The timing of planting may be postponed to avoid planting in incorrect seasons or in adverse weather conditions.

Table 6-10 Species to be used for woodland/forest rehabilitation

Vegetation community	Dominant canopy species	Dominant mid-storey species	Dominant shrub species	Dominant groundcover species
Brown Bloodwood/Pilliga Box Woodland	<i>Corymbia trachyphloia</i> <i>Eucalyptus pilligaensis</i> <i>Eucalyptus fibrosa</i>	<i>Callitris glaucophylla</i> <i>Acacia homalophylla</i> <i>Acacia harpophylla</i>	<i>Calytrix tetragona</i> <i>Phebalium squamulosum</i> <i>Acacia burrowii</i> <i>Persoonia sericea</i> <i>Allocasuarina diminuta</i>	<i>Pomax umbellata</i> <i>Eragrostis brownii</i> <i>Dianella revoluta</i> <i>Microlaena stipoides</i> <i>Goodenia hederacea</i>
Callitris Forest	<i>Callitris glaucophylla</i>	-	-	<i>Eragrostis cilianensis</i> <i>Goodenia rotundifolia</i> <i>Aristida benthamii</i> <i>Austrostipa aristiglumis</i> <i>Cleistochloa rigida</i>
Inland Grey Box Woodland	<i>Eucalyptus microcarpa</i> <i>Eucalyptus populnea</i>	<i>Geijera parviflora</i> <i>Callitris glaucophylla</i>	<i>Geijera parviflora</i> <i>Maytenus cunninghamii</i>	<i>Aristida benthamii</i> <i>Solanum ferocissimum</i>

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Vegetation community	Dominant canopy species	Dominant mid-story species	Dominant shrub species	Dominant groundcover species
	<i>Eucalyptus blakelyi</i>	<i>Casuarina cristata</i> <i>Capparis mitchellii</i>	<i>Acacia homalophylla</i>	<i>Austrostipa ramosissima</i> <i>Austrostipa verticillata</i> <i>Chrysocephalum apiculatum</i>
Riparian Forest	<i>Casuarina cunninghamiana</i> <i>Casuarina cristata</i> <i>Eucalyptus populnea</i> <i>Eucalyptus microcarpa</i>	<i>Eremophila mitchellii</i> <i>Myoporum montanum</i>	<i>Geijera parviflora</i> <i>Acacia penninervis</i> <i>Notelaea microcarpa</i>	<i>Aristida benthamii</i> <i>Austrostipa aristiglumis</i> <i>Austrostipa ramosissima</i> <i>Bothriochloa decipiens</i> <i>Cyperus gracilis</i>

Any ground disturbance caused by surface cracking will be seeded (if necessary) or covered with available leaf litter or broken vegetation. Seeding is not considered necessary for access tracks as natural regeneration of vegetation from seed in the topsoil and the surrounding environment is expected. However, in the event that natural regeneration does not adequately establish within three months of ripping, the site will be seeded as appropriate.

Initial follow-up care and maintenance works will include watering planted tube stock, possible fertilizer application, and monitoring for the incursion of weeds and damage caused by pest animal species.

Domain B – Agricultural Grazing

Approximately 1,630 ha of surface development areas and remediated underground mine areas will be re-established as agricultural land (pasture). Where monitoring indicates natural regeneration is not sufficient, these areas will be sown with a pasture seed mix relevant to the season of planting, with a typical fertiliser application rate as specified in Table 6-11.


Seed stock will be sourced from local providers where possible. Advice on alternative seed/s to be used in rehabilitation will be sought from local Agronomists if certain seed species are not available.

The timing of seeding may be postponed to avoid seeding in adverse conditions or where sufficient provenance seed is not available. Where seeding with the final seed mix is delayed, prepared rehabilitation areas will be sown with a suitable cover crop to minimise dust generation and erosion.

Initial care and maintenance may include watering and additional fertilizer where required.

Table 6-11 Winter and summer pasture species seed mixes

Summer			Winter		
Pasture species	Rate (kg/ha)	Fertiliser	Pasture species	Rate (kg/ha)	Fertiliser
Grasses					
Bombasti panic	1 - 2	Di-ammonium Phosphate 250kg/ha	Phalaris (Sirolan or Holdfast)	1 - 2	Di-ammonium Phosphate 250 kg/ha
Green panic	2 - 4		Wallaby Grass	0.3 - 1	
Purple pigeon grass	1 - 2				
Japanese Millet	10		Couch	5	

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Summer			Winter		
Pasture species	Rate (kg/ha)	Fertiliser	Pasture species	Rate (kg/ha)	Fertiliser
Legumes¹					
Subterranean clover	4 - 5	-	Subterranean clover	4 - 5	-
			Barrel (Sephi) medic	2 - 4	-
			Snail (Sava) medic ²	3 - 5	-
			Woolly pod vetch	4 - 6	-
			Serradella (Elagara)	1 - 2	-
			Lucerne	0.5	-

Notes:

- 1 Inoculated with appropriate rhizobia.
- 2 Specific soil conservation application

Reject Emplacement Area

The REA is currently identified with a final land use domain of agricultural grazing. However, modelling has indicated that consistent vegetation cover levels of 80% or greater are required to achieve erosional stability. Unless carefully managed, grazing of the REA has potential to reduce the effective vegetation cover below that target level until the vegetation can re-establish. As such, grazing creates a risk to the long-term erosional stability of the REA. Final land use will be the establishment of mixed native and introduced grasses (pastures) with native woodland overstorey communities to reflect the surrounding area, with grazing discouraged.

To maximise vegetation cover, capped surfaces (batters and plateau) will be seeded with mixed grass species either native or endemic to the area, and a low density of shrub species to provide a high percentage of vegetative cover. With appropriate agronomic conditions, grass can reach cover levels over and above 95%, with the capacity to protect the underlying surface from erosion even under high intensity rainfall.

Domain G – Water Storages

In the event that unacceptable levels of erosion are observed within retained water storages, fast growing species identified as having a particular soil conservation application will be planted around the water management structure. The planting of trees and other vegetation will enhance the filtration capability of these structures and surrounding areas, minimise the potential for erosion, and encourage their use by native fauna.

Weed and vertebrate pest control

Ecosystem and land use establishment includes initial management actions to limit the introduction of weeds and pest animal species in rehabilitation areas. Ongoing weed and pest animal management will be conducted in accordance with section 6.2.1 with additional measures to include:

- treatment of weeds on topsoil stockpiles prior to re-spreading;
- ensuring all plant and equipment are weed free prior to mobilisation to rehabilitation areas; and
- faunal exclusion fencing and/or tree guards (where required) to exclude pest animal species from rehabilitation areas / juvenile vegetation.

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6.2.6 Ecosystem and land use development

This section details how rehabilitated lands will be actively managed to achieve the approved final land use and the proposed management and monitoring programs that will be implemented to demonstrate that rehabilitation is likely to be sustainable in the long-term.

All domains

Activities associated with the ecosystem and land use development phase of rehabilitation will generally consist of rehabilitation monitoring, ongoing maintenance, and land management activities.

Rehabilitation monitoring will be undertaken throughout the ecosystem and land use development phase until it can be demonstrated that rehabilitation areas have met the specific completion criteria as detailed in section 4.2. Monitoring results will be assessed against the relevant TARP, and where required NCOPL will undertake maintenance or remedial works. Rehabilitation monitoring is discussed further in section 8.

Maintenance at rehabilitated areas will include, but is not limited to:

- weed and pest animal control (refer to section 6.2.1);
- managing bushfire risks;
- minor earthworks to remediate any significant erosion features, including contour banks and diversion channels;
- infill planting and/or seeding to meet vegetation community requirements;
- maintenance fertilising where required;
- maintaining erosion and sediment controls; and
- repair of fence lines, access tracks and other general related land management activities.

The ongoing rehabilitation maintenance activities will be identified via the rehabilitation monitoring program and ongoing requirements will be reported annually in the Annual Rehabilitation Report and Forward Program.


Final land use domain B: Agricultural – grazing

To demonstrate agricultural productivity, NCOPL will record pasture establishment success and progression towards analogue sites/pre mining pasture conditions. Areas of agricultural grazing domain will be monitored whilst bearing livestock.


Ongoing monitoring will identify potential threats (e.g. weed invasion, pest species, erosion, poor soil health). If potential threats are identified, appropriate management and amelioration measures will be implemented in accordance with the relevant TARP. This may include the application of gypsum and fertiliser to topsoil in order to address potential acidity, organic carbon and/or nutrient deficiency constraints, and enhance rapid establishment of a sustainable vegetation growth.

6.3 Rehabilitation of areas affected by subsidence

Subsidence will be remediated in accordance with the relevant Extraction Plan/s. Should subsidence effects pose a risk to successful rehabilitation, the relevant TARP will be implemented.

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To ensure that subsidence remediation techniques have been effective, NCOPL will conduct final subsidence inspections which will be included as part of the detailed mine closure planning.

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7. Rehabilitation quality assurance process

A Rehabilitation Quality Assurance Process (**RQAP**) will be implemented throughout the life of mine across all phases of rehabilitation:


The RQAP will include details of inspections, monitoring and record keeping which will be required to ensure that:

- rehabilitation is being implemented in accordance with the nominated methodologies; and
- identified risks to rehabilitation are being adequately addressed at each phase of rehabilitation.


Table 7-1 details the proposed RQAP for the Narrabri Mine.

Table 7-1 Narrabri Mine quality assurance


Phase	Key quality assurance steps	Timing	Formal documentation/validation method
Active mining	Records of competent personnel for active mining and rehabilitation.	Ongoing	<ul style="list-style-type: none"> • Position description
	Pre-clearance surveys	Ongoing	<ul style="list-style-type: none"> • Pre-clearance survey reports
	Permit to work	Ongoing	<ul style="list-style-type: none"> • Permit to work procedure
	Salvage of resources	Ongoing	<ul style="list-style-type: none"> • Resource salvage records • Post clearance survey reports
	Dumping plans and surveys for the REA	Ongoing	<ul style="list-style-type: none"> • REA survey reports • REA dumping plans
	Up to date mine plans	Ongoing	<ul style="list-style-type: none"> • Mine planning procedures • RMP and Forward Program
	Maintenance of a topsoil inventory to document stripped, stockpiled and re-spread resources	Ongoing	<ul style="list-style-type: none"> • Topsoil inventory • Soil assessment results
	Regular inspections to identify potential weed infestations. Details of weed status included in rehabilitation monitoring.	Ongoing	<ul style="list-style-type: none"> • Biodiversity monitoring reports • Rehabilitation monitoring reports
	Weed control records	Ongoing	<ul style="list-style-type: none"> • Results of weed control and record keeping by weed management contractor
	Regular inspections to review spontaneous combustion	Ongoing	<ul style="list-style-type: none"> • Spontaneous Combustion Management Plan • Dumping Procedure/Materials Handling Procedures • Inspection reports
Soil testing	Ongoing	<ul style="list-style-type: none"> • Soil surveys reports (pre mining) 	

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Phase	Key quality assurance steps	Timing	Formal documentation/validation method
			<ul style="list-style-type: none"> • Soil testing in rehabilitation areas • REA detailed closure design report (ATC Williams, 2022)
Decommissioning	Mine and borehole sealing	Ongoing and at mine closure	<ul style="list-style-type: none"> • Documentation of sealing (records of fill materials and concrete plugs, filling methods etc.) • Sign off from Resources Regulator
	Inspection of demolition to confirm all infrastructure to be demolished has been removed	Mine closure	<ul style="list-style-type: none"> • Inspection reports • Decommissioning reports
	Waste generated during decommissioning will be removed from site by an appropriately licensed waste contractor. Brine storage pond liners will be removed from site by an appropriately licensed waste contractor.	Ongoing	<ul style="list-style-type: none"> • Waste records
	Phase 2 contamination assessment report for any contaminated areas have been remediated to an appropriate standard commensurate with the post-mining land use	Mine closure	<ul style="list-style-type: none"> • Contamination assessment report
	Validation testing to ensure any contamination has been appropriately remediated and/or removed.	Mine closure	<ul style="list-style-type: none"> • Contamination remediation report
	Public safety risks are assessed during decommissioning such as fencing, signage and security	Mine closure	<ul style="list-style-type: none"> • To be included in the detailed mine closure planning
	Subsidence pegs removed	Mine closure	<ul style="list-style-type: none"> • To be included in the detailed mine closure planning
	Future landowner responsible for the ongoing upkeep and management of retained infrastructure	Mine closure	<ul style="list-style-type: none"> • To be included in the detailed mine closure planning
Landform establishment	Survey and preparation of as constructed drawings of final constructed slopes, landforms and water drainage structures	Mine closure	<ul style="list-style-type: none"> • Survey plans • As constructed drawings
	Demonstrate that the post-mining landform is stable and slopes are stable for agreed post-mining land use	Mine closure	<ul style="list-style-type: none"> • Geotechnical report
	Subsidence remediation conducted in accordance with the Extraction Plan	Mine closure	<ul style="list-style-type: none"> • End of panel reports • Final subsidence assessment

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Phase	Key quality assurance steps	Timing	Formal documentation/validation method
	Verification report to confirm the specified REA depth of capping has been implemented	Mine closure	<ul style="list-style-type: none"> Geotechnical reports
Growth medium establishment	Maintenance of a topsoil and subsoil inventory to document stripped, stockpiled and re-spread resources	Ongoing	<ul style="list-style-type: none"> Topsoil and subsoil inventory
	Records of re-spread topsoil, ameliorants, fertiliser etc.	Ongoing	<ul style="list-style-type: none"> Records of reinstated areas Rehabilitation monitoring reports
	Habitat features (hollow bearing logs, felled timber not mulched and large rocks) were salvaged during pre-stripping operations for re-use where practicable	Ongoing	<ul style="list-style-type: none"> Pre and post clearance survey reports
	Soil testing to confirm appropriate soil geochemical parameters for plant establishment	Ongoing	<ul style="list-style-type: none"> Soil assessment reports
	Records of identification and management of actual acid forming, potentially acid forming (PAF) and non-acid forming (NAF) material and ongoing monitoring.	Mine closure	<ul style="list-style-type: none"> Specialist geotechnical report
Ecosystem and land use establishment	Reseeding or planting activities undertaken, such as date of planting, weather conditions, fertilizer application rates, seeding rates and/or planting rates.	Ongoing	<ul style="list-style-type: none"> Revegetation records Seeding records
	Soil geochemical parameters for plant establishment and growth	Ongoing	<ul style="list-style-type: none"> Soil assessment reports
	Site inspections and monitoring of rehabilitated areas to allow early identification of any emerging threats to rehabilitation	Ongoing	<ul style="list-style-type: none"> Biodiversity monitoring reports Rehabilitation monitoring reports Site inspection reports
	Weed and pest animal infestations and control	Ongoing	<ul style="list-style-type: none"> Biodiversity monitoring reports Rehabilitation monitoring reports Weed control records Pest animal control records
Ecosystem and land use development	Inspections of temporary and permanent erosion and sediment controls	Ongoing	<ul style="list-style-type: none"> Biodiversity monitoring reports Rehabilitation monitoring reports Site inspection reports

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Phase	Key quality assurance steps	Timing	Formal documentation/validation method
	Weed and pest animal infestations and control	Ongoing	<ul style="list-style-type: none"> • Biodiversity monitoring reports • Rehabilitation monitoring reports • Weed control records • Pest animal control records
	Rehabilitation Monitoring	Ongoing	Rehabilitation monitoring reports

The RQAP detailed above will be reviewed when planning future rehabilitation activities. The objectives for rehabilitation will be one of continuous improvement. To assist with achieving continual improvement and to meet the requirements of each phase, NCOPL have developed a Rehabilitation Quality Flowchart, presented in Figure 7-1, to be signed off after each phase of rehabilitation prior to proceeding to the next phase.

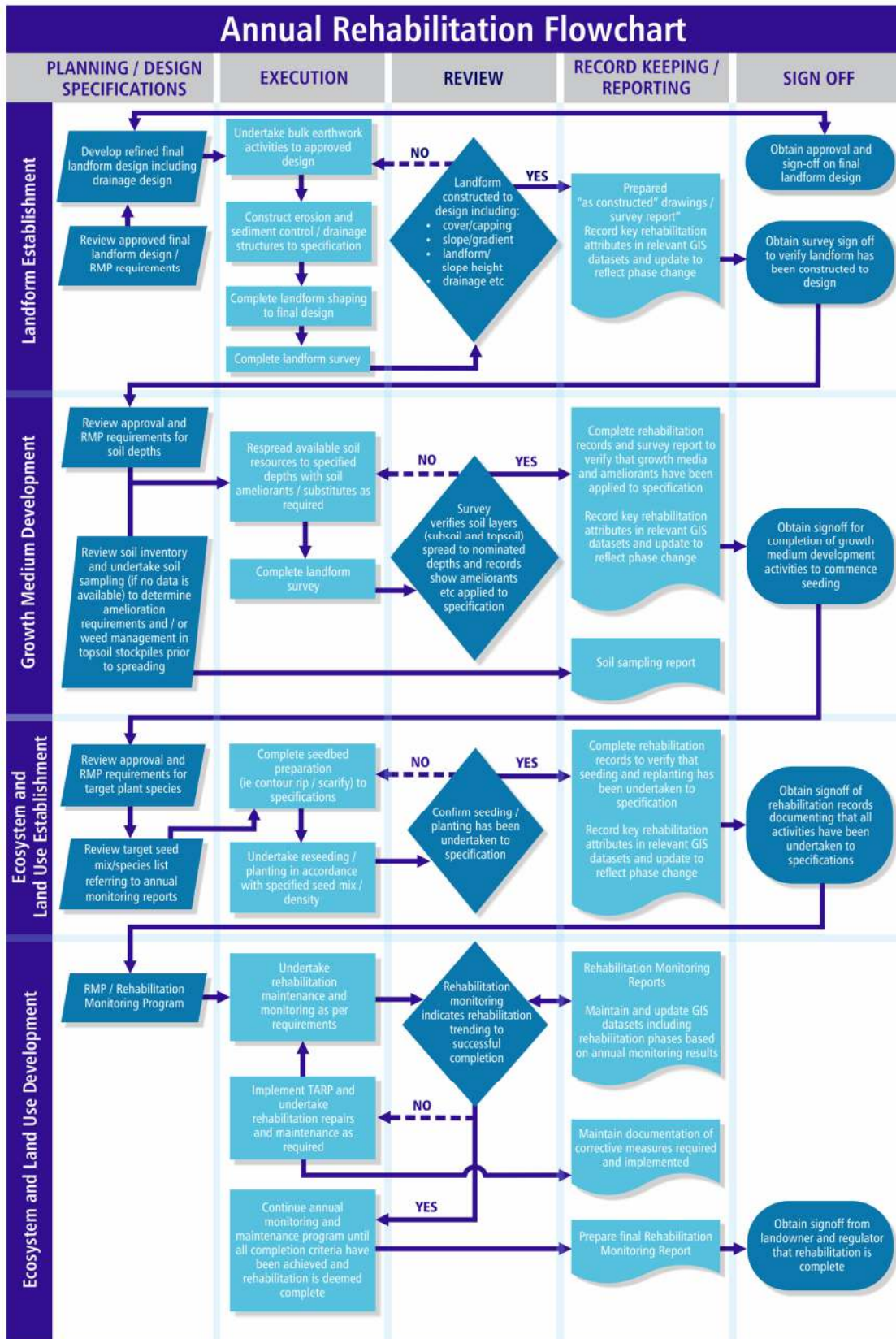



Figure 7-1 Rehabilitation quality assurance process

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8. Rehabilitation monitoring program

Rehabilitation monitoring is undertaken to measure and assess performance against the rehabilitation objectives and completion criteria (section 4.2). NCOPL will conduct monitoring of rehabilitated areas to:

- identify specific problems to enable research on causes and appropriate solutions (e.g. erosion, low emergent numbers, loss of seedlings, loss of particular species);
- determine that the actions detailed in this RMP are leading to positive rehabilitation outcomes (e.g. vegetation in rehabilitation site is the same as the target vegetation community, landform is stable);
- track progress of rehabilitation and vegetation establishment against the relevant completion criteria; and
- provide feedback for continuous improvement of the rehabilitation and revegetation program as detailed in this Plan.

Monitoring will be conducted by a suitably qualified and experienced person(s). Monitoring results will inform refinements of the rehabilitation methodology as required. Rehabilitation monitoring will be continued until it can be demonstrated that rehabilitation has satisfied all rehabilitation completion criteria. NCOPL will re-evaluate the rehabilitation monitoring program and methods annually based on performance and consultation with key stakeholders. Any changes will be outlined in this RMP, the Annual Review and the Forward Program.

8.1 Analogue site baseline monitoring

Analogue sites will be established to provide baseline data for comparison with rehabilitation monitoring sites. Baseline data will be used to determine if the vegetation composition and structure within the rehabilitation monitoring sites is characteristic of the target vegetation community(s). Analogue site selection will consider the final land use(s) for the rehabilitation areas.

The rehabilitation objectives and rehabilitation completion criteria detailed in section 4.2 have been developed based on previous environmental assessments conducted for the development that have identified the defining characteristics for each final land use domain.


8.2 Rehabilitation establishment monitoring

The following monitoring methodologies will be implemented at commencement of the ecosystem and land use establishment phase and will continue until the completion criteria for each monitoring site has been met or each site demonstrates that it is on a trajectory to meeting the completion criteria.

8.2.1 Topsoil monitoring

The following method will be implemented for monitoring topsoil:

- prior to use in rehabilitation, topsoil stockpiles will be sampled to determine amelioration requirements for rehabilitation;
- topsoil applied to rehabilitation areas is to be sampled and tested as part of the annual monitoring program to assess soil quality against the rehabilitation completion criteria; and

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8.2.2 Landform stability

Point intercept transects will be established to monitor landform stability. A number of transects will be established for monitoring purposes in each domain and each transect will be a minimum of 50 m apart. Each transect will be 100 m in length and will run in an east-west direction, roughly perpendicular to the contour bank. The beginning and end of each transect will be permanently marked with a star dropper. Along each transect at every 1 m interval the following information will be recorded:

- pasture species touching the point;
- the presence/absence of bare ground; and
- erosion occurring at the point.

While implementing the monitoring program, if the key monitoring objectives (i.e. soil erosion, new weed species) are observed adjacent to the transect (i.e. not directly on the transect), the location will be recorded and included in the report as occurring outside of the monitoring transects.

8.2.3 Vegetation Monitoring

The restoration of vegetation sought for the final land use will be monitored over time to ensure a continued trend towards rehabilitation completion criteria. Monitoring will track plant community structure (cover, tree and shrub density and height); vegetation composition (species richness, presence of weeds) and presence of pest animals, relative to analogue sites.

8.2.4 Subsidence monitoring

Subsidence monitoring will be conducted in accordance with relevant Extraction Plan/s. Final subsidence inspections will be conducted as part of the detailed mine closure planning.

8.2.5 Weed and pest animal monitoring


Weed and pest animal monitoring and control will be conducted in accordance with section 6.2.1 and is ongoing. Annual rehabilitation monitoring will record the presence of weeds and observational recording of pest animals.

8.2.6 Surface and groundwater

Monitoring of surface and groundwater impacts will continue during the life of mine and post closure in accordance with the Water Management Plan. The Water Management Plan will be revised as part of the detailed mine closure planning.

8.3 Measuring performance against rehabilitation objectives and rehabilitation completion criteria

The rehabilitation monitoring program as described in section 8.2 is designed to provide quantitative and qualitative data which will be used to assess rehabilitation progress towards the rehabilitation objectives and completion criteria, and to further assist in refining rehabilitation methods across the site.

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NCOPL is required to demonstrate (with records) that they have achieved the final land use for the mining area prior to applying for rehabilitation completion. In summary, NCOPL must demonstrate that:


- the approved rehabilitation objectives have been met;
- the approved rehabilitation completion criteria have been achieved; and
- the final landform and final land use(s) have been implemented.

Rehabilitation monitoring results will be compared against the relevant TARP and rehabilitation completion criteria to ensure a continued trend towards the objectives. TARPs provide the management responses when monitoring indicates areas of rehabilitation are not progressing.

Rehabilitation records must be maintained of all rehabilitation actions taken in accordance with the Mining Regulation 2016. To achieve rehabilitation completion, all monitoring required under the *Mining Act 1992* will be completed and no further ongoing monitoring will be required (e.g. subsidence, water or ecological monitoring). Consultation will also be required to be undertaken with relevant government agencies and any regulatory requirements under other legislation have been satisfied in accordance with the *Guideline - Achieving Rehabilitation Completion (Sign-Off)*⁷.

NCOPL will be required to formally apply for rehabilitation completion using the relevant application form.

⁷ NSW Resources Regulator (2021) Guideline - Achieving Rehabilitation Completion (Sign-Off)

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9. Rehabilitation research, modelling and trials


9.1 Current rehabilitation research, modelling and trials

NCOPL adopts a continuous improvement approach to rehabilitation. Results from rehabilitation monitoring and opportunistic observations are used to refine rehabilitation methodologies on an on-going basis. Where industry standards and best practice methodologies continue to evolve, NCOPL will consider these in rehabilitation application and integration into this RMP.

There are currently no current research, modelling or trials being undertaken.

9.2 Future rehabilitation research, modelling and trials

Should suitable research/trial opportunities be identified, they will be investigated and implemented. Rehabilitation monitoring and methodology records are shared among WHC operations to inform decision making regarding future rehabilitation campaigns.

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10. Intervention and adaptive management

If rehabilitation performance is not trending toward the rehabilitation objectives and completion criteria, NCOPL will implement additional response actions to investigate any potential threat to long term rehabilitation success. Threats to rehabilitation may include events such as extended periods of drought, bushfire, or pressures from the incursion of weeds.

The TARP (Table 10-1) provides an overview of management responses for lower (Level 1) and upper (Level 2) triggers. The TARP will continue to be updated to reflect updates to completion criteria and in response to emerging rehabilitation risks.

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Table 10-1 Trigger Action Response Plan

Aspect	Risk	Trigger	Response
Spontaneous combustion	Evidence of spontaneous combustion in capped and rehabilitated sections of the REA	Level 1 Isolated incidence of heating in REA.	Level 1 <ul style="list-style-type: none"> Investigate sources of potential ignition. Excavate material with propensity for spontaneous combustion in proximity to rehabilitated surface. Review rejects emplacement practices.
		Level 2 Multiple incidences of heating/ignition in REA.	Level 2 <ul style="list-style-type: none"> Consult with the relevant Government department to develop a remediation plan to mitigate spontaneous combustion such as increased capping depth. Review spontaneous combustion management and reject emplacement practices.
Soil type(s), quality and quantity	Salinity	Level 1 Increasing trend in soil/water salinity levels.	Level 1 Undertake soil testing to verify EC levels and recommend further soil amelioration.
		Level 2 Presence of salt scalds.	Level 2 <ul style="list-style-type: none"> Engage a suitably qualified person to develop a site-specific management plan for remediation. Undertake works as required.
	Soil physical, chemical, or biological characteristics	Level 1 Soil physical, chemical and/or biological characteristics are not within the range of baseline data by Year 5.	Level 1 <ul style="list-style-type: none"> Engage a suitably qualified person to recommend appropriate soil amelioration. Undertake amelioration and re-vegetation in accordance with the specialist recommendations.
		Level 2 Soil physical, chemical and/or biological characteristics are not within the range of baseline data by Year 10.	Level 2 <ul style="list-style-type: none"> Engage a suitably qualified person to recommend appropriate soil amelioration. Undertake amelioration and re-vegetation in accordance with the recommendations. Notify the relevant Government department to develop a remediation plan.
	Topsoil depth	Level 1 Topsoil is not reinstated to at least the minimum depth specified for the Growth Medium Development phase.	Level 1 <ul style="list-style-type: none"> Top dress with additional suitable topsoil resource to meet the minimum depth requirement. If additional suitable material is not immediately available, stabilise the area with cover crop until additional suitable topsoil is sourced.
		Level 2 Sufficient suitable topsoil cannot be identified for reinstatement at the minimum specified depth in the Growth Medium Development phase.	Level 2 <ul style="list-style-type: none"> Undertake a review of the topsoil inventory to confirm if sufficient material to meet minimum depth requirements is available. Investigate suitable topsoil resource substitutes and introduce if required.

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Aspect	Risk	Trigger	Response
	Soil surface layers	Level 1 Increasing trend in soil dispersiveness	Level 1 Undertake testing to determine required amelioration and/or additional seeding requirements.
		Level 2 Soils are moderately to highly dispersive.	Level 2 <ul style="list-style-type: none"> Review material handling practices. Ameliorate dispersive soils (for example with coarse gypsum). Re-vegetate if required.
	Insufficient cover material	Level 1 Annual update of the material balance identifies minor shortfall for closure (<10%)	Level 1 Identify alternative options for obtaining cover material.
		Level 1 Annual update of material balance identifies major shortfall for closure (>10%)	Level 1 Identify alternative options for obtaining cover material and or modifying capping depth in consultation with the relevant Government department.
Erosional stability	Erosion control	Level 1 Evidence of active rill or gully erosion < 200 mm in depth or tunnel erosion <1m.	Level 1 <ul style="list-style-type: none"> Review adequacy of existing erosion and sediment controls. Undertake repairs and implement additional controls as required. Engage a suitably qualified person if ongoing erosion is observed following repair and implementation of additional controls.
		Level 2 Evidence of active rill erosion or gully erosion > 200 mm in depth or tunnel erosion >1m.	Level 2 <ul style="list-style-type: none"> Review adequacy of existing erosion and sediment controls. Undertake repairs and implement additional controls as required. Engage a suitably qualified person to assist with the management of erosion and sedimentation at the site and provide recommendations to appropriately remediate the erosion. Remediate as soon as practicable.
Landform stability	Settlement/slumping	Level 1 Survey or remote sensing of the rehabilitated landforms indicates settlement or slumping that could compromise stability	Level 1 Undertake a review of the landform design to assess risks to stability and free draining design.
		Level 2 Survey or remote sensing of the rehabilitated landforms indicates major settlement or slumping.	Level 2 <ul style="list-style-type: none"> Engage a suitably qualified person to assist with the management of settlement and slumping and provide recommendations to appropriately remediate. Consider rehandling material and/or regrading if required.
REA	Slope gradient	Level 1 <70% of the rehabilitated REA has slopes within the limits stipulated in the REA Closure Design Report (ATC Williams 2022).	Level 1 Undertake re-grading and revegetation of the REA.

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Aspect	Risk	Trigger	Response
		Level 2 <55% of the rehabilitation area has slopes within the limits stipulated in the REA Closure Design Report (ATC Williams 2022).	Level 2 Undertake a review of the landform design, including survey if required. Undertake re-grading and revegetation of the area.
	Free draining landform	Level 1 Landform exhibiting minor ponding.	Level 1 <ul style="list-style-type: none"> An inspection of the site will be undertaken by a suitably qualified person to investigate opportunities to address issues. Remediate as appropriate.
		Level 2 Landforms exhibiting significant drainage issues, threatening or causing material harm to the environment.	Level 2 <ul style="list-style-type: none"> Undertake a review of the landform design, including survey if required. Undertake re-grading and re-vegetation of the area.
	Seepage	Level 1 Isolated incidence of seepage from REA.	Level 1 <ul style="list-style-type: none"> An inspection of the site will be undertaken by a suitably qualified person to investigate opportunities to address issues. Remediate as appropriate.
		Level 2 Landform exhibiting seepage issues, threatening or causing material harm to the environment.	Level 2 <ul style="list-style-type: none"> An inspection of the site will be undertaken by a suitably qualified person to identify remedial actions. Notify the relevant Government department and implement recommended corrective actions.
Water management	Erosion and scouring	Level 1 Water management structures (sediment dams, channels, contour banks) displaying minor erosion and/or scouring as determined by monitoring.	Level 1 An inspection of the site will be undertaken by a suitably qualified person to identify remedial actions such as re-vegetation or alternative scour protection.
		Level 2 Water management structures fail or display significant scouring/erosion as determined by monitoring.	Level 2 <ul style="list-style-type: none"> Engage a suitably qualified person to develop a site-specific remediation plan and review of the water management structure design. Implement remediation/design changes as a result of the review.
Agriculture - grazing	Ground cover %	Level 1 A minimum of 60% ground cover is not present within six months of landform establishment.	Level 1 <ul style="list-style-type: none"> Undertake field survey to identify likely causes of unsatisfactory germination rates and seed with pasture mix if required.

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Aspect	Risk	Trigger	Response
		Level 2 Ground cover is 50% or less at year 1 for pasture mix.	Level 2 <ul style="list-style-type: none"> Review seeding procedures including seasonal mixes, timing, and seed rate per hectare. Engage a suitably qualified person to investigate causes for germination failure and recommend remedial actions. Implement appropriate management actions including revising rehabilitation procedures if required.
Biodiversity	Weed infestation	Level 1 Increase in weed infestations and/or High Threat Weeds > 20% compared to baseline data.	Level 1 <ul style="list-style-type: none"> Undertake additional monitoring. Increase or review/amend weed control methods. Conduct follow up targeted weed spraying (if suitable for targeted species).
		Level 2 Increase in weed infestations and/or High Threat Weeds > 40% compared to baseline data.	Level 2 <ul style="list-style-type: none"> As for Level 1. Review weed management program to identify key priority areas and investigate alternative methods for control of target species.
	Revegetation success	Level 1 Rehabilitated area/s are not on a trajectory towards completion criteria at year 5 of the Ecosystem and Land Use Establishment phase.	Level 1 <ul style="list-style-type: none"> Undertake inspection of rehabilitated area/s to identify possible threats (e.g. topsoil quantity/quality, weed and animal pest, drought conditions etc.). Implement management actions commensurate to identified cause/risk.
		Level 2 Rehabilitated area/s are not on a trajectory towards completion criteria at year 10 of the Ecosystem and Land Use Establishment phase.	Level 2 <ul style="list-style-type: none"> Engage a suitably qualified person to investigate the cause and recommend management measures. Implement management actions commensurate to identified cause/risk as required (e.g. in fill planting).
	Tree death	Level 1 Tree health observed to be declining within ponded area.	Level 1 <ul style="list-style-type: none"> Engage a suitably qualified person to undertake preliminary investigations. If vegetation will be at risk, undertake a geomorphological assessment to determine options to have the subsidence ponded area freely drain.
		Level 2 Tree deaths observed within ponded area.	Level 2 <ul style="list-style-type: none"> Investigate options to dewater the ponded area to limit further impacts on vegetation health and implement identified adaptive management measures. Undertake survey to identify vegetation community and impacted area with disturbance recorded in the site clearing register.
	Pest animals	Level 1 Monitoring indicates animal pests impacting on rehabilitation and vegetation establishment.	Level 1 Increase the frequency or extent of pest animal monitoring and control based on advice from a suitably qualified person.

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Aspect	Risk	Trigger	Response
		Level 2 Increase in numbers of pest animals causing widespread damage to rehabilitation.	Level 2 Engage a suitably qualified person to prepare a site specific management plan and implement recommendations such as augmenting pest animal exclusion fencing and re-vegetation.
Drought	Drought affecting rehabilitated areas	Level 1 Drought results in vegetation health, composition and/or structure not within the range of analogue sites.	Level 1 <ul style="list-style-type: none"> Engage a suitably qualified person to undertake a preliminary investigations. Implement recommendation actions as a result of the investigation.
		Level 2 Monitoring identifies long term declining trend in vegetation health, composition and/or structure due to drought.	Level 2 <ul style="list-style-type: none"> Engage a suitably qualified person to undertake investigation to determine the recommend actions. Prepare a site-specific management plan and implement recommendation actions in consultation with the relevant Government department.
Mine subsidence	Mine subsidence in rehabilitated areas	Level 1 Surface cracks >50 mm but <320 mm present and/or erosion as a result of cracking identified.	Level 1 <ul style="list-style-type: none"> Provide safety fencing and signage if required. Advise relevant stakeholders. Implement remediation measures as appropriate which may include ripping of surface cracks, filling of cracks with grout, spoil or other suitable material. Implement appropriate erosion control measures as outlined in the site Erosion and Sediment Control Plan. Monitor remediated surface cracks within 3 months following remediation.
		Level 2 Surface cracks >320 mm and/or crack widths more than predicted for specific soil type or natural feature and/or erosion as a result of cracking identified.	Level 2 <ul style="list-style-type: none"> As for Level 1 Make area safe. On-going review and appraisal of any significant changes to surface slopes such as cracking along ridges, increased erosion down slopes, foot slope seepages and drainage path adjustments observed after each longwall is extracted.
Contamination	Contaminated land/water	Level 1 Water/soil monitoring results identify presence of hydrocarbons that exceed baseline levels.	Level 1 <ul style="list-style-type: none"> Engage a suitably qualified person to undertake preliminary investigations. Implement appropriate remediation strategy.
		Level 1 Water/soil monitoring results identify a hydrocarbon contamination that exceeds EPL criteria or presents a risk of material harm to the environment.	Level 1 <ul style="list-style-type: none"> Engage a suitably qualified person to undertake investigation to determine the cause of the incident. Report incident as per Pollution Incident Response Management Plan (PIRMP). Implement appropriate remediation strategy.

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Aspect	Risk	Trigger	Response
Water quality	Water quality	Level 1 Water quality exceeds impact assessment criteria (1 monitoring event). Refer to Water Management Plan	Level 1 <ul style="list-style-type: none"> Review and investigation of water quality monitoring and management where appropriate. Implement relevant remedial measures as required.
		Level 2 Water quality exceeds impact assessment criteria (consecutive monitoring events). Refer to Water Management Plan	Level 2 <ul style="list-style-type: none"> Engage a suitably qualified person to review sampling and climate data and review likely cause(s). If mine related, undertake an assessment to identify sources of water quality degradation and recommend remedial actions. Implement recommendations.
Infrastructure	Decommissioning/sealing failure	Inspections identify that former ventilation shafts/boreholes/mine entries have not been sealed in accordance with required standards.	<ul style="list-style-type: none"> Engage a suitably qualified person to undertake investigations and develop sealing strategy. Implement actions in consultation with the relevant Government department.

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11. Review, revision and implementation

Table 11-1 describes the triggers for reviewing and revising the rehabilitation management plan.

Table 11-1 Review and revision triggers

Source	Triggers
PA 08_0144	<p>The RMP will be reviewed within three months of any of the following:</p> <ul style="list-style-type: none"> completion of an Independent Environmental Audit (as required by Schedule 6 Condition 7); submission of an Incident Report (as required by Schedule 6 Condition 4); submission of an Annual Review (as required by Schedule 6 Condition 6); and any modification to the conditions of the Project Approval (unless the conditions require otherwise).
Mining Regulation 2016 Clause 11 of Schedule 8A	<p>NCOPL must amend the prepared RMP in the following circumstances:</p> <ul style="list-style-type: none"> as a consequence of an amendment made to the rehabilitation objectives, rehabilitation completion criteria or final landform and rehabilitation plan; to reflect any changes to the risk control measures in the RMP that are identified in a rehabilitation risk assessment; and/or whenever directed in writing to do so by the Secretary.

NCOPL will review, and if necessary, revise this RMP as required. This is to ensure that the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the Narrabri Mine operations.

A dedicated review register will be maintained which will provide the details of the review of all relevant strategies, plans and programs that need to be reviewed as required under Schedule 6 Condition 3 of the Project Approval. The revision status of this RMP is indicated in section 12.

The Environment Superintendent is responsible for the day-to-day management and implementation of the RMP.

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12. Review history

Revision	Comments	Author	Authorised by	Date
1		SLR Consulting Australia Pty Ltd	Environment Superintendent, NCOPL	29 July 2022
2A	Revision to include approved rehabilitation objectives and other minor updates	Onward Consulting	Environment Superintendent, NCOPL	16 November 2023

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Appendix A Risk assessment summary

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Table A-1 Key risks and control measures

Risk rating	Key risk	Key controls	Document reference
Moderate	Insufficient funding for or prioritisation of rehabilitation activities.	Existing controls:	
		Annual review of the Forward Program	Section 6.2.6
		Implementation of the Rehabilitation Management Plan	This Plan
		Mid to long term planning process	Section 6.2
		Detailed design for REA closure	Section 6
		Capping assessment completed	Section 6 and refer to the <i>Narrabri Mine Rejects Emplacement Area Capping Assessment and Closure Design Report (REA Closure Design Report)</i> (ATC Williams, 2022)
		Rehabilitation monitoring program covering surface and groundwater	Section 8
		Additional controls:	
Moderate	Final landform is not in accordance with approval design.	Existing controls:	
		Consideration of current approval and regulatory guidelines	Section 1.2
		Preparation of RMP including final land use requirements	This Plan
		Short, mid and long-term planning process	Section 6.2

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Risk rating	Key risk	Key controls	Document reference
		Rehabilitation monitoring program which addresses mine planning and landform design	Section 8
		Permit to Work process to control disturbance and rehabilitation activities	Section 6.2.1 Section 7
		Detailed design for REA closure	Section 6
		Capping assessment completed	Section 6 and refer to the REA Closure Design Report (ATC Williams, 2022)
Moderate	Failure to meet rehabilitation objectives and completion criteria or ongoing management issues and costs.	Existing controls:	
		Baseline ecological and rehabilitation surveys	Section 8
		Rehabilitation monitoring program covering surface and groundwater	Section 8
		Progressive rehabilitation using species commensurate with adjacent communities	Section 6.2.5
		Conduct weed and pest management as required	Section 6.2 Section 7 Section 8
		Implementation of the RMP including the TARP	Section 10
Moderate	Limited biological resource salvage and maintenance (e.g. subsoil, topsoil, capping materials, vegetative material, seedbank, rocks, habitat resources) through clearing, salvage and handling practices.	Existing controls:	
		Material is collected as part of stripping operations and stockpiled for re-use	Section 6.2.1
		Habitat features are identified and salvaged when required	Section 6.2.1
		Short term planning process	Section 5.3.1



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Risk rating	Key risk	Key controls	Document reference
		Annual review of the Forward Program	Section 6.2.6
		Soil and habitat structure management is captured in the RMP	Section 6.2
		Materials balance conducted	Section 6.2.1
		Quality assurance process in place	Section 7
		Topsoil and subsoil quality analysis	Section 6.2.1 Section 8.2
		Topsoil management in accordance with <i>Managing Urban and Stormwater: Soils and Construction Vol 1</i> (Landcom 2004).	Section 6.2.1
		PTW process.	Section 7
		Soil and Land Capability Assessment completed	Section 6.2.1
		Resources for gas drainage rehabilitation retained onsite	Section 1.1.2
		Stockpiled materials handling and maintenance	Section 6.2 Section 8
		Annual rehabilitation monitoring	Section 8
Moderate	Adverse geochemical/chemical composition of topsoils, subsoils, capping or imported materials (PAF, sodicity, salinity).	Existing controls:	Section 6.2.4
		Supervision of topsoil management and handling including location of final placement.	Section 6.2.1
		Quality assurance process in place	Section 7
		Annual review of the Forward Program	Section 6.2.6
		Continue test pitting program	Section 6.2.1
		Additional controls:	

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Risk rating	Key risk	Key controls	Document reference
		Soil quality results to be used to inform targeted amelioration requirements	Section 6.2.4
Moderate	Adverse surface and/or groundwater quality.	Existing controls:	
		Implementation of the Site Water Management Plan	Refer to the Water Management Plan
		Minimise water retention through separation of clean and dirty water	Refer to the Water Management Plan
		Comply with the EPL approval for discharges	Refer to the Water Management Plan
		Discharge procedure	Refer to the Water Management Plan
		Undertake progressive rehabilitation	This RMP
		Implementation of an alarm system to alert to rain events triggering dam management.	Refer to the Water Management Plan
		Water treatment plant to treat excess mine water	Refer to the Water Management Plan
		Site Water Balance	Refer to the Water Management Plan
		Catchment plan for each water storage which includes a TARP based on water levels	Refer to the Water Management Plan
		Weekly measurements of dam water levels	Refer to the Water Management Plan
		Environmental monitoring program including surface and groundwater	Refer to the Water Management Plan
		Permit to work process includes appropriate ESCP commensurate to works	Refer to the Water Management Plan
Moderate	Contamination resulting from associated activities (e.g. storage and use of	Existing controls:	

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Risk rating	Key risk	Key controls	Document reference
	hydrocarbons/chemicals, drilling fluids, spillage of dirty or produced saline water, brine, sewage).	Oil water separator	Section 6.2.1
		Spill response procedure in place	Section 6.2.1
		Bioremediation area and procedure	Section 6.2.2
		Removal of contaminated material to a licenced offsite waste facility	Section 6.2.2
		Water monitoring program in place	Refer to the Water Management Plan
		Onsite internal auditing and spot checks of storage facilities.	6.2.1
		Significant rainfall alerts to trigger wet weather inspections	Refer to the Water Management Plan
		Implementation of the Waste Management Plan	Waste Management Plan
		Hydrocarbon storage utilises appropriate bunding controls.	Section 6.2.1 and refer to the Waste Management Plan
Moderate	Uncertain capping design and performance presents a risk that the materials used for capping may not be a suitable growth medium or placed at a suitable thickness to support the final land use.	Existing controls:	
		The REA Closure Design Report has been finalised.	Refer to the REA Closure Design Report (ATC Williams, 2022)
		Seepage, water quality and design for stability were assessed.	Refer to the REA Closure Design Report (ATC Williams, 2022)
		Contained REA catchment area	Refer to the REA Closure Design Report (ATC Williams, 2022)
		Staged REA construction program	Section 6.2.3
		Groundwater monitoring is conducted	Refer to the Water Management Plan
		Proposed progressive rehabilitation at completion of stages	Section 6.2.3



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Risk rating	Key risk	Key controls	Document reference
		Regular inspections and monitoring of the REA	Section 7 Section 8
Moderate	Physical and structural properties of substrate not appropriate for rehabilitation.	Existing controls:	
		Material is collected as part of the stripping operation and stockpiled for re-use	Section 6.2.1
		Materials balance conducted	Section 6.2.1
		Soil and Land Capability Assessment completed	Section 6.2.1
		The REA Closure Design Report has been finalised.	Refer to the REA Closure Design Report (ATC Williams, 2022)
		Implementation of the Erosion and Sediment Control Plan	Refer to the Water Management Plan
		Annual review of the Forward Program	Section 6.2.6
		Short term planning process in place	Section 6.2.1
Moderate	Subsoil and topsoil deficit for rehabilitation activities.	Existing controls:	
		Current soil mass balance estimate indicates sufficient resource	Section 6.2.1
		Soil and Land Capability Assessment completed	Section 6.2.1
		Ongoing assessment program of stockpiled material	Section 6.2.1 Section 8
		Annual review of the Forward program	Section 6.2.6
		Short term planning process	Section 6.2.1
		Supervision of topsoil management and handling including location of final placement	Section 6.2.1

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Risk rating	Key risk	Key controls	Document reference
		Soil and habitat structure management is implemented as per RMP	Section 6.2.4
		Erosion and Sediment Control Plan	Refer to the Water Management Plan
		Additional controls:	
		Update / review topsoil and subsoil register. Include survey of stockpiled clay for REA capping	Section 6.2.1
		Undertake quality sampling for recently recovered topsoil and subsoil from REA	Section 6.2.1
Moderate	Availability of areas for revegetation in optimal seasonal conditions	Existing controls:	
		Activities are undertaken during optimal seasonal conditions	Section 6.2.5
		Short term planning process	Section 6.2.1
		Experienced personnel to conduct revegetation activities	Section 6.2.1
		The REA Closure Design Report has been finalised.	Refer to the REA Closure Design Report (ATC Williams, 2022)
		REA works conducted in stages	Section 6.2.3
Moderate	Limited vegetation structural development and/or ecosystem function.	Existing controls:	
		Annual review of the Forward Program	Section 6.2.6
		TARP to drive rehabilitation success through responses where actions are required	Section 10



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Risk rating	Key risk	Key controls	Document reference
		Revegetation via seeding and tube stock planting commensurate with target vegetation community	Section 6.2.5
		Rehabilitation monitoring program	Section 8
		Density of planting documented	Section 6.2.5
		Quality assurance program in place	Section 7
Moderate	Extended water ponding in drainage lines.	Existing controls:	
		Subsidence assessments conducted for each Extraction Plan	Refer to the relevant Extraction Plan/s
		Extraction Plans include a specific monitoring program for ponding	Refer to the relevant Extraction Plan/s
		End of panel reports completed for each LW panel	Refer to the relevant End of Panel Report
		Ponding remediation if required	Section 6.2.1 Section 6.2.3