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NORTHPARKES MINE MODIFICATION 6

E22 Portal, TSF2 Buttressing and E31 Precinct Submissions Report

FINAL

March 2022

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E22 Portal, TSF2 Buttressing and E31 Precinct Submissions Report

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
CMOC Northparkes

Project Director: David Holmes
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Report No. 20272/R02
Date: March 2022

Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which Northparkes Mines operates, the Wiradjuri people, and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

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Table of Contents

1.0 Introduction 1

1.1 Background 1

1.2 Public Exhibition Process 1

1.3 Purpose and Structure of Submissions Report 3

2.0 Analysis of Submissions 4

2.1 Submissions Overview 4

2.2 Agency Submissions 4

3.0 Actions Taken Following Exhibition of Modification 5

3.1 Project Refinements 5

3.1.1 Expansion of Area Removed from Approved Operational Area 5

3.1.2 Staging of Vegetation Disturbance 7

3.2 Stakeholder Engagement 10

4.0 Response to Submissions 11

4.1 Agency Submissions 11

4.1.1 BCS 11

4.1.2 DPE – Water 12

4.1.3 Resources Regulator 15

4.1.4 MEG 16

4.1.5 EPA 16

5.0 Justification and Evaluation 18

6.0 References 19

Figures

Figure 1.1 Locality Map 2

Figure 3.1 Proposed Modification 6

Figure 3.2 Staging of Disturbance 8

Tables

Table 3.1 Biodiversity Credit Requirements (By Stage) 9

Table 4.1 Northparkes Mines Water Entitlements and Use (2019/2020) 13

Appendices

Appendix A	Consolidated Project Description
Appendix B	Updated Mitigation Measures
Appendix C	Revised Biodiversity Development Assessment Report
Appendix D	Revised Groundwater Assessment
Appendix E	Site Water Balance
Appendix F	Submissions Register

1.0 Introduction

1.1 Background

CMOC-Northparkes Mines (Northparkes) is a copper and gold mine located 27 kilometres (km) north-west of Parkes, in the Central West of New South Wales (NSW) as shown in **Figure 1.1.** Northparkes is a joint venture between China Molybdenum Co., Ltd (CMOC) (80%) and the Sumitomo Groups (20%).

Approved operations at the Northparkes Mine include open cut and underground copper-gold mining, associated ore handling and processing and product transport through to December 2032. Ore extracted at Northparkes Mines is processed on-site to produce high quality copper concentrate which is transported by road to the Goonumbla Rail Siding and dispatched by rail to Port Kembla for export.

Mining operations at Northparkes commenced in 1993. On 16 July 2014, Northparkes was granted Project Approval (PA 11_0060) for the Northparkes Mine Step Change Project under the former Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). All prior development consents and project approvals for mining operations at the site have now been surrendered, with consolidated mining operations authorised solely under PA 11_0060.[1]

In November 2021, Northparkes submitted an application to modify PA 11_0060 pursuant to section 4.55(2) of the EP&A Act. The Proposed Modification (MOD 6) involves a number of changes to approved operational activities at Northparkes Mine, including:

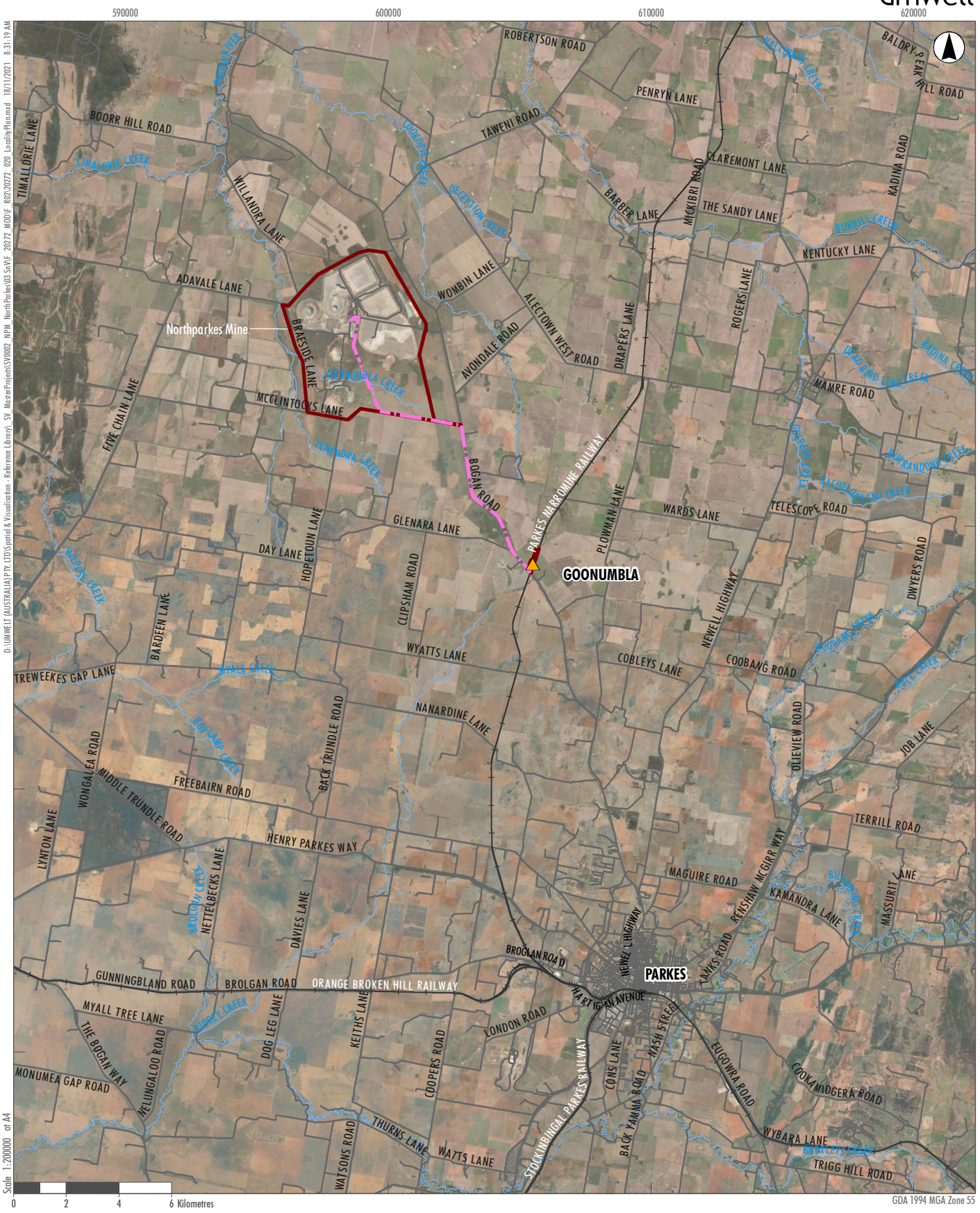
- changes to approved mining operations at the E31 and E31N open cut mining pits
- updated tailings construction requirements for Tailings Storage Facility (TSF) 2
- construction of a new E22 underground access portal and associated drive to improve integration with existing facilities
- relocation of approved activities and ancillary mine infrastructure within the approved Project Area in anticipation of future approval of the proposed Rocklands TSF, which form part of the E44 Rocklands Project (SSD-28984208).

A detailed description of the Proposed Modification is provided in the Modification Report.

1.2 Public Exhibition Process

The Modification Report prepared in support of the Proposed Modification was placed on public exhibition from 3 December 2021 to 16 December 2021. A total of five (5) submissions from government agencies were received in response to the public exhibition. No public submissions were received, either from local residents or community organisations.

[1] A detailed approval history for the Project is provided in Section 2.1 of the Modification Report (Umwelt, 2021)



Legend

- Northparkes Project Area
- Approved Road Haulage Route (Northparkes Mine to Goonumbla Rail Siding)
- Goonumbla Rail Siding
- Railway Line
- Road
- Drainage Line

FIGURE 1.1

Locality Map

Image Source: ESRI Basemap (2021) Data source: NPM(2021); NSW DFSI (2021)

1.3 Purpose and Structure of Submissions Report

This Submissions Report has been prepared by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of Northparkes, in accordance with the Department of Planning and Environment's[2] request for a Response to Submissions. This Submissions Report addresses the key issues raised in the submissions.

This Submissions Report has been prepared having regard to the *State significant guidelines – preparing a submissions report* (July 2021).

This report provides:

- an analysis of the issues and themes raised in the submissions (**Section 2.0**)
- a summary of the actions taken since the exhibition of the Modification Report, including an overview of minor proposed refinements to the Proposed Modification (**Section 3.0**)
- a detailed response to the issues raised in submissions (**Section 4.0**)
- project justification and evaluation (**Section 5.0**).

An updated Consolidated Project Description incorporating the minor refinements to the Proposed Modification is provided in **Appendix A**.

An updated summary of environmental management and mitigation measures for the Project (as it is proposed to be modified) is provided in **Appendix B**. These commitments are unchanged from the Modification Report, however **Appendix B** includes some minor typographical amendments.

[2] Formerly Department of Planning, Industry and Environment (DPIE)

2.0 Analysis of Submissions

2.1 Submissions Overview

The Modification Report, prepared in support of the Proposed Modification, was placed on public exhibition from 3 December 2021 to 16 December 2021. A total of five submissions from government agencies were received in response to the public exhibition.

No public submissions were received, either from local residents or community organisations.

On 21 December 2021, the Department of Planning and Environment (DPE) requested the preparation of a Response to Submissions (Submissions Report) responding to all issues raised in submissions.

2.2 Agency Submissions

Submissions on the Proposed Modification were provided by the following government agencies:

- Biodiversity, Conservation and Science (BCS) Directorate
- DPE - Water
- Resources Regulator (Regional NSW)
- Mining, Exploration and Geoscience (MEG) (Regional NSW)
- Environment Protection Authority (EPA).

Additionally, Parkes Shire Council advised that it had no comment on the Proposed Modification.

No government agencies objected to the Proposed Modification. Of the five agencies that provided comments on the Modification, only two agencies (BCS and DPE - Water) requested further information and/or assessment in relation to the proposal. Other agencies indicated that they had no concerns regarding the Proposed Modification, or that any concerns may be appropriately addressed through modified conditions of consent.

Section 4.0 provides a summary of issues raised in agency submissions as well as detailed responses to matters raised by BCS and DPE – Water. Additionally:

- a revised Biodiversity Development Assessment Report (BDAR) is provided in **Appendix C**
- a revised Groundwater Assessment is provided in **Appendix D**
- a Site Water Balance is provided in **Appendix E**.

3.0 Actions Taken Following Exhibition of Modification

This section provides an overview of actions taken during the preparation of the Submissions Report, including project refinements and additional stakeholder engagement.

3.1 Project Refinements

Following the public exhibition of the Proposed Modification, some minor refinements to the Proposed Modification have been made to address government agency submissions and to ensure the accuracy of the information presented. These amendments comprise:

- an expansion of the area proposed to be removed from the existing Approved Operational Area as part mitigation of additional vegetation disturbance associated with the Proposed Modification (see **Section 3.1.1**)
- staging of vegetation disturbance associated with the Proposed Modification (see **Section 3.1.2**)
- refinement of mapping of the Approved Operational Areas and Local Land Services Act Land Category mapping for the Project to correct minor errors (see Appendix G of the Revised BDAR (**Appendix C**)).

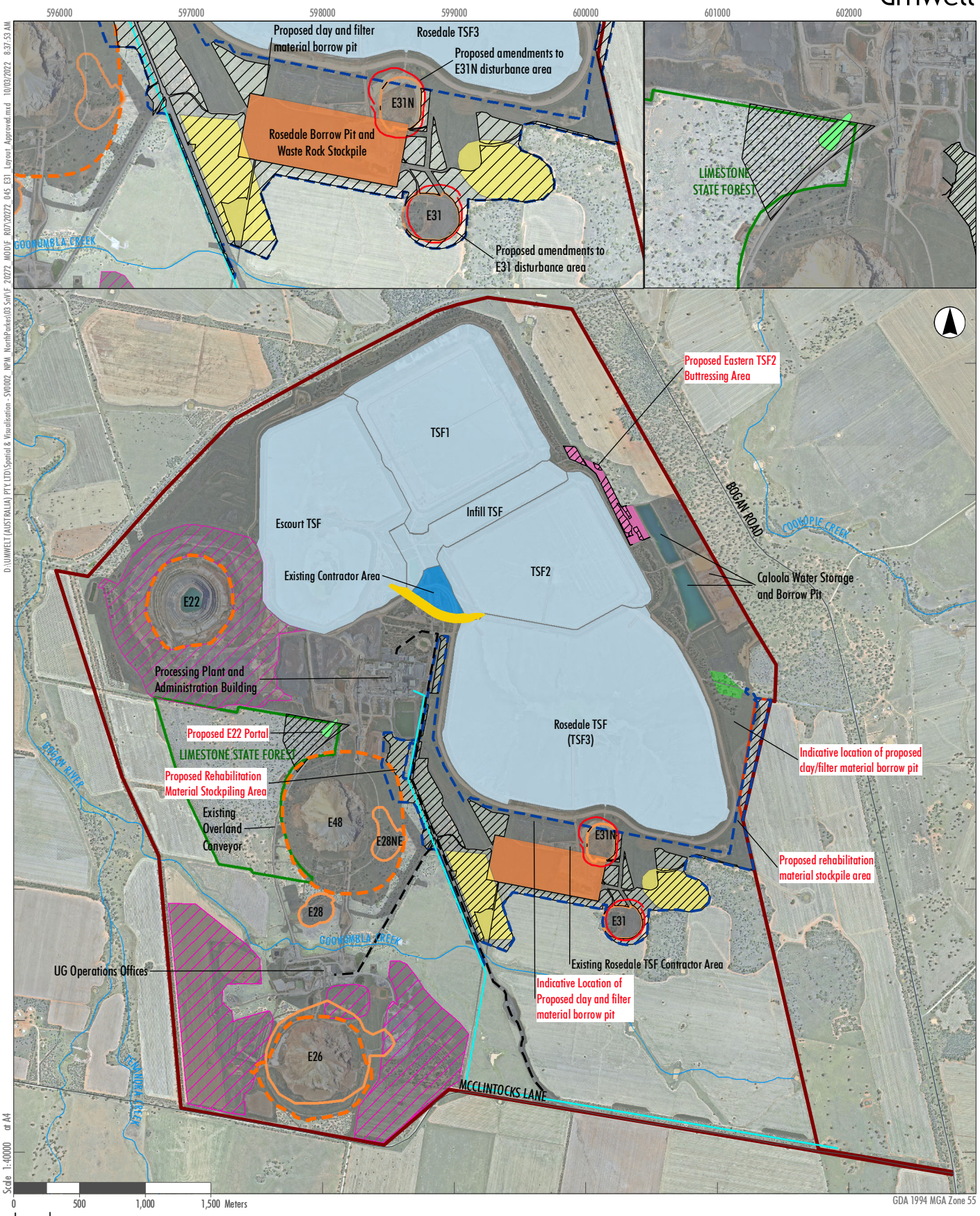
The refinements described below are reflected in **Figure 3.1** and **Figure 3.2** below. No other changes to the Proposed Modification, as described in the Modification Report (Umwelt, 2021), are proposed.

3.1.1 Expansion of Area Removed from Approved Operational Area

The Proposed Modification, as described in the Modification Report, included the removal of a 0.69 hectare (ha) area of land from the mine's Approved Operational Area. This area contains remnant woodland vegetation which has not been impacted by approved operations and is no longer required to be disturbed due to refinements to the design of the Rosedale TSF. The impacts of clearing in this area have already been offset in accordance with the conditions of PA 11_0060. Northparkes proposes to remove this area from the Approved Operational Area to partially compensate for the additional disturbance to remnant vegetation associated with the Proposed Modification.

Subsequent to the finalisation of the Modification Report, Northparkes has identified that there is further opportunity to expand this proposed disturbance 'swap area' from 0.69 ha to 2.78 ha. It is considered that the expansion of this area will provide increased size and improved connectivity for the remnant PCT 80 vegetation community in the proposed swap area with the established vegetation corridor to the east of the Project Area. The expanded area is shown in **Figure 3.1**.

Vegetation within the expanded 'swap area' represents 101 ecosystem credits for PCT 80 (Western Grey - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion) (refer to **Appendix C**). Consistent with like-for-like trading rules under the NSW Biodiversity Offsets Scheme, the removal of the swap area from the approved disturbance area would 'free-up' these credits for use in offsetting additional impacts to PCTs 56, 76, 80 and 82, which would also be impacted by the Proposed Modification (but not PCTs 248 and 277). Calculated offsetting requirements for these PCTs associated with the Proposed Modification has been assessed as being 103 ecosystem credits (refer to **Section 3.1.2** and **Appendix C**), meaning only 2 additional ecosystem credits from PCT 56, 76, 80 or 82 would be required for the Proposed Modification (in addition to the credit requirements not satisfied by the like-for-like trading rules for PCT 80).



Legend

- Northparkes Project Area
- E31 Precinct Area
- Proposed E31 and E31N Pit Extents
- Proposed Extension to Project Area Boundary
- Proposed Temporary Waste Rock Stockpile
- Proposed Eastern TSF2 Buttressing Area
- Proposed E22 Portal
- Proposed TSF Infill Area
- Proposed Additional Disturbance Areas
- Approved Open Cut Areas
- Approved Waste Dumps
- Approved Subsidence Limits
- Tailings Storage Facility
- Approved Rosedale Borrow Pit and Approved E31 Waste Rock Stockpile Area
- Approved Operational Area
- Area proposed to be removed from Approved Operational Area
- Proposed Infill TSF Bund (conceptual)
- Internal Access Road
- Water Supply Pipeline
- Drainage Line
- Roads

FIGURE 3.1

Proposed Modification

Image source: NPM (2020) Data source: NPM (2021)

3.1.2 Staging of Vegetation Disturbance

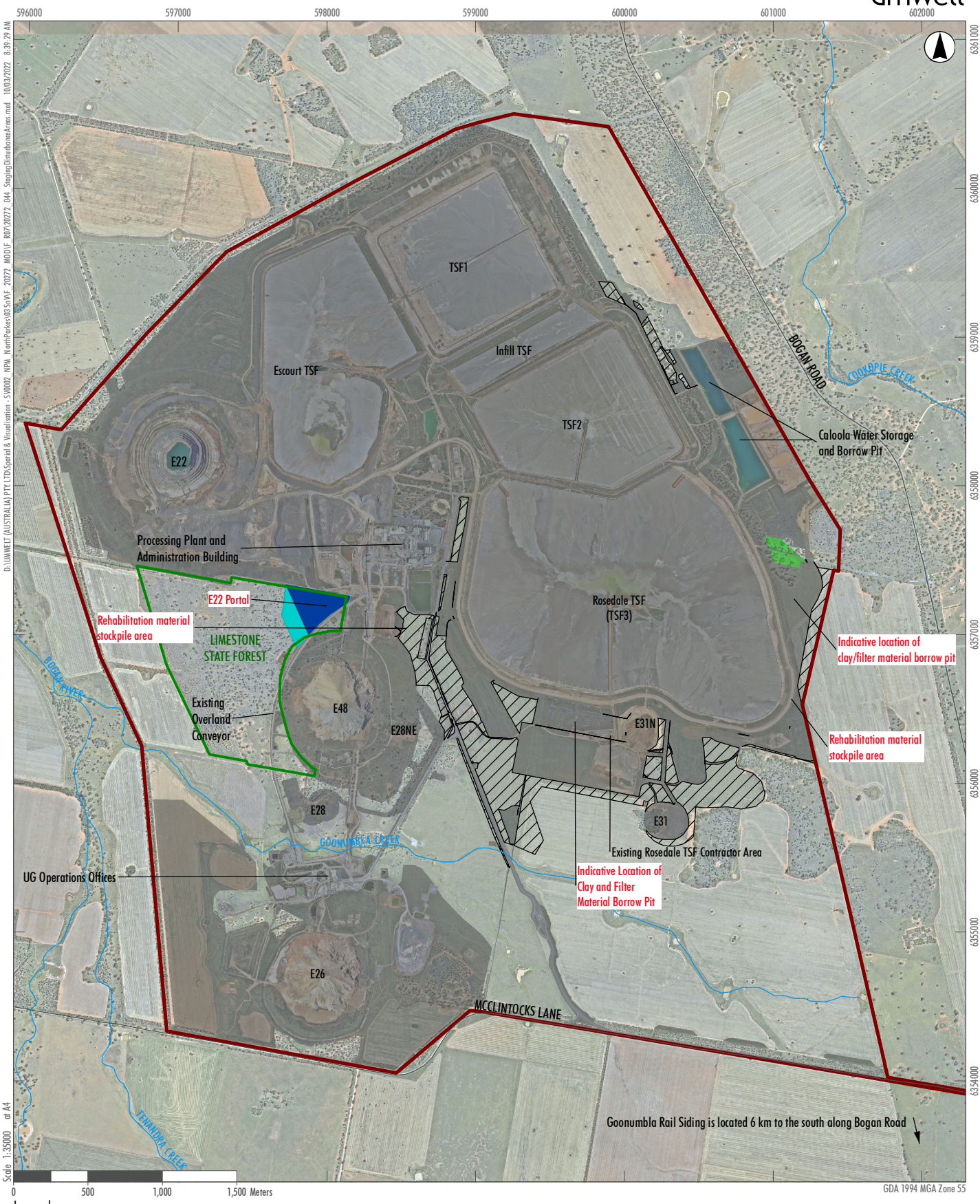
Northparkes proposes to undertake vegetation disturbance associated with the Proposed Modification in three stages, comprising:

- Stage 1: proposed disturbance within the E31 Precinct and TSF2 embankment buttressing area.
- Stage 2: proposed disturbance for the E22 portal.
- Stage 3: proposed additional disturbance for the E22 portal (which may or may not be required, pending the outcome of the detailed portal design).

The three stages of vegetation disturbance are shown in **Figure 3.2**.

Northparkes proposes to retire the relevant biodiversity credits prior to the commencement of vegetation clearing in each stage, unless otherwise agreed by the Planning Secretary. Should Northparkes determine during the detailed design phase that the Stage 3 area is not required for the establishment of the E22 portal and its associated infrastructure, this area will not be disturbed and no credit retirement will be required for this stage.

Table 3.1 below provides a summary of ecosystem credit requirements for each of the three stages. No species credits requirements are applicable to the Proposed Modification.



Legend

- Northparkes Project Area
- Approved Operational Area
- Area proposed to be removed from Approved Operational Area
- E31 and TSF 2 Proposed Disturbance Area (Stage 1)
- E22 Portal Proposed Disturbance Area 1 (Stage 2)
- E22 Portal Proposed Disturbance Area 2 (Stage 3)
- Drainage Line
- Roads

FIGURE 3.2

Staging of Disturbance Areas

Image source: NPM (2020) Data source: NPM (2021)

Table 3.1 Biodiversity Credit Requirements (By Stage)

Vegetation zone / PCT	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in VI score	BC Act status	Ecosystem credits required	Residual Credits Required (Less 'Land Swap' Area)
Stage 1 - E31 Precinct & TSF2 Buttressing							
Zone 1 – PCT 56 Poplar Box - Belah woodland on clay-loam soils on alluvial plains – degraded understorey	0.73	34.2	0	-34.2	Not listed	12	2
Zone 2 – PCT 80 Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion – good	0.19	89.4	0	-89.4	EEC	8	
Zone 4 – PCT 76 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – good	1.43	50.4	0	-50.4	EEC	36	
Zone 5 – PCT 82 Western Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams - good	1.11	85.5	0	-85.5	EEC	47	
Zone 6 – PCT 277 Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion – planting	0.073	54.8	0	-54.8	CEEC	2	2
Total credits for Stage 1						**105**	**4**
Stage 2 – E22 Portal (Area 1)							
Zone 3 (Stage 1 portion) – 248 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey	6.19	48.7	0	-48.7	Not listed	151	151
Total credits for Stage 2						**151**	**151**
Stage 3 – E22 Portal (Area 2)							
Zone 3 (Stage 2 portion) – 248 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey	3.38	48.7	0	-48.7	Not listed	82	82
Total additional credits for Stage 3						**82**	**82**

3.2 Stakeholder Engagement

Subsequent to the exhibition of the Modification Report, Northparkes has undertaken additional community engagement in relation to the Proposed Modification and its mining operations generally.

In December 2021, Northparkes contacted the owner of Receiver 3 (Hubberstone). No specific concerns regarding the Proposed Modification, however, blast monitoring and surface water management during significant rainfall events were discussed.

Additionally, in December 2021, Northparkes consulted with the owners of Receiver 17 (Adavale) and Receiver 18 (Lone Pine) regarding the siting of blast monitors associated with E31 and E31N open cut operations.

During the public exhibition period, the owner of Receiver 10a (Hillview) noted that Figure 3 in the Groundwater Assessment (Appendix I of the Modification Report) did not accurately identify all current registered bores in the vicinity of the Project Area. This figure was extracted from the Groundwater Assessment for the Northparkes Mine Step Change Project (Golder, 2013) to illustrate predicted groundwater drawdown associated with approved operations. It therefore only identified registered bores at the time the assessment was undertaken. For completeness, the Groundwater Assessment has been revised to include an updated figure showing registered bore locations as at 2 February 2022. The revised Groundwater Assessment is included in **Appendix D**.

Northparkes met with the owner of Receiver 10a (Hillview) in January 2022 and a copy of the revised assessment was provided to the landowner on 21 February 2022.

Additionally, Northparkes has advised the owner of Receiver 10a (Hillview) that existing protections under Condition 20 of Schedule 3 of PA 11_0060 will continue to apply to the Project following MOD 6. Condition 20 is set out below.

> ***Compensatory Water Supply***
>
> *The Proponent shall provide a compensatory water supply to any landowner of privately owned land whose water supply is adversely and directly impacted (other than an impact that is negligible) as a result of the project, in consultation with DPIE - Water, and to the satisfaction of the Secretary. The extent of adverse impact on water supply must be investigated in accordance with the procedures outlined in Condition 4 of Schedule 5. The compensatory water supply measures must provide an alternative long-term supply of water that is equivalent to the loss attributable to the project. Equivalent water supply should be provided (at least on an interim basis) within 24 hours of the loss being identified, unless otherwise agreed with the landowner.*
>
> *If the Proponent and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.*
>
> *If the Proponent is unable to provide an alternative long-term supply of water, then the Proponent shall provide alternative compensation to the satisfaction of the Secretary.*

During the January 2022 meeting, the owner of Receiver 10a (Hillview) also provided feedback regarding noise and blasting. It was agreed that Northparkes will continue to monitor and manage these impacts in accordance with the existing requirements under PA 11_0060, including with respect to the identification and repair of any blasting damage.

4.0 Response to Submissions

4.1 Agency Submissions

The following section provides a response to the issues raised in submissions on the Proposed Modification. The issues raised in the submissions are included in bold italic text with the response provided below in normal text. It is noted that no additional requests for information or additional assessments were made by DPE.

4.1.1 BCS

1.1 The disclaimer in Section 1.6 should be removed from the BDAR.

This is a standard disclaimer which appears in all BDARs prepared by GHD.

2.1 An additional two plots appropriately placed within the vegetation zone should be sampled, benchmark data used, or justification for duplicating the plot as representative be provided.

Additional plots were established within the relevant vegetation zone (Zone 3) in late November 2021, shortly after the finalisation of the Modification Report and original BDAR. Additional survey for species credit species in other areas of the Disturbance Footprint have also been conducted. Further discussion and justification for survey plots is provided in Section 3.2.2 of the revised BDAR (**Appendix C**).

3.1 Discussion relating to the results of surveys should be clearly defined between Mod 6 and the E44 Rocklands project.

References to the E44 Rocklands Project have been clarified in Section 5.4.1 of the revised BDAR (**Appendix C**).

3.2 Update Appendix B to reference E44 Rocklands as the related source.

Appendix B of the revised BDAR (**Appendix C**) has been updated.

4.1 The BDAR must include discussion relating to measures to avoid or minimise all impacts of the proposed development for the current disturbance area, in addition to explaining the measures that will be taken during the detailed design phase to further avoid and minimise.

As discussed in Section 7 of the BDAR (**Appendix C**), the Proposed Modification has been designed in accordance with the hierarchy of avoidance, mitigation and offsetting of biodiversity impacts.

The large majority of surface disturbance associated with the Proposed Modification would occur within the existing Approved Operational Area or within Category 1 – Exempt Land. Of the total area of proposed additional disturbance associated with the Proposed Modification, approximately 85% is identified as Category 1 Exempt Land.

Where possible, new and relocated site infrastructure has been sited so as to avoid native vegetation. For example:

- the proposed rehabilitation material stockpiling area to the northeast of the E48 mining area has been reduced to avoid existing vegetation adjacent on the western side of the access road
- the proposed realignment of the water supply pipeline would follow the existing access road alignment to avoid unnecessary disturbance.

While vegetation removal in the vicinity of the proposed E22 portal cannot be avoided, the following should be noted:

- vegetation within this area (PCT 248) is not commensurate with any threatened ecological community and exhibits a degraded understorey
- vegetation disturbance in the E22 portal area will be undertaken in two stages; where detailed design indicates that the additional disturbance area (Stage 3) is not required for the establishment of the E22 portal and associated facilities, this area will not be disturbed.

It is also noted that the proposed adjustment to the Approved Operational Area to remove the 'swap area' from the area currently approved for disturbance almost entirely mitigates the additional disturbance associated with the Stage 1 area in terms of ecosystem credit offset requirements.

The BDAR includes a range of additional commitments to manage and mitigate biodiversity impacts associated with the Proposed Modification. These are reflected in **Appendix B**.

4.2 Should the final area of impact be less than approved under this modification the approval conditions should reflect the biodiversity credit liability in the BDAR.

This is consistent with the proposed staging of vegetation disturbance. Should it be determined during the detailed design phase for the E22 portal that the additional Stage 3 area is not required, this area will not be disturbed, and consequently, retirement of biodiversity credits for Stage 3 will not be required.

5.1 If the consent authority endorses the proposed offset swap, the offset swap area indicated in Figure 6 of the BDAR should be removed from the current approval conditions as an area to be impacted.

Noted. This area has been removed from the "Approved Operational Area" in **Figure 2.1** and the consolidated Project Layout Figure (see Figure 1 in **Appendix A**). It is considered that a specific condition in this regard is unnecessary and the identified ecosystem credit offsetting requirements in **Table 3.1** above reflect the net offsetting requirements taking into account the removal of the swap area.

4.1.2 DPE – Water

1.0 Groundwater take and entitlement

1.1 Recommendation – Prior to Determination

That the proponent:

- ***provide a table comparing actual groundwater inflows to predicted groundwater inflows to the pits E31 and E31N for the period April 2015 to present.***

  Mining operations in the E31 and E31N pits has not yet commenced. As such, discussion regarding groundwater inflows and water licensing in this section relates to the mining operations generally.

  Northparkes' operational water needs are met through a combination of Water Access Licences (WALs) for the extraction of surface water and groundwater from the Lachlan River and its associated alluvial water sources. **Table 4.1** provides a summary of WALs currently held by Northparkes, and the respective take under each licence for the 2019/2020 water year.

As **Table 4.1** shows, passive mine inflows from the Murray Darling Basin Fractured Rock Groundwater Sources during this period were well within Northparkes' existing entitlement of 232 megalitres per year (ML/yr).

A review of Northparkes' Annual Reviews between 2017 and 2021 indicates that passive mine inflows have consistently remained below 10 ML/year (less than 0.003 ML/day).[3] Previous total modelled inflow predictions for the Northparkes Mine Step Change Project (Golder 2013) ranged between 219 ML/yr (0.6 ML/day) and 438 ML/yr (1.2 ML/yr).

Table 4.1 Northparkes Mines Water Entitlements and Use (2019/2020)

Water Access Licence (WAL)	Water Sharing Plan and Management Zone	Licensed Volume (ML)	Passive Take/ Inflows (ML)	Active Pumping (Yes/No)	Total (ML)
WAL43208	Lachlan River Water Sharing Plan Lachlan River Regulated River Water Source (High Security)	1305	0	No	0
WAL43207	Lachlan River Water Sharing Plan Lachlan River Regulated River Water Source (General Security)	3463	0	No	0
WAL34955	**Lachlan River Water Sharing Plan NSW Murray Darling Basin Fractured Rock Groundwater Sources**	**232**	**<10**	**No**	**<10**
WAL32138	Lachlan River Water Sharing Plan Lachlan Unregulated and Alluvial Water Sources	1110	0	No	0
WAL32120		1050	0	Yes	299.60
WAL32004		1600	0	Yes	1,178.85
WAL31969		1728	0	No	0
WAL31963		700	0	No	0
WAL31930		600	0	No	0
WAL31863		534	0	No	0
WAL31850		500	0	No	0

Source: Adapted from 2020 Annual Review (Northparkes 2020)

[3] It is noted that annual production ranged between 6.22 and 6.53 million tonnes per annum (Mtpa), compared with the approved limit of 8.5 Mtpa, during this period

The 2020 Northparkes Mines Site Water Balance (GHD 2020) (**Appendix E**) indicates that, consistent with previous predictions for the Northparkes Mine Step Change Project (Golder 2013), the maximum potential groundwater take from mine workings during the 2019/2020 water year was 150 ML/yr. However, GHD (2020) noted that actual observed inflows have remained lower than predicted.

Overall, the Site Water Balance (GHD 2020) indicates that there is currently no net groundwater take from the Northparkes operations, on the basis that:

- no open cut mining operations are currently under way, and
- there is more raw water being pumped to underground workings than total water being pumped out.

During the 2019/2020 water year, Northparkes pumped 629 ML of raw water to the underground workings for operational purposes. During that same period, Northparkes pumped 536 ML of water from the underground workings to its surface water storages. The balance (approximately 93 ML) is estimated to be entrained in ore extracted from the mine.

Based on the above, the current dewatering WAL allocation of 232 ML is considered sufficient to account for predicted water take associated with the Project, with or without the Proposed Modification. Nevertheless, consistent with Condition 19 of Schedule 3 of PA 11_0060, Northparkes will secure additional entitlements where necessary to account for all water take associated with its operations. Northparkes has confirmed that there are sufficient licences to trade or buy within the fractured rock groundwater source, where required. Additionally, Northparkes will adjust the scale of its operations as needed, in line with its entitlements.

- ***provide a copy of the Northparkes Mines Site Water Balance (GHD, 2020) to support the revised forecast for groundwater take from all workings including the E22 Portal***

  A copy of the Northparkes Mines Site Water Balance (GHD 2020) is provided in **Appendix E**.

- ***confirm whether the groundwater take predictions include the maximum annual water take from all water take points included in the modification.***

  Groundwater take predictions referenced above represent the maximum inflows predicted over the life of the Northparkes Mine Step Change Project (Golder 2013).

- ***where additional take points are identified the proponent will be required to quantify the water take and demonstrate sufficient entitlement is held or can be acquired.***

  As indicated in Section 5.6.2 of the Modification Report, the E22 portal and drive run in an approximately north south alignment, west of the E48 underground operations. Given the nature of the drive and its location between E48, E26 and E22 operations, it is unlikely to have any observable impact on groundwater systems. On this basis, groundwater take associated with the establishment of the portal has not been quantified. However, inflows are expected to be negligible, and would be accounted for within Northparkes' existing entitlements under WAL 34955 (see above).

  No other groundwater take points are proposed under the Proposed Modification.

1.2 Recommendation – Post approval

- ***Update the Water Management Plan in accordance with Schedule 5 Condition 5 of the Consent Conditions***

  Northparkes will review and, where necessary, revise its existing Water Management Plan (Northparkes 2017), consistent with the requirements of Condition 5 of Schedule 6 of PA 11_0060.

- ***That the proponent ensure that the relevant management plan consider the final landform storages requirement for water licensing or exemption.***

  Northparkes will consider licencing requirements associated with final voids and borrow pits as part of its overarching rehabilitation strategy, in preparation for mine closure. The proposed condition is consistent with existing mine closure considerations.

2.0 Surface disturbance and watercourse management

2.1 Recommendation – Post Approval

- ***Works within waterfront land need to be in accordance with the "Guidelines for Controlled Activities on Waterfront Land (NRAR 2018)".***

  Noted. The water management performance measures in Table 6 of PA 11_0060 require all linear infrastructure within 40 metres of watercourses (including Goonumbla Creek) to be designed, installed and maintained generally in accordance with these guidelines (or their latest version).

- ***The proponent must update the Soil and Water Management Plan to address clean and dirty water management and sediment and erosion control during construction and operation. The plan is to address the requirements of the guideline Managing Urban Stormwater: Soils and Construction (Landcom 2004).***

  Northparkes will review and, where necessary, revise its existing Water Management Plan (Northparkes 2017), consistent with the requirements of Condition 5 of Schedule 6 of PA 11_0060.

4.1.3 Resources Regulator

The Resources Regulator has reviewed the request and the Northparkes Mine Modification 6 E22 Portal, TSF2 Buttressing and E31 Precinct Modification Report have adequately addressed the Resources Regulator's environmental assessment requirements.

Noted.

The Resources Regulator requests an opportunity to review any amended or additional documentation lodged by the proponent that affects rehabilitation outcomes.

No project amendments or refinements are proposed that would affect rehabilitation outcomes. The proposed changes to the Approved Operational Area will be documented in the Mining Operations Plan (MOP)/Rehabilitation Plan.

It should be noted that the Resources Regulator does not provide any endorsement of the proposed rehabilitation methodologies presented in the plans provided. Under the conditions of a mining authorisation granted under the Mining Act 1992, the Resources Regulator requires the holder to adopt a risk-based approach to achieving the required rehabilitation outcomes.

The applicability of the controls to achieve effective and sustainable rehabilitation is to be determined based on site-specific risk assessments conducted by the authorisation holder. An authorisation holder may also be directed by the Resources Regulator to implement further risk control measures required to achieve effective rehabilitation outcomes during the life of the mine.

The proponent will be required to comply with rehabilitation requirements under the mining authorisations prior to the commencement of the works associated with the proposal.

The Resources Regulator may undertake assessments of the mine operators' proposed mining activities under the Work Health and Safety (Mines and Petroleum Sites) Act 2013 and Regulation as well as other WHS regulatory obligations.

Noted.

4.1.4 MEG

MEG has reviewed the information supplied and raises no issues regarding the Modification. MEG finds that the benefits of the Modification stated by the Proponent are reasonable and for this reason is supportive of the application.

Noted.

Furthermore, MEG notes that Section 5.1.5 of the Modification Report states offsetting residual biodiversity credits is required. We would appreciate the opportunity for early consultation in relation to the proposed location of any biodiversity offset areas or any supplementary biodiversity measures. This is to ensure there is no consequent reduction in access to prospective land for mineral exploration or potential for sterilisation of mineral or extractive resources.

Northparkes will consult with MEG regarding potential resource sterilisation issues in the event that a land-based offset strategy is proposed to satisfy the residual biodiversity credit requirements for the Proposed Modification.

4.1.5 EPA

The EPA has reviewed the Modification Report and accompanying attachments and provides its recommended conditions of approval below. The EPA notes that the Proposal may require a variation to the Licence to account for the proposed changes if the Proposal is approved. If approved, the Proponent will need to apply separately to the EPA to vary the licence.

Noted, however, it is considered that a variation of the existing Environment Protection Licence (EPL) is not required.

Recommended Conditions of Approval

Air Quality

The Modification Report's Air Quality Impact Assessment (AQIA) presents an emissions inventory for the Proposal and compares Total Solid Particle (TSP) emissions being 8% lower than the annual TSP emissions quantified and modelled by SKM (2013). The annual PM10 and PM2.5 totals for the Proposed Modification are 3% lower and 19% higher than the totals estimated by SKM (2013) for approved operations. This is due to the approved E26, E28 and E28N[4] open cut pits not being mined concurrently with the E31 and E31N open cut pits. Hence, there is an expected reduction in overall emissions.

Therefore, the EPA recommends that the following be included as a condition of approval:

- ***Prior to the commencement of earthwork construction a Trigger Action Response Plan for dust management must be prepared by the proponent. The plan should include but not be limited to:***
  - ***a. Define dust triggers levels;***
  - ***b. Locations of dust monitoring equipment;***
  - ***c. Monitoring program; and***
  - ***d. Proposed dust management control measures.***

These requirements are consistent with the approach to particulate matter management under the current Air Quality Management Plan (Northparkes 2021). The existing site-wide Air Quality Management Plan will be reviewed and updated as necessary to reflect the Proposed Modification.

Surface Water

The EPA notes that the proposed changes to surface water management have the potential to change the volume of clean, dirty and contaminated water required to be managed by the surface water management system. Appendix H refers to the existing surface water management structures within the site footprint but does not address potential sediment and erosion issues created by the stockpiling of material in laydown areas or vehicle movements during construction.

Therefore, the EPA recommends that the following be included as a condition of approval:

- ***Prior to the commencement of the proposal, the proponent must develop an erosion and sediment control plan specific to the proposed changes.***

The existing erosion and sediment control measures in the Surface Water Management Plan will be reviewed and updated as necessary to reflect changes associated with the Proposed Modification. It is noted that the proposed management measures set out in the Modification Report are consistent with those currently applicable to existing approved operations, as detailed in the Surface Water Management Plan.

[4] For clarification purposes, the approved (but not yet constructed) 'E28N' open cut pit is now referred to by Northparkes as E28NE. To align approval documentation with operational nomenclature, this approved open cut pit is identified as the 'E28NE' open cut pit within this report and associated documents.

5.0 Justification and Evaluation

The Proposed Modification will provide a range of benefits, including:

- improved resource recovery from within the E31 and E31N open cut areas
- improved operational efficiencies (including reduced overland ore transport) associated with E22 underground operations
- facilitating improvements to TSF2 and the Infill TSF Area to meet updated design and safety requirements
- avoiding or mitigating potential future impacts associated with the proposed E44 Rocklands Project by avoiding potential operational conflicts, improving operational synergies and minimising future material rehandling that will be required for the Rocklands TSF.

The assessments presented in this report indicated that the Proposed Modification is unlikely to significantly increase the environmental impacts of approved operations. In particular, these assessments demonstrate that:

- surface disturbance associated with the Proposed Modification is primarily limited to areas of approved disturbance for PA 11_0060 and areas which have been heavily disturbed by historical agricultural activity
- the proposed clearing of additional native vegetation associated with the Proposed Modification will be partially mitigated by the removal of a 2.78 ha area of approved disturbance from the Approved Operational Area; the residual impacts of clearing will be suitably offset in accordance with the NSW Biodiversity Offsets Scheme
- no additional impacts on Aboriginal or historic heritage values are expected as a result of the Proposed Modification, relative to approved operations
- noise and air quality impacts associated with the operations will continue to comply with relevant performance criteria and will be managed through the implementation of measures detailed in existing management plans
- surface water and groundwater impacts associated with the Proposed Modification will be minimal and generally consistent with approved operations.

6.0 References

GHD, 2020. *Northparkes Mines Site Water Balance*

Golder, 2013. *Northparkes Step Change Project – Responses to Review Comments*

Northparkes, 2017. *Northparkes Mines Water Management Plan*

Northparkes, 2017. *2017 Annual Review*

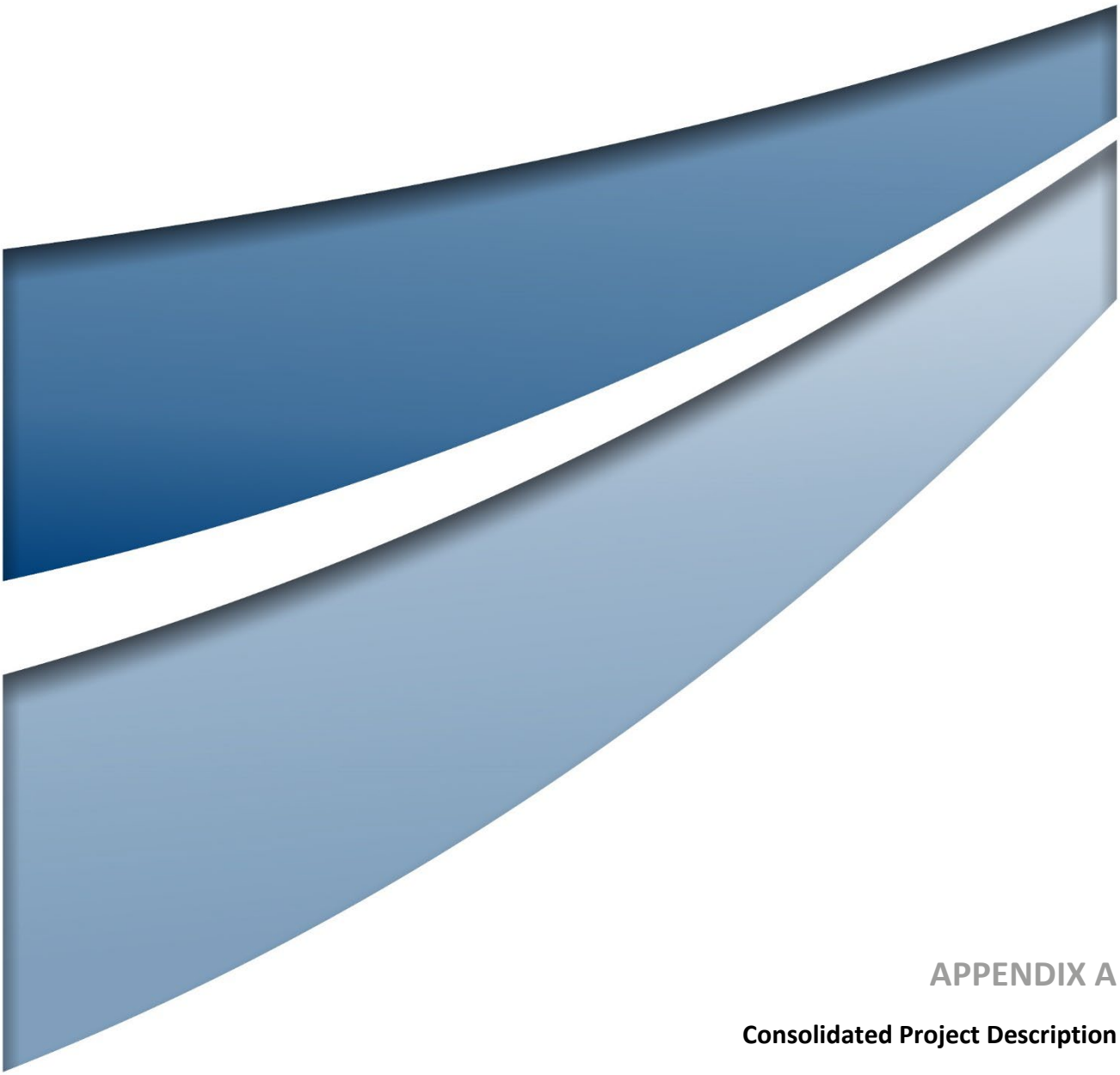
Northparkes, 2018. *2018 Annual Review*

Northparkes, 2019. *2019 Annual Review*

Northparkes, 2020. *2020 Annual Review*

Northparkes, 2021. *Air Quality Management Plan*

Umwelt, 2021. *Northparkes Mine Modification 6 E22 Portal, TSF2 Buttressing and E31 Precinct Modification Report*



APPENDIX A

Consolidated Project Description

Consolidated Project Description

A1 Introduction

This chapter provides a summary of approved operations under PA 11_0060 (as modified), consistent with *State significant development guidelines – preparing a modification report* (DPIE, July 2021). The Consolidated Project Description should be read in conjunction with the documents listed in **Section A3** of this chapter.

A2 Project Overview

The approved operations involves the consolidation and replacement of PA 06_0026 (Northparkes E48 Project, as modified) and DA 11092. The approved operations, as modified (incorporating MOD 6) includes:

- continuation of approved underground block cave mining, with the addition of sub-level caving, in the E48 and E26 ore bodies, and associated underground infrastructure
- development of underground block caving in the E22 resource beneath the E22 open cut void
- campaign open cut mining through development of five open cut resources including:
    - development of four small open cut pits E31, E31N, E28, E28NE
    - E26 open cut which is located in an area of previous underground block cave subsidence
- amendments to the configuration of TSFs including the development of the Rosedale TSF (TSF 3), including TSF2 embankment buttressing and extension to Infill TSF
- development of waste rock stockpile areas for the management of open cut waste rock which can be utilised in the development of TSFs
- establishment of temporary waste rock stockpile areas for the E31 and E31N pits
- use of waste rock (including stockpiled material) in the development, lifts and buttressing of TSFs
- continuation of approved ore processing infrastructure up to a capacity of 8.5 million tonnes per annum (Mtpa)
- road haulage of copper concentrate to the existing Goonumbla rail siding (with temporary haulage to Parkes National Logistics Terminal during upgrading of Goonumbla rail siding and in other circumstances (with the approval of the Planning Secretary))
- operation of railing loading facilities at Goonumbla rail siding
- continued use of existing mine infrastructure and site facilities, upgrades to ore conveyor, hoisting and processing infrastructure, construction and operation of an additional ball mill and new secondary crushing building, upgrading and relocation of power supply, relocation of existing Contractor Area within the Approved Operational Area

- construction and use of a new underground portal access (including associated drive, conveyor and other ancillary infrastructure) for E22 underground mining operations
- establishment and use of rehabilitation material (vegetation, topsoil and subsoil) stockpiling areas within the Approved Operational Area
- establishment of clay and filter material borrow pits for TSF construction and lifts
- continuation of existing approved water supply and management processes, with relocation of main water supply pipeline
- maintenance, replacement and relocation of water management and services infrastructure (as required, within the limits of the Approved Operational Area)
- activities ancillary to mining, waste rock management and operation of tailings storage facilities within the Approved Operational Area (including, vehicle washdown areas, water management infrastructure (such as drains, pipelines, and dams), internal access and haul roads and temporary support facilities such as site offices, crib rooms and self-contained toilet facilities, temporary construction and decommissioning laydown areas))
- development of a new access road (with access control facilities and associated carparking) to service all mine related traffic entering the site
- upgrade of McClintocks Lane and associated intersection works on Bogan Road
- continuation of approved mining operations until the end of 2032
- rehabilitation and closure of the mine site after the end of the operational life of the Project in accordance with relevant approvals.

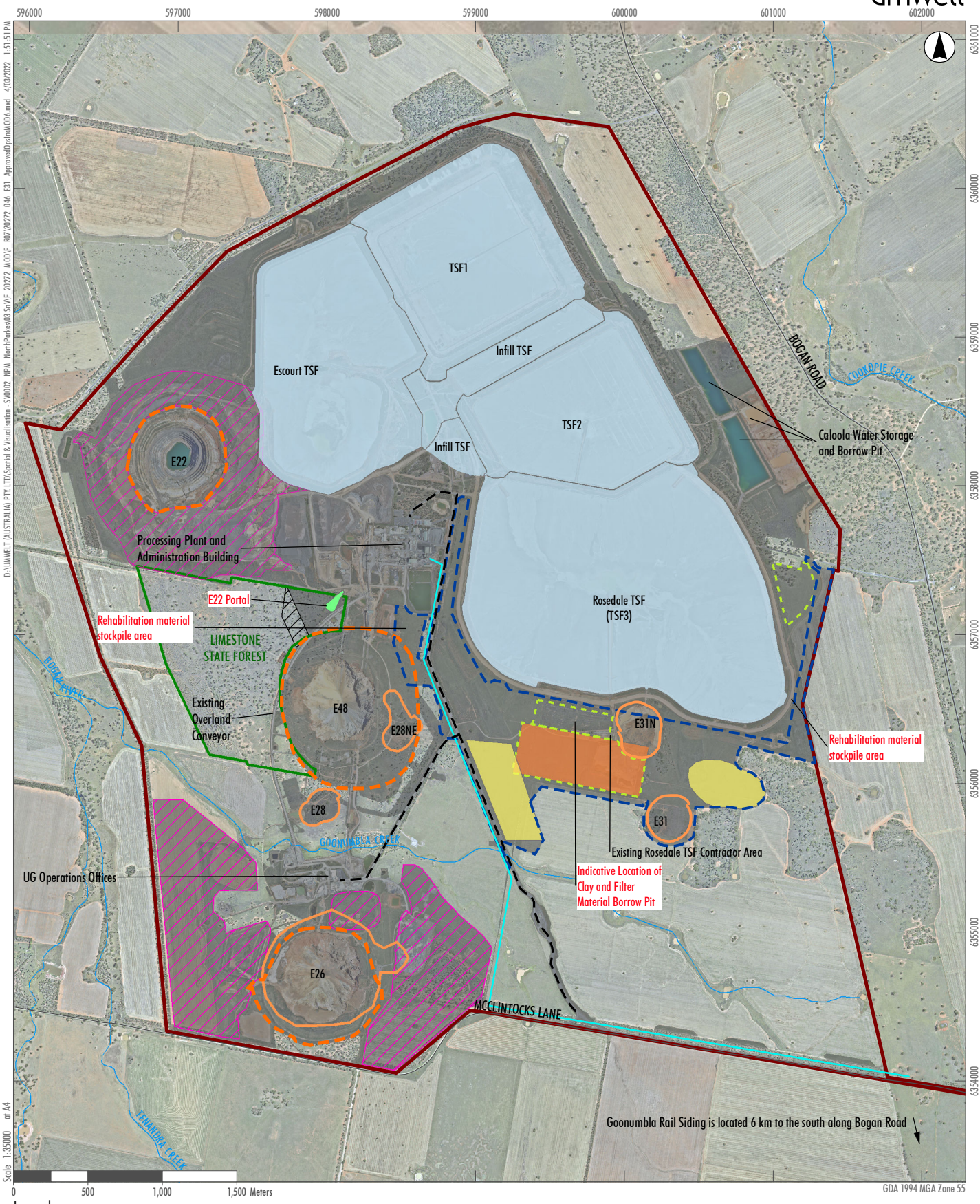
Table A1 below provides a summary of the key features of the approved operations (as modified). The key components of approved operations are shown in **Figures 1** to **4**.

Table A1 Summary of Approved operations (as modified)

Aspect	Approved Operations (PA 11_0060)
Mine Life	Mining until end of 2032
Mining Areas	• Underground caving of the E22, E26 and E48 ore bodies. • Development of open cut mining area in existing mine subsidence zone for E26. • Development of four small open cuts to extract ore from E28, E28NE, E31 and E31N.
Mining Methods	• Multiple Underground Block Caves and Sub Level Caves • Campaign Open cut mining of up to 7 Mtpa for stockpiling and processing as required.
Mine Products	Copper/gold concentrate
Blasting	• Surface blasting permitted between the hours of 9:00 am to 5:00 pm Monday to Saturday • Underground blasting permitted 24 hours per day, seven days per week
Open Cut Mining Depth	• E26 – approximately 300 m below ground level (mbgl) • E28/E28NE – approximately 60 mbgl • E31 – approximately 110 mbgl • E31N – approximately 95 mbgl

Aspect	Approved Operations (PA 11_0060)
Underground Mining Infrastructure	• Continued use of underground mining infrastructure, including ventilation and dewatering systems, power supply, maintenance workshops, underground refuelling station, underground offices, crib rooms and amenity facilities • Addition of new decline to E22 workings and associated portal
Ore Processing	Processing up to 8.5 Mtpa of ore through the existing processing plant sourced from underground and open cut mining areas
Ore Handling and Processing Infrastructure	• Continued operation of existing ore processing plant including surface crusher, crushed ore stockpiles, active grinding mills, froth flotation area and concentrate storage • An overland conveyor to transport ore from the hoisting shaft to the ore processing plant stockpiles • Construction and operation of an additional ball mill • New secondary crushing building • Upgrades to ore conveyor, hoisting and processing infrastructure • New conveyor connecting E22 Portal with existing conveyor system
Tailings Management	• Approved TSFs comprise the Estcourt TSF, TSF 1, TSF2, Rosedale TSF (also known as TSF 3) and the Infill TSF (incorporating Infill TSF extension area) • Buttressing works on TSF2 • Ongoing maintenance and lifts of TSFs Ancillary activities associated with TSF operation including pipelines to tailings delivery and water management (to be located within Approved Operational Areas)
Borrow Pits	Caloola, Estcourt, Rosedale and E31 Precinct Borrow Pits (to the east and the south of the Rosedale TSF) Use of extractive and waste rock material generated by construction and augmentation of water management infrastructure for construction and maintenance of TSFs and water management infrastructure elsewhere on the site
Waste Rock Management	• Establishment of waste stockpiles to store waste rock material generated during open cut mining campaigns • Establishment of two temporary waste rock stockpiling areas (up to 30 m in height), to the west and east of the Rosedale Borrow Pit, within the E31 Precinct • Use of waste rock (including stockpiled material) for TSF construction and maintenance
Water Management	• Operation, maintenance (and where appropriate, relocation) of water supply infrastructure • Continued supply and use of water via an extension of Parkes Shire Council's water pipeline via Main Water Supply Pipeline, including realignment to the west of the Access Road • Use of collected surface water runoff and recycled water from processing plant and TSFs • Continuation and extension of site water management system for operational purposes • Construction and maintenance of clean water diversion channels around the existing processing plant, site offices, TSFs and other operational areas, to ensure clean water is appropriately separated from operational water • New water management infrastructure associated with proposed E22 Portal (e.g. surge dams, dewatering sump etc)
Site Facilities	• Administration buildings and change rooms, core shed, laboratory, emergency response shed, warehouses, workshops, chemical and explosive storage areas, internal mine site roads and associated parking facilities • Block cave knowledge centre (including offices, classrooms, training workshops and additional car parking facilities) • Contractor area including carpark, offices, crib huts and a workshop, with flexibility to relocate Contractor Area within the existing Approved Operational Area (i.e. in the vicinity of the Processing Plant and Administration Buildings) to accommodate the extension to the Infill TSF

Aspect	Approved Operations (PA 11_0060)
Services Infrastructure	• Continued operation (and where appropriate, relocation) of logistics connections including telecommunications, electricity and waste water • Operation of four wastewater treatment plants and associated waste disposal areas.
Site Access	• Provision of an upgraded site access road along a new alignment from McClintocks Lane (and closure of the previous site access road as primary mine site access point) and associated maintenance • Development of an access control and visitor's car parking on new Access Road • Upgrade/sealing and maintenance of McClintocks Lane between the NPM access road and Bogan Road • Upgrades as required to the intersection of McClintocks Lane and Bogan Road.
Product Transport	• Road haulage of concentrate to Goonumbla rail siding for transport to Port Kembla • Temporary road haulage to Parkes National Logistics Terminal during the upgrade of the Goonumbla rail siding and in other circumstances (with the approval of the Planning Secretary))
Operating Hours	24 hours per day, seven days per week
No. Employees	Approximately 700 full time equivalents
Approved Operational Area	As shown in **Figure 1**
Rehabilitation and Final Landform	As shown conceptually in **Figures 3 and 4**
Biodiversity Offset Strategy	• Limestone National Forest Offset • Estcourt Tailings Storage Facility Offset • Kokoda Biodiversity Offset • Residual credit obligations under Modification 6 to be met using one or a combination of mechanisms available under the NSW Biodiversity Offsets Scheme



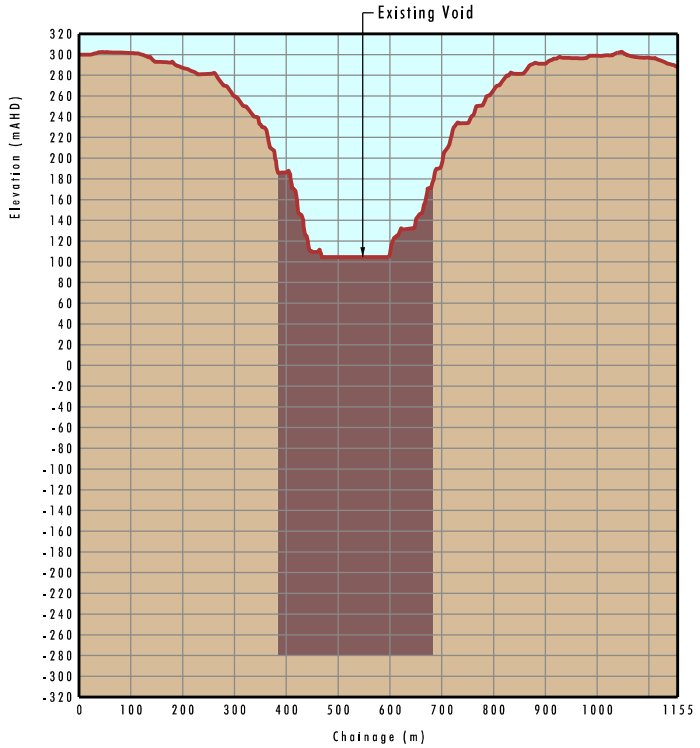
Legend

- Northparkes Project Area
- E31 Precinct Area
- Temporary Waste Rock Stockpile
- E22 Portal
- E22 Portal Proposed Disturbance Area 2 (Stage 3)
- Approved Open Cut Areas
- Approved Waste Dumps
- Subsidence Management Area
- Tailings Storage Facility
- Approved Rosedale Borrow Pit and Approved E31 Waste Rock Stockpile Area
- Approved Operational Area
- Indicative Borrow Pit
- Internal Access Road
- Water Supply Pipeline
- Drainage Line
- Roads

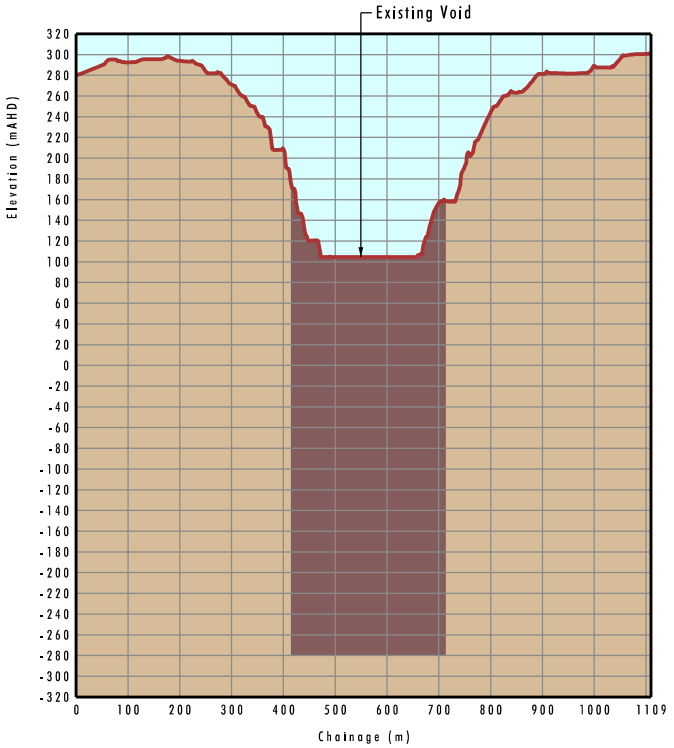
FIGURE 1

Approved Operations (Incorporating MOD 6)

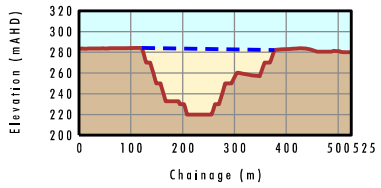
Image source: NPM (2020) Data source: NPM (2021)



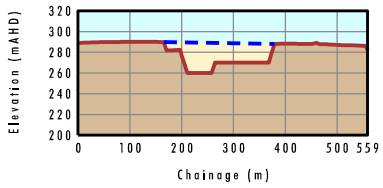
E22 East-West



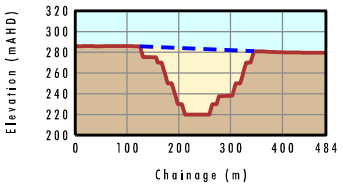
E22 North-South



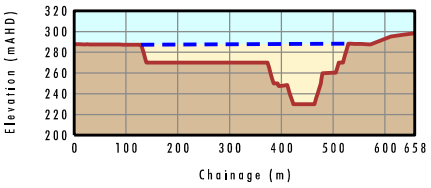
E28 East-West



E28NE East-West



E28 North-South



E28NE North-South

Legend

- Existing Surface Level
- Open Cut
- Underground Block Cave (Approximate Extent)
- Predicted Conceptual Open Cut Final Void

0 50 125 250m
Vertical Scale

0 100 250 500m
Horizontal Scale

FIGURE 2A

Conceptual Mine Plan Cross Sections

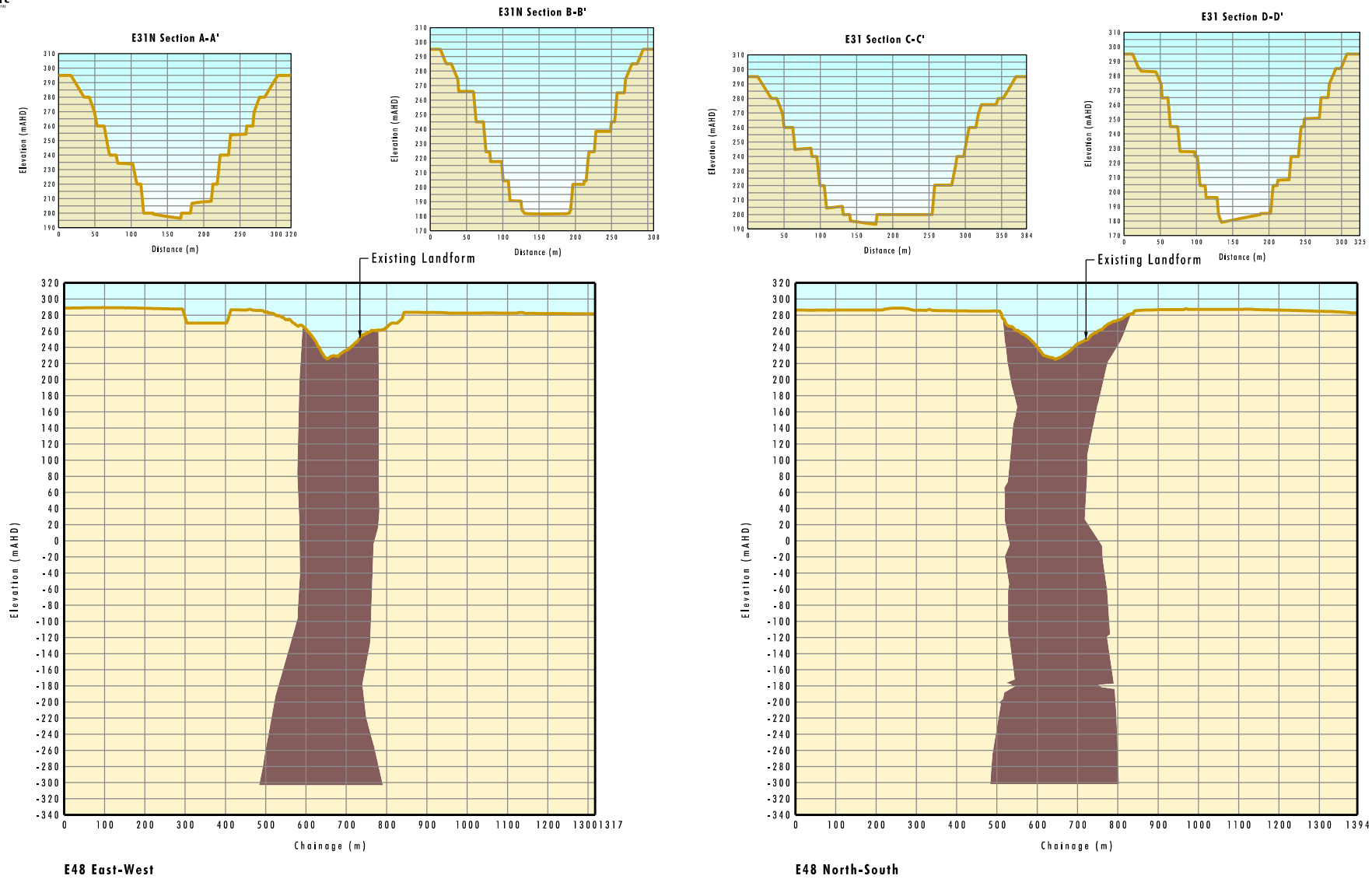
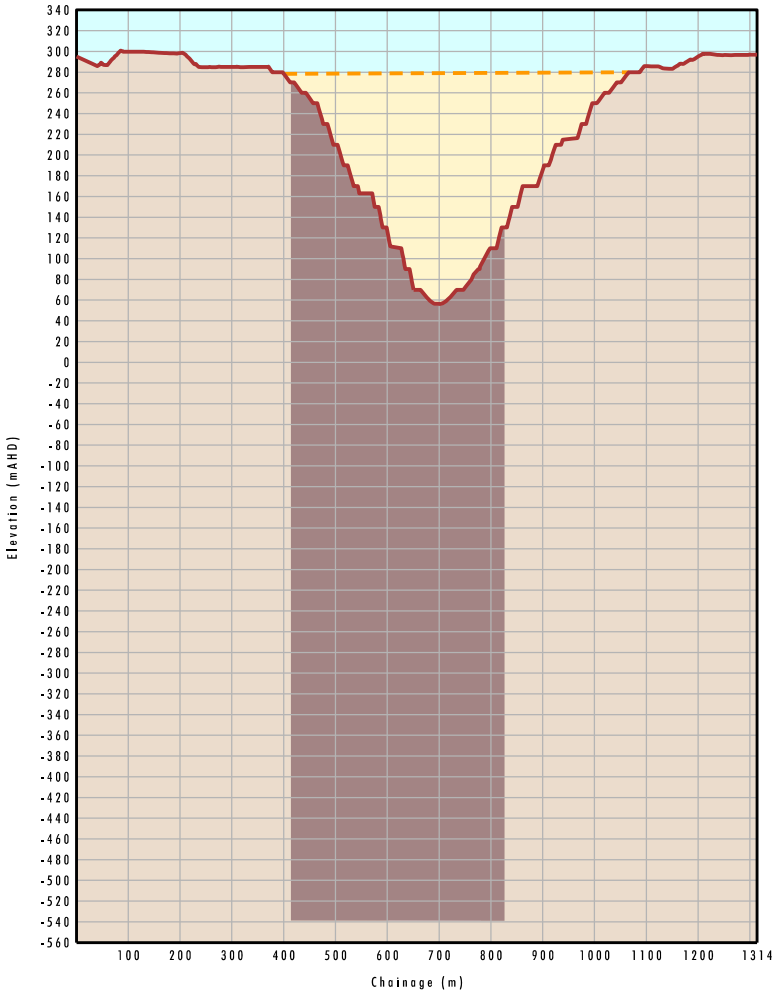
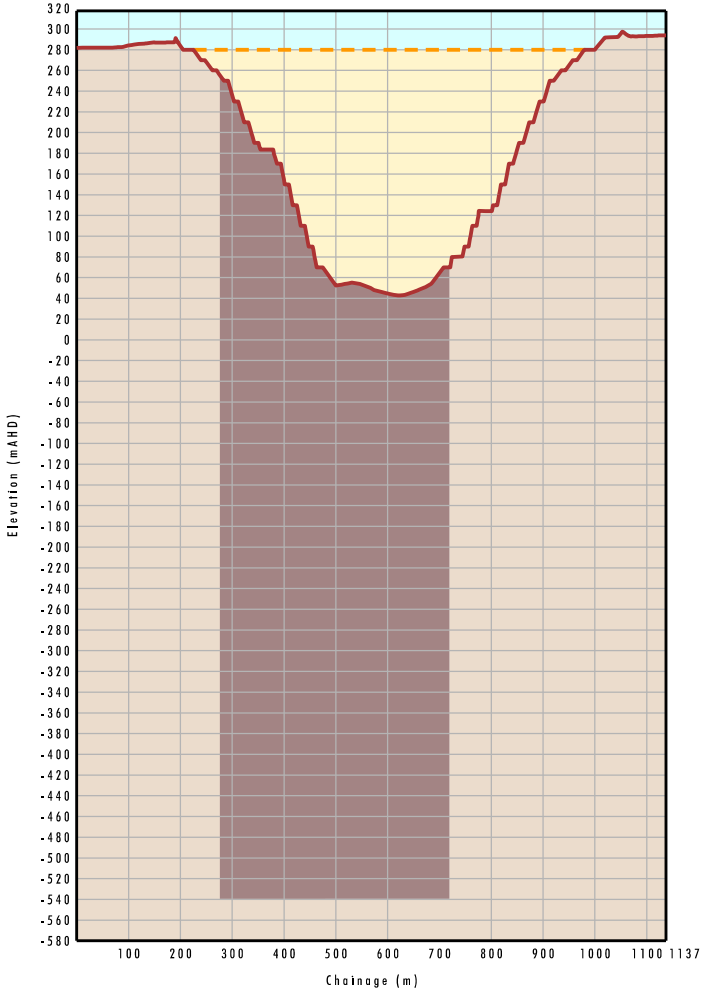


FIGURE 2B

Conceptual Mine Plan Cross Sections



E26 East-West



E26 North-South

Legend

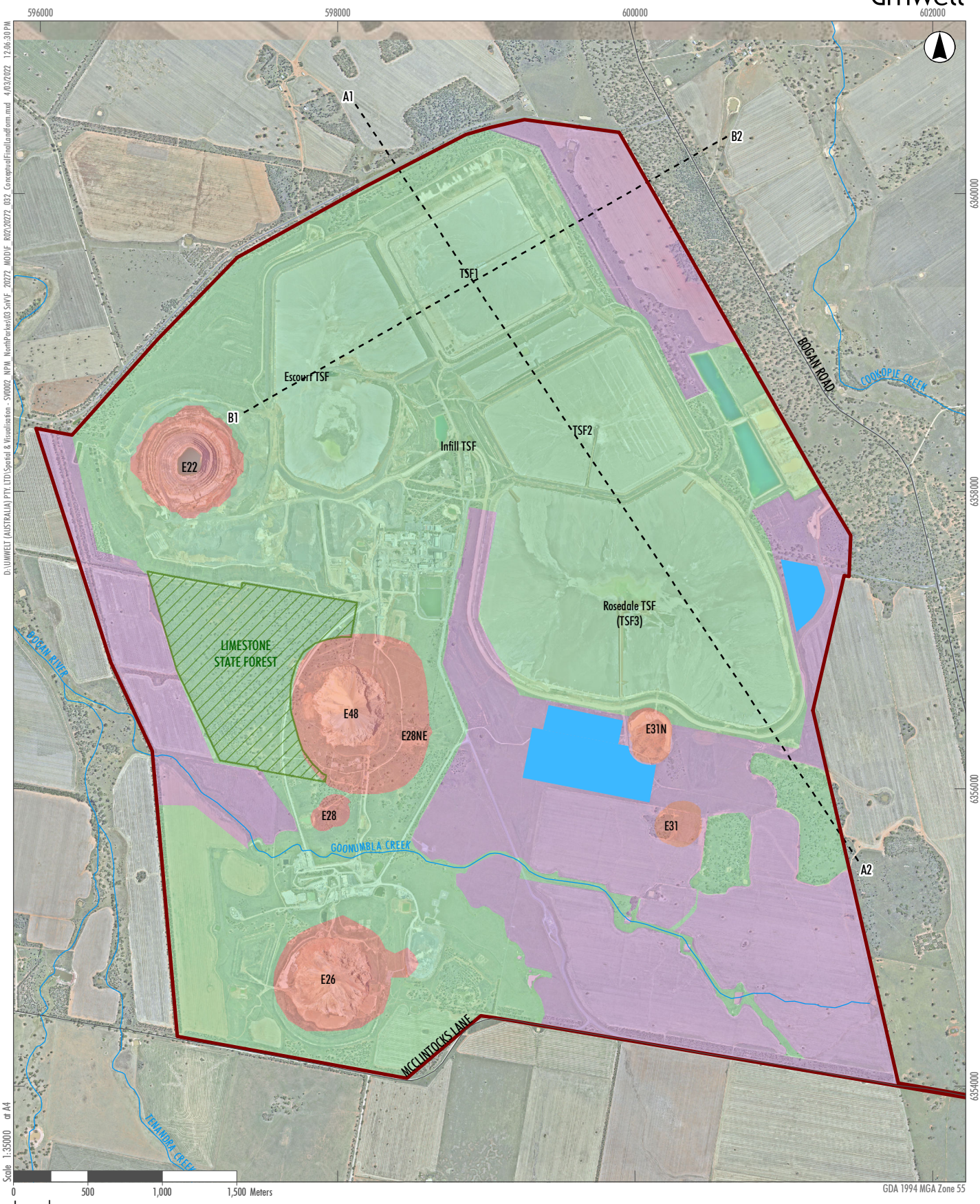
- Open Cut
- Underground Block Cave (Approximate Extent)
- Predicted Conceptual Open Cut Final Void
- Original Surface Level

0 50 125 250m
Vertical Scale

0 100 250 500m
Horizontal Scale

FIGURE 2C

Conceptual Mine Plan Cross Sections



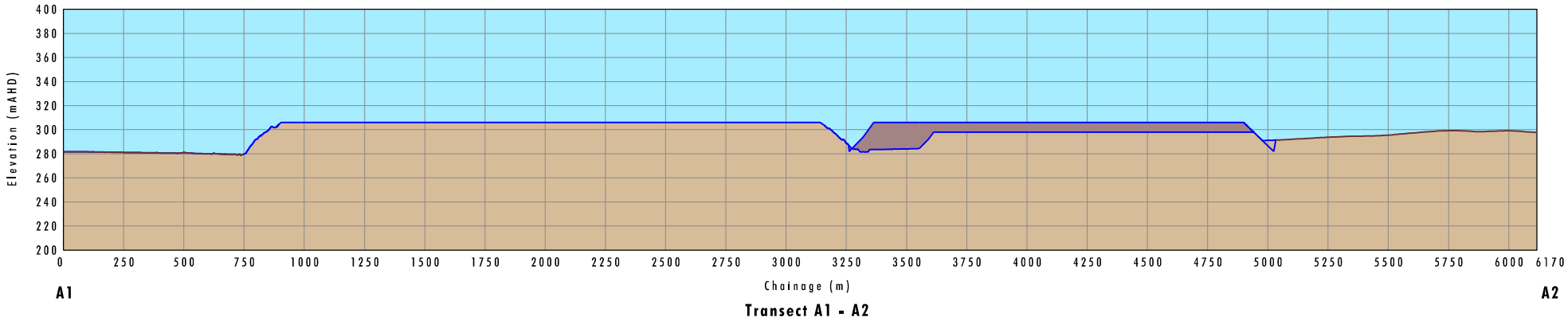
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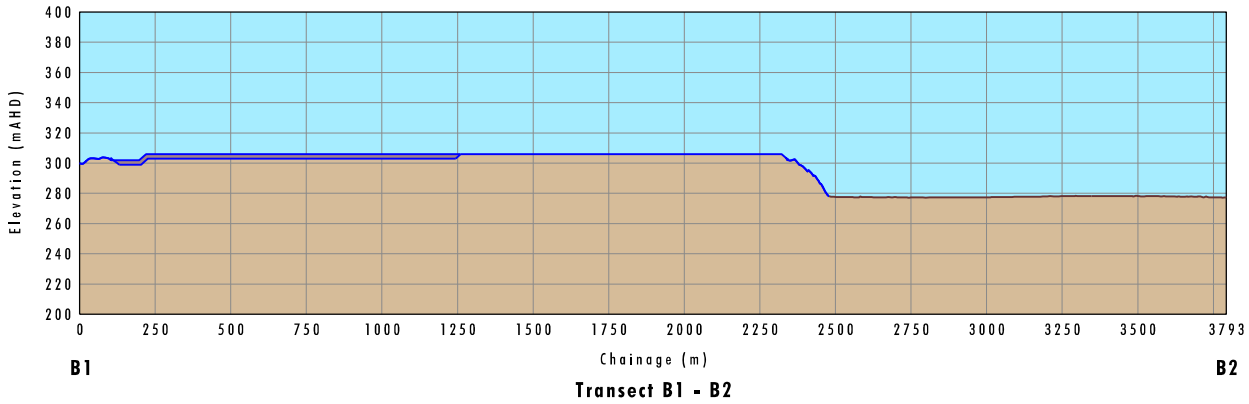
- Northparkes Project Area
- Water Storage Dam
- State Forest
- Drainage Line
- Roads
- Final Landform Cross Sections
- Agricultural Land Use
- Native Vegetation
- Restricted Land Use

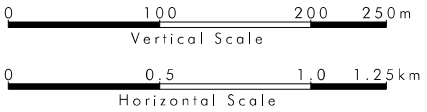
FIGURE 3

Conceptual Final Landform

Image source: NPM (2020) Data source: NPM (2021); NSW DFSI (2021)







Legend

- Approved Final Landform Cross Section
- Natural Ground Surface

FIGURE 4

Final Tailings Landform Cross Sections

A3 Relevant Documents

Table A2 List of Relevant Documents (PA 11_0060)

Document Reference	Document Title
Project Description and Environmental Assessments	
2013 EA	The Environmental Assessment titled *Northparkes Mines Step Change Project* (5 volumes), dated July 2013, the response to submissions dated September 2013 and the Addendum dated November 2013[1]
MOD 1 EA	The Environmental Assessment titled *Northparkes Mines – Application for a 75W Modification* dated April 2015
MOD 2 EA	the Environmental Assessment titled *75W Modification to PA 11_0060 to reference unformed road land parcel in Appendix 1 of the Northparkes Mines Step Change Project Approval (PA 11_0060)* dated 11 March 2016
MOD 3 EA	The Environmental Assessment titled *Section 75W Modification to Project Approval 11_0060 – Northparkes Mines Proposed Changes to Mine Plans* dated 5 July 2017
MOD 4 EA	The Environmental Assessment titled *Environmental Assessment for Section 75W Modification to Project Approval 11_0060 – Northparkes Mines Proposed Changes to Ore Processing Infrastructure and Administrative Amendments* dated 19 July 2018
MOD 5 EA	The Environmental Assessment prepared by Umwelt titled *Northparkes Mines Statement of Environmental Effects Supporting an Application to Modify Project Approval 11_0060* dated June 2018
MOD 6 Mod Report	The Modification Report prepared by Umwelt titled *Northparkes Mines Modification 6 – E22 Portal, TSF2 Buttressing and E31 Precinct* dated November 2021 and Submissions Report dated February 2022
Biodiversity Offset Strategies	
2013 EA	The Environmental Assessment titled *Northparkes Mines Step Change Project* (5 volumes), dated July 2013, the response to submissions dated September 2013 and the Addendum dated November 2013
E48 EA	The Environmental Assessment titled *Environmental Assessment Northparkes Mines – E48 Project, Volumes 1 – Parts 1 to 5, and Volume 2 – Parts 6 to 9*, prepared by RW Corkery & Co. Pty Ltd, dated August 2006
E48 MOD 1 BOS	Northparkes Mines Section 75W Modification Biodiversity Offset Strategy, prepared by GHD Pty Ltd, dated August 2009

[1] Includes description of existing approved operations which were to continue under PA 11_0060.

A4 Relevant Land

Table A3 Schedule of Land (PA 11_0060)

Lot	DP		Relevant Mining Lease
46	753998	CMOC Mining Pty Ltd	ML1743
41	753998	CMOC Mining Pty Ltd	ML1247, ML1743
49	753998	CMOC Mining Pty Ltd	ML1743
10	1132130	CMOC Mining Pty Ltd	ML1743
100	1207194	CMOC Mining Pty Ltd	ML1367
12	753998	CMOC Mining Pty Ltd	ML1367
1	831622	CMOC Mining Pty Ltd	ML1247
2	830291	CMOC Mining Pty Ltd	ML1247, ML1743
3	830291	CMOC Mining Pty Ltd	ML1743
3	831119	CMOC Mining Pty Ltd	ML1247
1	830291	CMOC Mining Pty Ltd	ML1247
381	1108642	Crown Land	ML1247
382	1108642	CMOC Mining Pty Ltd	ML1641
42	1120299	The State of NSW	ML1247
43	1120299	CMOC Mining Pty Ltd	ML1247
41	1120299	CMOC Mining Pty Ltd	ML1247, ML1367
1	831119	CMOC Mining Pty Ltd	May be overlapped by ML1247
Between 3/830291 and 49/753998		Crown Land (CMOC Application to Purchase Reference #DPI W563265)	N/A
1	818783	CMOC Mining Pty Ltd	N/A (Goonumbla Rail Siding)
1	848944	State Rail Authority of NSW	N/A (Goonumbla Rail Siding)
1	952674	State Rail Authority of NSW	N/A (Goonumbla Rail Siding)
Bogan Road and McClintock Lane road reserves			N/A (road upgrade works)

Attachment 1 – Review of Approved Disturbance Area (September 2021)

umwelt
Environmental & Social Consultants

NORTHPARKES MINE

Review of Approved Disturbance Area

FINAL

September 2021

NORTHPARKES MINE

Review of Approved Disturbance Area

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
CMOC Northparkes

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Report No.	20272/R05
Date:	September 2021

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	David Holmes	30/9/2021	David Holmes	30/9/2021

Table of Contents

1.0 Introduction 1

1.1 2006 E48 Project Approval 2

1.2 Step Change Project 7

1.3 PA11_0060 Modification 3 Application 9

1.4 Northparkes Mining Operations Plan 11

2.0 Mapping of Approved Disturbance for future 13

2.1 Mining Disturbance 13

2.2 Road Realignment Disturbance 28

2.3 Mining Disturbance around approved E31N footprint 28

2.3.1 Disturbance west of the E31N footprint 28

2.3.2 Disturbance East of the E31N footprint 28

2.4 Agricultural Disturbance 30

3.0 References 31

Figures

Figure 1.1 Description of Northparkes Approved Operation Pre-PA06-0060 4

Figure 1.2 E48 Project Components 6

Figure 1.3 Figure 5.9 from Step Change EA 8

Figure 1.4 Figure 3 from PA11_0060 Modification 3 Application 10

Figure 1.5 Plan 2 from Northparkes Mine MOP 2020-2022 12

Figure 2.1 Additional Identified Disturbance Areas – Area 1 15

Figure 2.2 Additional Identified Disturbance Areas – Area 2 17

Figure 2.3 Additional Identified Disturbance Areas – Area 3 20

Figure 2.4 Additional Identified Disturbance Areas – Area 4 23

Figure 2.5 Additional Identified Disturbance Areas – Area 5 25

Figure 2.6 Consolidated Approved Operational Area 27

Figure 2.7 Disturbance adjacent to approved E31N disturbance area 29

Tables

Table 1.1 Northparkes development consents and project approvals 1

Table 2.1 Additional Identified Disturbance Areas – Area 1 16

Table 2.2 Additional Identified Disturbance Areas – Area 2 18

Table 2.3 Additional Identified Disturbance Areas – Area 3 21

Table 2.4 Additional Identified Disturbance Areas – Area 4 24

Table 2.5 Additional Identified Disturbance Areas – Area 5 26

1.0 Introduction

CMOC-Northparkes Mines (Northparkes) is a copper and gold mine located 27 km north-west of Parkes, in the Central West of New South Wales, Australia. Northparkes is a joint venture between China Molybdenum Co., Ltd (CMOC) (80%) and the Sumitomo Groups (20%).

Mining at Northparkes has been undertaken for over 25 years with operations commencing in 1993 following approval of Development Consent DA504/90 by the Land and Environment Court in August 1991.

A full list of consents historically applicable to the site (excluding consents which were not commenced) is set out in **Table 1.1**.

Table 1.1 Northparkes development consents and project approvals

Development Consent/ Project Approval	Date of Grant	Description	Comments
DA504_90	7 August 1991 (Modified on 23 March 1993)	Open cut mining of three copper/gold deposits with underground mining at a later date and associated building works.	Granted by NSW Land and Environment Court following objector appeal against consent granted by Parkes Shire Council – Surrendered under PA06-0026
DA836_95	21 March 1995	Development of 2 Open Cut Mines and Haul Road	Granted by Parkes Shire Council - Lapsed
DA895_95	19 June 1996	Development of No 2 Tailings Impoundment (TSF2)	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA976_96	3 September 1996	Water Supply Augmentation	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA00204	17 January 2001	Caloola Clay Borrow Pit	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA03079	1 July 2003	Additions to Northparkes Mines (Estcourt Retention Pond)	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA03107	23 September 2003	In-Pit Tailings Disposal (E22 and E27 Voids)	Granted by Parkes Shire Council – Surrendered under PA06-0026
PA06-0026 (as modified)	28 February 2007 (Modified on 6 October 2009, 28 October 2009)	Northparkes E48 Project	Granted by Minister for Planning – Surrendered under PA 11_0060
DA11092	31 January 2012	Training Centre	Granted by Parkes Shire Council – Surrendered under PA11_0060

Development Consent/ Project Approval	Date of Grant	Description	Comments
PA 11_0060 (as modified)	16 July 2014 (Modified on 16 June 2015, 31 March 2016, 22 September 2017, 6 September 2018, 30 August 2019)	Northparkes Mine Step Change Project	Granted by Minister for Planning and Environment

Up until the 2013 Step Change Project Environmental Assessment, the approvals documentation (including consent documents) did not contain any mapping of the extent of the approved disturbance footprint for operations. The following summarises the disturbance mapping contained in key approval documents:

1.1 2006 E48 Project Approval

The E48 Project Approval consolidated all previous approvals for the Northparkes operation under a single Part 3A Project Approval (PA06-0026) and all preceding Council Consents were surrendered.

In the 2006 Environmental Assessment for the E48 Project (R.W Corkery & Co, 2006) (E48 Project EA), Part B described the existing approved operations which were to be carried through under the consolidated E48 Project Approval. As noted in Table 1 above, all of the development consents covering operations approved to that date were surrendered following the grant of PA06-0026. The existing activities approved under the existing consents which were surrendered were described in Table A2 as follows and shown in Figure B34 of the E48 Project EA (reproduced in **Figure 1.1**) as follows:

Existing Site Components and Activities (to continue for the remainder of the mine life).

- E26 Underground Mine, associated subsidence zone and waste rock/clay dumps.
- E26 Underground Mine Portal, Hoisting Shaft and Exhaust Fan.
- E26 Underground Mine Surface Infrastructure and Services.
- Overland Conveyer and E26 Service Road.
- Processing Plant and Rill Tower Stockpile (for underground ore) and ROM Pad (for open cut ore).
- Tailings Storage Facilities 1 and 2 and Return Water Dam.
- Administration and Training Buildings, Car Parks and various infrastructure and services.
- Process Water Dam, Caloola and Estcourt Borrow Pits and Water Storages.
- Various open cut waste rock/clay stockpiles and dumps.
- Mine Access Road and various internal roads and tracks.
- E22 Open Cut Mine (continued mining envisaged and subsequent tailings disposal - approved for tailings disposal).
- E27 Open Cut Mine (mining completed – used for water storage and approved for tailings disposal).

- Various compounds for equipment storage and services.
- Sound Bund and numerous tree lots.

As can be seen from **Figure 1.1**, only the general outline of key features is shown. There is no mapping of existing approved disturbance areas[1] and, in particular, topsoil and subsoil stockpiles are not mapped. Figure B10 from the E48 Project EA includes mapping of some existing infrastructure and services including power lines and supply water pipeline as well as sealed and unsealed roads and tracks however the scale of the figure and detail shown is not sufficient to define the extent of disturbance associated with these activities. Also not included were historical construction laydown areas (most of which will also be required for post-mining decommissioning works). Several other figures in Part B show elements of approved operations, however, as with Figure B10, these are not of sufficient detail to define the extent of existing and approved disturbance under the historical consents. A further complication is that there are internal access roads and water management infrastructure that is associated with ongoing agricultural operations but also utilised by mining operations. There is no demarcation between these activities as being mine related or farming related in the E48 Project EA.

[1] High level disturbance mapping was contained in Figure 4 of the Aboriginal Heritage Assessment (Part 8 of the Specialist Studies Compendium, Australia Archaeological Survey Consultants Pty Ltd dated August 2006) however a review of this mapping indicates that it does not show all areas that were clearly disturbed by approved mining activities and, in some cases, identifies areas that had not been disturbed but were identified as such. As such, these boundaries have not been relied on as being definitive of approved disturbance areas.



FIGURE 1.1

Approved Operational Area under PA11_0060

Image source: NSW Government - Historical Imagery (1991) Data source: NPM (2021); Umwelt (2021)

The additional features approved under PA06_0060 were:

- E48 Underground Mine, associated subsidence zone and waste rock stockpile.
- E48 Underground Mine Portal (Existing E26 Mine Portal).
- E48 Underground Mine Surface Infrastructure and Services (same as for E26).
- E48 Overland Conveyor/Service Corridor.
- Tailings Storage Facility 3 (Cells A and B) and Return Water Dam.
- Infill between Tailings Storage Facilities 1 and 2.
- Rosedale Borrow Pit.
- Various internal roads and tracks.
- A 45ha addition to Limestone National Forest (as a land swap).
- Various ancillary components and activities to the above components.

The location of the key features was shown on Figure C2 of the E48 Project EA (reproduced in **Figure 1.2**). As can be seen in **Figure 1.2**, only the key features are shown and there is no mapping of internal roads and tracks associated with the approved operation (and in particular, those associated with the construction and operation of the E48 Overland Conveyor, TSF 3, the Return Water Dam and the construction and use of material from the Rosedale Borrow Pit), nor are the locations of soil stockpiles associated with the construction of TSF3 and the Rosedale Borrow Pit identified.

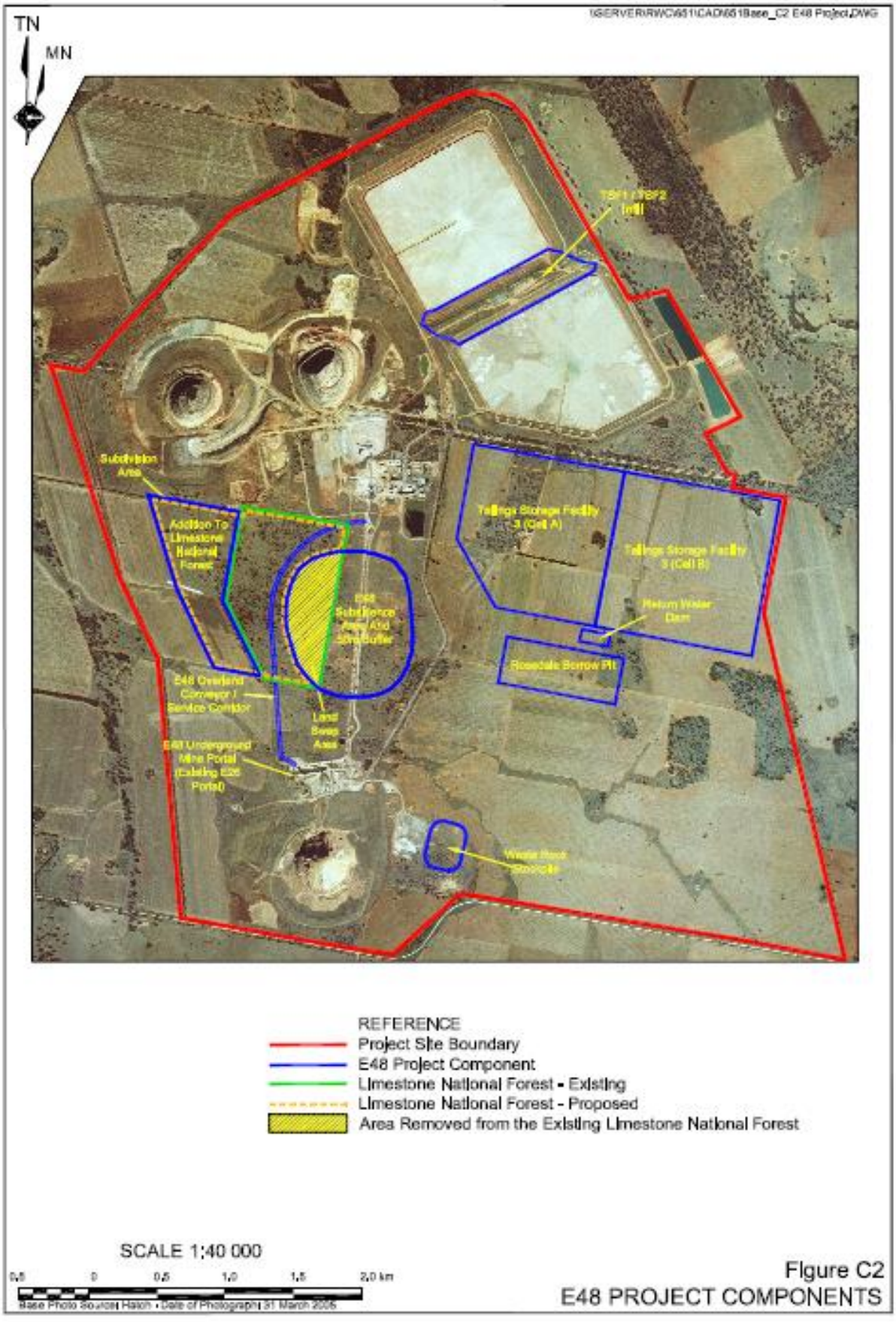


Figure 1.2 E48 Project Components

(R.W. Corkery & Co, 2006)

1.2 Step Change Project

In addition to retention of existing approved operations under PA06_0026, the Step Change Project (PA11_0060) included the following key physical elements:

- expansion of approved open cut mining in the E26 resource and associated waste rock emplacement areas
- Mining of four small open cut pits, E31, E31N, E28N and E28
- Development of block cave mining in the E22 resource (below the existing approved open cut)
- Augmentation of approved (but at the time, not yet constructed) TSF 3
- Construction of an upgraded site access road and upgrades to McClintocks Lane.

Figure 5.9 of the Step Change EA (Umwelt 2012) (reproduced in **Figure 1.3**) identified the 'Proposed Disturbance Area'. This figure however relied on the broad feature mapping of existing approved operations from the 2006 E48 Project EA and save for some access roads, underground infrastructure and the general 'as built' alignment of the E48 Project Conveyor realignment, did not pick up a range of historically approved disturbance nor the ancillary activities associated with the construction of TSF 3 (referred to as the Rosedale TSF in the Step Change EA). A conceptual layout only of the proposed access road was provided.

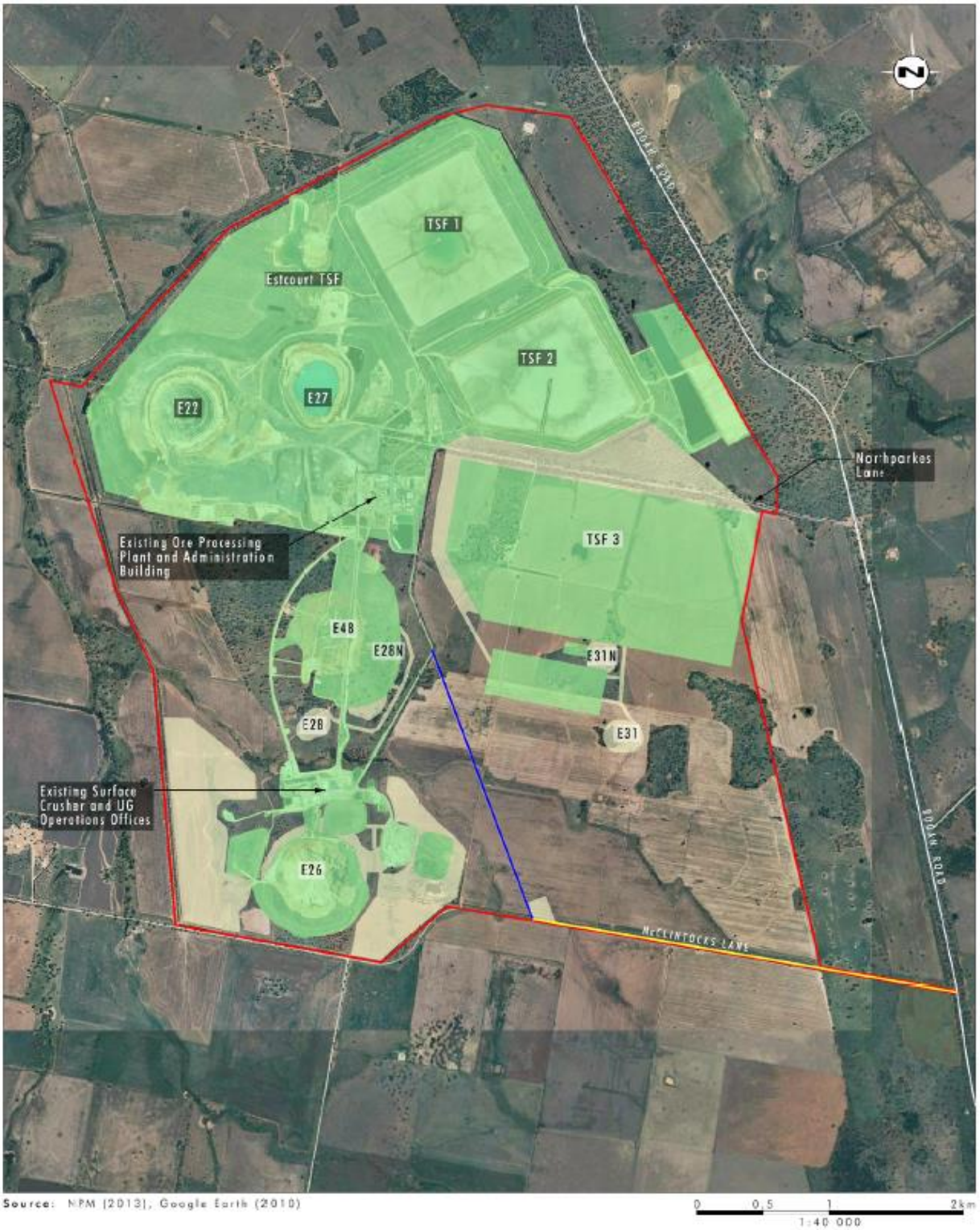


Figure 1.3 Figure 5.9 from Step Change EA

Notably, several key features of development approved in the E48 Project EA and identified as part of the proposed operations in Figure 2.8 to 2.11 were not captured by Figure 5.9 in the Step Change EA including:

- The approved E48 Subsidence footprint and associated 50m buffer zone
- Part of the clay stockpile located close to the existing ore processing facility
- A low grade ore stockpile to the southwest of the E26 open cut/subsidence zone.

Disturbance associated with other features of approved operations which were to be carried through to the Step Change Project which were not captured in the proposed disturbance area mapped in Figure 5.9 of the Step Change EA include:

- disturbance associated with utilities infrastructure including power lines and water supply pipeline (refer to Figure 2.7 in the Step Change EA)
- existing soil stockpiles and areas available for stockpiling topsoil and subsoil material from the TSF3 (Rosedale TSF) Area
- water management infrastructure (drains and pipelines) associated with existing approved operational areas (including waste rock stockpiles associated with E26, E22 and the approved TSFs (including TSF3)
- historical construction laydown areas and associated site facilities
- underground ventilation facilities.

Additionally, while the map captured the 'as built alignment' for the E48 Project conveyor, it did not fully capture associated disturbance, including the maintenance road.

Other features not identified in the proposed and approved disturbance area stockpiles were:

- topsoil and subsoil stockpiles associated with the Rockdale TSF, Rockdale Borrow pit area and newly approved open cut pits
- access and maintenance roads associated with top soil stockpiles and construction activities
- disturbance associated with water management works required for the redesigned Rosedale TSF, new open cut pits and expanded E26 waste stockpile areas.

1.3 PA11_0060 Modification 3 Application

Modification 3 to PA11_0060 sought changes to the approved underground mining operations in the E26 resource. As part of the Modification 3 application documentation, Figure 3 (reproduced in **Figure 1.4**) contained a replication of the approved Disturbance Area for PA11-0060 and an 'as built' disturbance area for the Access Road and associated Access Control area. A review of the approved disturbance shown in Figure 3 and areas approved for disturbance under historical consents which have been carried through to PA11_0060 indicates that this mapping of approved disturbance is incorrect and does not capture all approved disturbance areas. Observable in Figure 3, but not captured in the disturbance area mapping are:

- a number of subsoil and topsoil stockpile areas associated with the pre-stripping activities for the Rosedale TSF as specified in the Step Change EA and
- water management drains identified in the Surface Water Assessment for the Step Change Project (Appendix 11 of the Step Change EA).
- features identified as missing in the Step Change EA mapping discussed in **Section 1.2** above.

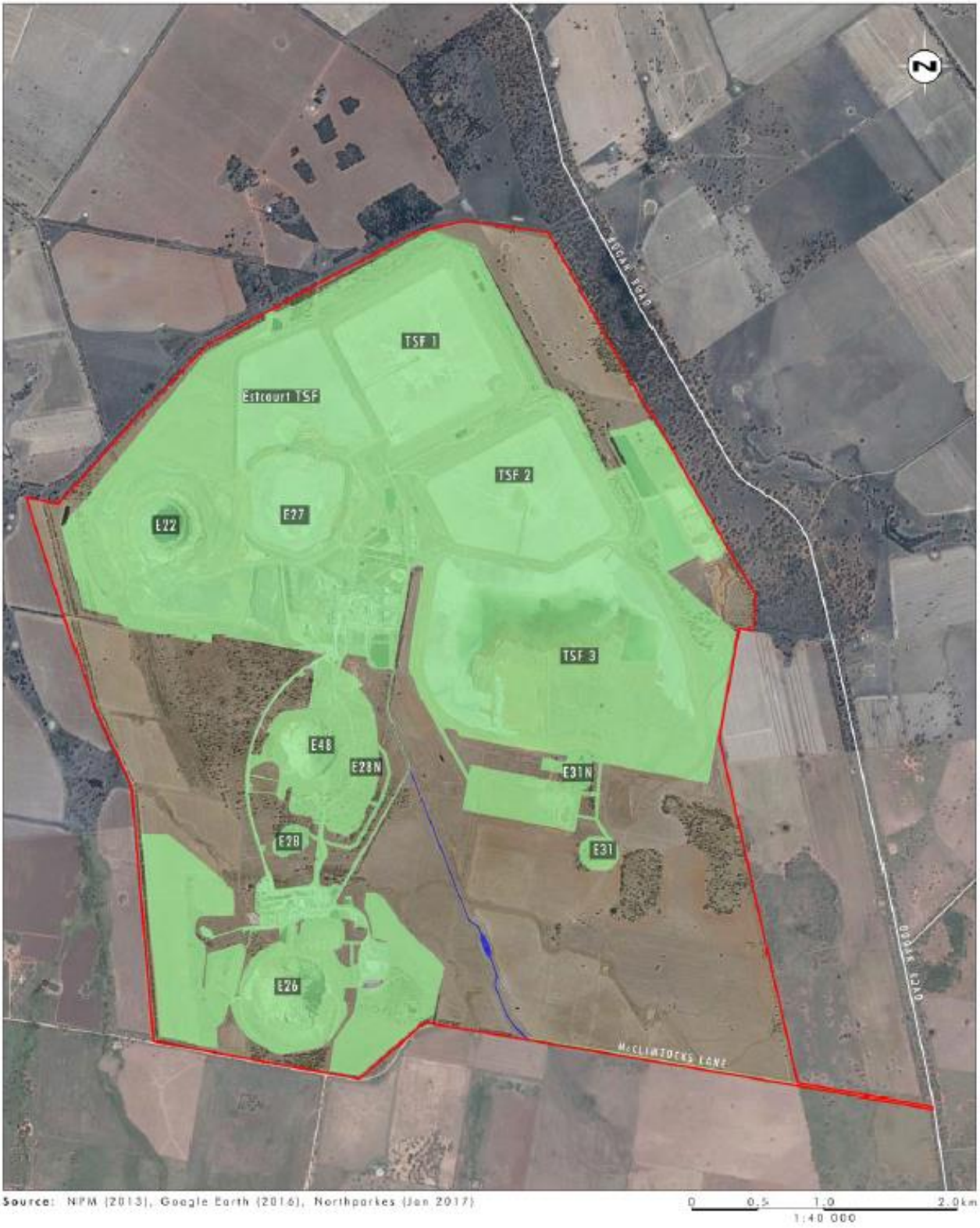


Figure 1.4 Figure 3 from PA11_0060 Modification 3 Application

1.4 Northparkes Mining Operations Plan

Notwithstanding the lack of detail regarding certain disturbance activities, in particular water management, access roads and soil stockpiles, in the environmental assessment documentation, the Mining Operations Plan for Northparkes has shown these features and considered them in operational environmental management processes and rehabilitation planning. Plan 2 from the Current Northparkes Mines Mining Operations Plan 2020-2022 is reproduced in **Figure 1.5**. This plan does not however fully capture all historical and approved but not yet constructed disturbance.

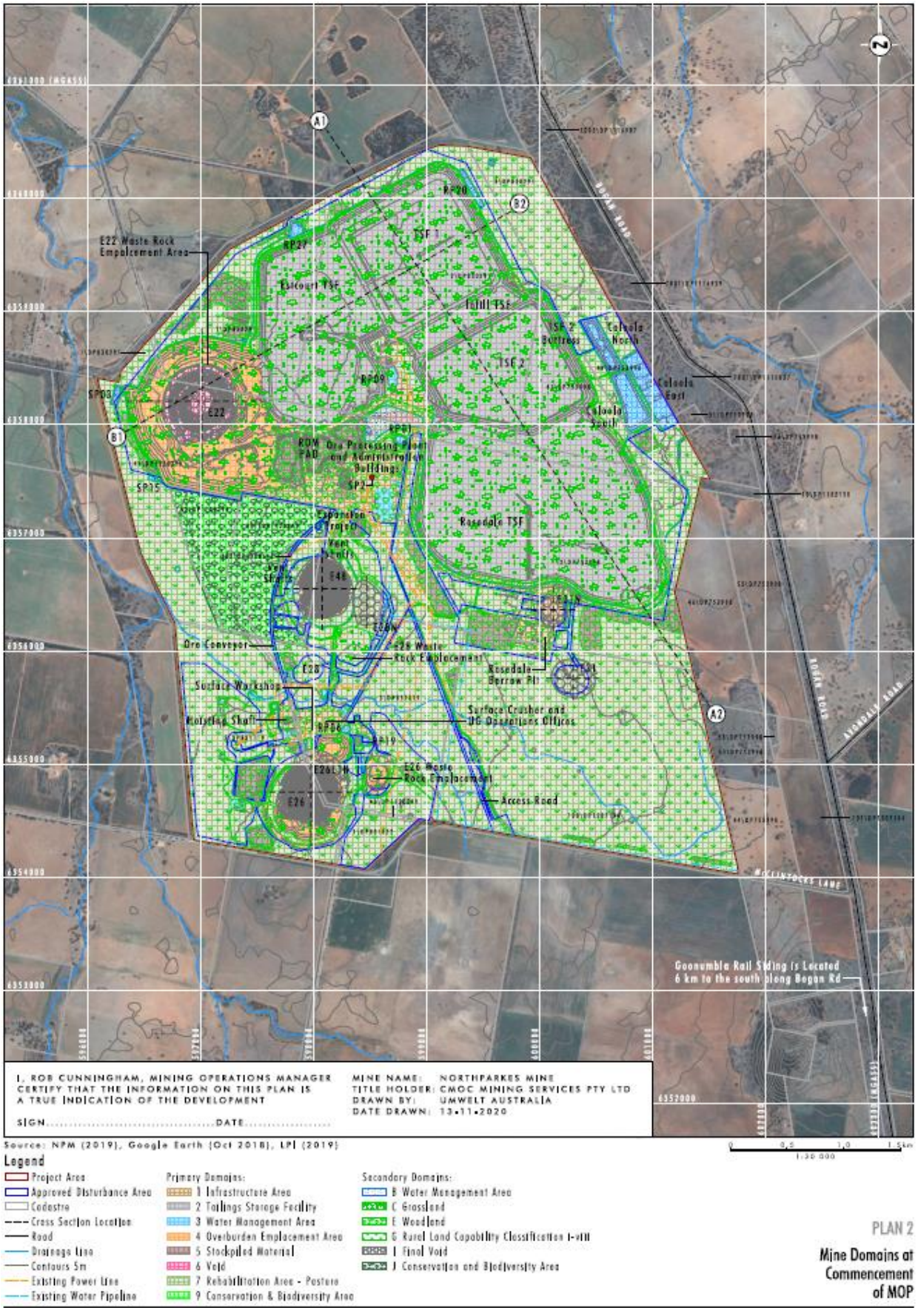


Figure 1.5 Plan 2 from Northparkes Mine MOP 2020-2022

2.0 Mapping of Approved Disturbance for future

2.1 Mining Disturbance

As part of the proposed PA11_0060 Modification 6 assessment, Umwelt has been engaged to fully document all historically approved and proposed future disturbance to provide a baseline against which future applications can assess proposed changes to approved operations. This mapping has been limited to the PA11_0060 Project Area.

In order to do this, Umwelt has undertaken the following steps:

1. Starting with the 'Disturbance Area' shown in Figure 3 of the PA11_0060 Modification 3 Environmental Assessment, added in the following omissions from key features approved in and prior to PA06_0026:
    - clay stockpile area north of E48
    - low grade ore stockpile to the southwest of E26
    - E48 subsidence management zone.
2. Reviewed aerial and satellite imagery available to identify areas of historical disturbance that was attributable to mining related activities
3. Assessed whether areas of identified disturbance were approved under consents at the time the disturbance was undertaken or was part of approved operations under surrendered consents that has been caried through to PA11_0060 and
4. Mapped areas of existing disturbance and approved but not yet undertaken disturbance.

As part of the above processes, a detailed review of 'As Built' features such as the Site Access Road and the E48 Conveyor which are identified conceptually in approval documentation was undertaken to ensure that the disturbance associated with this approved infrastructure accurately captured final built alignment and ancillary disturbance such as earthworks, table drains, maintenance roads and construction laydown areas.

Where identifiable from aerial imagery, construction laydown areas and ancillary construction disturbance have also been captured as similar areas will be required for closure works and, where possible, these existing disturbed areas should be used for these areas during closure (and maintenance) activities.

In a number of areas, the existing mapping of 'approved disturbance areas' includes small fragments of land between approved and existing disturbance areas that will necessarily be impacted by either water management works or works associated with rehabilitation works. These omissions in being mapped as approved disturbance have been identified where appropriate. It is noted that, almost without exception, these small 'infill' areas have a long history of agriculture disturbance. A review of available assessment documentation applicable to the activities impacting these areas indicates that heritage and ecological impacts in these areas have been considered. Accordingly, their omission from being mapped as 'approved disturbance' in historical assessment documentation does not mean that the impacts associated with their disturbance has not been assessed.

Disturbance associated with power lines, pipelines and telecommunications was only undertaken where this disturbance was evident in the imagery reviewed. The ongoing maintenance of this infrastructure and its removal post mining is approved under the current consents however the disturbance associated with these works is difficult to capture in disturbance mapping. Future disturbance associated with the maintenance of this infrastructure will be minimised and avoidance of remnant trees avoided where possible. Disturbance associated with the removal of this infrastructure as part of mine closure planning processes will be detailed in the Mine Closure Planning Process

Figure 2.1 to **Figure 2.5** show the areas of disturbance additional to those areas identified in the PA11_0060 Modification 3 mapping. The justification for including particular areas is detailed in **Table 2.1** to **Table 2.5**.

A consolidated 'Approved Operational Area' is mapped in **Figure 2.6**. **Figure 2.1** also includes the alignment of existing powerlines and water pipelines which will also require some future disturbance activities to undertake maintenance during operations and removal as part of the mine closure planning processes.



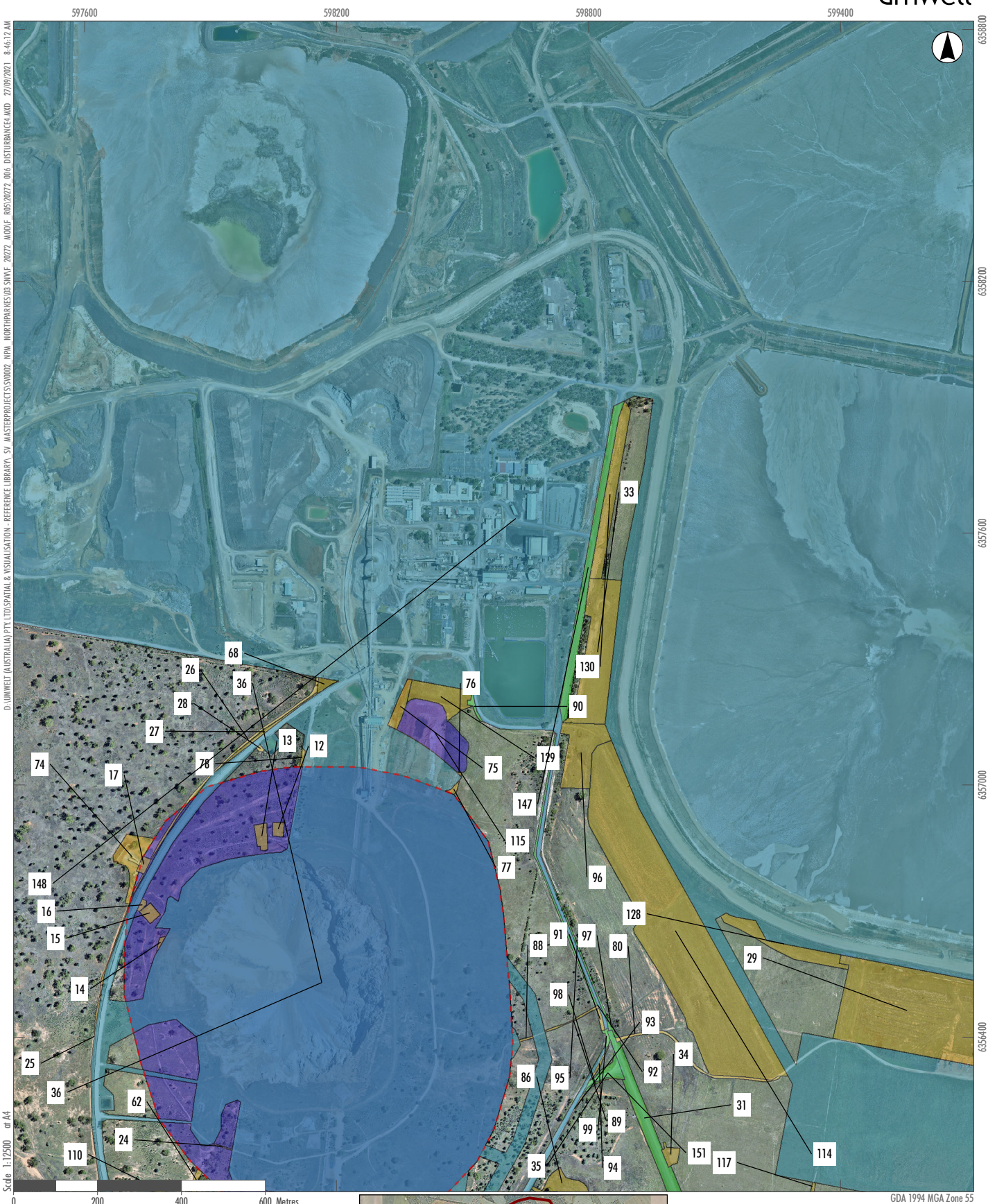
FIGURE 2.1

Additional Identified Disturbance Areas

Image Source: NPM (2020) Data source: NPM (2021); Umwelt (2021)

Table 2.1 Additional Identified Disturbance Areas – Area 1

Figure ID	Nature of approved disturbance	Relevant consent where approved
10	Internal Access Road (also used for farming purposes)	PA11_0060
11	Access Road (as built)	PA11_0060
29	Vegetation/Soil stockpile (Rosedale TSF and E31N)/Rosedale TSF construction laydown area	PA11_0060/PA06_0026
31	Access Road (as built)	PA11_0060
32	Access Road (as built)	PA11_0060
34	Access Road (construction laydown area)	PA11_0060
44	Internal Access Road (also used for farming purposes)	Farming road – ability to be used for E31 operations approved under PA11_0060
45	Internal haul road – soil stockpiles	PA06-0026/PA11_0060
46	Soil Stockpile	
47	Supply Pipeline alignment/Internal Access Road. Also used for farming purposes	DA976_96/PA06-0026/PA11_0060
48	Supply Pipeline alignment/Internal Access Road. Also used for farming purposes	DA976_96/PA06-0026/PA11_0060
59	Access Road (construction laydown area)	PA11_0060
63	Disturbance mapping omission	PA11_0060
80	Internal Access Road	PA06-0026/PA11_0060
84	Soil stockpile and ancillary disturbance area/ haul road	PA06-0026/PA11_0060
85	Soil Stockpile (Rosedale TSF)	PA06-0026/PA11_0060
87	Access Road (as built)	PA11_0060
114	Soil Stockpile (Rosedale TSF)	PA06-0026/PA11_0060
117	Supply Pipeline alignment/Internal Access Road. Also used for farming purposes	DA976_96/PA06-0026/PA11_0060
118	Topsoil strip – McClintocks Lane Upgrade Works	PA11_0060
119	Topsoil strip – McClintocks Lane Upgrade Works	PA11_0060
120	Topsoil strip – McClintocks Lane Upgrade Works	PA11_0060
124	Internal haul road – soil stockpiles	PA06-0026/PA11_0060
125	Internal haul road – soil stockpiles	PA06-0026/PA11_0060
126	Internal haul road – soil stockpiles	PA06-0026/PA11_0060
127	Soil stockpile – ancillary disturbance area	PA06-0026/PA11_0060
128	Ancillary disturbance, Rosedale TSF construction and maintenance	PA06-0026/PA11_0060
133	Access Road – ancillary construction disturbance	PA11_0060
142	Soil stockpile – ancillary disturbance area	PA06-0026/PA11_0060
144	Soil stockpile access road	PA11_0060
145	Soil stockpile access road	PA11_0060
146	Soil stockpile access road	PA11_0060
148	'Approved Disturbance Area' as identified in PA11_0060 Modification 3 EA.	PA11_0060
149	McClintocks Lance Upgrade Works	PA11_0060
152	Internal haul road – soil stockpiles	PA06-0026/PA11_0060



Legend

Disturbance Category

- As Built
- Correct Omission
- Mod 3 Mapping
- Updated
- E48 Approved Subsidence Footprint



FIGURE 2.2

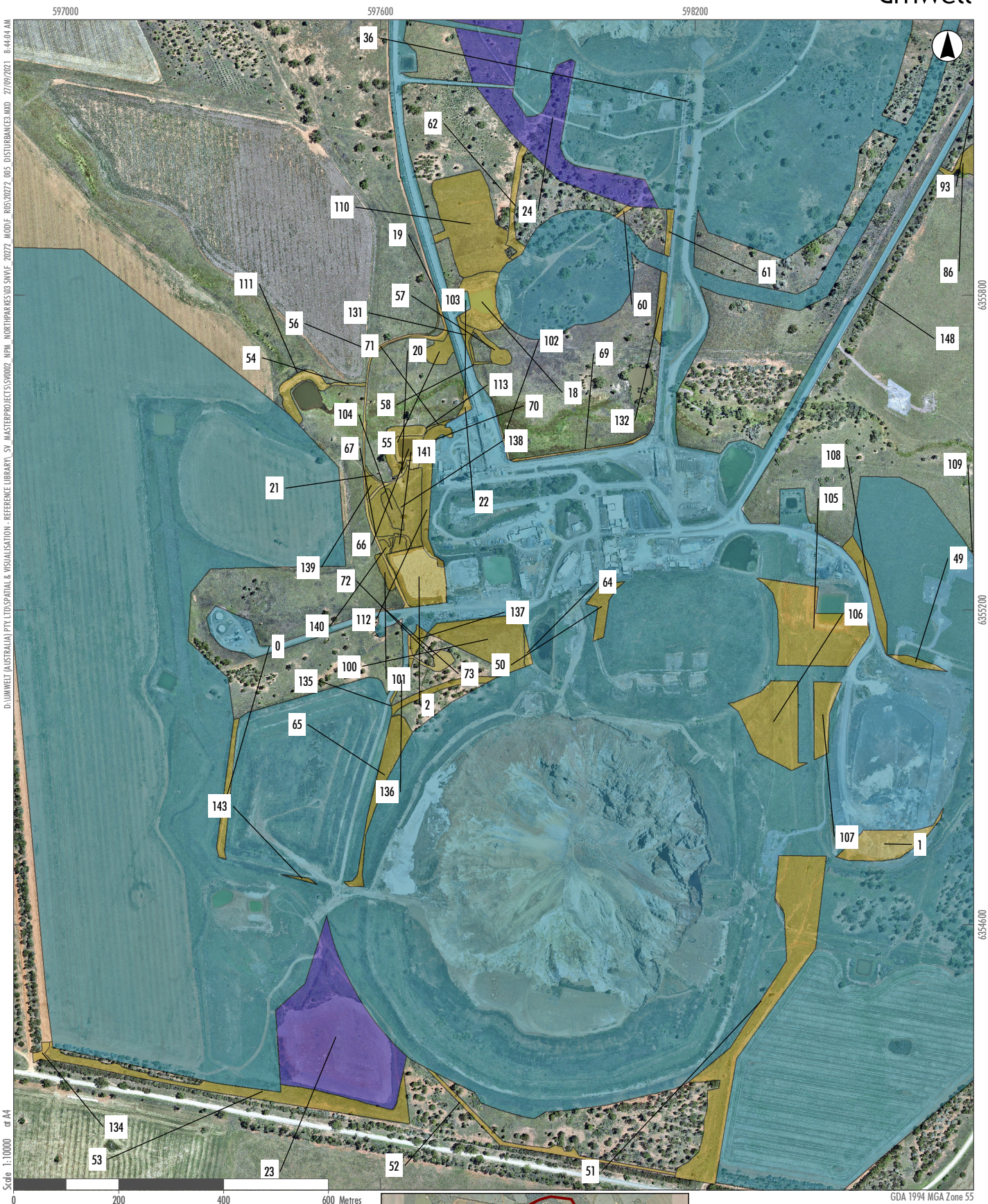
Additional Identified Disturbance Areas

Image Source: NPM (2020) Data source: NPM (2021); Umwelt (2021)

Table 2.2 Additional Identified Disturbance Areas – Area 2

Figure ID	Nature of approved disturbance	Relevant consent where approved
12	Construction laydown area	PA06-0026 or earlier consent (within E48 Subsidence management zone)
13	Construction laydown area	PA06-0026 or earlier consent (within E48 Subsidence management zone)
14	Ancillary mining disturbance	PA06-0026 or earlier consent (within E48 Subsidence management zone)
15	Water management infrastructure	PA06-0026 (within E48 Subsidence management zone)
16	Ancillary Conveyor construction disturbance	PA06-0026 (within E48 Subsidence management zone)
24	Internal access road (within E48 Subsidence Zone)	PA06-0026
25	Conveyor maintenance Road	PA06-0026
26	Conveyor/Ventilation fan infrastructure	PA06-0026 (within E48 Subsidence management zone)
27	Conveyor maintenance Road	PA06-0026
29	Vegetation/ Soil stockpile (Rosedale TSF and E31N)/ Rosedale TSF construction laydown area	PA11_0060/PA06_0026
31	Access Road (as built)	PA11_0060
33	Ancillary disturbance (Rosedale TSF Construction, Water management, Infrastructure)	PA06-0026 /PA11_0060
34	Access Road (construction laydown area)	PA11_0060
36	E48 Subsidence Management Zone (purple areas are omissions from mapped disturbance)	PA06-0026 (As shown in Figure 1.3 of Step Change EA but omitted from disturbance mapping)
62	Internal Access Road	PA06-0026
74	Ventilation Fan and associated infrastructure	PA06-0026/PA11_0060 (partly within E48 Subsidence Zone)
75	Ancillary disturbance/ construction area	PA06-0026 or earlier consent
76	Ancillary Disturbance - stockpiles	Approved pre 2006.
77	Ancillary Disturbance - stockpiles	Approved pre 2006.
78	Construction Laydown Area for Conveyor	PA06-0026
80	Internal Access Road	PA06-0026/PA11_0060
86	Soil stockpile	PA06-0026
88	Internal Access Road	Approved pre 2006.
90	Internal Access Road	Approved pre 2006.
91	Internal Access Road	Approved pre 2006.
92	Internal access road (former farm road)	Various
93	Internal Access Road	Approved pre 2006.
94	Internal Access Road	PA06-0026 or earlier consent
95	Access Road (as built)	PA11_0060
96	Rosedale TSF ancillary construction disturbance, infrastructure (power and telecommunications) and TSF infrastructure, soil stockpile ancillary disturbance.	PA06-0026/PA11_0060

Figure ID	Nature of approved disturbance	Relevant consent where approved
97	Access Road (as built)	PA11_0060
98	Access Road (as built)	PA11_0060
99	Internal Access Road	PA06-0026 or earlier consent
110	Soil Stockpile	PA06-0026
114	Soil Stockpile	PA06-0026/PA11-0060
115	Clay Stockpile (purple areas are omissions from mapped disturbance)	Approved pre 2006. Identified as existing approved feature in E48 Project EA (PA06-0026)
117	Supply Pipeline alignment/Internal Access Road. Also used for farming purposes	DA976_96/PA06-0026/PA11_0060
128	Ancillary disturbance, Rosedale TSF construction and maintenance	PA06-0026/PA11_0060
129	Infrastructure management/construction area (powerlines)	Approved pre 2006.
130	Infrastructure (powerlines and telecommunications) and Access Road construction	PA11_0060
147	Access road	Originally approved in DA504_90. Upgraded with Access Road works under PA11_0060
148	'Approved Disturbance Area' as identified in PA11_0060 Modification 3 EA.	PA11_0060
151	Access Road (as built)	PA11_0060



Legend

Disturbance Category

- Correct Omission
- Mod 3 Mapping
- Updated



FIGURE 2.3

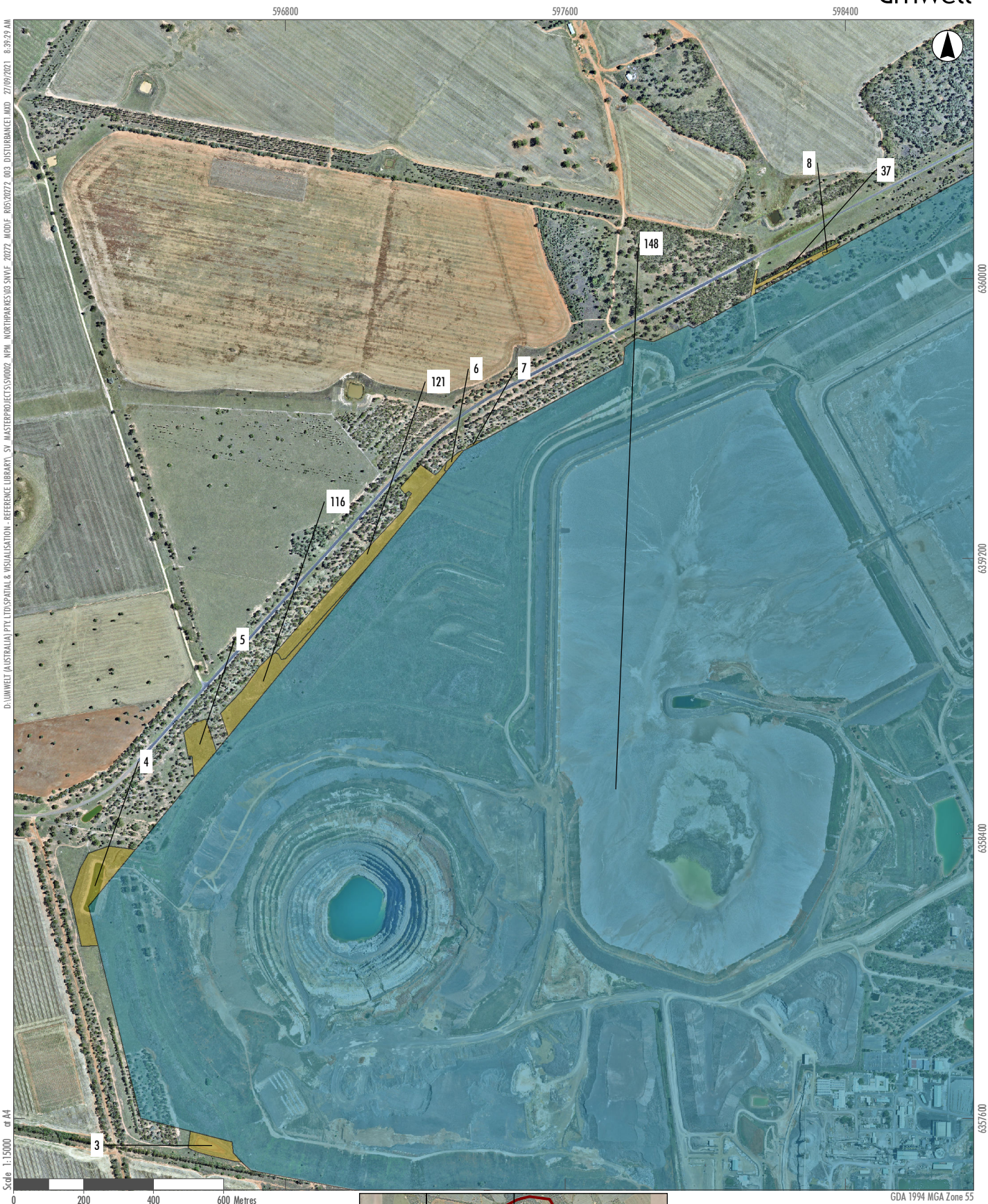
Additional Identified Disturbance Areas

Image Source: NPM (2020) Data source: NPM (2021); Umwelt (2021)

Table 2.3 Additional Identified Disturbance Areas – Area 3

Figure ID	Nature of approved disturbance	Relevant consent where approved
0	Ancillary Disturbance	DA504_90
1	Waste Stockpile	DA504_90. General outline captured in PA06-0026 but general area also identified as mine water management area in PA06_0026.
2	Water Treatment Facility	PA11-0060
18	Water Management Infrastructure	Approved pre 2006.
19	Internal Access Road	DA504_90
20	Internal Access Road	DA504_90
21	Access Road	DA504_90
22	Ancillary Disturbance	DA504_90
23	Low Grade Ore Stockpile (purple areas are omissions from mapped disturbance)	DA504_90 (As shown in Figure 1.3 of Step Change EA but omitted from disturbance mapping)
24	Internal access road (within E48 Subsidence Zone)	PA06-0026
36	E48 Subsidence Management Zone (purple areas are omissions from mapped disturbance)	PA06-0026 (As shown in Figure 1.3 of Step Change EA but omitted from disturbance mapping)
49	Ancillary disturbance/ water management	DA504_90/PA06-0026/PA11-0060
50	Waste Stockpile	DA504_90
51	Ancillary Disturbance – E26	DA504_90
52	Internal Access Road	DA504_90
53	Soil Stockpile	DA504_90
54	Internal Access Road	DA504_90
55	Construction/maintenance pad (powerlines)	DA504_90
56	Internal Access Road	DA504_90
57	Construction/maintenance pad (powerlines)	DA504_90
58	Internal Access road (former farming road)	PA06-0026
60	Internal Access Road	PA06-0026
61	Internal Access Road/ Ancillary construction/demolition disturbance	DA504_90
62	Internal Access Road	PA06-0026
64	Water Management	DA504_90
65	Soil Stockpile	DA504_90
66	Water Management	DA504_90
67	Internal Access Road	DA504_90
69	Ancillary disturbance	DA504_90
70	Soil Stockpile	DA504_90
71	Ancillary disturbance	DA504_90
72	Construction Pad	PA11_0060 (within area generally identified as waste stockpile under DA504_90)
73	Internal Access Road	PA06-0026

Figure ID	Nature of approved disturbance	Relevant consent where approved
86	Soil Stockpile	PA06-0026
93	Internal Access Road	Approved pre 2006.
100	Soil Stockpile	DA504_90
101	Soil Stockpile	DA504_90
102	Ancillary Disturbance	DA504_90
103	Internal Access Road/ Ancillary construction	PA06-0026
104	Soil stockpile	DA504_90
105	Water management/ Ancillary disturbance	DA504_90
106	Water Management/ Internal Access Road/ Ancillary disturbance	DA504_90
107	Water Management	DA504_90
108	Ancillary disturbance/ water management	DA504_90/PA06-0026/PA11-0060
109	Water Management Infrastructure	PA06-0026/PA11-0060
110	Soil Stockpile	DA504_90
111	Soil Stockpile/ Water Management Infrastructure	Approved pre 2006.
112	Soil Stockpile	DA504_90
113	Soil Stockpile	DA504_90
131	Ancillary Disturbance/ Construction/Water Management	PA06-0026
132	Internal Access Road/ Ancillary construction/demolition disturbance	DA504_90
134	Internal Access Road (also used for farming)	DA504_90
135	Internal Access Road	DA504_90
136	Internal Access Road/Ancillary disturbance	DA504_90
137	Ancillary Disturbance	DA504_90
138	Ancillary Disturbance	DA504_90
139	Ancillary Disturbance	DA504_90
140	Ancillary Disturbance	DA504_90
141	Ancillary Disturbance	DA504_90/PA11_0060
143	Ancillary Disturbance	DA504_90
148	'Approved Disturbance Area' as identified in PA11_0060 Modification 3 EA.	PA11_0060



Legend

Disturbance Category

- Mod 3 Mapping
- Updated



FIGURE 2.4

Additional Identified Disturbance Areas

Image Source: NPM (2020) Data source: NPM (2021); Umwelt (2021)

Table 2.4 Additional Identified Disturbance Areas – Area 4

Figure ID	Nature of approved disturbance	Relevant consent where approved
3	Water Management Infrastructure	DA504_90
4	Water Management Infrastructure	DA504_90
5	Soil Stockpile	DA504_90
6	Soil Stockpile	DA 03079
7	Soil Stockpile	DA 03079
8	Water Management Infrastructure	DA504_90/DA 03079
37	Internal Access Road	Various/ Farming
116	Soil Stockpile	DA504_90/DA 03079
121	Water Management Infrastructure (Clean Water)	DA504_90
148	'Approved Disturbance Area' as identified in PA11_0060 Modification 3 EA.	PA11_0060



Legend

Disturbance Category

- Mod 3 Mapping
- Updated



FIGURE 2.5

Additional Identified Disturbance Area

Image Source: NPM (2020) Data source: NPM (2021); Umwelt (2021)

Table 2.5 Additional Identified Disturbance Areas – Area 5

Figure ID	Nature of approved disturbance	Relevant consent where approved
9	Water Management Infrastructure	PA11_0060
10	Internal Access Road (also used for farming purposes)	PA11_0060
30	Soil Stockpile	PA06-0026
38	Soil Stockpile	DA895_95
39	Vegetation/ Soil Stockpile	PA11_0060
40	Internal Access Track (formerly farming)	PA11_0060/Farming
41	Ancillary Disturbance – Water management and soil stockpiles	PA06-0026/ PA11_0060
42	Internal Access Track (formerly farming)	PA11_0060/Farming
43	Internal Access Track (formerly farming)	PA11_0060/Farming
79	Water Management Infrastructure	DA504_90/DA895_95/PA06-0026
81	Water Management Infrastructure	DA504_90/DA895_95/PA06-0026
82	Soil Stockpiles	DA895_95/DA00204
83	Ancillary Disturbance – Vegetation and Soil Stockpile	PA11_0060
122	Water Management Infrastructure	DA504_90/DA895_95/PA06-0026
123	Soil Stockpile	DA895_95
148	'Approved Disturbance Area' as identified in PA11_0060 Modification 3 EA.	PA11_0060

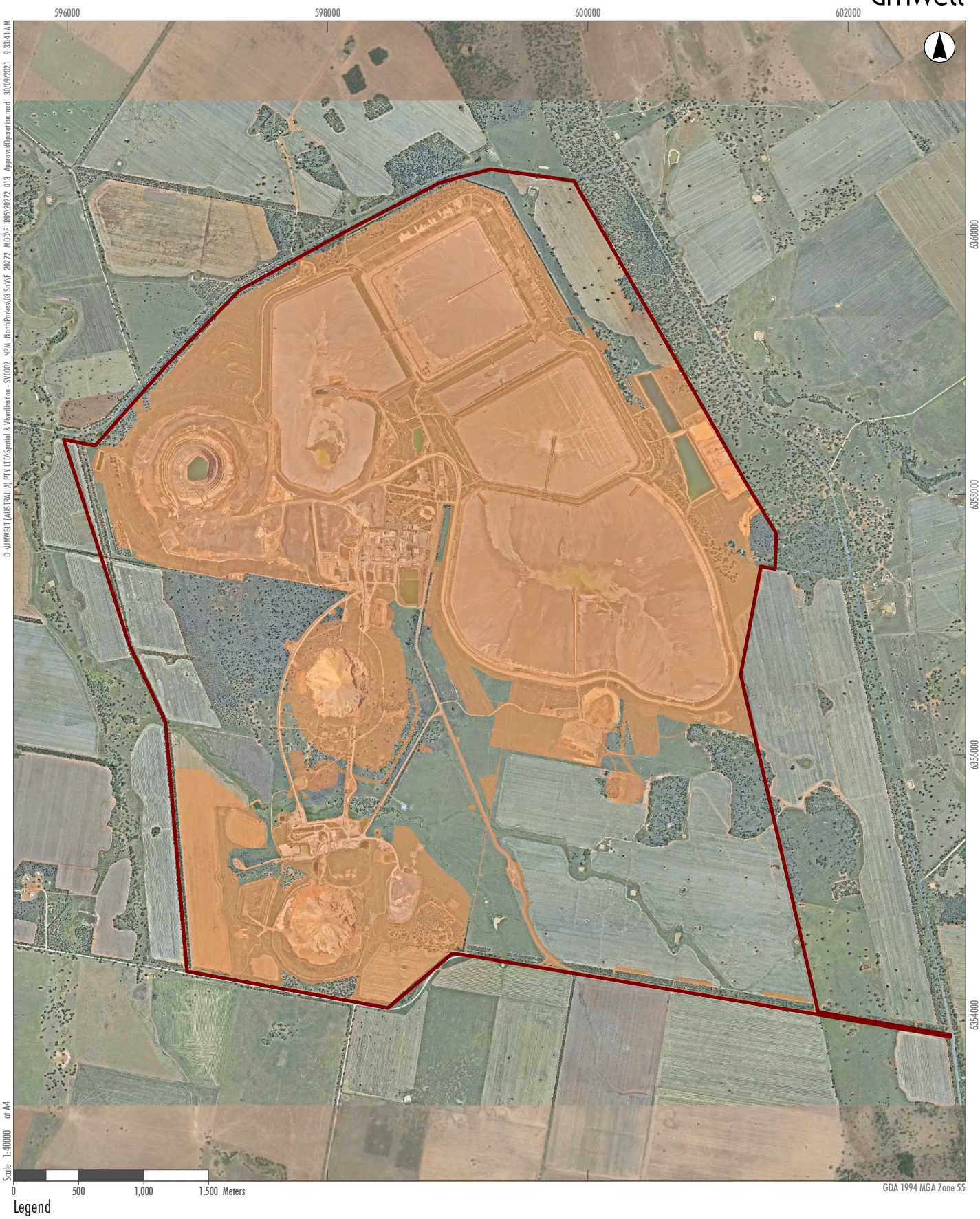


FIGURE 2.6

Approved Operational Area

Image source: NSW Government - Historical Imagery (1991) Data source: NPM (2021); Umwelt (2021)

2.2 Road Realignment Disturbance

As part of the approval requirements for DA504_90, Northparkes realigned part of McClintocks Lane, part of Adavale Lane and constructed a new road between McClintocks Lane and Adavale Lane running along the western boundary of the Northparkes Project Area. McClintock Lane was also upgraded as part of PA11_0060. With the exception of the upgrades to McClintocks Lane associated with its use as the primary access route for the Northparkes Mine (refer to **Figure 2.1** and **Table 2.1**), disturbance associated with these roadworks has not been mapped.

2.3 Mining Disturbance around approved E31N footprint

A review of the aerial imagery has identified an area around the approved E31N pit area that was disturbed by mining in 2018-20 but is outside the area mapped as being part of the approved disturbance footprint. Due to the focus of the assessment on additional impacts from the approval of the E31N open cut pit in this area as part of the Step Change Project assessment, these two areas have been reviewed in detail to ascertain whether the disturbance was approved under the approved works under PA06-0026 carried through to PA11_0060 (i.e. ancillary disturbance related to the use and construction of the Rosedale TSF Return Dam, TSF 3 Construction, Rosedale Borrow Pit or soil stockpiles associated with these activities).

2.3.1 Disturbance west of the E31N footprint

A small area to the west of the E31N footprint has been disturbed for activities associated with roads between the Rosedale Borrow Pit, area identified as the TSF Return Water Dam in PA06-0024 and the Rosedale TSF associated with the construction of the Rosedale TSF. As identified in **Figure 2.1** and **Table 2.1** the disturbance within this area is considered to be consistent with the activities approved under PA06_0026 and has therefore been mapped as part of the approved disturbance area. Part of this area has also been used for sourcing clay material for the Rosedale Borrow Pit construction. As the sourcing of this material is within the area disturbed by ancillary approved activities and is broadly within the approved E31N footprint, the use of this area for extraction of clay material is considered to be 'generally in accordance with' the development described in the Step Change Project EA. It is noted that this area would also be considered to be Category 1 – exempt land under the *Local Land Services Act 2013* (LLS Act) land due to the history of cropping in this area up to and after 1990.

2.3.2 Disturbance East of the E31N footprint

An approximately 0.73Ha area of land on the eastern side of the area of E31N Approved Disturbance (as identified in the PA11_0060 Modification 3 EA) has been disturbed from activities associated with preparatory works for the E31N open cut pit (Teal coloured area in **Figure 2.7**). This disturbance has removed approximately 0.24 Ha of PCT56 – Poplar Box – Belah woodland on clay loam soils of the alluvial plains of north-central NSW. Ground truthing of similar quality vegetation to the immediate south of the area removed indicates this vegetation is degraded. The remaining approximately 0.49 Ha has been identified as Category 1 – exempt land for the purposes of the LLS Act due to a history of cropping prior to and in 1990-1991 and indications from previous ecological field work that the grassland is exotic and likely to be Low Conservation Value Grassland. It is noted that two paddock trees which were present in this area in 1990 have also been removed.

While this disturbance is ancillary to the mining of E31N (i.e. necessary for the construction of safety bunds, water management and general access around the pit, the impacts associated with these activities were not assessed in the Step Change Project EA and the disturbance activities undertaken are not considered to be ancillary to the activities approved under PA06-0026. While it is arguable that this disturbance could be considered to be 'generally in accordance with the 'EA' as defined in PA11_0060, this small area of mining related disturbance has conservatively been mapped as ***not being*** part of the approved disturbance area under PA11_0060.

Due to the small and largely incidental nature of this disturbance, it is recommended that an adjustment to the approved disturbance area be pursued as part of the PA11_0060 Modification 6 application in an area that has not yet been disturbed and is not required for future disturbance to compensate for the loss of the vegetation in the Category 2 land in this area. This adjustment should remove an equivalent area of similar or higher conservation value woodland, preferably in an area that retains a reasonable level of connectivity to vegetation outside of the area identified as being the part of the 'Approve Operation Area' (refer to **Figure 2.6**).

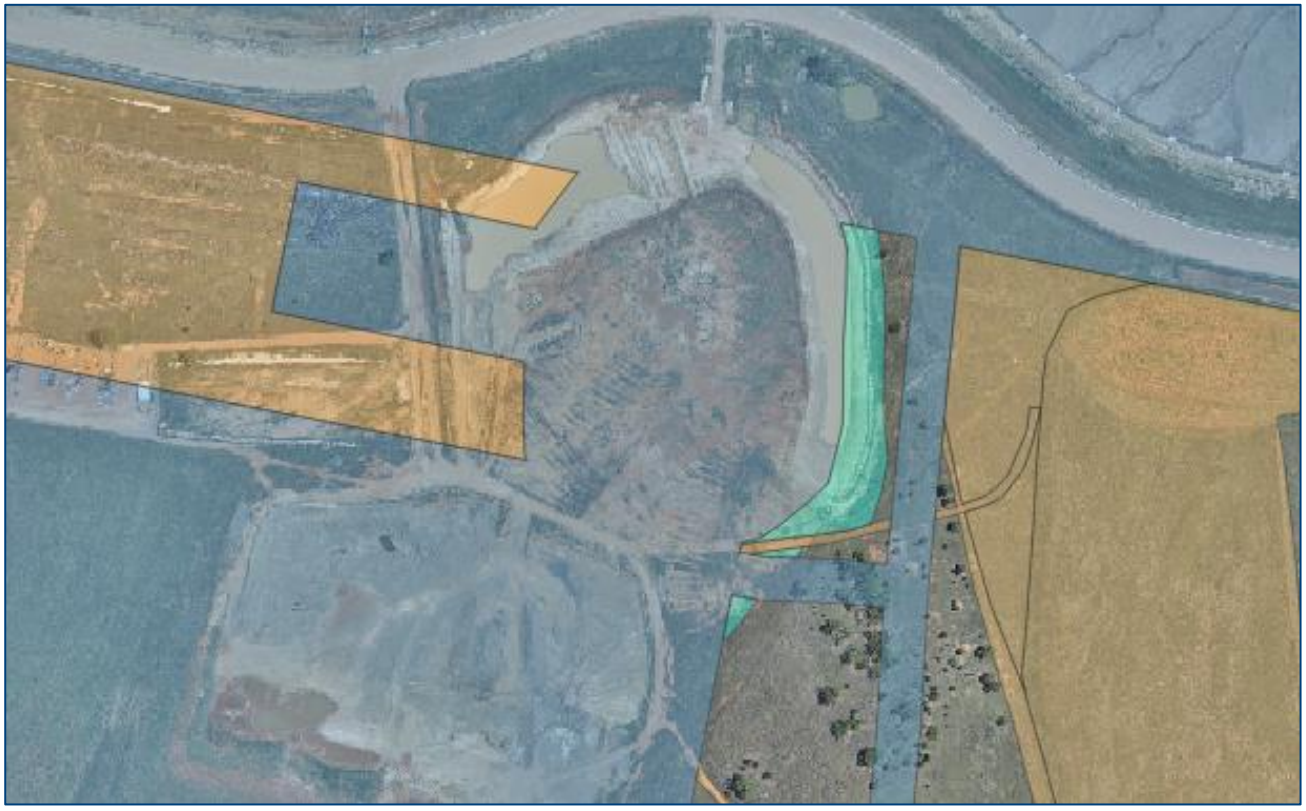


Figure 2.7 Disturbance adjacent to approved E31N disturbance area

2.4 Agricultural Disturbance

Northparkes continues to manage parts of the PA11_0060 Project Area for agricultural uses. Ongoing disturbance of these areas associated with cropping activities, farm access roads and general land management practices (including dams and drainage management) continues to be undertaken. Disturbance associated with these activities has not been mapped except for some access roads which are used for both mining and farming purposes (including farm access roads which have been realigned around approved mining disturbance areas).

While some of the drainage management works on these properties is utilised as part of the mine water management system (predominately clean water diversions and drainage lines for design overflow from sediment dams), this has not been mapped except where the predominate use of these works is associated with mine related activities and future disturbance associated with final landform re-establishment works is likely to be required. The main examples where this disturbance has been mapped is the area around the E26 void and approved waste dumps and some areas around the Rosedale TSF and the approved E31 and E31N pit areas.

3.0 References

Australia Archaeological Survey Consultants Pty Ltd (2006) *Northparkes Mines – E48 Project: Aboriginal Heritage Assessment* (Part 8 in Northparkes Mines – E48 Project Environmental Assessment (RW Corkery & Co (2006))

R.W Corkery & Co (2006), *Northparkes Mines – E48 Project Environmental Assessment*

Umwelt (2013), *Environmental Assessment: Northparkes Mines Step Change Project*



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Attachment 2 – Review of Approved Disturbance Area - Addendum (March 2022)

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NORTHPARKES MINES

Review of Approved Disturbance Area - Addendum

FINAL

March 2022

NORTHPARKES MINES

Review of Approved Disturbance Area - Addendum

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
CMOC Northparkes

Project Director:	David Holmes
Project Manager:	Lauren Evans
Technical Director:	David Holmes
Report No.	20272/R05-Addendum
Date:	March 2022

Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which Northparkes Mines operates, the Wiradjuri people, and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

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Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Lauren Evans	2/3/2022	David Holmes	2/3/2022

Table of Contents

1.0 Updated E28 Haul Road Alignment 1

2.0 References 4

Figures

Figure 1.1 Figure 3.4 from Step Change RTS Addendum 1
Figure 1.2 Revised 'Approved Operational Area' east of approved E28NE pit 2
Figure 1.3 Northparkes Mine PA 11_0060 Approved Operational Area 3

1.0 Updated E28 Haul Road Alignment

In September 2021, a consolidated mapping of the Approved Operational Area was undertaken and documented in the Report 'Northparkes Mine Review of Approved Disturbance Area' (Umwelt 2021). (Approved Disturbance Report). This Addendum has been prepared to correct a minor error in this mapping.

The Approved Disturbance Report used the mapping of 'Disturbance Areas' contained in Figure 3.4 from the PA11_0060 Modification 3 Application which reflected the 'Proposed Disturbance Area' mapping (Figure 5.9) from the Step Change EA. Unfortunately, Figure 3.4 did not capture the revised footprint for the E28 Haul Route to minimise impacts on a population of the Pine Donkey Orchid (*Diuris tricolor*) located to the east of the proposed (and now approved) E28NE open cut footprint. This revised footprint is shown in Figure 3.4 of the *Northparkes Mine Step Change Project Response to Submissions – Addendum* (Umwelt 2013) (Step Change RTS – Addendum) which is reproduced in **Figure 1.1** below.



Figure 1.1 Figure 3.4 from Step Change RTS Addendum

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The Approved Operational Area mapping has been updated to reflect the revised E28 haul route and associated buffer area where disturbance associated with road construction works was also approved. The updated Approved Operational Area in this area is shown in **Figure 1.2**.

The consolidated 'Approved Operational Area' is shown in **Figure 1.3**.



FIGURE 1.2

Revised 'Approved Operational Area'

Image source: NPM Aerial Imagery (2020) Data source: NPM (2021)

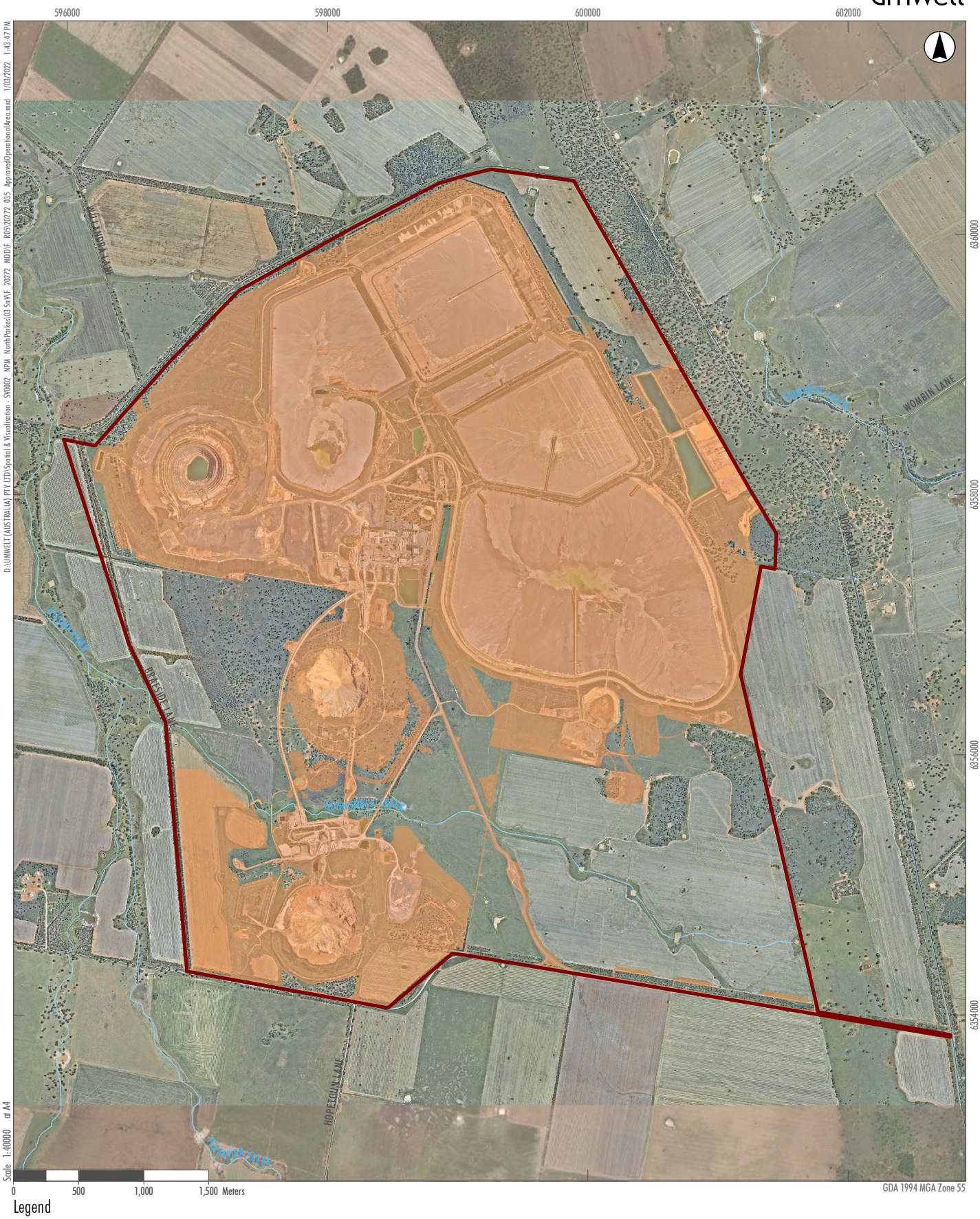


FIGURE 1.3

Northparkes Mine PA 11_0060
Approved Operational Area

Image source: NPM Aerial Imagery (2020) Data source: NPM (2021)

2.0 References

Umwelt (2013), Environmental Assessment: Northparkes Mines Step Change Project Response to Submissions - Addendum, dated November 2013

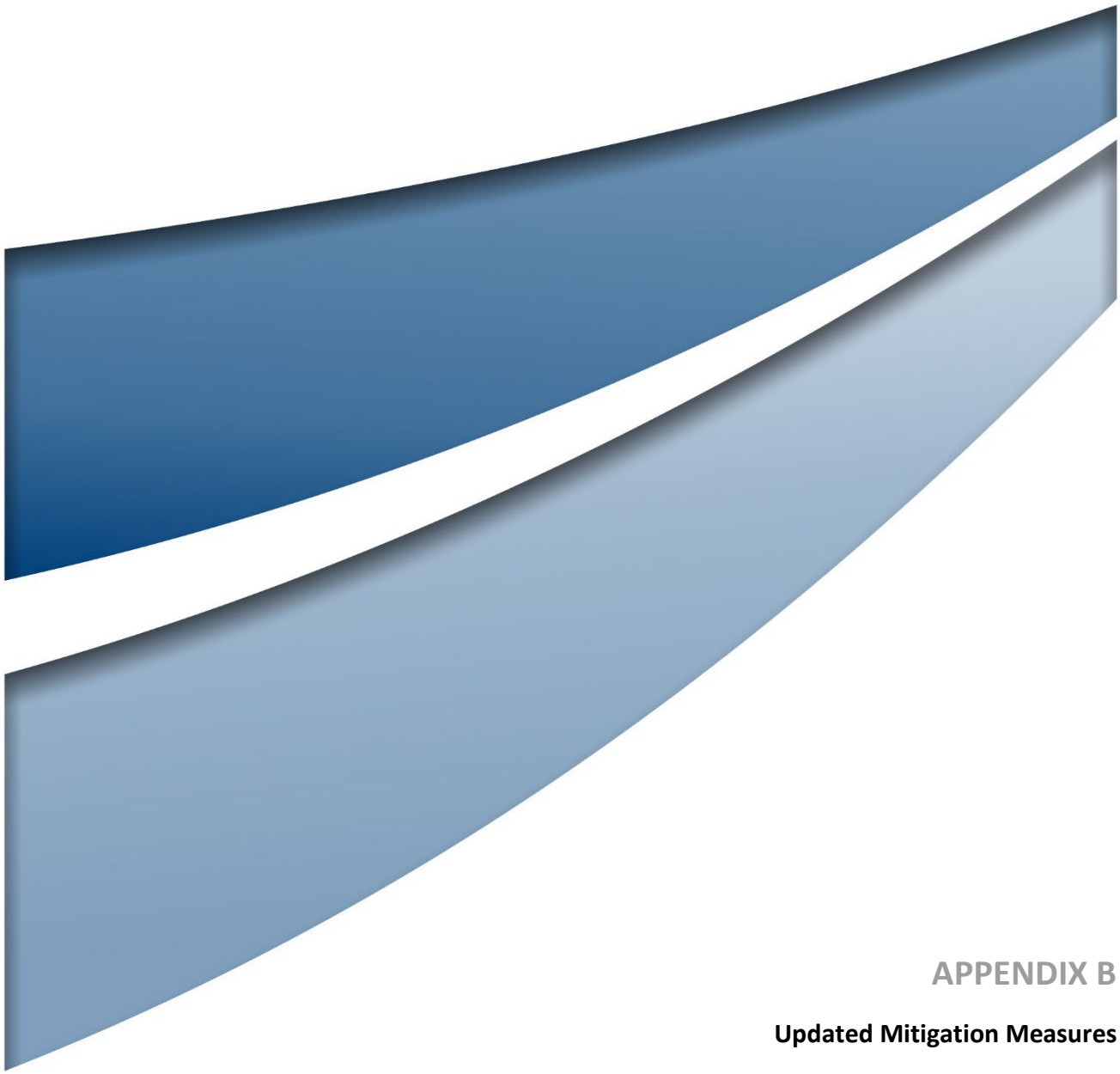
Umwelt (2021) Northparkes Mine Review of Approved Disturbance Area, dated September 2021



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APPENDIX B

Updated Mitigation Measures

Updated Project Description

Table B1 provides an updated summary of mitigation measures for PA 11_0060 as modified (incorporating MOD 6). It is intended that **Table B1** will replace the Statement of Commitments in Appendix 3 of PA 11_0060 and Table B1 in the Modification Report.

Table B1 Updated Mitigation Measures

Updated Mitigation Measures (PA 11_0060, as modified)	
Noise	
N1	NPM will undertake additional targeted noise monitoring during construction periods for TSFs, whilst campaign open cut mining operations occur during winter night time operations. This targeted monitoring program will include the use of real time monitoring and be undertaken to identify situations when metrological conditions have the potential to exacerbate noise impacts on neighbouring receivers. Appropriate noise mitigation measures will be implemented as required.
Traffic and Transport	
TT1	The proposed road upgrades, including the development of a new internal access road, upgrades to McClintocks Lane and its intersection with Bogan Road and the development of a new visitors car park, will each be designed in accordance with appropriate guidelines and standards and finalised in consultation with Parkes Shire Council and local landholders/neighbours as appropriate.
TT2	NPM will maintain current arrangements for financial contribution for the purpose of road maintenance as agreed with Parkes Shire Council and DP&I in accordance with the executed Planning Agreement.
TT3	NPM will prepare a detailed Construction Traffic Management Plan for the construction period of the Project, which will include details of: • any staging works • construction routes • heavy vehicles including oversize vehicles • traffic management during the construction of the upgraded intersection in Bogan Road and McClintocks Lane.
TT4 (MOD 5)	NPM will implement the following measures during temporary haulage arrangement to Parkes National Logistics Terminal: • Truck movements will be limited as follows: ○ No more than two A-Double vehicles used to transport the copper concentrate, with no more than four Northparkes generated truck movements past a receiver in any one hour ○ No more than 32 truck movements in any 24 hour period, and no more than four movements per hour ○ No truck movements between 10.00 pm and 7.00 am on Saturday and Sunday nights • Adherence to the conditional restrictions on access to the Restricted Access Vehicle (RAV) routes on McClintocks Lane, Bogan Road and Brolgan Road • Adherence to sign-posted and RAV route conditioned speed limits • Preparation and implementation of a driver fatigue management policy and plan • Preparation and implementation of a transport code of conduct.

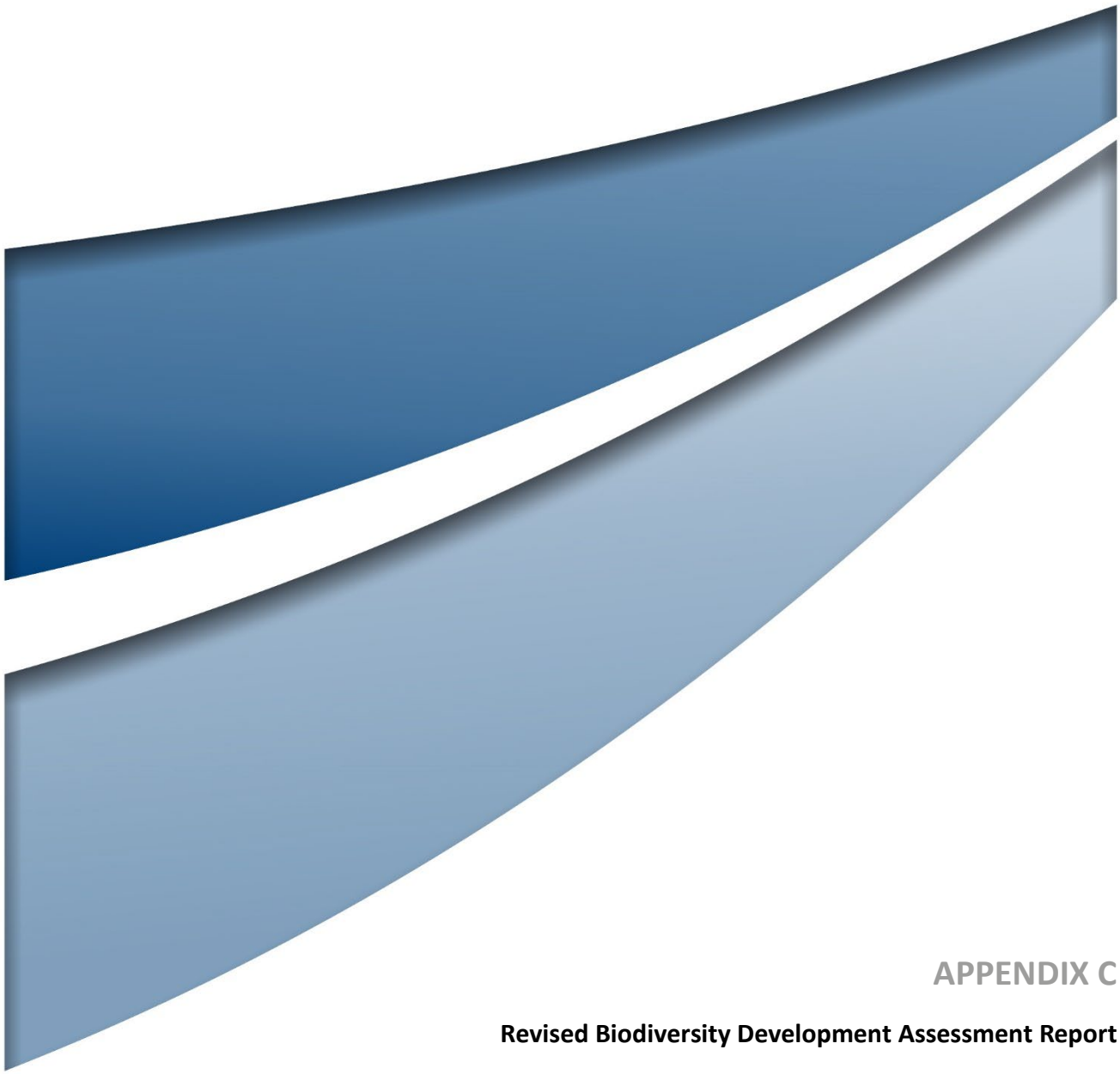
Updated Mitigation Measures (PA 11_0060, as modified)	
Aboriginal Cultural Heritage	
ACH1	NPM commits to a comprehensive survey of all portions of the proposed disturbance area that have not been subject to 100 per cent survey coverage prior to disturbance. Thus, any and all areas of the development footprint that will be affected will be examined prior to construction commencing, in consultation with the Aboriginal Heritage Working Group, and agreed management measures will be implemented.
ACH2	In the unlikely event that unexpected archaeological remains or potential heritage items not identified as part of this report are discovered during the Project, all works in the immediate area will cease. The remains and potential impacts will be assessed by a qualified archaeologist or heritage consultant and, if necessary, the Heritage Branch, BCD notified in accordance with Section 146 of the Heritage Act (NSW).
ACH3	If potential human remains are located following any surface disturbance, all works will halt in the immediate area to prevent any further impacts to the remains. The NSW Police will be contacted immediately. No action will be undertaken until police provide written notification to the Proponent.
ACH 4 (MOD 6)	• The previously recorded modified tree (P1-Alectown, 35-6-0156) will be updated to 'not a site' on the AHIMS register. The tree will not be impacted until the approved Aboriginal Site Impact Recording Form (ASIRF) has been received. • The Aboriginal Cultural Heritage Management Plan (ACHMP) will be consulted for the appropriate procedures if unanticipated Aboriginal objects or human skeletal remains are encountered during works
Socio-Economic	
SE1	• NPM will continue investigating the sizing of contracts in order to facilitate the inclusion of local businesses within ongoing operations. • NPM will consult with PSC in regard to other influences on accommodation demands when scheduling operations requiring short-term increases in employees and contractors. • Should unanticipated impacts become evident during the life of the Project, NPM will liaise with PSC and/or the relevant government body in relation to how infrastructure challenges in the future may be met as a community. • NPM will commence SIA, with regard to mine closure (including consultation with PSC, FSC, and the community), five years prior to the anticipated end of mine life, unless further extensions of mine life are being sought at that time. • NPM will continue its existing community engagement and consultation program and will extend the program to facilitate feedback from the community with regard to community perceptions of NPM in order to proactively manage matters as they arise.

Updated Mitigation Measures (PA 11_0060, as modified)	
SE2 (MOD 5)	NPM will implement the following measures during temporary haulage arrangement to Parkes National Logistics Terminal: • A-Double configuration vehicles to be used to limit the number of commutes • Northparkes to periodically engage with landowners or residents adjoining the proposed transport route to monitor the impacts of traffic noise • Fatigue management of drivers to be enforced to ensure safety of employees, pedestrians and other road users • Promote and enforce safe driving practices • Drivers to travel the proposed route prior to commencement of copper concentrate delivery to familiarise themselves to changes in road signage, speed zones and high impact areas • Employees to report any road maintenance concerns to road managers to ensure continued condition of the proposed transport route • Implement a reporting procedure for any impact to private property including debris damage during commute along the proposed haul route • Continue to employ locally and invest in community sustainability projects • Continue to provide financial and other support to local groups and organisations.
Biodiversity	
B1	**N**PM will implement the biodiversity management strategies outlined in Appendix 9 of the 2013 EA, including: • Feral animal and noxious weed control consistent with existing practices at the NPM • Rehabilitation of disturbed areas to provide soil stabilisation and protection and possible future farming opportunities • Adaptive management, as required, if a previously recorded or unassessed threatened species is identified in the proposed disturbance area during operations • Ongoing monitoring and maintenance of any revegetation works and habitat enhancement activities • Establishment of an ongoing monitoring program to monitor native flora and fauna across the Project Area.

Updated Mitigation Measures (PA 11_0060, as modified)	
B2	**Pre-Clearance Protocol** NPM will implement a tree felling procedure to minimise the potential for impacts on native fauna species (including threatened species) as a result of the clearing of hollow-bearing trees. The procedure will include: • comprehensive pre-clearing surveys by a suitably experienced and qualified ecologist, no more than two weeks prior to felling. This will include marking of hollow-bearing trees, as well as any other notable features such as fallen timber, hollow logs or boulders suitable for salvage; active nests, dreys or dens requiring consideration; and seed-bearing trees for salvage. Surveys will include detailed searches for threatened flora and fauna species, including micro-bats • removal of non hollow-bearing trees/vegetation as close to the hollow-bearing tree felling date as possible (in order to discourage fauna usage of the area). It is not considered necessary for a suitably experienced and licensed ecologist to be present to supervise such works, providing pre-clearing surveys have been completed within the designated timeframe • detailed hollow-bearing tree felling procedures, including (but not limited to): ○ supervision of all hollow-bearing tree felling works by a suitably experienced and licensed ecologist. If an ecological issue is encountered, the ecologist is to advise on the most appropriate measures to ensure minimal impact on fauna species, particularly threatened species ○ visual canopy inspection on the day of the felling of hollow-bearing trees for fauna species and active nests ○ shaking of hollow-bearing tree (with heavy machinery) for at least 30 seconds to encourage resident fauna to abandon tree, prior to felling ○ lowering of hollow-bearing trees as gently as possible with heavy machinery ○ inspection of all hollows in felled trees by a suitably experienced and licensed ecologist ○ capture of any displaced/injured fauna by a suitably experienced and licensed ecologist ○ release of unharmed fauna into nearby secure habitats by a suitably experienced and licensed ecologist ○ injured fauna to be assessed and taken to wildlife carer, if necessary, by a suitably experienced and licensed ecologist ○ felled trees to be rolled so that the number of hollows blocked against the ground are minimised ○ all felled trees to remain in place overnight to allow any unidentified fauna to escape ○ salvage of suitable hollows for treatment and installation within rehabilitation and revegetation areas as compensatory habitat, where practicable. All personnel who will capture/handle/house and/or transport native fauna species (injured or uninjured) will be appropriately licensed under the requirements of the NSW Animal Ethics Committee. Site personnel (particularly vehicle operators) will be briefed on fauna awareness issues and will be required to report incidents involving injury to native wildlife. Assistance from a wildlife carer or veterinarian will be sought if injured native wildlife are encountered.

Updated Mitigation Measures (PA 11_0060, as modified)	
B3	**Nest Boxes** • To address the loss of hollows from clearing activities, the following will be undertaken: ○ Augmentation of existing hollows within retained woodland remnants within the Project Area (see below). The amount of nest boxes to be used for this purpose will be developed based on further surveys of the proposed disturbance area during pre-clearing surveys. ○ Staged mitigation of hollow loss from the proposed disturbance areas by placing nest boxes in surrounding vegetation. • The type of nest box to be used will be dependent on the size of the hollows being removed and the type of species likely to be utilising the hollows. In general, the likely composition of nest box types will include a mix of bat roost boxes, parrot boxes, glider boxes, possum boxes and owl boxes. • The number of nest boxes to be established will be dependent on the number of hollows to be removed and the existing provision of tree hollows in areas targeted for the addition of next boxes. • Hollow-bearing tree surveys will be undertaken prior to clearing to determine the number of hollows to be impacted but given the abundance of hollows across the Wider Study Area, it is considered that hollow replacement should be undertaken at a ratio of one nest box (or suitable salvaged hollow) for every two natural hollows removed during felling.
B4	**Salvage of Habitat Features** • The salvage and relocation of hollow logs, fallen timber and boulders will be undertaken wherever possible. • Pre-clearance surveys will be used to clearly mark hollow-bearing trees. Hollow salvage operations will then be incorporated into the clearing phase (where appropriate) and will involve the careful removal of identified suitable hollows, hollow capping and any other restorative/protection works required. Hollows will be re-erected in trees in suitable positions within the non-impacted woodland areas within the Project Area. • Salvaged and re-erected hollows will be subject to the same levels of maintenance and monitoring as nest boxes.

Updated Mitigation Measures (PA 11_0060, as modified)	
B5 (MOD 6)	NPM will implement the following mitigation measures during works associated with MOD 6: • Ensure all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the site and protection measures to be implemented to protect biodiversity. • Use of and regular inspection and maintenance of erosion and sediment control measures. • Fence off or mark trees and areas of native vegetation to be retained, to avoid additional impacts on vegetation. Fencing should protect the entire Tree Protection Zone (a general 5 m buffer zone will be applied, which is sufficient for the tree sizes present). • Establish appropriate buffers around trees that are to be retained. Work would avoid damage to the structural root zones (SRZ) of the trees. • Restrict stockpiles of construction materials, fill or vegetation to existing cleared areas and not within areas of adjoining native vegetation. • Applying water to stockpile areas during windy conditions. • Construction traffic would remain on existing roads and tracks and avoid areas of native vegetation where practicable. • Reinstatement of unstable surfaces as quickly as practicable after construction for those areas not to be directly used for proposal infrastructure. Residual biodiversity impacts associated with MOD 6 will be offset in accordance with the *NSW Biodiversity Offsets Scheme* and the *Biodiversity Conservation Act 2016*.
Visual	
V1	• NPM will implement the following mitigation measures to mitigate potential visual impacts from the Project: ○ Maintenance of existing vegetation where possible for visual screening, including infill planting where necessary ○ Additional screen plantings will be utilised in strategically located positions to augment existing plantings and limit views into the Project from public roads, in particular McClintock's Lane ○ Continued establishment of revegetation corridors outside the active mine area through ongoing land management practices ○ Ensuring that areas of disturbance are kept to the minimum practicable at any one point in time ○ Rehabilitation of disturbed areas in undertaken as soon as practical ○ Aiming to minimise night lighting impacts on surrounding land owners and road users by ensuring, where practicable, that lighting plants are positioned such that light is directed toward work areas and not towards private residences and roads.



APPENDIX C

Revised Biodiversity Development Assessment Report

Northparkes Mines Modification 6 – E31 Precinct, E22 Portal & TSF2 Buttressing

Biodiversity Development Assessment Report

Northparkes Mines

9 March 2022

→ The Power of Commitment



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Contents

1. Introduction **1**
1.1 Overview 1
1.2 Key features of the proposal 1
1.3 Requirement for BDAR 3
1.4 Purpose of this report 3
1.5 Glossary of terms and acronyms 3
1.6 Scope and limitations 5

2. Legislative context **7**
2.1 Biodiversity Conservation Act 2016 7
2.1.1 Biodiversity Offset Scheme and Biodiversity Assessment Methodology 7
2.2 Fisheries Management Act 1994 7
2.3 Biosecurity Act 2015 8
2.4 Environmental Protection and Biodiversity Conservation Act 1999 8
2.5 Assessment guidelines and information 9

3. Methods **10**
3.1 Desktop assessment 10
3.1.1 Data review 10
3.1.2 Background research 10
3.1.3 Category 1 – Exempt Land mapping 11
3.2 Site survey 11
3.2.1 Survey overview 11
3.2.2 Vegetation and flora surveys 12
3.2.3 Terrestrial fauna surveys 16
3.2.4 Aquatic habitat assessment 18
3.3 Survey conditions 18
3.4 Geographical Information System (GIS) analysis 19
3.5 BAM calculations 19
3.6 Staff qualifications 20

4. Landscape context **22**
4.1 Location 22
4.2 Existing land uses 22
4.3 Climate 23
4.4 Landscape features 23
4.4.1 NSW (Mitchell) landscape 23
4.5 Determining site context 24
4.5.1 Native vegetation cover 24
4.5.2 Patch size 25

5. Native vegetation **27**
5.1 Flora species 27
5.1.1 Species richness 27
5.1.2 Priority and high threat species 27
5.2 Vegetation in the region 27

5.3 Vegetation in the proposal site 28
5.3.1 Native vegetation extent 28
5.3.2 Plant community types 28
5.3.3 Vegetation zones 30
5.3.4 Vegetation profiles 30
5.3.5 Groundwater dependent ecosystems 39
5.4 Fauna and habitat resources 39
5.4.1 Fauna species 39
5.4.2 Fauna habitats 40
6. Conservation significance 43
6.1 Identification of threatened species under the BAM 43
6.1.1 Predicted threatened species (ecosystem credit entities) 43
6.1.2 Candidate threatened species (Species credit entities) 46
6.2 Threatened species survey results 50
6.2.1 Threatened flora 50
6.2.2 Threatened fauna 51
6.2.3 Threatened ecological communities 51
7. Avoid and minimise impacts 54
7.1 Overview 54
7.2 Measures to avoid and minimise impacts 54
8. Assessment of impacts 55
8.1 Direct impacts 55
8.2 Indirect impacts 57
8.3 Impacts on aquatic habitats 58
8.4 Prescribed impacts 59
8.4.1 Karst, caves, crevices, cliffs, rocks and other geological features of significance 59
8.4.2 Human made structures and non-native vegetation 59
8.4.3 Habitat connectivity 59
8.4.4 Water bodies, water quality and hydrological processes 60
8.4.5 Vehicle strike 60
8.5 Consideration of MNES 60
9. Mitigation and management of impacts 62
9.1 Mitigation of impacts 62
9.2 Remediation of the mine 63
10. Impact Summary 64
10.1 Assessment of serious and irreversible impacts 64
10.2 Impacts requiring offset 66
10.3 Impacts not requiring offset 68
10.4 Options to meet offset obligations / approach to delivering offsets 68
10.5 Offsets for impacts on MNES 71
11. Conclusion 73
12. References 75
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and derived native grasslands of South-eastern Australia – endangered ecological community 2
Superb Parrot (*Polytelis swainsonii*) – vulnerable species 6
Grey-headed Flying Fox (*Pteropus poliocephalus*) – vulnerable species 9
Corben's Long-eared Bat (*Nyctophilus corbeni*) – vulnerable species 12

Table index

Table 1	Survey techniques and timing	12
Table 2:	Minimum plot survey requirements	13
Table 3	Site data collected within each plot	15
Table 4	Candidate flora species credit entities targeted during surveys	16
Table 5	Candidate fauna species credit entities targeted during surveys	17
Table 6	Targeted fauna survey techniques and effort	17
Table 7	Daily weather observations during the survey period	18
Table 8	GHD ecology staff and qualifications	20
Table 9	Landscape features	23
Table 10	Native vegetation cover	24
Table 11	Patch sizes at the proposal site	25
Table 12	Vegetation in the proposal site	28
Table 13	Vegetation zones within the proposal site	30
Table 14	Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW	31
Table 15	Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	31
Table 16	Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW	33
Table 17	Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	34
Table 18	Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	35
Table 19	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	36
Table 20	Non-native vegetation	37
Table 21	Fauna habitats – woodland patches	40
Table 22	Confirmed predicted threatened species	43
Table 23	Excluded predicted threatened species	45
Table 24	Confirmed candidate species credit species for which surveys were conducted	46
Table 25	Excluded candidate species	49
Table 26	Direct impacts	55
Table 27	Indirect impacts	57
Table 28	Mitigation measures	62
Table 29	Box-Gum Woodland SAII assessment	64
Table 30	Ecosystem credits required to offset impacts of the proposal	67
Table 32	'Like for like' ecosystem credits required to offset impacts of the proposal	69
Table 33	Proposed swap area characteristics and impact area credits required	70
Table 34	Total offset obligation vs offset obligation using swap area	70
Table 35	Fauna species	1
Table 36	Assessment of significance – Grey Box Woodland	3
Table 37	Assessment of significance for the Superb Parrot	6
Table 38	Assessment of significance for the Grey-headed Flying Fox	9
Table 39	Assessment of significance for Corben's Long-eared Bat	12

Figure index

Figure 1: The proposal 6
Figure 2: Survey effort 21
Figure 3: Landscape features 26
Figure 4: Vegetation in the proposal site 42
Figure 5: Threatened biota and habitat resources 53
Figure 6: Areas requiring offsets 72

Appendices

Appendix A Likelihood of occurrence of threatened and migratory biota
Appendix B Survey results
Appendix C Field data sheets
Appendix D BAM Calculator data
Appendix E EPBC Act assessments of significance
Appendix F Biodiversity credit report
Appendix G Land category mapping report
Appendix H Estimated Biodiversity Conservation Fund payment price

Certification under Section 6.15 of the *Biodiversity Conservation Act 2016*

I, Melissa Cotterill (BAAS18127) certify that this Biodiversity Development Assessment Report and the accompanying finalised credit reports dated 09/03/2022 has been prepared in accordance with the requirements of (and information provided under) the Biodiversity Assessment Method.



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Melissa Cotterill – BAAS18127
09/03/2022

1. Introduction

1.1 Overview

Northparkes Mines (Northparkes) proposes to modify PA 11_0060 for underground and open cut mining at Northparkes Mines, located about 27 kilometres north-west of Parkes. Northparkes proposes to construct a new portal for the existing E22 underground mining area and undertake embankment buttressing to reinforce Tailings Storage Facility 2 (TSF2). Additionally, Northparkes proposes to make changes to the approved E31 Precinct, including minor adjustments to the E31 and E31N open cut pits, relocation of stockpiling areas and ancillary infrastructure and the establishment of borrow pits. These modifications are collectively known as 'the proposal'.

Northparkes proposes to modify PA 11_0060 under section 4.55(2) of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The proposal represents Modification 6 of the existing approval.

This Biodiversity Development Assessment Report (BDAR) considers the assessment requirements of the NSW *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This BDAR has been prepared by an accredited assessor in accordance with the Biodiversity Assessment Method (BAM).

The Northparkes E44 Rocklands Project encompasses part of the area of the proposal and includes construction of the new Rocklands TSF. The E44 Rocklands Project is the subject of a separate BDAR (GHD in preparation). Where relevant and appropriate, survey results and biodiversity assessment data from the E44 Rocklands Project has contributed to this BDAR.

A BDAR was submitted for approval in November 2021. The following changes and updates have been made during progression of the proposal and are captured in this updated BDAR:

– Supplementary field surveys to exclude candidate species credit species and obtain minimum plot numbers (conducted in November 2021)
– Revision of Local Land Services Category Mapping (as per Addendum report – refer Appendix G)
– Staging of vegetation disturbance.

1.2 Key features of the proposal

Northparkes Mines is located about 27 kilometres north-west of Parkes in the NSW South Western Slopes.

The key features of the proposal include:

– construction and use of a new underground portal access (including associated drive, conveyor and other ancillary infrastructure) for E22 underground mining operations
– TSF2 embankment buttressing (including associated amendments to the approved disturbance area)
– changes to TSF construction within the approved disturbance footprint associated with increased safety requirements for TSFs since first approved
– minor changes to the E31 and E31N open cut pits to reflect updated geological data and improved resource recovery, including:
    - minor adjustments to disturbance areas for the approved pits and associated infrastructure (roads, safety bunds, water management etc)
    - minor increases to maximum approved mining depths
– establishment of temporary waste rock stockpile areas for the E31 and E31N pits to avoid unnecessary material re-handling in the future due to the proposed Rocklands TSF
– additional detail regarding the approved methods and locations of rehabilitation material (soils and vegetation)
– establishment of additional clay and filter material borrow pits for TSF construction and lifts
– relocation of the Contractor area facilities (eg site offices, crib huts and a workshop) which would also service the E31 and E31N mining operations
– relocation of the main water supply pipeline and Rosedale (TSF3) tailings pipeline

– clarification regarding approved disturbance boundaries and the location of ancillary infrastructure within the E31 Precinct.

Vegetation disturbance associated with the proposed modification would be undertaken in stages, comprising:

– Stage 1: E31 Precinct and TSF2 embankment buttressing works
– Stage 2: E22 Portal direct disturbance required for the establishment of the portal
– Stage 3: E22 Portal additional disturbance that may be required subject to detailed design.

Further detail is provided in the sections below.

E31 precinct

A review of the mine design for E31 and E31N has identified that minor adjustments to the approved disturbance boundaries of the two pits are required. The revised open cut footprints outside of currently approved operational areas includes land that is assessed as being Category 1 – Exempt Land under the *Local Land Services Act 2012* as well as areas of native vegetation.

In addition, Northparkes has identified the potential to utilise waste rock from the E31 and E31N pits in the construction of future tailings facilities, including Rocklands TSF. This will form part of the upcoming Northparkes E44 Rocklands Project. To avoid rehandling of this waste rock in the future (and associated noise and air quality impacts), alternative stockpiling locations have been identified within the E31 Precinct which would improve integration of these approved mining operations with the proposed Rocklands TSF construction. The proposed stockpiles are located on land assessed as being Category 1 – Exempt Land.

The proposed construction of the Infill TSF extension will require the realignment of the haul road servicing the E31 pits. This realignment necessitates the removal of a small area of vegetation in the north of the E31 precinct area.

Northparkes also proposes to establish a new rehabilitation material stockpiling area for topsoil, subsoil and vegetative material to the west of the access road. The establishment of this area would facilitate the future construction of the proposed Rocklands TSF and avoid rehandling of rehabilitation materials within the E31 Precinct. The use of this area for stockpiling soil and vegetation material also avoids further impacts on actively managed farming land as this area is not presently farmed due to its proximity to the mining operation. The disturbance footprint identified for these activities to the west of the access road has minimised biodiversity impacts by avoiding remnant paddock trees (pre-1990) and an area of regrowth around some of these trees. This area is located in either currently approved operational areas or land assessed as being Category 1 – Exempt Land.

TSF2 embankment buttressing

Northparkes has identified that the walls of the TSF2 require additional buttressing if constructed to their approved height to meet relevant safety standards and to enable the approved future lifts of the TSF wall to occur. This buttressing will require an adjustment to the approved disturbance boundary to the east of TSF2. An extension is also required to the approved Infill TSF area, which is located wholly within existing approved disturbance areas.

E22 Portal

The new portal and associated decline to the existing approved E22 access heading is proposed to improve operational efficiencies and reduce overland ore transport. The new portal would be located in the north-eastern corner of Limestone National Forest (a State Forest). This area is not currently approved for disturbance. The portal would primarily be used for ore transport to the surface, however it may also be used for personnel/vehicle/equipment access. The new portal would also incorporate an associated conveyor (connecting into the mine's existing conveyer system) and water management infrastructure (e.g. surge dams, dewatering sumps etc.). The area in which the portal would be constructed would be split into two stages following the stage 1 works described above:

– Stage 2 being the direct disturbance required for the establishment of the portal
– Stage 3 covering any additional disturbance that may be required, pending the outcome of the detailed design phase.

Other changes

The relocation of contractor facilities currently located to the west of the TSF2 is required as a consequence of the works required for buttressing the western side of TSF2 and construction of the Infill TSF (covered by existing approvals). These contractor facilities will be relocated within the existing approved operational area, in the general vicinity of the existing administration building. The relocated contractor facilities will also service the E31 mining operations, and would be used for the construction of the Rocklands TSF when approved.

The proposed modification will also include a minor adjustment to the PA 11_0060 disturbance area to align this boundary with the existing lease boundary and provide additional space for soil stockpiling in areas. This change does not involve any additional impacts on native vegetation.

Northparkes Mines, including the proposal, is approved to operate until 31 December 2032. At the end of its operational life, the mine would be decommissioned and rehabilitated.

The proposal site and key features are mapped on Figure 1.

1.3 Requirement for BDAR

A BDAR is required for this proposal as a modification to the Northparkes Mines State significant development consent PA 11_0060, which covers the approved operations at Northparkes Mines. The approved operational area under PA 11_0060 excludes some areas required for the Modification 6 activities and therefore a modification of PA 11_0060 under section 4.55 of the EP&A Act is required. As a State significant development, a BDAR is required to accompany a modification application where there is an impact to additional land.

1.4 Purpose of this report

The purpose of this report is to assess the potential biodiversity impacts from the construction and operation of the proposal. The report:

– Outlines the methods used in the biodiversity assessment
– Describes the existing environment of the study area, including the results of the desktop assessment and site surveys
– Assesses the value and conservation significance of native vegetation and habitats at the proposal site and the potential for threatened biota and matters of national environmental significance (MNES) listed under the EPBC Act to occur at the proposal site or be affected by the proposal
– Provides a description of the proposal, including potential impacts on biodiversity values and measures to avoid or mitigate impacts
– Assesses the significance of impacts on threatened biota and MNES
– Presents the data used to perform the BAM credit calculations for the proposal
– Calculates the number and type of biodiversity credits that would be required to offset residual impacts of the proposal in accordance with the BAM.

1.5 Glossary of terms and acronyms

Term	Definition
AOBV	Areas of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method The rules for biodiversity assessment established under the BC Act that determine credits created, credits required and the circumstances that improve or maintain biodiversity values.
BAM-C	Biodiversity Assessment Method Calculator
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act 2016*

Term	Definition
BC Regulation	Biodiversity Conservation Regulation 2017
BCD	Biodiversity Conservation Division (of the Department of Planning, Industry and Environment)
BCF	Biodiversity Conservation Fund. Under the NSW Biodiversity Offsets Scheme (BOS), development proponents may choose to pay into the BCF as an alternative to retiring biodiversity credits to meet their project offset obligation.
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
Biodiversity credit	A unit of biodiversity value to measure specific development impacts or conservation gains in accordance with the BAM. Includes ecosystem credits and species credits.
Biodiversity credit report	Specifies the number and type of biodiversity credits: required to offset the impacts of a development to obtain a Biodiversity Certification Agreement; or that would be generated through conservation and management of a Stewardship site under a Biodiversity Stewardship site agreement.
Biodiversity offsets	Specific measures that are put in place to compensate for impacts on biodiversity values.
Biodiversity values	The composition, structure and function of ecosystems, including threatened species, populations and ecological communities, and their habitats.
BOS	Biodiversity Offset Scheme
CEEC	Critically endangered ecological community
CEMP	Construction Environmental Management Plan
DBH	Diameter at breast height
DEE	Department of the Environment and Energy
DPI	Department of Primary Industries
Ecosystem credit	A credit that relates to a vegetation type and the threatened species that are reliably predicted by that vegetation type (as a habitat surrogate).
EEC	Endangered ecological community
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FFMP	Flora and Fauna Management Plan
HTW	High threat weed
IBRA	Interim Biogeographic Regionalisation for Australia
LEP	Local Environment Plan
LGA	Local Government Area
Locality	The area within a 10 km radius of the proposal site.
Migratory species	Species listed under listed under international agreements (i.e Ramsar, JAMBA, CAMBA and ROKAMBA conventions) to which Australia is a party
MNES	Matters of National Environmental Significance
NSW	New South Wales
NPW Act	*National Parks and Wildlife Act 1974*
OEH	Office of Environment and Heritage

Term	Definition
PCT	Plant community type
Proposal site	The area that would be directly impacted by construction and operation of the proposal. Encompasses the modification 6 E31's, TSF2 and E22 Portal area site including all ancillary features. Comprises the 'development site' as referenced in the BAM
SAII	Serious and irreversible impact
SAII entity	Species and ecological communities that are likely to be the subject of serious and irreversible impacts (SAIIs)
SEPP	State Environment Planning Policy
Species credit	A credit that relates to an individual threatened species that cannot be reliably predicted based on habitat surrogates. Threatened species that require species credits are identified in the Threatened Biodiversity Data Collection
Study area	The area that was assessed for direct or indirect impacts arising from construction and operation of the proposal. This includes the area on which the modification will be constructed, as well as adjacent land currently used for agriculture. Comprises the 'subject land' as referenced in the BAM. A buffer of 1,500 metres has been used in desktop assessments in accordance with the BAM.
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened ecological community
Threatened biota	Threatened species, populations or ecological communities listed under the BC Act, FM Act and/or the EPBC Act.

1.6 Scope and limitations

This BDAR has been prepared by GHD for Northparkes Mines and may only be used and relied on by Northparkes Mines for the purpose agreed between GHD and Northparkes Mines as set out in section 1.4 of this report.

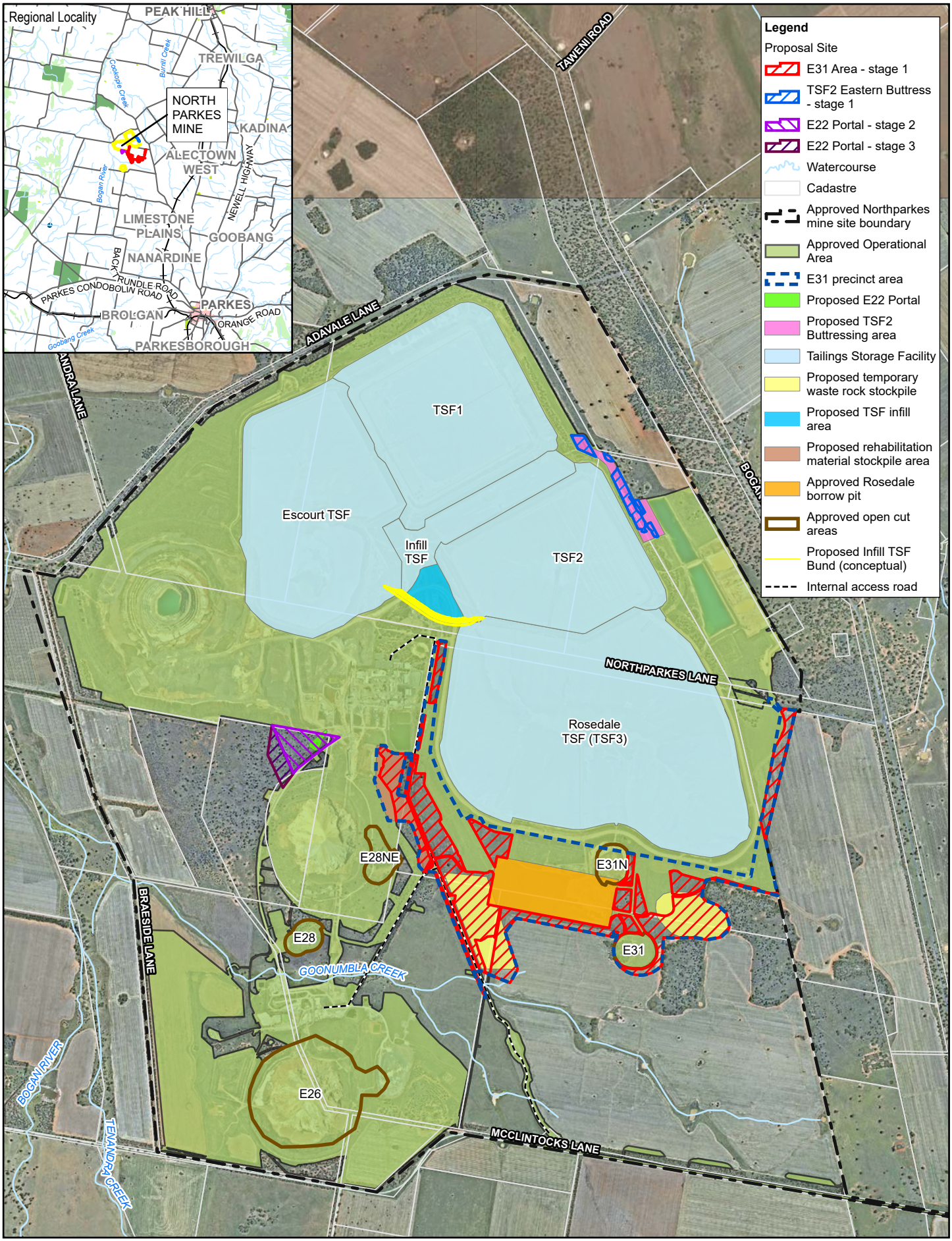
GHD otherwise disclaims responsibility to any person other than Northparkes Mines arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this BDAR on the basis of information provided by Northparkes Mines and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report.



Paper Size ISO A4

0 250 500 750 1,000

Metres

Map Projection: Transverse Mercator

Horizontal Datum: GDA 1994

Grid: GDA 1994 MGA Zone 55

N

Northparkes Mines
Biodiversity Development Assessment Report
Modification 6

Project No. **12551921**
Revision No. **0**
Date **09/03/2022**

The proposal

Figure 1

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Print date: 09 Mar 2022 - 11:30

Data source: CMOC: Disturbance Bdy, Aerial Imagery, 2021, LPI: DTDB / DCDB, 2017; World Imagery: Maxar. Created by: fmackay

2. Legislative context

2.1 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) provides legal protection for biota of conservation significance in NSW. The BC Act aims to, amongst other things, 'maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development'. It provides for the listing of threatened species and communities, establishes a framework to avoid, minimise and offset the impacts of proposed development (the Biodiversity Offsets Scheme), and establishes a scientific method for assessing the likely impacts on biodiversity values and calculating measures to offset those impacts (the Biodiversity Assessment Method, BAM). These are discussed further below.

2.1.1 Biodiversity Offset Scheme and Biodiversity Assessment Methodology

The BC Act, together with the *Biodiversity Conservation Regulations 2017*, provides a mechanism to address impacts on biodiversity from land clearing associated with development. Under this legislation, there are provisions for a Biodiversity Offsets Scheme (BOS), which includes a framework to avoid, minimise and offset impacts of development on biodiversity.

The aim of the BOS is to provide a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting. It also allows for the establishment of biodiversity stewardship agreements, which are in-perpetuity agreements entered into by landholders, to secure offset sites and generate biodiversity credits, which can be used to offset impacts of development. The aim of the BOS is to ensure that the impacts of development, clearing or biodiversity certification will result in no net loss of biodiversity.

The Biodiversity Assessment Method (BAM) was established by OEH as a standard method to implement the aims of the BOS and to address the loss of biodiversity and threatened species. The scheme creates a market framework for the conservation of biodiversity values and the offsetting of development impacts. It also provides the mechanisms to offset impacts of development, clearing or biodiversity certification such that there is no loss of biodiversity values.

The BAM sets out how biodiversity values will be assessed, prescribes requirements to avoid and minimise impacts, establishes rules for calculating the number and class of credits required for unavoidable impacts, and determines the trading rules that will apply. The methodology includes a software package known as the Biodiversity Assessment Method Calculator (the BAM calculator) which processes site survey and assessment data. The BAM calculator specifies the type and extent of surveys required for a biodiversity assessment and then processes survey data to calculate the number and type of biodiversity credits that are either required at a development site or will be generated at a stewardship site. The BAM must be applied by a person accredited under the BC Act.

The Biodiversity Conservation Fund (BCF) ensures that landowners have the funds needed to carry out the management actions required each year and provides a financial incentive to landowners to carry out those actions. The scheme is administered by DPIE and ensures accountability and compliance through legislation, regular reporting requirements and financial measures. Under certain circumstances a developer may make a payment directly into the BCF to offset the impacts of a proposed development in lieu of purchasing and retiring biodiversity credits. The BCT must then use funds in the BCF to purchase and retire appropriate biodiversity credits.

2.2 Fisheries Management Act 1994

The objects of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It provides for the listing of threatened species, populations and ecological communities, listing of 'Key Threatening Processes', and the requirements or otherwise for the preparation of a Species Impact Statement (SIS). There are no farm dams, permanent or

ephemeral aquatic habitat in the proposal site to provide potential habitat to aquatic biota or other biota dependant on aquatic habitats. No further assessment under the FM Act is therefore required.

2.3 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for risk-based management of biosecurity in NSW. It provides a statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

There was one priority weed listed in the Central West region (which includes the Parkes local council area) *Lycium ferocissimum (*African Boxthorn) recorded within the study area during field surveys. Legal requirements to minimise the potential for the introduction and/or spread of weeds as a result of the proposal are discussed in Section 5.1.2.

2.4 Environmental Protection and Biodiversity Conservation Act 1999

The purpose of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on 'matters of national environmental significance' undergo an assessment and approval process. Under the EPBC Act, an action includes a project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance (MNES)' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Minister for the Environment. MNES relevant to this report include threatened species and ecological communities and migratory species.

The NSW Government and Australian Government finalised amendments to the Assessment Bilateral Agreement after changes to NSW legislation, and the Amending Agreement no. 1 was signed on 24 March 2020. The Australian Government formally endorsed the NSW BOS through the EPBC Act Condition-setting Policy (DAWE 2020).

Under the bilateral agreement, only one decision including conditions on approval is made by NSW, accounting for impacts to MNES occurring in NSW. Specific consideration of the assessment, approval and offsetting requirements for MNES under the bilateral agreement is only required for controlled actions. The EPBC Act condition setting policy (DAWE 2020) notes that where a project demonstrates compliance with an endorsed state or territory policy, the proponent will not be required to simultaneously comply with the corresponding Australian Government policy. As such, a proponent is not required to calculate offsets separately using the EPBC Act offsets policy (DSEWPAc 2012) and associated calculator, unless offsets are required for a matter that cannot be assessed using the BAM.

The EPBC Act has been considered in this assessment through:

– Desktop review to determine the listed biodiversity matters that are predicted to occur within the locality of the proposal and hence could occur, subject to the habitats present
– Targeted field surveys for listed threatened biota and migratory species (conducted during the E44 Rocklands Project investigations in the study area (GHD in preparation))
– Assessment of potential impacts on threatened and migratory biota, including assessments of significance in accordance with the EPBC Act Significant Impact Guidelines 3.1 (DotE 2013)
– Identification of suitable impact mitigation and environmental management measures for threatened and migratory biota, where required.

Based on the assessments of significance of impacts on MNES presented in this BDAR the proposal would not result in a significant impact on any MNES. Therefore, no further assessment or consideration of biodiversity offset requirements under the EPBC Act or bilateral agreement is required.

2.5 Assessment guidelines and information

This report has been prepared in accordance with the Biodiversity Assessment Method (DPIE 2020a) and with reference to the following guidelines:

– Surveying threatened plants and their habitats – NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b)
– Survey guidelines for Australia's threatened birds – Guidelines for detecting birds listed as threatened under the *Environmental Protection and Biodiversity Conservation Act 1999* (DEWHA 2010)
– Survey guidelines for Australia's threatened mammals – Guidelines for detecting mammals listed as threatened under the *Environmental Protection and Biodiversity Conservation Act 1999* (DEWHA 2011)

3. Methods

3.1 Desktop assessment

3.1.1 Data review

A desktop database review was undertaken to identify threatened flora and fauna species, populations and ecological communities (threatened biota) listed under the BC Act and EPBC Act, that could be expected to occur in the locality, based on previous records, known distribution ranges, and habitats present. These were also used to obtain the necessary site data to perform BAM calculations.

A 20 kilometre search radius from the proposal site was used to identify threatened species that were previously recorded in the locality. A larger search radius than the standard 10 kilometres was used to overcome the risk of potentially low survey effort in the region suggesting lower occurrence of threatened species.

The threatened biota and migratory species identified in the desktop assessment are presented in Appendix A. Following collation of database records and threatened species and community profiles, a 'likelihood of occurrence' assessment was prepared for threatened biota and migratory species with reference to the broad vegetation types and habitats contained within the study area. This was further refined following field surveys and verification of vegetation types and identification and assessment of habitat present within the proposal site. A likelihood of occurrence ranking was attributed to these biota based on this information.

Information sources used in the preparation of this report include:

- NSW Department of Planning, Industry and Environment (DPIE) BioNet Atlas for records of threatened biota previously recorded in the locality and Threatened Biodiversity Data Collection (TBDC) profiles of threatened species listed under the BC Act (DPIE 2021a)
- DPIE Threatened biodiversity profile search online database for threatened ecological communities and species listed under the BC Act (DPIE 2021b)
- NSW BioNet Vegetation Classification Databse (DPIE 2021c) to identify candidate plant community types (PCTs) in the study area
- DAWE (2021a) EPBC Act Protected Matters Search Tool – for a 10 kilometre radius around the proposal site (searched September 2021)
- DAWE (2021b) Species profile and threats database, online profiles
- The list of species credit-type species and predicted species identified by the BAM calculator (DPIE 2021b)
- Information from field surveys and studies conducted for the E44 Rocklands BDAR, (GHD in preparation) including targeted flora and fauna surveys in the study area.

3.1.2 Background research

Background research was conducted to identify:

- Landscape-scale features of the study area in accordance with Subsection 3.1.3 of the BAM (DPIE 2020a)
- Site context of the study area including assessing vegetation cover and patch size as required under Section 3.2 and Subsections 4.3.2 of the BAM (DPIE 2020a)
- The likely distribution of native vegetation and threatened ecological communities, based on previous mapping and aerial photograph interpretation, for targeted field verification as required under Section 4 of the BAM (DPIE 2020a)
- A list of predicted and candidate threatened species and populations of flora and fauna to assess the habitat suitability and threatened biodiversity data collection as required under Section 5 of the BAM (DPIE 2020a)
- Availability of baseline information to determine whether additional surveys, mapping and reporting is required to support project approval.

The background research included analysis of the following information sources:

– Previous biodiversity reports relating to the study area including the Northparkes Mines Step change Project (Umwelt 2013) and the E44 Rocklands Project information (GHD in preparation)
– NSW (Mitchell) Landscapes mapping and landscape descriptions (DECC 2008a,b)
– Interim Biogeographic Regionalisation of Australia (IBRA version 7.0) mapping
– Initial BAM calculations
– State Vegetation Type Map: Central West / Lachlan Region v1.4, 2016 VIS-ID 4468, State Government of NSW and Department of Planning, Industry and Environment 2016 (DPIE 2016)
– Atlas of Groundwater Dependent Ecosystems (GDE) (BOM 2021a)
– Directory of Important Wetlands of Australia (DIWA) (DEWHA 2008)
– Aerial photographs and satellite imagery of the proposal site and buffer area.

3.1.3 Category 1 – Exempt Land mapping

Section 6.12 of the BC Act requires a BDAR to be prepared in accordance with the BAM which is established under Section 6.8 of the BC Act. Section 6.8(3) of the BC Act excludes certain areas from the assessment of impacts of clearing of native vegetation and loss of habitat, which includes Category 1 – Exempt Land (within the meaning of Part 5A of the *Local Land Services Act 2013* (LLS Act). Category 1 – Exempt Land is defined in Part 5A, Division 2 of the LLS Act is broadly defined a being:

– Land cleared of native vegetation as at 1 January 1990 or lawfully cleared after 1 January (but before 25 August 2017)
– Low conservation value grasslands
– Land containing only low conservation groundcover (not being grasslands)
– Native vegetation identified as regrowth in a Property Vegetation Plan under the repealed *Native Vegetation Act 2003*
– Land bio-certified under the BC Act.

Grassland areas within the proposal site have been classified as Category 1 – Exempt Land due to past and ongoing cropping activities, or due to being low conservation grasslands dominated by exotic groundcover species according to the *Interim Grasslands and other Groundcover Assessment Method* published by the Minister for the Environment in the Gazette on 25 August 2017. Areas of vegetation planted by Northparkes since 1990 and rehabilitation of areas disturbed by approved mining activities since 1990 have also been classified as Category 1 – Exempt Land.

Land category mapping and the methodology used to categorise areas is defined in the *Northparkes Mine – Local Land Service Act 2013 – Land Category Mapping* report by Umwelt (2021) and Addendum (2022), included in Appendix G. Land category mapping relative to the proposal site is also shown on Figure 4.

3.2 Site survey

3.2.1 Survey overview

Surveys for the proposal were conducted in accordance with the BAM and with reference to appropriate threatened species survey guidelines for targeted species. The entire area of native vegetation and adjacent areas for the E31 Precinct, E22 Portal and TSF2 buttress sites were accessible during the survey period and assessed via walking transects. Where relevant and appropriate, survey data from the E44 Rocklands Project has been used (GHD in preparation). Current site surveys and survey data from the E44 Rocklands Project that has been used to inform this assessment includes:

– Site stratification and vegetation mapping
– Sampling of vegetation integrity plots
– Habitat assessments, including hollow-bearing tree assessments
– Targeted surveys for threatened flora
– Targeted surveys for threatened fauna.

In addition, the Flora and Fauna Assessment prepared for the Northparkes Mines Step Change Project (Umwelt 2013) was used as a reference to review previous vegetation mapping and survey results including targeted survey for threatened flora species.

Survey effort was formally stratified across the proposal site in accordance with the BAM. Survey effort that has directly contributed to this BDAR is summarised in Table 1, mapped on Figure 2 and is described in detail below.

Table 1 Survey techniques and timing

Stage	Date	Survey technique
Preliminary site inspection and vegetation mapping	9-10 August 2020	Initial site overview Vegetation mapping
BAM assessment survey and candidate species credit flora surveys	28 Sept – 2 Oct 2020	Vegetation mapping Targeted flora searches Opportunistic fauna survey Habitat assessment
BAM assessment survey and candidate species credit flora surveys	9-12 November 2020	Vegetation mapping Targeted flora searches Opportunistic fauna survey Habitat assessment
BAM assessment survey and candidate species credit fauna surveys	24-28 May 2021	Targeted fauna survey Opportunistic fauna survey Habitat assessment
BAM assessment survey and candidate species credit fauna surveys	2-5 August 2021	Targeted fauna survey Opportunistic fauna survey Habitat assessment
BAM assessment survey and candidate species credit fauna and flora surveys	11-16 October 2021, 22-23 November 2022	Vegetation mapping Targeted flora searches Targeted fauna survey

3.2.2 Vegetation and flora surveys

Vegetation mapping

Vegetation was assessed with reference to the BAM (DPIE 2020a). Regional vegetation mapping and vegetation mapping from the Step Change Project (Umwelt 2013) was ground-truthed in the field via driven and walked transects across the study area to verify community type and boundaries, floristic and structural homogeneity within patches and to update mapping as required. The entire proposal site was accessible.

Native vegetation communities in the study area were assigned to the closest equivalent Plant Community Type (PCT) held in the BioNet Vegetation Classification database (DPIE 2021c). The closest equivalent PCT for each vegetation community was determined through a comparison of the floristic descriptions of PCTs in the database with the vegetation integrity plot data collected from the site. In addition to floristic and structural similarity, the landscape position, soil type and other diagnostic features of the vegetation communities on the sites were also compared to the descriptions in the database. Threatened ecological communities (TECs) as defined in NSW and Commonwealth legislation were also identified based on descriptions in TEC profiles and scientific committee determinations.

The native vegetation in the proposal site was stratified into vegetation zones in accordance with Section 4.3 of the BAM (DPIE 2020a). A vegetation zone is defined in the BAM as a relatively homogenous area that is the same PCT and has the same broad condition state. Six vegetation zones were identified in the proposal site and assigned a patch size in accordance with Subsection 4.3.2 of the BAM (DPIE 2020).

Vegetation integrity survey plots (assessing site condition)

Following the stratification of the proposal site into vegetation zones, plot surveys were conducted in accordance with Section 4.3.3 and Section 4.3.4 the BAM (DPIE 2020a) to obtain vegetation integrity data for the calculation of biodiversity credits. The field data sheets are provided in Appendix C.

Plots were located to comply with the minimum number of plots required by Table 3 of the BAM (DPIE 2020a). In total, ten plots were sampled within the proposal site, eight within vegetation zones and two within low conservation value grassland to confirm its Category 1 - Exempt Land status and exclusion from assessment under the BAM. Vegetation to be removed is from six vegetation zones that have been identified in the proposal site (see Figure 4).

The proposal has subsequently been divided into three stages, whereby credits for Stage 1 (E31 and TSF2 areas, aligning with Zones 1, 2, 4, 5 and 6) would be retired prior to commencement of the project with impacts to the E22 Portal area (Stages 2 and 3, aligning with Zones 3 Area 1 and Area 2 respectively) deferred and only required to be offset prior to disturbance in each of the respective areas. It is noted that disturbance in Stage 3 may be able to be avoided during the detailed design process. Credits for Stage 3 would only be retired should impacts exceed the Stage 2 area and have been calculated in an alternative related case to the parent case (00027634). The breakdown of the stages within the development footprint comprises:

– Stage 1 – 3.53 hectares, comprising vegetation zones 1,2, 4, 5 and 6
– Stage 2 – 6.19 hectares, comprising part of vegetation zone 3
– Stage 3 – 3.38 hectares, comprising part of vegetation zone 3.

Should impacts to any area of Stage 3 be required, the entire credit total for the stage would be retired according to the related case credit report, prior to the impacts occurring.

The approach to staging was proposed following field surveys. The number of vegetation integrity plots sampled does not meet the minimum requirements under the BAM for the area of vegetation zone 3 in each stage individually, however minimum plot numbers for the stages combined were achieved. Due to the homogeneity of the original vegetation zone 3, the three plots sampled across the original 9.57 hectare of the zone were used to calculate vegetation integrity and credits for both Stage 2 and Stage 3.

The location of the survey plots used for all zones is shown on Figure 2 and the minimum plot survey requirements for native vegetation zones are provided in Table 2. In addition to the plots included in Table 2 below, plots BO15 and BO16 were sampled in low conservation value grassland.

Table 2: Minimum plot survey requirements

Vegetation zone	Area in proposal site (ha)	Minimum number of plots required	Number of plots sampled	Plot ID, comments
Stage 1	**3.53**			
Zone 1 PCT 56 – Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW – degraded understorey	0.73	1	1	BO14
Zone 2 PCT 80 – Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion – good	0.19	1	1	BO25
Zone 4 PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – good	1.43	1	1	BO20

Vegetation zone	Area in proposal site (ha)	Minimum number of plots required	Number of plots sampled	Plot ID, comments
Zone 5 PCT 82 – Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion – good	1.11	1	1	BO22
Zone 6 PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion – planting	0.073	1	1	BO21
Stage 2	**6.19**			
Zone 3 (Area 1 portion) PCT 248 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey	6.19	3	3	AO17, AN2, AN3
Stage 3	**3.38**			
Zone 3 (Area 2 portion) PCT 248 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey	3.38	2	3	A017, AN2, AN3

Plots were sampled at random locations within each of the vegetation zones by walking a random distance into the vegetation zone and then locating the plot on a randomly generated compass bearing. The plots were purposely not located near ecotones, tracks and their edges or other locally disturbed areas.

The site value was determined by assessing ten attributes used to assess function, composition and structure of vegetation within a 50 metre by 20 metre plot. These attributes were then assessed against benchmark values. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement (DECC 2009).

Attributes assessed within each plot are listed in Table 3. All flora species within a 20 metre by 20 metre quadrat nestled within the 50 metre by 20 metre plot were identified according to the nomenclature of the Royal Botanic Gardens and Domain Trust (RBGT 2021). Each species identified was allocated a growth form group and designated as either native, exotic or high threat exotic in accordance with the lists accessed by assessors via the BAM calculator.

The overall condition of vegetation was assessed through general observation and comparison against the PCT condition benchmark data as well as using parameters such as species diversity, history of disturbance, weed invasion and canopy health.

Table 3 Site data collected within each plot

Attribute	Area assessed
Native plant species richness	20 X 20 metre plot
Percentage foliage cover for each species	20 X 20 metre plot
Estimated number of individuals for each species	20 X 20 metre plot
Number of large trees	50 X 20 metre plot
Tree regeneration (presence/absence)	50 X 20 metre plot
Tree stem size class	50 X 20 metre plot
Total length of fallen logs	50 X 20 metre plot
Litter cover	5 times 1 X 1 metre plot
High threat exotic vegetation cover	20 X 20 metre plot
Hollow bearing trees	50 X 20 metre plot

Threatened plant surveys

Potential candidate species credit entities for the proposal site were identified and assessed in accordance with Section 5.2 and Section 5.3 of the BAM (DPIE 2020). All threatened plants are classified under the BAM as species credit entities as their occurrence cannot be reliably predicted based on vegetation type.

The suite of threatened plants with potential to occur in the proposal site was identified based on the desktop assessment results and the species credit entities identified by preliminary BAM calculations (see Appendix A). Habitat for these species was identified and assessed based on threatened species profiles and the experience and judgement of GHD ecologists. A large area of the proposal site is highly modified and dominated by introduced groundcover species due to previous agricultural use, and can be readily discounted as supporting populations of threatened plant species. In addition, the majority of these areas have been mapped as Category 1 – Exempt Land under the LLS Act, which means they are exempt from being assessed for native vegetation under the BAM. Areas of native woodland in both good and degraded condition were considered potential habitat for select threatened flora species to occur and surveyed during the current survey period, with some areas of the E31's site also surveyed during previous surveys for the E44 Rocklands Project.

In addition to the Category 1 mapped land, there are areas of grassland adjacent to the woodland patch in the proposal site that could not be immediately mapped as Category 1 land due to the absence of obvious cropping activity. For these areas, the *Interim Grassland and other Groundcover Assessment Method Calculator* (Interim GGAM Calculator) was used to determine if the grassland would classify as low conservation value and therefore be incorporated into the Category 1 land mapping. These grassland areas were surveyed for threatened flora species during Spring 2020 surveys for the E44 Rocklands Project and Spring 2021 surveys during the current survey period. Two plots were completed in these areas to confirm the condition state of the grassland with data entered into the Interim GGAM Calculator and determined to be low conservation value grassland. These areas of grassland were therefore incorporated into the Category 1 land mapping and approved as Category 1 land by BCS on 21 October 2021 (as amended by the Addendum (Umwelt 2022)).

Eight threatened flora species associated with vegetation types present on site were considered to have potential habitat within eucalypt woodland in the proposal site (see Table 4). The Pine Donkey Orchid (*Diuris tricolor*) is known to occur within Northparkes Mines in similar vegetation.

Searches were undertaken with due consideration of threatened species survey guidelines (DPIE 2020b), by utilising five metre grid transects within all areas of associated PCTs for each species within the proposal site. This survey effort was largely limited to the areas of woodland within the study area due to the degraded grassland areas and cropped paddocks not providing suitable potential habitat or associated PCTs. Threatened flora transects (Figure 2) are a representation of the broader areas of habitat searched during surveys. These areas were all searched via walked transect lines spaced five metres apart throughout the entire area of associated PCTs for each threatened plant species.

Table 4 Candidate flora species credit entities targeted during surveys

Common name	Scientific name	BAM survey months	Survey method
Ausfeld's Wattle	*Acacia ausfeldii*	August to October	Five metre-spaced parallel transects in associated PCTs in September-November 2020, October 2021 and November 2021
A spear-grass	*Austrostipa metatoris*	October to November	
Oaklands Diuris	*Diuris* sp.	November	
Pine Donkey Orchid	*Diuris tricolor*	September and October	
Slender Darling Pea	*Swainsona murrayana*	September	
Silky Swainson-pea	*Swainsona sericea*	September and October	
Spiny Peppercress	*Lepidium aschersonii*	November to April	
Winged Peppercress	*Lepidium monoplocoides*	November to February	

3.2.3 Terrestrial fauna surveys

Fauna habitat assessment

Fauna habitat assessments were undertaken based on previous and ongoing survey effort for the E44 Rocklands Project which included ground-truthing of parts of the proposal site, and our understanding of the potential habitats available throughout the proposal site. Additional surveys were conducted for the proposal. This included observation of potential shelter, basking, roosting, nesting and/or foraging sites. Specific habitat features and resources such as water bodies food trees, the density of understorey vegetation, the composition of ground cover, the soil type, presence of hollow-bearing trees, leaf litter and ground debris were noted.

Indicative habitat criteria for targeted threatened species (i.e. those determined as having the potential to occur within the proposal site following the desktop review) were identified based on previous surveys in the study area. Habitat criteria were based on information provided in OEH and DPIE threatened species profiles, field guides, and the knowledge and experience of GHD field ecologists.

Habitat assessments undertaken in the study area in adjacent habitat included searches for resources of potential value to threatened fauna including:

– Trees with bird nests or other potential fauna roosts
– Rock outcrops or overhangs providing potential shelter sites for fauna
– Burrows, dens and warrens
– Distinctive scats or latrine sites, owl whitewash and regurgitated pellets under roost sites
– Tracks or animal remains
– Evidence of activity such as feeding scars, scratches and diggings
– Specific food trees and evidence of foraging (chewed *Allocasuarina* cones)

The locations and quantitative descriptions of significant habitat features were captured with a handheld GPS and or logged on Arc Collector project map and photographed where appropriate. The field survey effort included dawn and dusk observations of hollows for evidence of occupancy.

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. This included a conscious focus on suitable areas of habitat during flora surveys, for instance fallen timber was scanned and/or turned for reptiles and mature trees and stags were scanned for roosting birds. Due to the proposal site being located adjacent to the surveyed area and containing similar habitat, it is reasonable to assume that habitat features and fauna species observed in the E44 Rocklands Project study area are also likely to occur in the proposal site.

Targeted surveys

Under the BAM, targeted surveys are not required for threatened fauna species that can be reliably predicted to occur at the proposal site based on habitat surrogates (predicted / ecosystem credit species). These species are

assumed to be present within certain PCTs, given a certain patch size and condition. These species and their habitats were recorded along with fauna that are not listed as threatened, as a general guide to the condition and biodiversity value of similar habitat within the study area during previous surveys.

Targeted, seasonal surveys are required for candidate threatened species entities i.e. species credit species and specific habitat resources such as nesting or roosting habitat for dual credit species. Candidate species credit entities that have a moderate or higher potential to occur at the proposal site (refer to Appendix A) were targeted during these surveys. Candidate species credit entities required to be surveyed are identified in Table 5. All fauna observations were recorded on pro forma field data sheets. Targeted surveys for these species were conducted in May, August and October 2021. Further detail regarding targeted surveys for these species is provided in Table 6 and Table 5.

Survey effort was conducted in the proposal site and across the study area in similar habitats to that identified within the proposal site for the E44 Rocklands Project. Survey effort for the Squirrel Glider (*Petaurus norfolcensis)* was completed in woodland and forest habitat adjoining the proposal site. The targeted survey effort in habitat in the broader study area adjoining the proposal site is a reliable indicator of presence/absence of these species in this BDAR and BAM credit calculations (see Figure 2). Nest tree searches, diurnal bird searches, call playback and spotlighting for all relevant candidate species were conducted throughout the proposal site and also the wider study area during surveys for the E44 Rocklands Project.

Further detail regarding candidate fauna species targeted during surveys is provided in Section 6.1.

Table 5 Candidate fauna species credit entities targeted during surveys

Common name	Scientific name	BAM survey months	Survey method / timing
Barking Owl	*Ninox connivens*	May-Dec	Call playback, spotlighting – August, October, November
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Oct-Jan	Diurnal bird surveys, nest tree surveys – October, November
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Jan-Sept	Diurnal bird surveys, nest tree surveys – May, August
Little Eagle	*Hieraaetus morphnoides*	Aug-Oct	Diurnal bird surveys, nest tree surveys – August, October
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*	Sept-Dec	Diurnal bird surveys, nest tree surveys – September, October, November
Masked Owl	*Tyto novaehollandiae*	May-Aug	Call playback, spotlighting – May, August
Square-tailed Kite	*Lophoictinia isura*	Sept-Jan	Diurnal bird surveys, nest tree surveys – October, November
Squirrel Glider	*Petaurus norfolcensis*	All year	Call playback, spotlighting, trapping - May
Superb Parrot	*Polytelis swainsonii*	Sept-Nov	Diurnal bird surveys, nest tree surveys – September, October, November

Table 6 Targeted fauna survey techniques and effort

Survey technique	Survey effort
Trapping	Modification 6 area – none completed. E44 adjacent areas – trapping surveys were completed between 24 and 28 May 2021 (five nights). This survey consisted of one transect containing 20 Elliot size A terrestrial traps and 10 Elliot size B arboreal traps mounted on tree platforms. Total effort for:

Survey technique	Survey effort
	Terrestrial Elliot A = 100 trap nights Arboreal Elliot B = 50 trap nights
Nest tree searches	All potential nest trees for candidate species were marked with a GPS and hollow sizes / potential stick nests etc. were recorded to determine suitability for species.
Call playback	Squirrel glider call playback was conducted between 24 and 25 May 2021 for a total of 2 hours. Total effort = 6 person hours.
Spotlighting	Spotlighting transects were conducted between 24 and 28 May 2021 and 2 and 5 August 2021. These surveys were undertaken between the hours of 6:30 PM and 10:30 PM. The duration of spotlighting surveys was between 3 and 8 person hours per night. Total effort = 28 person hours.
Diurnal bird surveys	In May 2021, 2 person hours of bird survey were undertaken each day of 6 days. In August, 2 person hours of bird survey were undertaken each day of 4 days. Diurnal bird surveys were also completed during October 2021 surveys for 2 person hours each day for five days. Total effort = 30 person hours over 15 days

3.2.4 Aquatic habitat assessment

There are no farm dams or waterways in the proposal site boundary to provide potential habitat for aquatic biota or biota dependant on these habitats. There are farm dams and ephemeral drainage lines present in the wider study area.

3.3 Survey conditions

The field surveys were undertaken between September 2020 and November 2021. Bureau of Meteorology (BOM) records for the survey dates are outlined in Table 7. These records were taken at Parkes Airport weather station (065068) located approximately 30 kilometres south-east of the proposal site (BOM 2021b). Conditions were broadly suitable to detect species targeted during surveys, i.e. the rain in the lead up to spring surveys for flora species meant flowering periods were reliable and in some cases earlier than the nominated survey period, enabling detection of species outside of these periods.

Table 7 Daily weather observations during the survey period

Date	Minimum temperature (Deg Celsius)	Max temperature (Deg Celsius)	Rainfall (mm)
28 September 2020	-0.7	17.6	0
29 September 2020	0.5	19.6	0
30 September 2020	9.1	18.2	0.2
1 October 2020	10.3	20.1	0.6
2 October 2020	1.6	24.6	0.2
9 November 2020	11.0	26.1	0
10 November 2020	12.2	28.1	0
11 November 2020	13.4	31.9	0
12 November 2020	17.7	30.0	0
24 May 2021	4.4	21.7	0
25 May 2021	7.8	22.4	0
26 May 2021	8.4	16.3	5.8
27 May 2021	0.2	15.0	0
28 May 2021	0.6	13.9	0
29 May 2021	-3.6	14.8	0

Date	Minimum temperature (Deg Celsius)	Max temperature (Deg Celsius)	Rainfall (mm)
2 August 2021	-1.0	17.7	0.4
3 August 2021	6.8	13.2	5.6
4 August 2021	5.3	10.8	0.8
5 August 2021	4.1	12.8	1.6
11 October 2021	17.6	10.4	6.0
12 October 2021	18.4	9.8	10.0
13 October 2021	19.9	9.4	0.2
14 October 2021	22.3	12.2	3.6
15 October 2021	14.5	8.9	1.6
22 November 2021	13.2	25.7	6.8
23 November 2021	14.7	26.7	0

3.4 Geographical Information System (GIS) analysis

GIS was used to:

– Plot the proposal site on a high resolution aerial photo base and to map vegetation zones, survey effort, habitat resources and biodiversity values across the site
– Calculate the extent of native vegetation to be impacted
– Identify patch sizes relevant to the proposal site
– Confirm the relevant IBRA bioregion, IBRA subregion and NSW (Mitchell) Landscape for the site.

Additional GIS analysis was used to plot a 1,500 metre buffer area surrounding the proposal site in which site context components were calculated. Native vegetation cover, extent and connectivity were assessed using aerial photography. Aerial photo interpretation was used to identify and record distinct vegetation patches, determine the broad condition state of vegetation types and the location and extent of vegetated habitat corridors. Aerial photography was examined at scales between 1:2000 and 1:4000.

The buffer area and GIS area calculations were used to enter information about landscape value.

3.5 BAM calculations

The proposal was assessed according to the methodology presented in the BAM (DPIE 2020), and the Biodiversity Assessment Methods Calculator Users Guide (OEH, 2017b). The BAM calculator is a software application that is used to apply the BAM. Data is entered into the BAM calculator based on information collected in the desktop assessment, site surveys and from using GIS mapping software.

The BAM calculations were performed by Melissa Cotterill using calculator version 1.4.0.00. Data entered into the BAM calculator is provided in Appendix D. The biodiversity credit report is included in Appendix F.

The proposal has been split into three stages, whereby credits for Stage 1 would be retired prior to commencement of the proposal. Credits for the Stage 2 area would be retired at a later stage with impacts to the Stage 3 area potentially able to be avoided during the detailed design process. Credits for Stage 3 would only be retired should impacts exceed the Stage 2 area. Each stage has been calculated in an alternative assessment case related to the parent case (00027634). The related cases for the project comprise:

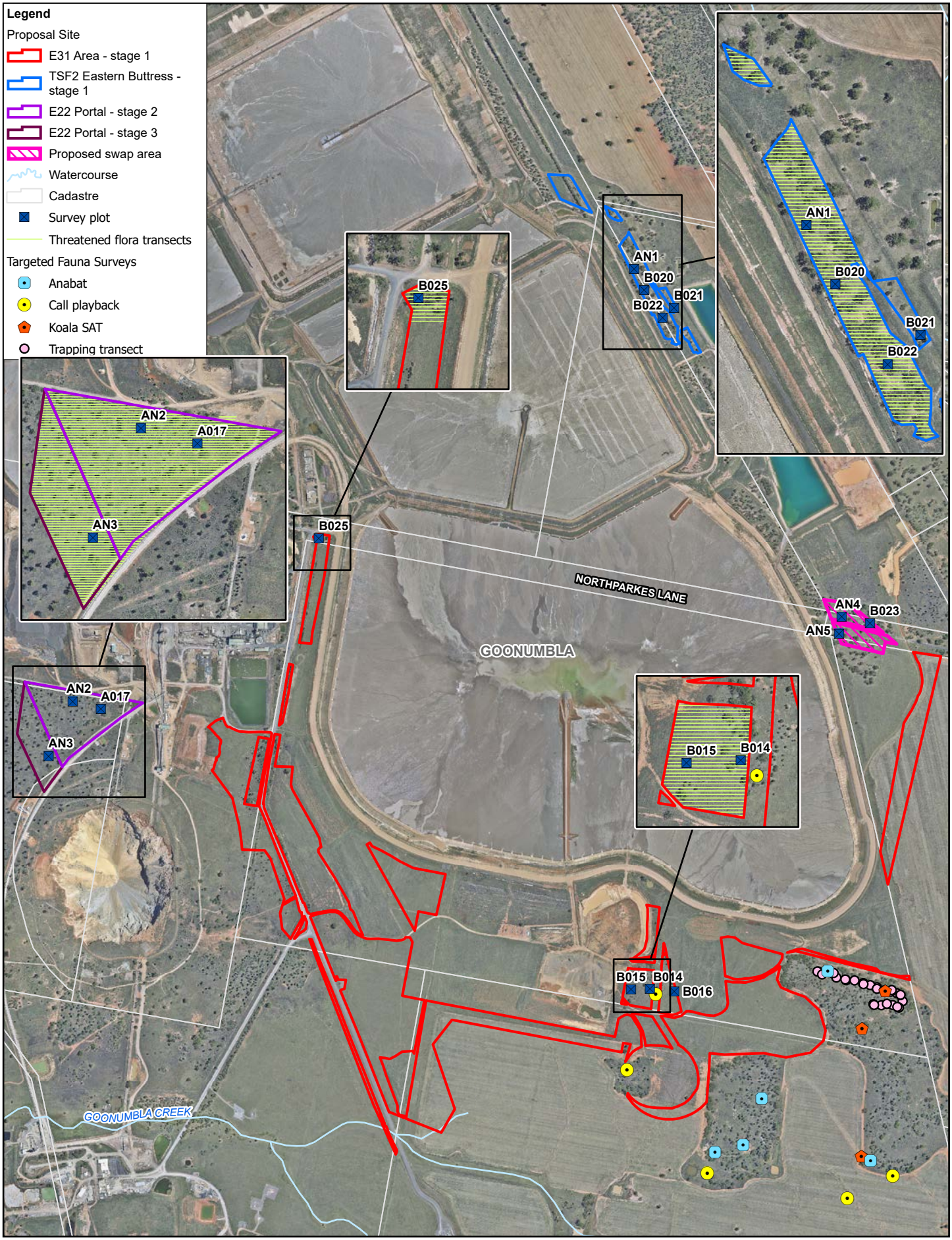
– 00027634/BAAS18127/21/00027635 – Stage 1 – E31 Precinct, TSF2
– 00027634/BAAS18127/22/00031467 – Stage 2 – E22 portal
– 00027634/BAAS18127/22/00031117 –Stage 3 – E22 portal.

3.6 Staff qualifications

This BDAR was prepared by Melissa Cotterill (accredited assessor number BAAS18127) in accordance with the BAM. A technical review of the report and credit calculations was undertaken by Ben Harrington (BAAS17023). Staff qualifications are presented in Table 8.

Table 8 GHD ecology staff and qualifications

Name	Position / Project role	Qualifications	Relevant experience
Leigh Maloney	Senior Ecologist / Field surveys, preliminary review	BEnvSc (Hons) Accredited BAM Assessor (BAAS18086)	17+ years
Melissa Cotterill	Senior Ecologist / Lead author of BDAR, BAM calculations	BSc (Biology) Accredited BAM Assessor (BAAS18127)	10 years
Ben Harrington	Technical Director – Biodiversity / Technical review of BDAR and credit calculations	BSc MSc Accredited BAM Assessor (BAAS17023)	17+ years
Brianna Turner	Ecologist / Site surveys, contributing author of BDAR	BSc (Ecology)	3 years
Luke O'Brien	Ecologist Site surveys	BEnv BSc (Hons)	5 years
Mal Weerakoon	Ecologist Site surveys	BSc, MPhil. (Zoology)	5 years



Paper Size ISO A4

0 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Northparkes Mines
Biodiversity Development Assessment Report
Modification 6

Project No. **12551921**
Revision No. **0**
Date **09/03/2022**

Survey effort

Figure 2

G:\22\12530064\GIS\Maps\12551921_NthParkes_BDAR\BDAR_Mod6_0.aprx
Print date: 09 Mar 2022 - 11:30

Data source: CMOC: Disturbance Bdy, Aerial Imagery 2021, LPI: DTDB / DCDB, 2017; . Created by: fmackay

4. Landscape context

The BAM requires the assessment of landscape features to help describe the biodiversity values of the proposal site and assess the impacts of the proposal. Landscape features relevant to the BAM calculations are shown on Figure 3, discussed below and summarised in Table 9.

4.1 Location

The proposal site is located about 27 kilometres north-west of Parkes, within the Parkes Shire local government area. The proposal site is located on land comprised of remnant woodland, including that within Limestone National Forest, and land used for agriculture and mining activities within the Northparkes Mines site, on the northern side of McClintocks Lane and the western side of Bogan Road. The proposal site is located within parts of the following lots:

– E31 Precinct
  - Lot 3 DP831119
  - Lot 12 DP753998
  - Lot 41 DP1120299
  - Lot 100 DP1207194.
– E22 Portal:
  - Lot 381 DP1108642
  - Lot 41 DP1120299
– TSF2 embankment buttressing:
  - Lot 49 DP753998
  - Lot 41 DP753998

The entire proposal site is located within the approved Northparkes Mine site boundary except for a small area along the eastern edge where it is proposed to extend the Consent area to align with the Northparkes Mining Lease boundary (see Figure 1).

4.2 Existing land uses

The proposed Modification 6 area occupies a total area of about 94.37 hectares (97.87 hectares including Stage 3), and is comprised of land within Limestone National Forest, land adjacent to the TSF2 and Caloola Water Storage and borrow pit, which currently consists of remnant vegetation, and land currently used for agriculture as part of the Northparkes farming operation, which includes an extensively cropped area. The E31 Precinct comprises the existing approved E31 and E31N open cut pits and the Rosedale borrow pit and approved waste rock stockpile area, with some clearing and construction works having commenced. The Rosedale TSF is located directly north of the E31 Precinct and additional farming land and remnant native woodland occur directly to the south.

The E22 Portal would be constructed within Limestone National Forest and is located adjacent to the Northparkes processing plant and administration building and the E22 and E48 subsidence areas. An existing overland conveyer is located within the State Forest travelling from the E48 area to the processing plant to the north. The TSF2 embankment buttressing would be an alteration to the existing TSF2, which is located north of the Rosedale TSF and south of TSF1. Bogan Road occurs to the east of the proposal site.

The entire proposal site is within the existing approved Northparkes Mines site boundary. The site is accessed via McClintocks Lane which runs from the south of the mine site. There are no formal or named roads within the proposal site.

4.3 Climate

In the town of Parkes, located about 27 kilometres south-east of the proposal site, the climate is warm and temperate. About 630.5 millimetres of precipitation falls annually with lowest rainfall occurring in April, and highest in January. January typically experiences the warmest temperatures, with an average maximum temperature of 33.8 degrees celsius and August experience the coolest average minimum temperatures at 2.2 degrees celsius.

4.4 Landscape features

The study area occurs in the NSW South Western Slopes IBRA bioregion. Landscape features within the proposal site are summarised in Table 9 and shown in Figure 3 as required by Section 3.1 of the BAM.

Table 9 Landscape features

Landscape features	Study area
IBRA bioregion	NSW South Western Slopes
IBRA subregion	Lower Slopes
NSW (Mitchell) Landscape regions	Goonumbla Hills
Local Government Area (LGA)	Parkes
Rivers and streams	There are no named drainage lines, creeks or farm dams within the proposal site. Goonumbla Creek and an unnamed ephemeral drainage line are located in the south-west of the proposal site and would not be directly impacted by the proposal as they are located adjacent to the disturbance area with infrastructure to be placed outside of these areas.
Important wetlands	No important wetlands occur at the proposal site, on adjacent lands or downstream.
Connectivity features	Vegetation at the proposal site provides some connectivity with areas outside the site. The E22 Portal area is connected to an approximately 100 hectare patch of native vegetation in Limestone National Forest.
Areas of geological significance and soil hazard features	There are no karst, caves, crevices, cliffs, rocks or other areas of geological significance located within the proposal site or buffer area surrounding the site.
Areas of outstanding biodiversity value	No declared areas of outstanding biodiversity value occur in or near the proposal site
Landscape features	No additional landscape features are known from the area.

4.4.1 NSW (Mitchell) landscape

The proposal site is located within two NSW (Mitchell) Landscapes: the Bogan Alluvial Plains and Goonumbla Hills. The description for these soil landscapes are reproduced below from DECC (2008a):

Bogan Alluvial Plains: *Partly scalded, higher level plains along the Bogan River of Holocene alluvium represented by the meander plain and backplain facies of the Marra Creek Formation. Narrow, defined drainage lines and swamps, extensive gilgai in grey and brown clays, occasional lagoons, swamps and remnant lakes, some with low lunettes, relief to three metres. Red brown texture-contrast soils on plains with brown and grey cracking clays in sinuous patterns on backplains and light orange-brown fine to medium sands in channels and occasional source bordering dunes.*

Scattered to moderate coolibah (Eucalyptus microtheca), black box (Eucalyptus largiflorens), whitewood (Atalaya hemiglauca), leopardwood (Flindersia maculosa), myall (Acacia pendula), Poplar box (Eucalyptus populnea), belah (Casuarina cristata), wilga (Geijera parviflora), budda (Eremophila mitchellii), nepine (Capparis lasiantha), warrior bush (Apophyllum anomalum) with grasses and some saltbushes (Atriplex sp.) on plains. Belah (Casuarina cristata), Poplar box, river cooba (Acacia stenophylla), eurah (Eremophila bignoniflora), lignum (Duma cunninghamii), neverfail (Eragrostis setifolia), Warrego summer-grass (Paspalidium jubiflorum), windmill grasses

(Chloris sp.), copperburr (Sclerolaena sp.) and forbs on brown and grey clays. Black box, eurah and lignum in depressions. White cypress pine (Callitris glaucophylla) on sandy soils.

Goonumbla Hills: *Rounded low hills on Ordovician and Silurian sandstone, andesite, siltstone and phyllite with a partial blanket of Tertiary quartz gravels and sands. General elevation 290 to 390 metres, local relieve 70 metres. Stony yellow earths on the sands, thin brown structures loams on the hills merging with red-brown and red texture-contrast soils on the flats. Open forest of grey box (Eucalyptus microcarpa), white cypress pine (Callitris glaucophylla), with Poplar box (Eucalyptus populnea) in the creeks and red ironbark (Eucalyptus sideroxylon) with shrubs on the gravel. Extensively cleared, grazed and cultivated.*

'Goonumbla Hills' was entered as the NSW (Mitchell) Landscape for the BAM calculator case. The soils, vegetation, landform and uses across the majority of the proposal site is well matched to the Goonumbla Hills soil landscape. It is characterised by loam and red-brown soils on flats and supports vegetation containing Grey Box, White Cypress Pine and Poplar Box as described in the description of this soil landscape.

4.5 Determining site context

To determine site context as required under Section 3 of the BAM (Section 3.2 and Subsection 4.3.2), an assessment of native vegetation cover and patch size has been undertaken and is outlined below.

4.5.1 Native vegetation cover

Native vegetation cover (woody and non-woody) was assessed on the proposal site and within a 1,500 metre buffer area surrounding the outside edge of the boundary of the modification 6 site. Due to the staging of the proposal, two additional related cases for the E22 portal area, with a new landscape assessment were created to input the correct percentage native vegetation cover. Additional mapping of native vegetation cover and patch sizes was not required for the separate Stage 2 and 3 areas due to both being accounted for and contained within the landscape assessment area for the original proposal. Aerial photography was examined at scales between 1:2000 and 1:4000. The percent native vegetation cover within the 1,500 metre buffer area before development is 22.7 percent and includes (see Table 10):

– Remnant native vegetation types
– Planted native vegetation types.

Areas that were excluded include:

– Cleared areas (including existing Approved Operational Areas)
– Category 1 – Exempt Land, including low conservation value grasslands
– Non-native vegetation
– Dams, ponds and other waterbodies
– Buildings
– Mine workings.

The identification of native vegetation (including derived native grasslands) in the buffer areas was based on review of the Central West / Lachlan Region v1.4, 2016 VIS-ID 4468 State Vegetation Type Map (DPIE 2016), in combination with aerial photograph interpretation, Step Change Project (Umwelt 2016) vegetation mapping and ground-truthing during field surveys.

Table 10 Native vegetation cover

Native vegetation cover unit	1,500 m buffer area Stage 1)	1,500 m buffer (Stage 2 and 3)
Total assessment area	3240 ha	855 ha
Area of native vegetation cover in assessment area (woody and non-woody)	737 ha	134 ha
Development area (native and non-native vegetation)	98.17 ha	3.50 ha

Native vegetation cover unit	1,500 m buffer area Stage 1)	1,500 m buffer (Stage 2 and 3)
Development area (native vegetation)	9.72 ha	3.38 ha
% native vegetation cover BEFORE development	22.7%	15.7 %
% native vegetation cover AFTER development	22.3%	15.3 %
Cover class	>10-30%	>10-30%

4.5.2 Patch size

Patch size is defined under the BAM (DPIE 2020) as an area of native vegetation that:

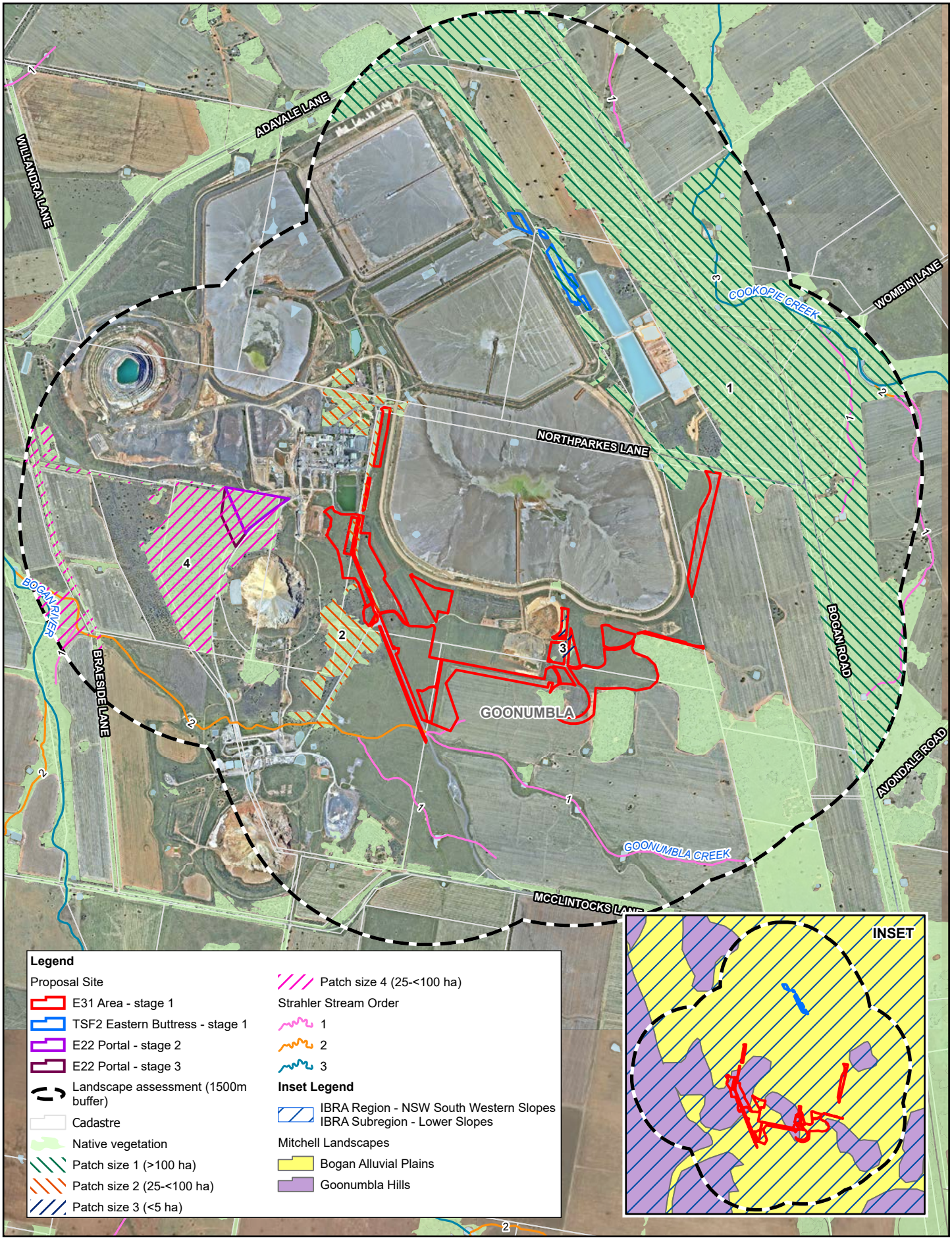
– Occurs on the development site or biodiversity stewardship site (i.e. proposal site)
– Includes native vegetation that has a gap of less than 100 metres from the next area of native vegetation (or ≤ 30 metres for non-woody ecosystems).

Patch size may extend into adjoining land that is not part of the development site. Patch size area is assigned to each vegetation zone as a class, being < 5 hectares, 5-<25 hectares, 25-<100 hectares or ≥ 100 hectares.

Four different patches were identified as occurring within the proposal site and extending beyond the proposal site (see Table 11 and Figure 3). These patch size polygons are associated with vegetation zones in the proposal site and include remnant woodland, derived native grassland and native plantings.

Table 11 Patch sizes at the proposal site

Patch	Size (nearest whole hectare)	Patch size class
1	496	>100 ha
2	35	25-<100 ha
3	2	<5 ha
4	94	25-<100 ha



Paper Size ISO A4

0 250 500 750 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Northparkes Mines
Biodiversity Development Assessment Report
Modification 6

Project No. **12551921**
Revision No. **0**
Date **07/03/2022**

Landscape features

Figure 3

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Print date: 07 Mar 2022 - 10:38

Data source: DSEWPaC: IBRA Regions, 2013; OEH: Vegetation E4468, 2008; Mitchell Landscapes, 2017; CMOC: Disturbance Bdy, Aerial Imagery, 2021; LPI: DTDB / DCDB, 2017; World Imagery: Earthstar Geographics. Created by: fmackay

5. Native vegetation

5.1 Flora species

5.1.1 Species richness

A total of 121 flora species from 35 families were identified within the proposal site during the field surveys, including 78 native species and 43 exotic species (Appendix B). The most species rich families recorded were Asteraceae (24 species, 15 native and nine exotic), Poaceae (19 species, eleven native and eight exotic) and Fabaceae (ten species, two native and eight exotic).

No threatened flora species were identified within the proposal site or study area during field surveys, despite targeted surveys being conducted for key threatened flora species throughout. Targeted threatened flora survey effort included all areas of remnant woodland and extended into adjacent areas of low conservation grassland. Grassland areas are dominated by exotic flora species due to the agricultural activities that previously dominated the site, with cropping also prevalent, and were therefore largely excluded from survey effort due to not providing suitable habitat for threatened flora species.

5.1.2 Priority and high threat species

There was one priority weed listed in the Central West region (which includes the Parkes local council area) *Lycium ferocissimum (*African Boxthorn) recorded within the study area during field surveys. African Boxthorn carries a '*Prohibition on certain dealings'* duty, which states that the species must not be imported into the state, sold, bartered, exchanged or offered for sale.

The following exotic species recorded in the study area are classified as high threat weeds for the purposes of the BAM:

– *Bromus diandrus (*Great Brome)
– *Carthamus lanatus* (Saffron Thistle)
– *Phalaris aquatica (*Phalaris)
– *Lycium ferocissimum (*African Boxthorn)

5.2 Vegetation in the region

The Parkes region is located on the Lower Slopes, ranging from undulating to hilly ranges and isolated peaks set in wide valleys at the apices of the Riverina alluvial fans. The geology of the region features Ordovician to Devonian folded and faulted sedimentary sequences with inter-bedded volcanic rocks and large areas of intrusive granites and Tertiary and Quaternary alluvium. Soils are characterised by shallow stony soils on steep slopes, texture contrast soils grading from red subsoils on upper slopes to yellow subsoils on lower slopes. There are extensive red-brown earths on undulating plains and grey clays on alluvium (OEH 2016a).

The region supports a wide variety of vegetation types from semi-arid woodland to grassy woodlands. Typical species in the lower parts of the region are dominated by *Eucalyptus microcarpa* (Grey Box) with *Eucalyptus melliodora* (Yellow Box), *Casuarina cristata* (Belah) and *Callitris glaucophylla* (White Cypress Pine) with *Eucalyptus dwyeri* (Dwyer's Red Gum) on granite, *Eucalyptus sideroxylon* (Mugga Ironbark) on sedimentary and *Eucalyptus dealbata* (Tumbledown Red Gum), White Cypress Pine and *Eucalyptus macrorhyncha* (Red Stringybark) in the ranges. *Eucalyptus populnea* (Poplar Box), *Brachychiton populneus* (Kurrajong), *Geijera parviflora* (Wilga) and *Eucalyptus polyanthemos* in the northern part of the subregion, with limited areas of mallee species in the central west. *Acacia pendula* (Weeping Myall), *Alectryon oleifolius* (Rosewood) and *Acacia homalophylla* (Yarran) occur on grey clays with Yellow Box, Poplar Box and Belah occurring on alluvial loams. *Eucalyptus camaldulensis* (River Red Gum) occurs on all streams, with *Eucalyptus largiflorens* (Black Box) occurring in the west with some *Duma florulenta* (Lignum) and *Acacia stenophylla* (River Cooba) (OEH 2016a).

The discovery of gold in the region saw the widespread felling of local box and stringybark timber, which was used for fuel for steam dredges (OEH 2016b). By the 1820s, pastoralists were making their mark on the landscape, with

cattle stations prominent in the region (OEH 2016b). As such, much of the original vegetation in the region has been cleared to support agriculture, both cropping and grazing, with remaining intact or remnant woodland vegetation on the flats occurring as scattered patches within a predominantly agricultural landscape.

5.3 Vegetation in the proposal site

5.3.1 Native vegetation extent

The majority of the proposal site has been cleared and used for agriculture, mostly cropping, which continues within the site. The majority of the vegetation is exotic pastures and cropping land. The proposal site has been extensively cleared and cultivated, with cropping, pasture and grassland dominated by exotic species comprising 83.23 hectares of the site and native vegetation 9.72 hectares. In addition to this, there is an area of about one hectare that comprises a mixed planting of native tree species, however this area is within a Category 1 – Exempt Land mapped area and therefore not required to be assessed under the BAM (refer Appendix G). The majority of the proposal site has been previously disturbed, with remnant woodland limited to small isolated patches adjacent to mine workings and agricultural land. Patches of woodland dominated by Grey Box have retained a groundcover dominated by native species, despite the relatively small patch sizes and surrounding disturbance from mine workings and agriculture. There are scatted native groundcover species occurring throughout the Poplar Box dominated woodland, E22 Portal area and exotic grassland areas, which classify as low conservation value grassland, however these generally do not dominate.

5.3.2 Plant community types

Four patches of native vegetation are present in the proposal site. The patch in the central section of the proposal (E31 precinct) is dominated by a canopy of Poplar Box and White Cypress Pine, with a groundcover dominated by introduced species due to the ongoing disturbance and modification of the surrounding area by agricultural use. The patch in the TSF2 buttressing area is formed from three PCTs, dominated by a mixture of Grey Box, Poplar Box and planted Blakely's Red Gum and Yellow Box, with all patches dominated by native groundcover species. The patch of native vegetation in the north-western section of the proposal site is dominated by a canopy of Grey Box and is also dominated by a groundcover of native species. The E22 Portal patch of vegetation is dominated by a canopy of mixed species including Yellow Box, Grey Box and Poplar Box. This area contains relatively dense regrowth of White Cypress Pine and is dominated by introduced species in the groundcover.

The native vegetation in the proposal site correspond to six PCTs. The vegetation types (including PCTs) mapped within the study area are summarised in Table 12.

Four of the PCTs identified within the proposal site comprises an occurrence of a threatened ecological community under the EPBC Act and/or BC Act (see Figure 4), with the other two PCTs not conforming to the listing of the corresponding threatened ecological community (see section 6.2.3).

Table 12 Vegetation in the proposal site

Vegetation type	Percent cleared	BC Act status	EPBC status	Extent in proposal site (ha)	Vegetation class	Start VI score
Stage 1				**87.23**		
PCT 56 – Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW – degraded understorey	78	Not listed	Does not meet the key diagnostic characteristics in the listing advice	0.73	Floodplain Transition Woodland	34.2
PCT 80 – Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes	83	Inland Grey Box woodland (EEC)	Does not meet the key diagnostic characteristics in the listing advice for	0.19	Floodplain Transition Woodland	89.4

Vegetation type	Percent cleared	BC Act status	EPBC status	Extent in proposal site (ha)	Vegetation class	Start VI score
Bioregion and Riverina Bioregion – good			Inland Grey Box woodland			
PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – good	92	Inland Grey Box woodland (EEC)	Inland Grey Box woodland (EEC)	1.43	Floodplain Transition Woodland	50.4
PCT 82 – Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion - good	75	Inland Grey Box woodland (EEC)	Inland Grey Box woodland (EEC)	1.11	Floodplain Transition Woodland	85.5
PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion – planting	94	Box-Gum woodland (CEEC)	Does not meet the key diagnostic characteristics in the listing advice for Box-Gum woodland	0.073	Western Slopes Grassy Woodland	54.8
Category 1 – Exempt Land, including low conservation value grasslands, cropping and plantings	N/A	Not listed	Not listed	83.70	N/A	N/A
Stage 2				**7.14**		
PCT 248 Area 1 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey	80	Does not meet the key diagnostic characteristics in the listing advice for Inland Grey Box woodland	Does not meet the key diagnostic characteristics in the listing advice for Inland Grey Box woodland	6.19	Floodplain Transition Woodland	48.7
Exotic grassland and cleared areas	N/A	Not listed	Not listed	0.46	N/A	N/A
Category 1 – Exempt Land, including low conservation value grasslands, cropping and plantings	N/A	Not listed	Not listed	0.48	N/A	N/A
Stage 3				**3.49**		
PCT 248 Area 2 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey	80	Does not meet the key diagnostic characteristics in the listing advice for Inland Grey Box woodland	Does not meet the key diagnostic characteristics in the listing advice for Inland Grey Box woodland	3.38	Floodplain Transition Woodland	48.7

Vegetation type	Percent cleared	BC Act status	EPBC status	Extent in proposal site (ha)	Vegetation class	Start VI score
Exotic grassland and cleared areas	N/A	Not listed	Not listed	0.11	N/A	N/A

Notes: EEC - endangered ecological community; CEEC – critically endangered ecological community

5.3.3 Vegetation zones

The historical clearing and management of the proposal site for agricultural practices has left the proposal site in a generally degraded condition. The PCTs that occur within the proposal site occur as only one condition state and therefore one vegetation zone. PCT 56 and 248 occur as an intact canopy layer with a degraded understorey and were therefore assigned a 'degraded' condition state. PCT 80, 82 and 76 have a more native understorey and were therefore assigned a 'good' condition. PCT 277 exists as a planting and was therefore assigned as a 'planting' condition state. There are no obvious changes to condition to justify multiple vegetation zones within each PCT. Due to the floristic and structural homogeneity within the area of PCT 248 for both Stage 2 and Stage 3, Zone 3 descriptions and characteristics are relevant to both stages with data consistent across the zone.

Vegetation zones at the proposal site are identified in Table 13 and shown on Figure 4.

Table 13 Vegetation zones within the proposal site

Vegetation zone	PCT ID	PCT	Condition	Area	Patch size (ha)	Patch size class
1	56	Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW	Degraded understorey	0.73	2	<5
2	80	Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Good	0.19	35	25-<100
3 – Area 1	248	Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW	Degraded understorey	6.19	94	25-<100
3 – Area 2	248	Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW	Degraded understorey	3.38	94	25-<100
4	76	Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Good	1.43	496	≥100
5	82	Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Good	1.11	496	≥100
6	277	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Planting	0.073	496	≥100

5.3.4 Vegetation profiles

Description profiles of the PCTs present in the study area are provided in Table 14 to Table 19. Non-native vegetation is described in Table 20.

Table 14 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW

Attribute	Description
Vegetation Formation	Grassy Woodlands
Vegetation Class	Floodplain Transition Woodlands
PCT ID	56
PCT % Cleared	78%
Plots sampled	BO14
Floristic description	This community is tall to mid-high woodland dominated by Poplar Box (*Eucalyptus populnea* subsp. *bimbil*) and Belah (*Casuarina cristata*) commonly with the small tree Western Rosewood (*Alectryon oleifolius*). Tall shrubs are sparse and include Wilga (*Geijera parviflora*), Warrior Bush (*Apophyllum anomalum*), *Capparis* spp., *Citrus glauca* and Thorny Rhagodia (*Rhagodia spinescens*). Low shrubs include Galvanized Burr (*Sclerolaena birchii*), Black Roly Poly (*Sclerolaena muricata*), other copperburs, *Maireana coronata, Maireana decalvans* and *Enchylaena tomentosa*. The ground cover is sparse during dry times but mid-dense after rain and includes grasses such as *Chloris truncata, Enteropogon acicularis* and *Austrostipa scabra* subsp. *scabra*. Forb species include *Einadia nutans* subsp. *nutans, Oxalis chnoodes, Bulbine alata, Erodium crinitum, Wahlenbergia fluminalis* and *Brachyscome heterodonta*.
Justification for PCT selection	The proposal site occurrence of this PCT is dominated by: – Canopy of Poplar Box with White Cypress Pine. – Groundcover of *Austrostipa scabra, Enteropogon acicularis* and *Erodium crinitum* Although the vegetation zone is dominated by introduced species, there are species that occur that are consistent with those in the PCT description. The distribution of the PCT, soil types and landform characteristics are consistent with the PCT description in the database.
Conservation significance	The occurrence of this community within the study area does not meet the key diagnostic characteristics in the listing advice for *Poplar Box Grassy Woodland on Alluvial Plains* as listed under the EPBC Act due to the groundcover being greater than 70 percent dominated by exotic species. In addition, the patch does not meet the minimum size requirement to qualify for listing with at least 10 trees per hectare that are greater than 30 centimetres at breast height and/or contain hollows.
Photograph	

Table 15 Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

Attribute	Description
Vegetation Formation	Grassy Woodlands
Vegetation Class	Floodplain Transition Woodlands
PCT ID	80
PCT % Cleared	83%
Plots sampled	BO25
Floristic description	This community is a tall woodland up to 25 metres high but averaging about 20 metres and co-dominated by Western Grey Box (*Eucalyptus microcarpa*) and White Cypress Pine (*Callitris glaucophylla*) with the pine tending to be shorter than the eucalypts. Other trees may include Yellow Box (*Eucalyptus melliodora*), Buloke (*Allocasuarina luehmannii*), *Pittosporum angustifolium* and Kurrajong (*Brachychiton populneus*). A sparse layer of shrubs may be present however they may be absent where grazing has been intense or the understorey has been cleared. Tall shrub species may include Wilga (*Geijera parviflora*), *Eremophila deserti*, Quandong (*Santalum acuminatum*) and wattles such as *Acacia deanei* subsp. *deanei*, *Acacia hakeoides, Acacia brachybotrya* and *Acacia buxifolia*. The low shrub *Maireana microphylla* is often the most common shrub present when tall shrubs have been eliminated. A sparse to mid-dense ground cover includes short shrubs such as *Einadia nutans* subsp. *nutans* and *Eremophila debilis* with grass species such as *Austrostipa scabra* subsp. *scabra, Austrodanthonia setacea, Austrodanthonia fulva, Anthosachne scabra*, En*teropogon acicularis* and *Aristida ramosa*. Forb species include *Calotis cuneifolia, Sida corrugata, Dichondra* sp. A, *Daucus glochidiatus, Oxalis perennans, Arthropodium minus, Bulbine* spp. and *Goodenia pinnatifida*. The rock fern *Cheilanthes sieberi* subsp. *sieberi* is common along with the graminoid *Lomandra filiformis*.
Justification for PCT selection	The proposal site occurrence of this PCT is dominated by: – Canopy of Western Grey Box (*Eucalyptus microcarpa*) with White Cypress Pine (*Callitris glaucophylla*) and Buloke (*Allocasuarina luehmannii*). This PCT was chosen over similar PCTs such as 76 and 82 due to Grey Box occurring with White Cypress Pine and Buloke as the canopy species, with Poplar Box being absent as in PCT 82 and Grey Box not occurring as the only canopy species as in PCT 76. *Pittosporum* occurs as a tall shrub, with *Maireana microphylla* and other sub-shrubs listed in the PCT database commonly occurring. Grass and forb species that commonly occur in the community are consistent with those in the PCT description. The distribution of the PCT, soil types and landform characteristics are consistent with the PCT description in the database.
Conservation significance	This vegetation community is consistent with the final determination for the EEC *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* listed under the BC Act and is commensurate with the related EEC listed under the EPBC Act as *Grey Box (*Eucalyptus microcarpa*) Grassy Woodland and Derived Native Grasslands of South-Eastern Australia*.

Attribute	Description
Photograph	

Table 16 Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW

Attribute	Description
Vegetation Formation	Grassy Woodlands
Vegetation Class	Floodplain Transition Woodlands
PCT ID	248
PCT % Cleared	80%
Plots sampled	AO17, AN2, AN3
Floristic description	This community is a tall woodland averaging about 14 metres high dominated by a number of box eucalypts including Western Grey Box (*Eucalyptus microcarpa*), Yellow Box (*Eucalyptus melliodora*) and Polar Box (*Eucalyptus populnea* subsp. *bimbil*) with Western Rosewood (*Alectryon oleifolius* subsp. *canescens*) as a small tree. Shrubs are very sparse or absent. They include Senna form taxon 'zygophylla', *Hakea tephrosperma, Myoporum montanum, Acacia deanei* subsp. *deanei* and *Maireana microphylla*. The ground cover is usually mid-dense and is dominated by grasses such as *Austrostipa scabra* subsp. *scabra*, *Enteropogon acicularis* and *Elymus scaber* var. *scaber* along with forbs such as *Calotis lappulacea, Sida corrugata, Vittadinia cuneata* and *Atriplex semibaccata*. Low shrubs such as *Maireana enchylaenoides* and *Sclerolaena diacantha* may be present.
Justification for PCT selection	The proposal site occurrence of this PCT is dominated by: – Canopy of Yellow Box (*E. melliodora*), Western Grey Box *(E. microcarpa*) and Poplar Box (*E. populnea* subsp. *bimbil*) as sparse canopy trees, and a dense layer of White Cypress Pine (*Callitris glaucophylla*). This PCT was selected over similar PCTs that are ecotonal with this community and dominated by Grey Box on heavier soils and Poplar Box on loam soil, due to the mixture of canopy species. Grass and forb species that commonly occur in the community are consistent with those in the PCT description including *Austrostipa scabra, Vittadinia cuneata* and *Sida corrugata*. The distribution of the PCT, soil types and landform characteristics are consistent with the PCT description in the database.
Conservation significance	Due to the degraded nature of the vegetation community and the relatively dense cover of White Cypress Pine, the community is not consistent with the final determination for the EEC *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* listed under the BC Act and is not commensurate with the related

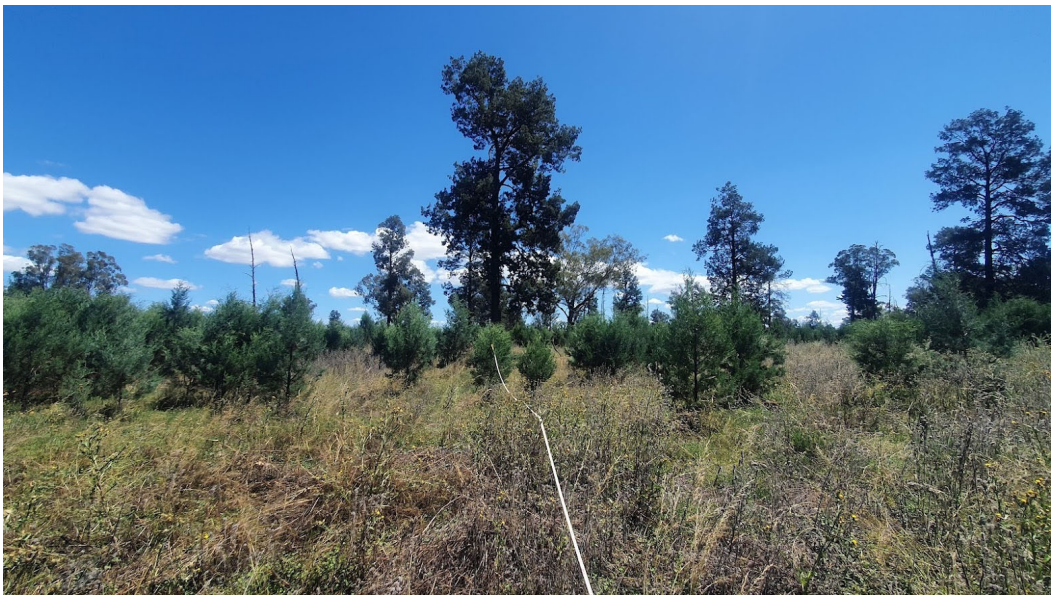
Attribute	Description
	EEC listed under the EPBC Act as *Grey Box (*Eucalyptus microcarpa*) Grassy Woodland and Derived Native Grasslands of South-Eastern Australia*.
Photograph (showing homogeneity across vegetation zone)	 Photograph from Plot AN2  Photograph from Plot AN3

Table 17 ***Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions***

Attribute	Description
Vegetation Formation	Grassy Woodlands
Vegetation Class	Floodplain Transition Woodlands
PCT ID	76
PCT % Cleared	92%
Plots sampled	BO20
Floristic description	This community is a tall woodland to 25 metres high dominated by Western Grey Box (*Eucalyptus microcarpa*) often as the only tree species often occupying 90 percent of the canopy cover but other trees may include Yellow Box (*Eucalyptus melliodora*), White Cypress Pine (*Callitris glaucophylla*)

Attribute	Description
	and minor Buloke. The shrub layer is absent or sparse and includes *Dodonaea viscosa* subsp. *cuneata*, *Acacia buxifolia, Acacia acinacea, Acacia hakeoides, Bursaria spinosa*. Grazing has eliminated shrubs these in many places. A mid-dense or dense grass ground cover is present composed of *Austrodanthonia caespitosa, Austrodanthonia setacea, Austrostipa scabra* subsp. *falcata, Paspalidium constrictum, Themeda australis, Austrostipa aristiglumis, Aristida behriana* and *Anthosachne scabra*. The small scrambler *Einadia nutans* subsp. *nutans* is usually present. Native forbs include Sid*a corrugata, Wahlenbergia gracilis, Vittadinia gracilis, Dianella porracea, Oxalis perennans* and *Chamaesyce drummondii*.
Justification for PCT selection	The proposal site occurrence of this PCT is dominated by: – Canopy of Western Grey Box (*E. microcarpa*) This PCT was chosen over similar PCTs such as 80 and 82 due to Western Grey Box occurring as the only canopy species, with White Cypress Pine and Poplar Box being absent as is in these other communities. Due to past agricultural management and disturbance within the community shrub species were generally absent from the community. Native grass and forb species are generally consistent with those listed in the PCT database. The distribution of the PCT, soil types and landform characteristics are consistent with the PCT description in the database.
Conservation significance	This vegetation community is consistent with the final determination for the EEC *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* listed under the BC Act and is commensurate with the related EEC listed under the EPBC Act as *Grey Box (*Eucalyptus microcarpa*) Grassy Woodland and Derived Native Grasslands of South-Eastern Australia*.
Photograph	

Table 18 ***Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion***

Attribute	Description
Vegetation Formation	Grassy Woodlands
Vegetation Class	Floodplain Transition Woodlands
PCT ID	82
PCT % Cleared	75%
Plots sampled	BO22

Attribute	Description
Floristic description	This community is a tall woodland between 12 and 25 metres high dominated by Western Grey Box (*Eucalyptus microcarpa*), Poplar Box (*Eucalyptus populnea* subsp. *bimbil*) and White Cypress Pine (*Callitris glaucophylla*). Kurrajong (*Brachychiton populneus*) and Buloke (*Allocasuarina luehmannii*) may be present. Shrubs are sparse and include Deanes Wattle (*Acacia deanei*), Shrubby Rice Flower (*Pimelea microcephala* subsp. *microcephala*), Budda (*Eremophila mitchellii*), Wilga (*Geijera parviflora*), hop bush (*Dodonaea viscosa* subsp. *spatulata*), Tar Bush (*Eremophila glabra* subsp. *glabra*) and daisy bush (*Olearia pimelioides*). The ground cover is sparse and contains forbs such as Purple Burr daisy (Calotis cuneifolia), Yellow Burr Daisy (*Calotis lappulacea*), Oxalis perennans, fuzzweed (*Vittadinia cuneata*) and kidney weed (*Dichondra repens*). Grass species include *Austrostipa scabra* subsp. *scabra*, *Monachather paradoxus*, *Walwhalleya subxerophilum, Eragrostis lacunaria, Enteropogon acicularis* and *Rytidosperma caespitosum*.
Justification for PCT selection	The proposal site occurrence of this PCT is dominated by: – Canopy of Western Grey Box (*E. microcarpa*) and Poplar Box (*E. populnea* subsp. *bimbil*) and a minor occurrence of White Cypress Pine (Callitris glaucophylla). Due to past agricultural management and disturbance within the community shrub species were sparse within the community. This PCT was chosen over similar PCTs such as 76 and 80 due to Grey Box occurring with Poplar Box, in combination with native grass and forb species being consistent with those listed in the PCT database including *Calotis lappulacea, Dichondra repens* and *Enteropogon acicularis*. The community grades into PCT 75 on sandier soils, however there is no Yellow Box present in this woodland patch. The distribution of the PCT, soil types and landform characteristics are consistent with the PCT description in the database.
Conservation significance	This vegetation community is consistent with the final determination for the EEC *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* listed under the BC Act and is commensurate with the related EEC listed under the EPBC Act as *Grey Box (*Eucalyptus microcarpa*) Grassy Woodland and Derived Native Grasslands of South-Eastern Australia*.
Photograph	

Table 19 Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion

Attribute	Description
Vegetation Formation	Grassy Woodlands
Vegetation Class	Western Slopes Grassy Woodlands

Attribute	Description
PCT ID	277
PCT % Cleared	94%
Plots sampled	BO21
Floristic description	This community is a tall woodland to about 20 metres high dominated by Blakely's Red Gum (*Eucalyptus blakelyi*) and Yellow Box (*Eucalyptus melliodora*). Blakely's Red Gum or Yellow Box vary in their dominance and either can be absent in some places grading into areas with more Apple Box (*Eucalyptus bridgesiana*), Long-leaved Box (*Eucalyptus goniocalyx*) and rarely *Eucalyptus microcarpa*. Shrubs are sparse or absent and may include *Acacia dealbata*. The ground cover may be dense to sparse depending on rainfall and is dominated by grass species including *Poa sieberiana, Bothriochloa macra, Aristida ramosa, Themeda australis, Rytidosperma* sp. and *Austrostipa* sp. Forbs include *Vittadinia cuneata, Chrysocephalum apiculatum* and *Sida corrugata*.
Justification for PCT selection	This PCT occurs as a disjointed planting in the TSF2 buttressing site. PCT 277 is the closes fit PCT. The proposal site occurrence of this PCT is dominated by: – Canopy of Blakley's Red Gum (*E. blakelyi*) and Yellow Box (*E. melliodora*) The landscape position on flat areas and soil types are also consistent with the community and dominant groundcover species are also generally consistent with the description of the PCT in the database.
Conservation significance	This vegetation community is consistent with the final determination for the CEEC *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions* listed under the BC Act. It is not commensurate with the EPBC Act listing of the community due to the small size of the patch and insufficient native species in the patch. The community exists as a planting and is therefore, highly modified.
Photograph	

Table 20 Non-native vegetation

Attribute	Description
Vegetation Formation	N/A
Vegetation Class	N/A

Attribute	Description
PCT ID	N/A
PCT % Cleared	N/A
Plots sampled	N/A
Floristic description	Non-native vegetation in the study area is dominated by exotic grasslands comprising cropping or highly disturbed grasslands on the edge of crops and degraded woodland vegetation. The dominant species recorded within these areas include Wimmera Ryegrass (*Lolium rigidum*), Paterson's Curse (*Echium plantagineum*), Saffron Thistle (*Carthamus lanatus*), Small-flowered Mallow (*Malva parviflora*), Clover (*Trifolium* spp.) and Capeweed (*Arctotheca calendula*).
Justification for PCT selection	N/A
Conservation significance	N/A
Photograph	 Non-native vegetation (cropped) in the proposal site.

Attribute	Description
	 Non-native vegetation (exotic grassland) in the proposal site.

5.3.5 Groundwater dependent ecosystems

The NSW *State Groundwater Dependent Ecosystems Policy* defines groundwater dependent ecosystems (GDEs) as ecosystems which have their species composition, and their natural ecological processes determined by groundwater (DLWC 2002). Ecosystems vary dramatically in the degree of dependency of groundwater, from having no apparent dependence through to being entirely dependent on it (DLWC 2002).

Dependence (or interaction) of the vegetation communities identified within the proposal site on groundwater was determined by searching the Atlas of GDEs (BOM 2021a). This Atlas predicts the occurrence of groundwater dependent ecosystems and ecosystems that potentially use groundwater. It shows ecosystems that interact with the subsurface expression of groundwater (including vegetation ecosystems) or the surface expression of groundwater (such as rivers and wetlands). The Atlas also shows the likelihood that landscapes are accessing water in addition to rainfall, such as soil water, surface water or groundwater.

Native vegetation within the proposal site is not within a mapped area for being reliant on subsurface presence of groundwater (BOM 2021a). All areas of native vegetation within the proposal site are mapped as low potential for terrestrial GDEs.

5.4 Fauna and habitat resources

5.4.1 Fauna species

A total of 49 species of fauna were recorded during the current field surveys and surveys that were previously conducted for the E44 Rocklands Project in the study area. Surveys for the E44 Rocklands Project were used to inform this BDAR due to the close proximity of the project to the proposal site and consistency of vegetation and habitat resources with that in the proposal site. These included 41 native bird species, five mammal species (including three introduced species), and three frog species (see Appendix B). The survey period in which species were identified is distinguished in Appendix B.

5.4.2 Fauna habitats

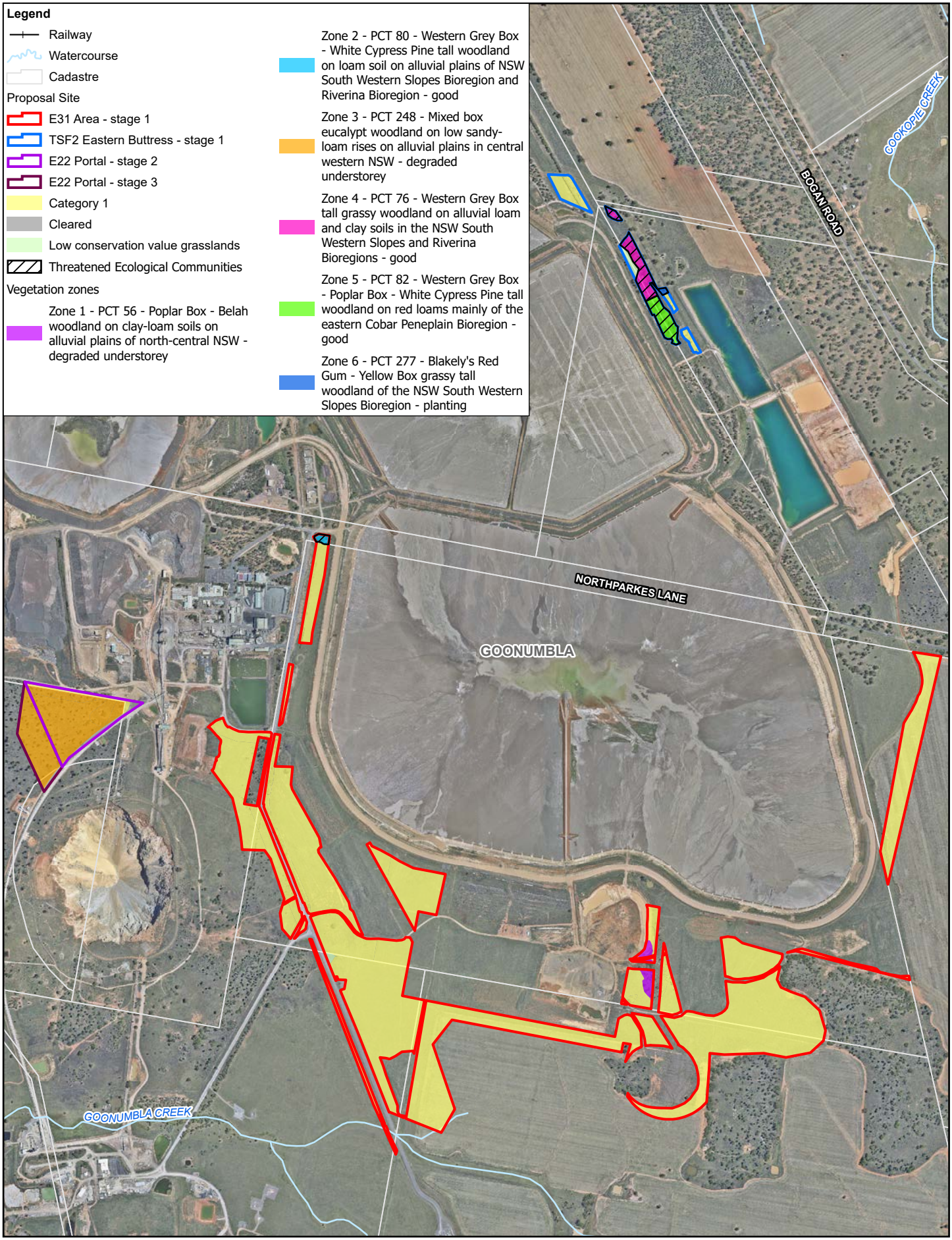
Fauna habitat resources at the proposal site are associated with patches of woodland, mostly dominated by a canopy of Grey Box and/or Poplar Box. Better quality fauna habitat resources at the proposal site are associated with patches of good quality woodland generally dominated by Grey Box and containing hollow-bearing trees. These patches are likely to provide better quality fauna habitat than the highly degraded Poplar Box Woodland that is dominated by a groundcover of introduced species and lacks hollow-bearing trees. Other areas within the proposal site are dominated by cropping and exotic grassland and may provide marginal habitat for some fauna species. There are no farm dams within the proposal site. The far upstream reach of Goonumbla Creek and an unnamed ephemeral drainage line that flows into it located in the south-western portion of the proposal site. However this area is located within a cropped paddock and an area mapped as Category 1, is highly degraded with no fringing or emergent vegetation, and only likely to provide marginal fauna habitat.

There are no caves or culverts, cliff lines, substantial rock outcrops, important wetlands or waterbodies within the proposal site. Fauna habitat present at the site are detailed in Table 21.

Table 21 Fauna habitats – woodland patches

Native woodland	
Description	Woodland in the study area is comprised of two separate vegetation types; one with a canopy of Poplar Box with White Cypress Pine and a groundcover dominated by introduced species and the other with a canopy of Grey Box, with a more native groundcover. There are 32 hollow-bearing trees predominantly within the Grey Box woodland, which is in relatively good condition containing an understorey dominated by native species. Leaf litter and woody debris is present to varying degrees throughout the woodland. No regeneration is occurring within the Poplar Box woodland patch and there is no direct connectivity to other patches of woodland in the study area. The woodland in the E22 Portal area is part of a larger patch within Limestone National Forest and is in a generally degraded state throughout, containing an understorey dominated by introduced species and a relatively dense layer of cypress pine regrowth.
Fauna recorded	A number of woodland bird species were recorded within these areas, including the Eastern Rosella (*Platycercus eximius*), Australian Magpie (*Cracticus tibicen*) and Noisy Miner (*Manorina melanocephala*). Mammals such as the Eastern Grey Kangaroo (*Macropus giganteus)* and Brown Hare (*Lepus capensis*) were also observed in the study area.
Threatened species	The Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) and Superb Parrot (*Polytelis swainsonii*) were both recorded in similar woodland in the study area, adjacent to the proposal site. A Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) was recorded foraging in mixed box woodland with a relatively dense cypress pine shrub layer to the west of the proposal site.

Native woodland	
	 Native Grey Box - Poplar Box woodland in the proposal site.  Native Grey Box woodland with native understory



Paper Size ISO A4

0 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Northparkes Mines
Biodiversity Development Assessment Report
Modification 6

Project No. **12551921**
Revision No. **0**
Date **07/03/2022**

Vegetation in the proposal site

Figure 4

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Print date: 07 Mar 2022 - 10:38

Data source: CMOC: Disturbance Bdy, Aerial Imagery 2021, LPI: DTDB / DCDB, 2017; . Created by: fmackay

6. Conservation significance

6.1 Identification of threatened species under the BAM

6.1.1 Predicted threatened species (ecosystem credit entities)

Based on the bioregional context for the assessment and the PCTs, patch size, vegetation cover and habitat resources present at the proposal site, the BAM calculator generates a list of threatened fauna species that are associated with native vegetation at the proposal site (i.e. potential 'predicted threatened species', or potential 'ecosystem credit entities'). The potential for these predicted threatened species to occur within the site were further refined based on the desktop assessment, habitat resources observed during field surveys and the knowledge and experience of the assessor.

The suite of 'confirmed' predicted threatened species associated with ecosystem credits required for the proposal site, and with relevant habitat resources present on the site, are listed in Table 22. For each confirmed predicted threatened species, the vegetation zone association is provided. Targeted surveys are not required under the BAM for these species as they are assumed to be present. It is noted that three of these species were recorded in the study area during surveys.

Notably, many threatened species of woodland birds would only occur in vegetation with canopy vegetation, as part of relatively extensive patch and/or with habitat resources such as abundant fallen woody debris (see Appendix A for further detail and justification).

The sensitivity to gain class is based on the species life history characteristics and ecological information. It estimates the ability of a species to respond to improvements in habitat condition at an offset site.

Table 22 Confirmed predicted threatened species

Common name	Scientific name	Sensitivity to gain class	Vegetation zone association
Barking Owl (foraging habitat)	*Ninox connivens*	High	Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Black-breasted Buzzard (foraging habitat)	*Hamirostra melanosternon*	Moderate	Zone 1 – PCT 56
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	Moderate	Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 6 – PCT 277
Black Falcon	*Falco subniger*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Brolga	*Grus rubicunda*	Moderate	Zone 5 – PCT 82
Corben's Long-eared Bat	*Nyctophilus corbeni*	High	Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 5 – PCT 82
Diamond Firetail	*Stagonopleura guttata*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Flame Robin	*Petroica phoenicea*	Moderate	Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277

Common name	Scientific name	Sensitivity to gain class	Vegetation zone association
Gang-gang Cockatoo (foraging habitat)	*Callocephalon fimbriatum*	Moderate	Zone 6 – PCT 277
Gilbert's Whistler	*Pachycephala inornata*	Moderate	Zone 2 – PCT 80
Glossy Black-Cockatoo (foraging habitat)	*Calyptorhynchus lathami*	High	Zone 1 – PCT 56 Zone 2 – PCT 80
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Grey-headed Flying-fox (foraging habitat)	*Pteropus poliocephalus*	High	Zone 1 – PCT 56 Zone 4 – PCT 76 Zone 6 – PCT 277
Grey Falcon	*Falco hypoleucos*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Little Eagle (foraging habitat)	*Hieraaetus morphnoides*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Little Lorikeet	*Glossopsitta pusilla*	Moderate	Zone 6 – PCT 277
Little Pied Bat	*Chalinolobus picatus*	High	Zone 1 – PCT 56 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82
Major Mitchell's Cockatoo (foraging habitat)	*Lophochroa leadbeateri*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82
Masked Owl (foraging habitat)	*Tyto novaehollandiae*	High	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82
Pied Honeyeater	*Certhionyx variegatus*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 5 – PCT 82
Scarlet Robin	*Petroica boodang*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Speckled Warbler	*Chthonicola sagittata*	High	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Spotted Harrier	*Circus assimilis*	Moderate	Zone 1 – PCT 56 Zone 3 – PCT 248 Zone 5 – PCT 82 Zone 6 – PCT 277
Square-tailed Kite	*Lophoictinia isura*	Moderate	Zone 1 – PCT 56 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 6 – PCT 277
Superb Parrot (foraging habitat)	*Polytelis swainsonii*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277

Common name	Scientific name	Sensitivity to gain class	Vegetation zone association
Swift Parrot (foraging habitat)	*Lathamus discolor*	Moderate	Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Turquoise Parrot	*Neophema pulchella*	High	Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Varied Sittella	*Daphoenositta chrysoptera*	Moderate	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
White Bellied Sea-Eagle (foraging habitat)	*Haliaeetus leucogaster*	High	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277
Yellow-tailed Sheathtail-bat	*Saccolaimus flaviventris*	High	Zone 1 – PCT 56 Zone 2 – PCT 80 Zone 3 – PCT 248 Zone 4 – PCT 76 Zone 5 – PCT 82 Zone 6 – PCT 277

Species indicated by **bold text** were recorded within the proposal site or the wider study area.

The potential predicted threatened species listed in Table 23 were assessed as unlikely to occur and were excluded from the list of confirmed threatened species.

Table 23 Excluded predicted threatened species

Common name	Scientific name	Justification
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	Geographic limitation – the proposal site does not occur east of the Newell Highway.
Koala (foraging habitat)	*Phascolarctos cinereus*	No habitat constraint listed in the Threatened Biodiversity Data Collection. However, this species has only been recorded in the IBRA subregion on one occasion since 1992, with the exception of the translocated population in Narrandera, over 250 kilometres south-west of the proposal site and is therefore considered a vagrant species. The species is not known to occur according to mapping of Areas of Regional Koala Significance (ARKS).
Painted Honeyeater	*Grantiella picta*	Habitat constraint – mistletoes not present at a density of greater than five mistletoes per hectare.
Regent Honeyeater	*Anthochaera phrygia*	No habitat constraints listed in the Threatened Biodiversity Data Collection. However, the only associated PCT for this species is a very small, modified planting that was selected as the closest fit PCT. The species is unlikely to utilise this vegetation as potential habitat.
Spotted-tailed Quoll	*Dasyurus maculatus*	No habitat constraints listed in the Threatened Biodiversity Data Collection. However, the only associated PCT for this species is a very small, modified planting that was selected as the closest fit PCT. The species is unlikely to utilise this vegetation as potential habitat.
Stripe-faced Dunnart	*Sminthopsis macroura*	No habitat constraints listed in the Threatened Biodiversity Data Collection. However, this species has not been previously recorded in the IBRA subregion and is therefore considered a vagrant species.
White-throated Needletail	*Hirundapus caudacutus*	No habitat constraints listed in the Threatened Biodiversity Data Collection. However, this species has only been recorded in the IBRA subregion on one

Common name	Scientific name	Justification
		occasion since the year 2000 and is therefore considered a vagrant species.

6.1.2 Candidate threatened species (Species credit entities)

Threatened species that cannot reliably be predicted to occur on a development site based on PCT, distribution and habitat criteria are identified by the Threatened Biodiversity Data Collection as 'species credit' entities. In some circumstances, the particular habitat components of species assessed for ecosystem credit species, such as the breeding habitat of a cave roosting bat or forest owls, are also assessed for species credits. The credit calculator references geographic, vegetation and habitat data for the proposal site to generate a list of the species credit entities that are predicted to occur (i.e. the 'potential candidate threatened species').

Searches of threatened species databases were also completed to identify any additional potential candidate threatened species (to those generated by the credit calculator) that are known or predicted to occur in the locality (refer to likelihood of occurrence table in Appendix A). The likelihood of occurrence of these additional potential candidate threatened species were reviewed, giving consideration to the habitats available in the study area.

Potential candidate threatened species that could occur in the study area based on the habitat resources observed during field surveys were confirmed as candidate threatened species. 'Confirmed' candidate threatened species require targeted survey in accordance with Section 5.3 of the BAM (DPIE 2020). The list of confirmed candidate threatened species is presented in Table 24; these species were the subject of targeted survey. Surveys were conducted in the appropriate season for all confirmed candidate threatened species and so the targeted survey results can be considered a reliable indicator of their presence or absence at the proposal site (see Table 24).

Table 24 Confirmed candidate species credit species for which surveys were conducted

Common name	Scientific name	BioNet records in locality	Survey months	Presence	Justification and location
Fauna					
Barking Owl (breeding habitat)	*Ninox connivens*	1	May-Dec	No - surveyed	No evidence of the species was recorded at the site despite targeted surveys in August, October and November. There are only two potential nest trees within the proposal site suitable for the species.
Gang-gang Cockatoo (breeding habitat)	*Callocephalon fimbriatum*	None	Oct-Jan	No - surveyed	No evidence of the species was recorded at the site despite targeted surveys in October and November. In addition, the PCT association for this species is a very small area of planted vegetation that the species is unlikely to utilise as habitat.
Glossy Black-Cockatoo (breeding habitat)	*Calyptorhynchus lathami*	None	Jan-Sept	No - surveyed	No evidence of the species was recorded at the proposal site despite targeted surveys in May and August and wider study area. Foraging habitat for the species is limited to individual trees with the species known to breed near foraging resources.

Common name	Scientific name	BioNet records in locality	Survey months	Presence	Justification and location
Little Eagle (breeding habitat)	*Hieraaetus morphnoides*	5	Aug-Oct	No - surveyed	No evidence of the species was recorded at the site despite targeted surveys in August and October. No potential nest trees for the species were identified in the proposal site or wider study area.
Major Mitchell's Cockatoo (breeding habitat)	*Lophochroa leadbeateri*	2	Sept-Dec	No - surveyed	No breeding behaviour or breeding pairs observed during targeted surveys in October and additional surveys during September and November in the proposal site and wider study area.
Masked Owl (breeding habitat)	*Tyto novaehollandiae*	None	May-Aug	No - surveyed	No evidence of the species was recorded at the site despite targeted surveys in May and August. There are only two potential nest trees within the proposal site suitable for the species.
Square-tailed Kite (breeding habitat)	*Lophoictinia isura*	None	Sept-Jan	No - surveyed	No evidence of the species was recorded at the site despite targeted surveys in October and November. No potential nest trees for the species were identified in the proposal site or wider study area.
Squirrel Glider	*Petaurus norfolcensis*	None	All year	No - surveyed	No evidence of the species was recorded at the site despite targeted surveys in better quality habitat within the study area in August. Targeted spotlighting was also completed in the proposal site during May and October.
Superb Parrot (breeding habitat)	*Polytelis swainsonii*	14	Sept-Nov	No - surveyed	No evidence of species breeding during surveys in September, October and November. No breeding behaviour observed in wider study area.
Flora					
Ausfeld's Wattle	*Acacia ausfeldii*	None	Aug- Oct	No - surveyed	No evidence of the species was recorded at the site in surveys in October 2021.
A spear-grass	*Austrostipa metatoris*	None	Oct-Nov	No - surveyed	No evidence of the species was recorded at the site in surveys in October 2021 and November 2020.
Oaklands Diuris	*Diuris* sp.	None	November	No - surveyed	This species nominated survey period is November, however given the

Common name	Scientific name	BioNet records in locality	Survey months	Presence	Justification and location
					favourable conditions preceding surveys with significant rainfall, other Diuris species were seen flowering earlier than their usual expected period based on annual surveys. The conditions prior to and during the survey period were determined to be suitable to detect the species if it were present. No evidence of the species was detected during surveys in October 2021, or in surveys in November 2020.
Pine Donkey Orchid	*Diuris tricolor*	13	Sep-Oct	No - surveyed	No evidence of the species was recorded at the site in surveys in September 2020 and October 2021.
Slender Darling Pea	*Swainsona murrayana*	7	September	No – surveyed	Although surveys were conducted in early October instead of September for this species, the conditions on site were optimal in October 2021. Other Swainsona species were recorded flowering at this time and the species was not recorded during the Step Change Project (Umwelt 2016) as part of surveys in the study area that included targeted searches in the proposal site.
Silky Swainson-pea	*Swainsona sericea*	3	Sept-Oct	No - surveyed	No evidence of the species was recorded at the site despite targeted surveys in September 2020, October 2021 and November 2020.
Spiny Peppercress	*Lepidium aschersonii*	None	Nov-April	No - surveyed	No evidence of the species was recorded at the site despite targeted surveys in November 2020 and November 2021.
Winged Peppercress	*Lepidium monoplocoides*	None	Nov-Feb	No - surveyed	The survey dates for this species in the TBDC are September to December, noting to survey about 1-2 months after significant rain. Given the significant rain events in the months preceding survey, the presence of other seeding Lepidium species, and the survey period listed in the TBDC it was determined that the survey period in October was suitable to

Common name	Scientific name	BioNet records in locality	Survey months	Presence	Justification and location
					detect the species if present. No evidence of the species was recorded at the site in surveys in October 2021 or subsequent surveys in zone 3 in November 2021.

A number of species could be reliably discounted as occurring within the study area based on the habitat types present, lack of microhabitats, degraded habitat features and/or the known distribution of the species. A number of dual credit fauna species have foraging habitat present but either no potential breeding habitat was identified during the field surveys, or the species does not breed in the area. These species are **not** 'confirmed candidate threatened species' for the purposes of this assessment and do not require further assessment. Detailed justification for the conclusion is provided in Table 25 and/or the 'habitat/constraints' fields in the credit calculator.

Table 25 Excluded candidate species

Common name	Scientific name	Justification and location
Fauna		
Black-breasted Buzzard (breeding habitat)	*Hamirostra melanosternon*	No suitable breeding habitat. No waterbodies, land within 40 metres of riparian woodland on inland watercourses or waterholes containing dead or dying eucalypts in the proposal site.
Bush Stone-curlew	*Burhinus grallarius*	Habitat constraint – no suitable fallen/standing dead timber and/or logs with the proposal site located and adjacent to an operation mine, which is unlikely to constitute suitable habitat for the species
Eastern Pygmy-possum	*Cercartetus nanus*	No habitat constraints listed in the Threatened Biodiversity Data Collection. However, this species has not been previously recorded in the IBRA subregion and is therefore considered a vagrant species.
Glossy Black-Cockatoo, Riverina population	*Calyptorhynchus lathami* - endangered population	Geographic limitation – proposal site is not located within the Carrathool, Griffith, Leeton or Narrandera LGA
Grey-headed Flying-fox (breeding habitat)	*Pteropus poliocephalus*	No suitable breeding habitat. No breeding camps present in the study area
Koala (core habitat)	*Phascolarctos cinereus*	No core habitat present according to mapping of Areas of Regional Koala Significance (ARKS)
Large-eared Pied Bat	*Chalinolobus dwyeri*	Habitat constraint – no cliffs or rocky areas containing caves, overhangs, escarpments, outcrops or crevices, or within two kilometres of old mines or tunnels
Pink-tailed Legless Lizard	*Aprasia parapulchella*	No rocky habitat or areas within 50 metres of rocky habitat suitable for the species to be present.
Regent Honeyeater (breeding habitat)	*Anthochaera phrygia*	No suitable breeding habitat. No mapped habitat present in the area

Common name	Scientific name	Justification and location
Sloane's Froglet	*Crinia sloanei*	Habitat constraint – no permanent or ephemeral wet areas in the proposal site and surrounding area. Targeted surveys for the species were conducted in areas of potential suitable habitat in the study area for the Rocklands E44 project and the species was not recorded.
White-browed Treecreeper population in Carrathool LGA south of the Lachlan River and Griffith LGA	*Climacteris affinis* - endangered population	Geographic limitation – proposal site is not located within the Carrathool LGA south of the Lachlan River and Griffith LGA
White Bellied Sea-Eagle (breeding habitat)	*Haliaeetus leucogaster*	No suitable breeding habitat. No large dams or waterways present in the area.
Flora		
A spear-grass	*Austrostipa wakoolica*	Proposal site is located outside the geographic limitations of the species (i.e. south of Narrandera)
Lanky Buttons	*Leptorhynchos orientalis*	Proposal site is located outside the geographic limitations of the species (i.e. west of Narrandera/Lockhart Road and north or Urana/Lockhart Rand)
Mossgiel Daisy	*Brachyscome papillosa*	Proposal site is located outside the geographic limitations of the species (i.e. south and west of the Coolamon to Ardlethan Road, west of Lockhart and north or Rand)
Sand-hill Spider Orchid	*Caladenia arenaria*	Proposal site is located outside the geographic limitations of the species (i.e. west of Lockhart and north or Rand)
Small Scurf-pea	*Cullen parvum*	No habitat constraints listed in the Threatened Biodiversity Data Collection. However, the only associated PCT for this species is a very small, modified planting that was selected as the closest fit PCT. The habitat is therefore classified as degraded and the species is unlikely to be present.
Spike-Rush	*Eleocharis obicis*	Proposal site does not contain specific habitat constraints for the species i.e. semi-permanent/ephemeral wet areas or periodically waterlogged sites.

6.2 Threatened species survey results

6.2.1 Threatened flora

No threatened flora species were recorded in the proposal site or study area during field surveys conducted in September 2020, November 2020, October 2021 or November 2021, consistent with the nominated survey months for the eight candidate threatened flora species listed in Table 24.

All potential threatened plant habitat associated with native vegetation in the proposal site was traversed on foot, with no notable barriers to human movement or visibility encountered during the field survey. Field staff were able to traverse all areas of potential threatened flora habitat on foot, in a manner that reflected threatened species

survey guidelines (DPIE 2020b, 2016; Cropper 1993). All candidate threatened flora species can be excluded from occurring at the proposal site, given they were not located despite targeted, seasonally appropriate survey by experienced botanists familiar with each of the species.

6.2.2 Threatened fauna

Three threatened fauna species listed under the BC Act were recorded during surveys (see Figure 5):

– Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) – ecosystem credit species
– Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) – dual credit species. This species is an ecosystem credit species for foraging habitat and a species credit species for breeding habitat.
– Superb Parrot (*Polytelis swainsonii*) – dual credit species. This species is an ecosystem credit species for foraging habitat and a species credit species for breeding habitat.

Twenty-five Superb Parrots in total were recorded adjacent to the proposal site during multiple survey periods, foraging within Poplar Box – Belah woodland and on the edge of the woodland patches within the study area. There was no evidence of breeding behaviour such as males returning to hollows to feed females or presence of fledglings despite inspection of candidate nest trees with potentially suitable hollows. No individuals were observed in the proposal site. Targeted field surveys were undertaken at a suitable time of year in the study area to detect the Superb Parrot during the breeding period. It can reliably be discounted as breeding within the proposal site due to targeted, seasonally appropriate survey effort not detecting any evidence of breeding behaviour in candidate hollow-bearing nest trees.

Nine Grey-crowned Babblers were recorded adjacent to the proposal site, foraging within Poplar Box – Belah woodland. No individuals were observed in the proposal site.

One Major Mitchell's Cockatoo was observed in the wider study area foraging in a cypress pine tree near the E22 Portal area. Potential nest trees for the species are present in the proposal site and study area, however no evidence of breeding pairs in the vicinity of these trees or breeding behaviour was evidenced during any survey period, both in the proposal site or wider study area.

The proposal site contains broadly suitable habitat for the additional candidate threatened species listed in Table 24. Targeted field surveys were undertaken at a suitable time of year to detect each of these species if present at the proposal site. None of these species were observed and there have been no local records of the species (DPIE 2021a).

The candidate threatened fauna species can be excluded from occurring at the proposal site, given they were not located despite targeted, seasonally appropriate survey by experienced ecologists familiar with each of the species and the habitat resources associated with breeding activity. The majority of dual credit candidate credit species could be excluded from targeted surveys due to the absence of habitat constraints required as habitat features such as hollow-bearing trees and large wetland areas.

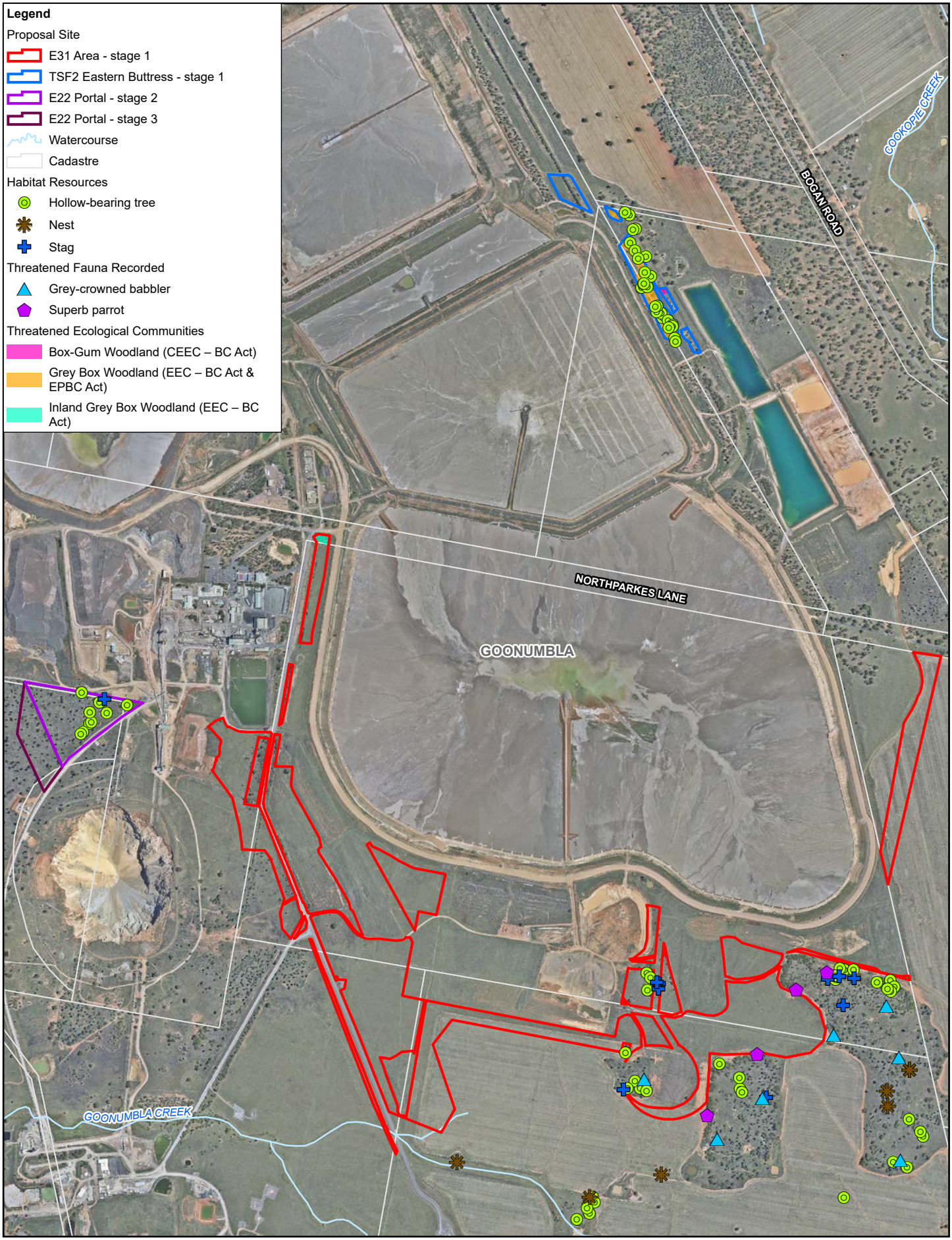
There are no waterbodies at the proposal site to provide potential habitat for any threatened listed species under the FM Act.

6.2.3 Threatened ecological communities

PCT 277 at the proposal site comprises an occurrence *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions* which is listed as a CEEC under the BC Act. The occurrence in the proposal site is a small area (0.073 hectares) of planted vegetation that has been classified as PCT 277 as the closest matching PCT. It is not commensurate with the EPBC Act listing of the community due to the small size of the patch and insufficient native species in the patch.

PCT 56 identified within the proposal site does not comprise an occurrence of a threatened ecological community under the BC Act. PCT 56 does not meet the key diagnostic characteristics in the listing advice for *Poplar Box Grassy Woodland on Alluvial Plains* as listed under the EPBC Act due to the dominance of introduced cover in the groundlayer and not meeting the minimum patch size requirement to qualify for listing with at least 10 trees per hectare greater than 30 centimetres in diameter at breast height.

PCTs 76, 80 and 82 comprises an occurrence of the threatened ecological community *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions*, which is listed as an EEC under the BC Act. These communities are dominated by a canopy of Grey Box, with PCTs 76 and 82 also being commensurate with the related EEC listed under the EPBC Act as *Grey Box* (Eucalyptus microcarpa) *Grassy Woodland and Derived Native Grasslands of South-Eastern Australia*. PCT 80 does not classify for listing as the EPBC Act form of the community due to the small size of the patch which does not meet minimum size requirements (see Figure 5).



Paper Size ISO A4

0 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Northparkes Mines
Biodiversity Development Assessment Report
Modification 6

Project No.	**12551921**
Revision No.	**0**
Date	**07/03/2022**

Threatened biota and habitat resources

Figure 5

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Print date: 07 Mar 2022 - 10:39

Data source: CMOC: Disturbance Bdy, Aerial Imagery 2021, LPI: DTDB / DCDB, 2017; . Created by: fmackay

7. Avoid and minimise impacts

7.1 Overview

The mitigation of adverse effects arising from the proposal has been presented according to the hierarchy of avoidance, mitigation and offsetting of impacts. The proposal has been located and designed to avoid impacts on biodiversity values as far as possible as discussed in Section 7.2. The proposal has been purposefully sited in an area of agricultural land that contains minimal remnant native vegetation or threatened species habitat. The proposal would result in minimal direct impacts on native biota and their habitats within the proposal site associated with a small area of native vegetation that could not be practically avoided.

There is limited potential for impacts on native vegetation or threatened species habitat in the study area during the longer-term operational phase of the proposal. Specific mitigation measures are recommended in section 9.1 to further minimise impacts on the natural environment and biodiversity values.

7.2 Measures to avoid and minimise impacts

During the development of the proposal, the areas proposed for development have been largely focused on land classified as Category 1 - Exempt Land and areas that have previously been heavily disturbed due to past agricultural and forestry practices. These areas are largely cleared of remnant vegetation and dominated by introduced groundcover species. Therefore, impacts to biodiversity have been largely avoided, with the proposal site boundary being purposefully located to avoid remnant patches of woodland in the south-eastern section of the Northparkes Mines site boundary. The proposal does not encroach into these remnant patches of woodland.

The placement of stockpiling areas to the west of the access road has purposefully minimised biodiversity impacts by avoiding remnant paddock trees (pre-1990) and an area of regrowth around some of these trees. This area has been located within currently approved operational areas or land assessed as being Category 1 – Exempt Land.

The E22 portal disturbance area has been separated into two separate areas (Stage 2 and Stage 3) to allow for refinement of the detailed design and to avoid impacts as far as practicable. Stage 2 (6.19 hectares of native vegetation) is the direct disturbance that would be required for the establishment of the E22 portal and Stage 3 (3.38 hectares of native vegetation) is additional disturbance that may be required, pending the outcome of the detailed design phase. The design of the portal and associated conveyer infrastructure won't be finalised until post approval of Modification 6. Some of the design variables include portal angle, length of the drive, transfer locations and connection to other existing infrastructure. The intent is to locate the portal in the north-east corner of the Limestone State Forest to minimise the disturbance as much as possible.

The total proposal site area of 94.37 hectares (excluding Stage 3) comprises 84.18 hectares of Category 1 – Exempt Land, including low conservation grasslands, cropping and plantings; and just 9.72 hectares of native vegetation (see Table 26).

8. Assessment of impacts

8.1 Direct impacts

Removal or modification of vegetation

The proposal would predominantly impact Category 1 – Exempt Land and areas of exotic grassland, with relatively small patches of remnant vegetation proposed to be removed. In total, the proposal would remove 9.72 hectares of native woodland, plus an additional 3.38 hectares if development in the Stage 3 area associated with the E22 portal is required, as summarised in Table 26. All vegetation would be completely removed by the proposal for establishment of the clay and gravel borrow pits, extension of the E31 and E31N pits, E22 Portal construction, TSF2 buttressing, waste rock stockpiling areas and all associated ancillary infrastructure.

The separation of the consideration of impacts into Stage 1 (E31 and TSF2 activities) and Stage 2 and Stage 3 (E22 Portal activities) is linked to a staged approach to delivery of biodiversity offsets. Vegetation clearing in each of the Stages will not commence until the offset requirements for the relevant stage have been satisfied.

As described above, the E22 portal disturbance area has been separated into two areas to allow for refinement of the detailed design and to avoid impacts as far as practicable.

Table 26 Direct impacts

Plant community type	Threatened ecological community	Area impacted (ha)
Stage 1		
Zone 1 – PCT 56 – Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW – degraded understorey	Does not meet condition criteria for EPBC Act TEC	0.73
Zone 2 – PCT 80 – Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion – good	TEC – Grey Box Woodland (BC Act & EPBC Act)	0.19
Zone 4 – PCT 76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – good	TEC – Grey Box Woodland (BC Act & EPBC Act)	1.43
Zone 5 – PCT 82 – Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion - good	TEC – Grey Box Woodland (BC Act & EPBC Act)	1.11
Zone 6 – PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion – planting	CEEC – Box-Gum Woodland (BC Act, does not meet condition criteria for EPBC Act CEEC)	0.073
Total native vegetation Stage 1		**3.53**
Stage 2		
Zone 3 (Area 1) – PCT 248 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey	Does not meet condition criteria for BC Act or EPBC Act TEC	6.19
Total native vegetation Stage 2		**6.19**
Stage 3		
Zone 3 (Area 2) – PCT 248 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey	Does not meet condition criteria for BC Act or EPBC Act TEC	3.38
Total native vegetation Stage 3		**3.38**
Exotic grassland and cleared areas		0.58

Plant community type	Threatened ecological community	Area impacted (ha)
Category 1 – Exempt Land, including low conservation grasslands, cropping and plantings		83.70
Total proposal site (Stage 1 and Stage 2)		**94.37**

Removal of habitat and habitat resources

The vegetation that would be removed or modified provides potential habitat resources for native fauna species, including threatened species of fauna. The survey effort to date has been sufficient to exclude impacts on all candidate species credit entities. The majority of candidate species credit species are dual credit species with breeding habitat excluded based on targeted, seasonally appropriate survey effort not detecting any evidence of breeding behaviour in candidate hollow-bearing nest trees. Other candidate species credit species were excluded based on the lack of large waterbodies and riparian habitat.

The clearing of about 9.72 hectares (Stages 1 and 2) of native woodland within a 94.37 hectare (Stages 1 and 2) proposal site would include the removal of mature trees and some hollow-bearing trees. Mature trees have value for fauna populations as sources of foraging resources such as leaves, nectar, sap or seed and substrate for invertebrate prey.

The proposal would involve the removal of about 32 hollow-bearing trees. These trees are scattered throughout the patches of remnant woodland, however are limited in the Poplar Box woodland due to its relatively young age class of trees. Hollows are a limited resource, relied on by many native fauna for shelter and breeding. Galahs (*Eolophus roseicapilla*) and Cockatiels (*Nymphicus hollandicus*) were observed at hollows during surveys in the wider study area. The removal of these hollows would reduce the extent of potential breeding habitat for native species in the area, including hollow-dependant bird species, arboreal fauna and microchiropteran bats.

In the context of the areas of remaining native woodland surrounding the proposal site, particularly in the patches in the south-east portion of the lot in which the proposal is located, the proposal would remove a very small proportion of the alternative habitat resources for local populations of native fauna. There is over 90 hectares of remnant native vegetation within these adjacent patches. It is therefore unlikely that the proposal would substantially impact on the available habitat resources of local fauna in the study area.

Fauna injury and mortality

As described above, the proposal site provides a variety of habitat resources for native fauna species, including foraging, roosting and shelter resources for threatened species as well as common native fauna. Groundcover vegetation, leaf litter and woody debris would provide shelter and foraging substrate for reptiles, frogs and invertebrates. Construction may result in the injury or mortality of some individuals of these less mobile fauna species and other small terrestrial fauna that may be sheltering in vegetation within the proposal site during clearing activities. More mobile native fauna such as native birds, bats, terrestrial and arboreal mammals that may be sheltering in vegetation in the proposal site are likely to evade injury during construction activities.

Recommendations have been made in Section 9.1 above to minimise the risk of vegetation clearing activities resulting in the injury or mortality of resident fauna including existing tree felling procedures for rescue of fauna.

Fragmentation or isolation of habitat

The proposal site is mostly located in already cleared land. The majority of the proposal site is comprised of exotic grassland previously modified for agricultural practices, and already comprises a gap in habitat for less mobile or shelter dependent native fauna. Small isolated patches of woodland vegetation would be removed from the central section of the proposal site in the E31 area, which are surrounded by exotic grassland and not connected to any other native vegetation. The proposal would result in the complete removal of these small patches of vegetation, however this would comprise a minor contribution to the degree of habitat fragmentation in the local area. These patches are already isolated within an extensively cleared area dominated by exotic grassland and mine infrastructure. It is unlikely these patches of vegetation provide preferred habitat for fauna species in the study area or that they provide important ‘stepping stones’ of connectivity due to their isolation. There is alternative refuge habitat in larger patches of woodland vegetation in the locality that would not be disturbed for the proposal.

Vegetation to be removed for the E22 Portal is located within Limestone National Forest and would remove a portion of connected habitat within the State Forest, reducing the patch size. Vegetation to be removed for the

TSF2 buttressing and the north-western patch of vegetation in the E31 area would result in the complete removal of these patches of vegetation. There are patches of connected vegetation that would be retained and would provide alternative refuge habitat for fauna species in the study area including fauna displaced by clearing of the proposal site. Patches of vegetation within the future Rocklands TSF site would be removed for the E44 Rocklands Project. This would further reduce the alternative habitat available for native fauna species in the study area and locality once removed. Alternative habitat would remain within Limestone National Forest and in the large patch of woodland to the east of the TSF2 site, which is part of a large Travelling Stock Reserve of over 300 hectares and extends north connecting to a Northparkes offset area within the locality. Additionally, Northparkes have planted tree corridors to the east and south of the proposed Rocklands site, which will form habitat connectivity between otherwise isolated patches of native vegetation.

Native vegetation in the proposal site is surrounded by, or at the edge of, existing clearings that have been cleared for mining or agriculture (see Figure 3). The proposal would not isolate any patches of habitat and no connecting links would be severed. The proposal site predominantly contains extensively fragmented patches of remnant habitat within an agricultural landscape and is unlikely to support populations of shelter dependant or less mobile fauna species. In this context vegetation removal for the proposal is unlikely to comprise a significant barrier to the movement of any locally occurring fauna species. The proposal would fragment vegetation in Limestone National Forest by reducing the area of available habitat, however, the remaining area of the State Forest would remain as one contiguous patch.

8.2 Indirect impacts

Indirect impacts that may occur as a result of the proposal are described in Table 27. Mitigation measures proposed to minimise the risk of these impacts are detailed in Section 9.1. Given the current degraded nature of the majority of the proposal site, the existing and past agricultural practices that have occurred and the proposed mitigation measures, indirect impacts are not likely to result in any substantial negative impacts on native vegetation or other threatened species habitat to a greater extent than that which already occurs in the study area. No biodiversity offsets have been calculated for indirect impacts.

Table 27 Indirect impacts

Impact	Description
Weed invasion and edge effects	'Edge effects' refer to the increased noise and light or erosion and sedimentation at the interface of intact vegetation and cleared areas. Edge effects may result in impacts such as changes to vegetation type and structure, increased growth of exotic plants, increased predation of native fauna or avoidance of habitat by native fauna. Altered environmental conditions along new edges can allow invasion by pest animals specialising in edge habitats and/or change the behaviour of resident animals. Edge effects would result from construction activities and then continue to affect vegetation and habitats adjoining the proposal site. The majority of the proposal site and adjoining land has been extensively cleared for agricultural purposes. Patches of remnant vegetation occur to the south-east, south and south-west of the proposal site and would be exposed to additional edge effects through clearing for the proposal (see Figure 3). Various weeds and exotic pasture species are present throughout the proposal site. Construction of the proposal would result in direct disturbance occurring adjacent to these woodland patches, and has the potential to further introduce or spread weeds. Given the existing degree of vegetation clearing and ongoing disturbance from mining activities and agricultural practices in the study area this would comprise a minor increase in the degree of edge effects.
Pests and pathogens	Construction activities, in general, have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*), Myrtle Rust (*Uredo rangelii*) and Chytrid fungus (*Batrachochytrium dendrobatidis*) into native vegetation. The potential for impacts associated with these pathogens is low, given the disturbed nature of much of the study area, lack of permanent flowing water on site, and the environmental safeguards that would be implemented during the construction process.
Noise, light and vibration	Construction of the proposal would require the use of additional vehicles and plant in the site. Fauna that occupy habitats within the proposal site and adjacent areas are likely to be accustomed to some existing noise and vibration originating from

Impact	Description
	vehicles and mining machinery. There is light spill currently experienced at the site and adjacent area from the night operation of the mine. Noise and vibration disturbance during construction could disturb resident fauna. Operational noise, vibration and light impacts would be located closer to patches of remnant vegetation, and may affect fauna species utilising habitat along the edges of woodland patches. While there would be localised, temporary increases in noise, vibration and light, resident fauna would be habituated to the relatively high background levels associated with current mine operations. In this context increases above existing background levels during construction are unlikely to result in a significant impact on fauna that occur in the study area.
Sedimentation and erosion	Construction of the proposal has the potential to result in sedimentation and erosion within the proposal site and adjoining native vegetation and aquatic habitats, through soil disturbance and construction activities. Aquatic habitat in the proposal site is limited to an ephemeral drainage line in the south-western section of the proposal site within a previously ploughed paddock. There is no fringing or emergent vegetation in the drainage line. The drainage line flows into Goonumbla Creek, which in the study area is also devoid of fringing and emergent vegetation. Regardless, sediment laden runoff to waterways can alter water quality and adversely affect aquatic life during periods of flow and where present. Given the modified nature of drainage lines in adjacent areas and their ephemeral nature, the potential for impacts is negligible. The Northparkes Environmental Management System (EMS) provides management measures to minimise any potential impacts within the mine site during all works.
Aquatic disturbance and pollution	Construction of the proposal has the potential to result in the mobilisation of contaminated sediments into waterways, or chemical spills from vehicles or plant. The introduction of pollutants from the proposal into the surrounding environment, if uncontrolled, could potentially impact on water quality further downstream during periods of flow. Given the modified nature of drainage lines in adjacent areas and their ephemeral nature, the potential for impacts is negligible. Management measures to prevent potential impacts on waterways are included in the Northparkes Water Management Plan and EMS and are likely to be effective in preventing impacts on biodiversity values downstream of the proposal site.
Air quality	Air quality impacts have the potential to impact the use of adjacent habitat by native fauna species due to dust generating activities and increased vehicle emissions from mining machinery in the proposal site. Potential impacts include smothering of vegetation by dust, decreasing growth and health of vegetation communities and flora species. Management measures to prevent air quality impacts, such as dust suppression on roads and stabilisation of disturbed areas are included in the Northparkes EMS and are likely to be effective in preventing impacts on biodiversity values in habitats adjoining the proposal site.

8.3 Impacts on aquatic habitats

There are no farm dams, creeks or other areas of substantial aquatic habitat located within the proposal site. An unnamed ephemeral drainage line that flows into Goonumbla Creek is located in the south-western portion of the proposal site. However, this area is located within a cropped paddock, highly degraded with no fringing or emergent vegetation, and only likely to provide marginal fauna habitat. In addition, this drainage line would not be directly impacted by the proposal, with key features located outside of the drainage line (see Figure 1).

There is no mapped Key Fish Habitat in the proposal site, with a small portion of Goonumbla Creek mapped just within the study area to the south-west of the proposal site. It is unlikely this would be impacted by the proposal and no habitat for threatened biota listed under the FM Act would be directly impacted. Indirect impacts would include sedimentation and erosion during construction, however this is unlikely given the distance between the proposal site and the aquatic habitat. Given the generally dry nature of the ephemeral drainage line in the proposal site, the risk of indirect impacts is low. There would be no blockage of fish passage or removal of snags as a result of the proposal.

8.4 Prescribed impacts

Prescribed impacts relevant to the proposal are described below. Given the scale and context of the proposal there are unlikely to be any substantial impacts on threatened species and their habitats beyond those associated with the removal of vegetation and habitat in the proposal site.

8.4.1 Karst, caves, crevices, cliffs, rocks and other geological features of significance

No areas of geological significance are present. No caves suitable for roosting or breeding of bats are present.

8.4.2 Human made structures and non-native vegetation

No buildings, culverts, bridges or similar human-made structures of particular relevance to fauna would be removed for the proposal.

The proposal would remove up to 84.18 hectares of non-native vegetation associated with exotic grassland predominantly from past cropping activities. Non-native vegetation does not comprise habitat for any threatened flora species (see section 6.1.2) and provides minimal habitat resources for threatened fauna species. Only mobile fauna species of open country would occur in non-native vegetation at the proposal site. Raptors may hunt over non-native grassland on occasion. Similarly, microchiropteran bats may forage above the non-native grassland. Bird species that forage in woodland areas may also forage in the adjacent non-native grassland on occasion. No threatened fauna species would rely on habitat resources in these areas for their survival in the locality, but may use these areas on occasion as part of a much larger home range.

Areas of exotic vegetation would be removed and soil excavated for use as borrow pits, pit extensions, and for ancillary facilities such as haul roads. Stockpiling areas would also be permanently disturbed through extended smothering of vegetation. These areas would undergo permanent vegetation removal, however this is unlikely to comprise a substantial impact on biodiversity values due to fauna species being unlikely to rely on habitat resources in these areas.

8.4.3 Habitat connectivity

Habitat fragmentation through the clearing of vegetation can increase the isolation of remnant vegetation and create barriers to the movements of small and sedentary fauna such as ground dwelling mammals, reptiles and amphibians. Furthermore, habitat fragmentation can create barriers to the movement of pollinator vectors, such as insects, or seed vectors, such as birds, and consequently affect the life cycle of both common and threatened flora.

Native vegetation in the proposal site is surrounded by, or at the edge of, existing cleared areas that have been cleared for mining or agriculture (see Figure 3). Habitat in the proposal site provides very little value as a fauna movement corridor. Small isolated patches of woodland vegetation would be removed from the central section of the proposal site, which are surrounded by exotic grassland and not connected to any other native vegetation. A small patch of woodland would be removed from the north-western section of the proposal site, which is also surrounded by exotic grassland and mine workings with a minor connection to remnant vegetation to the north and west. The proposal would result in the complete removal of these small patches of vegetation, however these patches of vegetation are unlikely to provide substantial habitat connectivity due to their isolation. More mobile species such as bats and birds may use these patches as alternative habitat, however species that require larger tracts of connected vegetation are unlikely to occur within these small, fragmented patches. Larger patches of woodland vegetation are located adjacent to the proposal site and likely to provide preferred habitat for fauna species in the study area with no vegetation removal occurring within these patches.

Direct impacts to habitat connectivity associated with removal of native vegetation are discussed further in section 8.1.

8.4.4 Water bodies, water quality and hydrological processes

No waterbodies, including farm dams, would be removed by the proposal. Waterbodies in the proposal site are limited to a minor, unnamed ephemeral drainage line located in the south-western section of the proposal site, however there would be no direct impacts on this drainage line with key features of the proposal not intersecting with it. This drainage line does not contain any fringing or emergent vegetation and is located within a previously cropped paddock that has been entirely disturbed. There is no evidence that aquatic habitat in the vicinity of the proposal site would be occupied by any threatened biota (see section 8.3). It is likely to provide poor quality habitat for threatened species, if any. Indirect impacts to this drainage line are likely to be negligible, with water only occurring in the drainage line following high rainfall events.

There may be minor impacts on aquatic habitat downstream of the proposal site with the drainage line in the south-western section of the proposal site flowing into Goonumbla Creek during periods of flow. However, Goonumbla Creek is also a highly disturbed Creek in the study area with no fringing or emergent vegetation, and likely also to hold water only during periods of increased rainfall. The proposal would include implementation of management measures to avoid downstream impacts.

8.4.5 Vehicle strike

Bogan Road and McClintocks Lane run along the eastern and southern boundary, respectively, of the lot in which the proposal is located. An unnamed road travels from McClintocks Lane along the western boundary of the proposal site into the Northparkes Mine site, with the decommissioned Northparkes Lane connecting this road along the northern boundary to Bogan Road in the east. The majority of vehicle movements in the study area are associated with machinery movements within the mine and delivery of materials to and from the mine along the local road network. Currently, vehicle movements within the proposal site are related to accessing various parts of the existing mine, and agricultural areas. The movements of vehicles and machinery would increase during both the construction and operation phases of the proposal, however the risk of vehicle strike would be minimal noting that fauna species would be unlikely to utilise the mine site as habitat once in operation.

The potential risk of vehicle strike is most relevant to common species of agricultural landscapes such as kangaroos which may be using the proposal site to move between areas of foraging or shelter habitat. More mobile threatened species of open country such as the Grey-crowned Babbler may traverse the proposal site on occasion but are likely to evade vehicles and so the risk of injury and mortality is low.

8.5 **Consideration of MNES**

The proposal may result in potential direct impacts to the following MNES:

– *Grey Box* (Eucalyptus microcarpa) *Grassy Woodland and Derived Native Grasslands of South-Eastern Australia* (PCT 76 and 82), which is listed as an EEC
– Corben's Long-eared Bat *(Nyctophilus corbeni)*, which is listed as a vulnerable species
– Superb Parrot (*Polytelis swainsonii*), which is listed as a vulnerable species
– Grey-headed Flying-fox (*Pteropus poliocephalus*), which is listed as a vulnerable species.

Areas of woodland containing a canopy dominated by Grey Box, and that are greater than 0.5 hectares in size to meet the minimum size requirements for listing, are consistent with the criteria for *Grey Box Grassy Woodland and Derived Native Grasslands of South-Eastern Australia* as listed under the EPBC Act. These areas have a predominantly native understorey and are of sufficient size to be classified as the EPBC Act listed form of the community. The area of this community to be removed is 2.54 hectares.

Corben's Long-eared Bat was not recorded in the proposal site during surveys. However, the species may use the proposal site for foraging and breeding. The proposal would remove 7.49 hectares of native woodland from associated PCTs that provide potential habitat for the species. There are over 90 hectares of similar native woodland habitat in the adjacent patches of vegetation within the buffer area that provide potential habitat for the Corben's Long-eared Bat. The habitat to be removed, therefore represents only a minor fraction of the potential habitat for the species in the study area (less than one percent in the surrounding buffer area). This is an even smaller fraction of the potential alternative habitat within the locality.

The Superb Parrot was recorded during the survey period for the E44 Rocklands Project, in woodland adjacent to the proposal site. The proposal would remove 9.72 hectares of native woodland from associated PCTs that provide potential foraging and movement habitat for the species. There are over 90 hectares of similar native woodland habitat in the adjacent patches of vegetation within the buffer area that provide known habitat for the Superb Parrot. The habitat to be removed, therefore represents only a minor fraction of the potential habitat for the species in the study area (less than two percent in the surrounding buffer area). This is an even smaller fraction of the potential alternative habitat within the locality.

The Grey-headed Flying-fox was not recorded in the proposal site or study area during surveys. However the regional population of this highly mobile species likely to use the proposal site for foraging habitat on occasion. The proposal would remove 2.23 hectares of native woodland from associated PCTs that provide potential foraging habitat for the species. There are over 90 hectares of similar native woodland habitat in the adjacent patches of vegetation within the buffer area that provide potential habitat for the Grey-headed Flying-fox. The habitat to be removed, therefore represents only a minor fraction of the potential habitat for the species in the study area (less than one percent in the surrounding buffer area). This is an even smaller fraction of the potential alternative habitat within the locality.

In general, the habitat to be removed for these species provides limited value given its fragmentation and location next to an existing operational mine. In the context of potential habitat in the locality, better quality habitat is present in areas outside the proposal site and study area boundary.

Assessments of significance of impacts on these MNES have been prepared in accordance with the '*Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999*' (DotE, 2013) and are provided in Appendix E.

Given the small area of direct impacts on native vegetation that has the potential to provide habitat for these MNES in the context of the alternative potential habitat in the surrounding study area and locality, the proposal is unlikely to constitute a significant impact, and no further assessment or approval of the proposal under the EPBC Act is likely to be required.

The occurrence of PCT 56 within the proposal site does not meet the key diagnostic characteristics in the listing advice for *Poplar Box Grassy Woodland on Alluvial Plains* as listed under the EPBC Act and therefore was not assessed further.

The occurrence of PCT 277 within the proposal site does not meet the key diagnostic characteristics in the listing advice for *White Box Yellow Box Blakey's Red Gum Grassy Woodland* as listed under the EPBC Act and therefore was not assessed further.

9. Mitigation and management of impacts

9.1 Mitigation of impacts

Construction of the proposal would be done according to the guidelines and protocols within Northparkes Environmental Management System (EMS). The EMS includes industry-standard measures for the management of soils, surface water, weeds and pollutants as well as pre-clearing procedures for fauna habitat resources such as hollow-bearing trees. Implementation of the EMS will assist in preventing indirect impacts such as erosion, weed transmission and water pollution within the mine site and adjacent areas.

In order to address the potential impacts of the proposal on biodiversity, the mitigation measures outlined in Table 28 would be implemented. No adaptive management actions are proposed.

Table 28 Mitigation measures

Timing	Mitigation measures	Responsible party	Risk of residual impact
Pre-construction / clearing	Continued implementation of established pre-clearance protocols for Northparkes Mines Step Change Project	Construction contractor/ Site ecologist	Low
	Ensure all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the site and protection measures to be implemented to protect biodiversity.	Construction contractor/ Site ecologist	Low
	Use of and regular inspection and maintenance of erosion and sediment control measures.	Construction contractor	Low
	Fence off or mark trees and areas of native vegetation to be retained, to avoid additional impacts on vegetation. Fencing should protect the entire Tree Protection Zone (a general 5 metre buffer zone will be applied, which is sufficient for the tree sizes present).	Construction contractor/ Site ecologist	Low
	Appropriate buffers would be established around trees that are to be retained. Work would avoid damage to the structural root zones (SRZ) of the trees	Construction contractor/ Site ecologist	Low
Construction / clearing	Restrict stockpiles of construction materials, fill or vegetation to existing cleared areas and not within areas of adjoining native vegetation	Construction contractor	Low
	Water should be applied to stockpile areas during windy conditions	Construction contractor	Low
	Construction traffic would remain on existing roads and tracks and avoid areas of native vegetation where practicable.	Construction contractor	Low
	Continued implementation of established procedures for Northparkes Mines Step Change Project for the management of habitat features, including hollow-bearing trees	Site ecologist	Low
	Reinstatement of unstable surfaces as quickly as practicable after construction for those areas not to be directly used for proposal infrastructure	Construction contractor	Low

9.2 Remediation of the mine

At the end of the mine's life (31 December 2032) it would be decommissioned according to the Project Approval. Rehabilitation would be undertaken according to the Rehabilitation Management Plan and the Mining Operations Plan of Northparkes Mine. Northparkes Mines would remove all existing infrastructure and a rehabilitation plan would be prepared detailed the actions required to return the site to a condition considered suitably remediated.

The approved final uses of the land on which the mine operates are agriculture, native vegetation and conservation.

10. Impact Summary

10.1 Assessment of serious and irreversible impacts

Under the BC Act, a determination of whether an impact is serious and irreversible must be made in accordance with the principles set out in Section 6.7 of the BC Regulation.

The principles are aimed at capturing impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales. These impacts will:

– Cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or
– Further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or
– Impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
– Impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

The decision-maker must determine whether or not an impact on biodiversity values is likely to be a serious and irreversible impact (SAII). The framework allows for decision-makers to take into account the scale of an impact and the potential for avoidance and mitigation. These factors are weighed against the status and vulnerabilities of the potential SAII entity to ultimately determine if a proposal would result in a SAII (DPIE 2019). If there is a SAII for a State significant development, the development may be approved but the approval authority must take those impacts into consideration and determine whether there are any additional and appropriate measures that would minimise those impacts if approval is granted.

The proposal site contains one threatened ecological community that is listed as an SAII entity. The proposal would remove a small area (0.073 hectares) of planted vegetation that has been classified as Box-Gum Woodland as listed under the BC Act. Therefore, further consideration of this SAII is required and included in Table 29. No other SAII entities would be impacted by the proposal.

Table 29 Box-Gum Woodland SAII assessment

Box-Gum Woodland	
1. Current status	
a. evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal)	The National Recovery Plan (2011) estimates that about 250,729 hectares of Box-Gum Woodland still exists in NSW. Ninety-three percent of the pre-European extent of the community is estimated to have been cleared, comprising a rapid decline in the extent of the community.
b. extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by: i. change in community structure ii. change in species composition iii. disruption of ecological processes iv. invasion and establishment of exotic species v. degradation of habitat, and vi. fragmentation of habitat	According to the NSW NW Threatened Species Scientific Committee (TSSC) (2020), Box-Gum Woodland is subject to a number of threats that have caused severe declines in biotic processes and interactions throughout its range and are likely to cause continuing decline in the future, including: – Agricultural production – including the grazing of domestic stock, with less than 10 percent of the original distribution of the community likely to have avoided the long-term impacts of pastoralism. Grazing has led to a reduction in understorey species diversity and richness due to the loss of native species that are palatable and intolerant to grazing by domestic stock. Grazing also promotes the colonisation of exotic species that compete with native species. – Dryland salinity – extensive areas of the community are subject to dryland salinity which arises from elevated water

Box-Gum Woodland	
	tables and has been associated with eucalypt dieback, the death of understorey species and invasion by exotic species – Elevated soil nitrogen – as a result of the application of chemical fertilisers, which is associated with the invasion of weeds and conversion from native to exotic pasture. Eucalypt dieback is also associated with elevated soil nutrients due to increased insect attack – Fire regimes – Prolonged absence of fire may result in declines in species diversity as less competitive species are excluded. Fire promotes the regeneration of shrub species, which can alter the shrub/grass composition of the community.
c. evidence of restricted geographic distribution for the threatened species s (Principle 3, clause 6.7(2)(c) BC Regulation) presented by: i. extent of occurrence ii. area of occupancy iii. number of threat-defined locations	The TSSC (2020) estimates the communities extent of occurrence as 702,800 kilometres squared with an area of occupancy of 151,100 kilometres squared. The annual loss of the community to agriculture during 2009-2016 was estimated at 395 hectares, which increased to 654 hectares during 2016-2017 and 1,344 hectares during 2017-2018. The Community has been extensively cleared throughout its range and remnants typically are small, isolated, highly fragmented, occur in predominantly cleared landscapes and exhibit highly modified understoreys.
d. evidence that the TEC is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation)	Due to the threatened processes that have contributed to the loss and decline of the community being widespread and difficult to manage, the community has largely been permanently altered across its distribution. Agricultural practices have caused invasion of exotic flora species and fauna species such as Rabbits in addition to domestic stock. Highly invasive weed species have reduced native plant cover, which has often followed impacts by heavy grazing. These species colonise rapidly and impacts are difficult to reverse with certain native species likely to be permanently lost (TSSC 2020). Regeneration of the community following cropping activities is unlikely, with paddock trees often the only retained component.
Impact assessment	
a. the impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal: i. in hectares, and	The proposal would result in direct impacts to 0.073 hectares of Box-Gum Woodland. The community in the proposal site exists as a planting of mixed eucalypt species with PCT 277, associated with Box-Gum Woodland, being the closest fit PCT.
ii. as a percentage of the current geographic extent of the TEC in NSW	The extent of the planted community to be removed by the proposal is negligible (less than 0.0002 percent of the estimated remaining extent of the community).
b. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by: i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals	The proposed impacts on the community are negligible comprising removal of 0.073 hectares of plantings that are classified as Box-Gum Woodland. The patch of the community to be removed is not connection to any other remnant patches in the locality. the proposal would not isolate any patches of the community or otherwise lead to further environmental degradation or disruption of biotic processes of the community.
ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by: distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and	The proposal would result in the complete removal of the planting classified as Box-Gum Woodland. The study area is mostly dominated by Grey Box and Poplar Box woodland communities and therefore there is very limited Box-Gum Woodland mapped in the locality. The proposal would not impact on the connectivity or dispersal ability of patches of Box-Gum Woodland in the wider locality with no mapped Box-Gum Woodland in the buffer area of the proposal.

Box-Gum Woodland	
estimated maximum dispersal distance for native flora species characteristic of the TEC, and other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development.	
iii. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s) (Section 4.3) including the relevant composition, structure and function condition scores for each vegetation zone	The community is located entirely within vegetation zone 6. The community comprises sub-mature, planted vegetation which has been categorised as Box-Gum Woodland based on the closest fit PCT. The vegetation integrity score for the vegetation zone is 54.8, with the following condition scores: – Composition – 83.1 – Structure – 67.6 – Function – 29.3.

10.2 Impacts requiring offset

Impacts associated with the proposal that require offsetting comprise the removal of 9.72 hectares (Stages 1 and 2) of native vegetation, and associated habitat for threatened biota. Impacts within the proposal site that require biodiversity offsets are shown on

Figure 6. Impacts associated with the removal of an additional 3.38 hectares of native vegetation for Stage 3 of the proposal would require offsetting only if impacts extend beyond the Stage 2 footprint for the E22 portal.

The data from the fieldwork and mapping was entered into version 1.4.0.00 of the BAM calculator as a 'Development Assessment' to determine the number and type of biodiversity credits that would be required to offset impacts of the proposal ('Parent' case 00027634), assessment cases:

– 00027634/BAAS18127/21/00027635 – Stage 1 – E31 Precinct, TSF2
– 00027634/BAAS18127/22/00031467 – Stage 2 – E22 portal
– 00027634/BAAS18127/22/00031117 –Stage 3 – E22 portal.

The biodiversity credit reports are included in Appendix F and summarised below.

Ecosystem credits

There is 9.72 hectares of native vegetation at the proposal site that would be impacted by construction of Stages 1 and 2 of Modification 6 at the Northparkes Mine, in addition to 3.38 hectares of native vegetation associated with Stage 3 if required. It is assumed the construction and operation of the mine modification would result in the complete removal of all vegetation layers and habitat resources as follows:

– Total removal of canopy, shrubs layers and groundcover layers, i.e. zero values for compositional, structural and functional attributes, including:
  - Number of large trees
  - Stem size class
  - Regeneration
– Removal of all woody debris, i.e. zero values for fallen logs
– Removal of all leaf litter, i.e. zero values for leaf litter.

Therefore the 'future vegetation integrity score' for the six vegetation zones present was entered as 0.

Ecosystem credits that would be required to offset the impacts of the proposal are shown in Table 30.

Table 30 Ecosystem credits required to offset impacts of the proposal

Vegetation zone / PCT	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in VI score	BC Act status	Ecosystem credits required
Stage 1						
Zone 1 – 56 Poplar Box - Belah woodland on clay-loam soils on alluvial plains – degraded understorey	0.73	34.2	0	-34.2	Not listed	12
Zone 2 – 80 Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion – good	0.19	89.4	0	-89.4	EEC	8
Zone 4 – 76 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – good	1.43	50.4	0	-50.4	EEC	36
Zone 5 – 82 Western Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams - good	1.11	85.5	0	-85.5	EEC	47
Zone 6 – 277 Blakely's Red Gum – Yellow Box grassy tall	0.073	54.8	0	-54.8	CEEC	2

Vegetation zone / PCT	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in VI score	BC Act status	Ecosystem credits required
woodland of the NSW South Western Slopes Bioregion – planting						
Total credits for E31 Precinct & TSF2 buttressing (Stage 1)						**105**
Stage 2						
Zone 3 (Area 1) – 248 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey	6.19	48.7	0	-48.7	Not listed	151
Total credits for E22 portal (Stage 2)						**151**
Stage 3						
Zone 3 (Area 2) – 248 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey	3.38	48.7	0	-48.7	Not listed	82
Total additional credits for E22 portal (Stage 3)						**82**

Species credits

The Grey-crowned Babbler and Superb Parrot were recorded in habitat adjacent to the proposal site during field surveys for the E44 Rocklands Project and are confirmed predicted threatened species for this assessment. Major Mitchell's Cockatoo was recorded in habitat adjacent to the proposal site and is also a confirmed predicted threatened species. The ecosystem credits listed above would offset the removal of foraging habitat for these species and breeding habitat for the Grey-crowned Babbler as it is not a dual credit species. The Superb Parrot and Major Mitchell's Cockatoo are dual credit species, being credit species for their breeding habitat. No evidence of breeding, including breeding behaviour or breeding pairs was exhibited during field surveys for these species during current surveys or surveys for the E44 Rocklands Project in adjacent habitat during the nominated survey period, within the proposal study area or the study area for the E44 Rocklands Project, which covers an extensive area. Therefore, no species credits are required. No species credits are required for any threatened candidate flora or fauna species.

10.3 Impacts not requiring offset

Offsets are not required for impacts on non-native vegetation, or land classed as Category 1 – Exempt Land (refer to BAM Section 1.5.1). No credits were calculated for predominantly exotic grassland, cropping and land classed as Category 1 – Exempt Land, including low conservation value grasslands, as confirmed by the Interim GGAM Calculator.

10.4 Options to meet offset obligations / approach to delivering offsets

In accordance with the offset rules established by the *Biodiversity Conservation Regulation 2017* there are various means by which offset obligations described in Section 10.1 can be met. These include:

– Retiring the appropriate credits from an established stewardship site
– Monetary payment directly into the Biodiversity Conservation Trust Fund, or
– Funding an approved biodiversity action. Funding a biodiversity action may be available as a last resort, subject to consultation with approval authorities, if all other options are determined to be unsuitable.

Existing biodiversity credits

Should Northparkes Mines opt to offset the residual impacts of the proposal by securing and retiring appropriate credits from stewardship site/s, these must fit within the trading rules of the BOS in accordance with the 'like for like' report generated by the credit calculator. The like for like trading rules for the ecosystem credits required for the proposal are summarised in Table 31. Species credits may be offset with the same species credits available anywhere within NSW. If such credits are unavailable, credits would be sourced in accordance with the 'variation report' generated by the BAM calculator.

The staging of the construction of the E22 portal area has been proposed with the aim of avoiding impacts to the Stage 3 area if possible. Credits for Stages 1 and 2 are associated with the known impacts for the construction of the proposal and would be retired according to the associated credit reports prior to commencement of disturbance in the respective stage areas. Impacts to the Stage 3 area are potentially able to be avoided during the detailed design process. Credits for Stage 3 would only be retired should impacts exceed the Stage 2 area and would be retired according to the Stage 3 credit report if required.

Table 31 'Like for like' ecosystem credits required to offset impacts of the proposal

Credit class	Any PCT in the below class	And in any of the below trading groups	Containing hollow-bearing trees	In the below IBRA subregions
Credit classes for PCT 56	Floodplain Transition Woodlands (includes PCTs 56, 74, 76, 80, 81, 82, 237, 244, 248, 251, 628)	Floodplain Transition Woodlands ≥70% and <90% cleared group (including Tier 2 or higher threat status)	Yes	Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee Or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.
Credit classes for PCT 80	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (includes PCTs 76, 80, 82, 101, 110, 237, 248)	-	Yes	
Credit classes for PCT 248	Floodplain Transition Woodlands (includes PCTs 56, 74, 76, 80, 81, 82, 237, 244, 248, 251, 628)	Floodplain Transition Woodlands ≥70% and <90% cleared group (including Tier 2 or higher threat status)	Yes	
Credit classes for PCT 76	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (includes PCTs 76, 80, 82, 101, 110, 237, 248)	-	Yes	
Credit classes for PCT 82			Yes	
Credit classes for PCT 277	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands (refer Appendix F for included PCTs).		No	

Proposed swap area

Northparkes have identified a 2.78 hectare area of retained vegetation within the existing approved operational area for which a previous offset obligation has been discharged (refer Figure 6). The existence of this area and the potential to use it for discharging part of the offset obligation for this proposal has been previously discussed with DPIE. This area of woodland would be removed from the approved disturbance footprint and the 'saved' offsetting obligations related to this area no longer being impacted by the project is proposed to be swapped for part of the offset obligation for the current proposal. Three vegetation integrity plots were sampled during the survey period for the proposal to confirm the condition of the vegetation. The BAM calculator was used to determine the vegetation integrity score and estimated amount of credits that would have been required to offset impacts in this area and that could be discounted from the biodiversity credit obligation for the proposal (refer Table 32).

Table 32 Proposed swap area characteristics and impact area credits required

PCT	Area (ha)	Vegetation integrity score	Ecosystem credits
Proposed swap area			
80 – Western Grey - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion – good	2.78	72.7	101
Impact area zones suitable for trading (Stage 1 only)			
Zone 1 – 56 Poplar Box - Belah woodland on clay-loam soils on alluvial plains – degraded understorey	0.73	34.2	12
Zone 2 – 80 Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion – good	0.19	89.4	8
Zone 4 – 76 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – good	1.43	50.4	36
Zone 5 – 82 Western Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams - good	1.11	85.5	47
Total Stage 1 credit requirements (zones 1, 2, 4, 5)			**103**

The like-for like options for this PCT (refer Table 31) mean that PCT 80 can be used to offset impacts on PCT 56, 76, 80 and 82 as occur in the proposal site. Comparison of the impact areas and required ecosystem credits indicate the credits associated with the proposed swap area could be used to discount 101 credits out of the total 103 Stage 1 ecosystem credit requirements from zones 1,2,4 and 5. An overview of the total offset obligation verses the offset obligation using the swap area is shown in Table 33.

Table 33 Total offset obligation vs offset obligation using swap area

Proposal Stage 1	Offset obligation (credits)
Stage 1 (E31 and TSF2 areas)	105
Stage 1 (E31 and TSF2 areas) less swap area credits	4
Stage 2 (E22 Portal)	151
Stage 3 (E22 Portal)	82

Payment into the Biodiversity Conservation Fund

A payment to the Biodiversity Conservation Fund (BCF) could be considered if a suitable number and type of biodiversity credits could not be secured.

Appendix H presents the estimated cost of BCF payments for the proposal. The price per credit was obtained from the biodiversity offset payment calculator (BOPC) which is the tool currently used by the BCT to determine BCF payment amounts. It should be noted that the BCT is currently undertaking a review of the BCF payment system and exploring alternatives to the current BOPC system. BCF payments will be determined on a non-negotiable,

case-by-case basis once an application is made by a proponent. The payment amounts presented within this report were calculated using the BOPC on 15 November 2021 and are included in Appendix H.

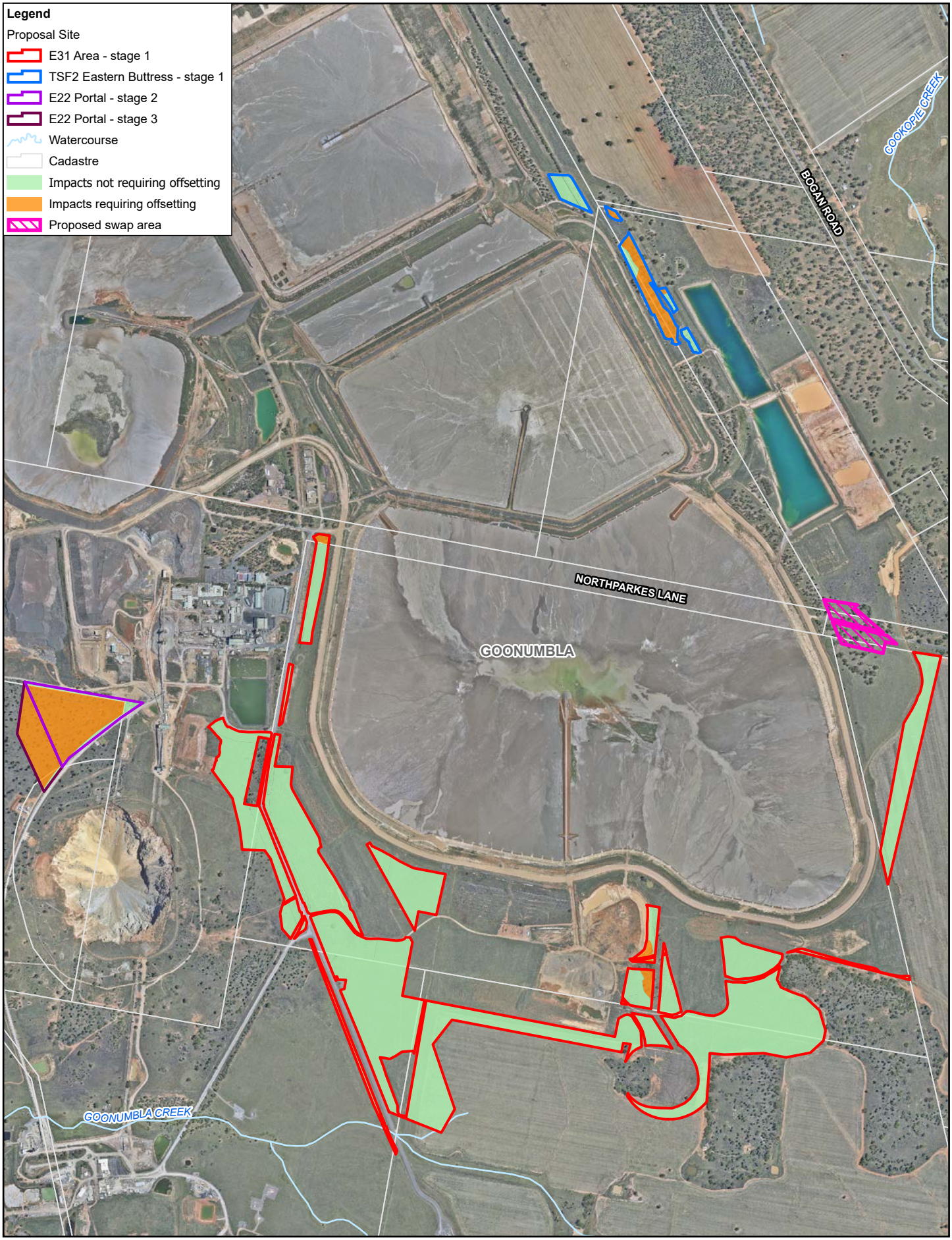
10.5 Offsets for impacts on MNES

Under the bilateral agreement, only one decision including conditions on approval is made by NSW, accounting for impacts to MNES occurring in NSW. Specific consideration of the assessment, approval and offsetting requirements for MNES under the bilateral agreement is only required for controlled actions. Offsets are required for any significant residual impacts on MNES, according to the requirements of the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy October 2012* (EPBC Act Offsets Policy) (DSEWPaC, 2012).

The proposal would remove habitat for the following MNES listed under the EPBC Act:

– 2.54 hectares of *Grey Box Grassy Woodland and Derived Native Grasslands of South-Eastern Australia* (represents less than one percent of the potential mapped habitat in the study area – refer Figure 3)
– 7.49 hectares (10.87 hectares including Stage 2) of potential Corben's Long-eared Bat habitat from associated PCTs (represents less than two percent of the potential mapped habitat in the study area – refer Figure 3)
– 1.43 hectares of assumed presence habitat for Spiny Peppercress (represents less than one percent of the potential mapped habitat in the study area – refer Figure 3)
– 9.72 hectares (13.11 hectares including Stage 2) of potential Superb Parrot foraging habitat from associated PCTs (represents less than two percent of the potential mapped habitat in the study area – refer Figure 3)
– 2.23 hectares of potential Grey-headed Flying-fox foraging habitat from associated PCTs (represents less than one percent of the potential mapped habitat in the study area – refer Figure 3).

The assessments of significance prepared for the EEC Grey Box Woodland, and the vulnerable Superb Parrot, Corben's Long-eared Bat, Spiny Peppercress and Grey-headed Flying-fox indicated that the proposal is unlikely to have a significant impact on these MNES due to the limited removal of habitat in the context of the alternative habitat in the surrounding study area and locality. The proposal is unlikely to remove any important habitat for these species. Therefore, no offsets would be required under the EPBC Act.



Paper Size ISO A4

0 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Northparkes Mines
Biodiversity Development Assessment Report
Modification 6

Project No. **12551921**
Revision No. **0**
Date **09/03/2022**

Areas requiring offsets

Figure 6

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Print date: 09 Mar 2022 - 17:41

Data source: CMOC: Disturbance Bdy, Aerial Imagery 2021, LPI: DTDB / DCDB, 2017; . Created by: fmackay

11. Conclusion

Northparkes Mines proposes to make changes to the existing E31 and E31N open cut pits that are currently approved under PA 11_0060, south of the Rosedale TSF, located about 27 kilometres north-west of Parkes. Additionally, the proposal also includes construction of a new portal for the E22 underground mining area and Tailings Storage Facility 2 (TSF2) embankment buttressing to reinforce the TSF2. The proposal is known as Modification 6 of the existing approval.

The majority of the study area has been cleared and used for agriculture. The proposal site has been predominantly cleared and cultivated and comprises cropland and grassland dominated by exotic species. Remnant woodland is generally limited to small isolated patches adjacent to mine workings and agricultural land. Patches of woodland dominated by Grey Box have retained a groundcover dominated by native species, despite the relatively small patch sizes and surrounding disturbance from mine workings and agriculture. There are scatted native groundcover species occurring throughout the Poplar Box dominated woodland, E22 Portal area and exotic low conservation value grassland areas.

PCT 76, 80 and 82 comprise a local occurrence of the *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* which is listed as an endangered ecological community (EEC) under the BC Act. Areas of woodland containing a canopy dominated by Grey Box, and that are greater than 0.5 hectares in size to meet the minimum size requirements for listing, are consistent with the criteria for listing as the EEC form of *Grey Box Grassy Woodland and Derived Native Grasslands of South-Eastern Australia* listed under the EPBC Act. These areas have a predominantly native understorey and are of sufficient size to be classified as the EPBC Act listed form of the community. The area of this community to be removed is 2.54 hectares from a total 9.72 hectares of native vegetation in the proposal site.

Three threatened fauna species listed under the *Biodiversity Conservation Act 2016* (BC Act) were recorded during surveys in the study area for the proposal and during surveys for the E44 Rocklands Project in similar habitat types; the Grey-crowned Babbler, which is an ecosystem credit species, and the Superb Parrot and Major Mitchell's Cockatoo, which are a dual credit species, with species credits required for breeding habitat. No evidence of breeding was recorded during field surveys for these species during the nominated survey period in the proposal site and wider study area, therefore no species credits were calculated.

The location and layout of the proposal was purposefully designed to avoid or minimise impacts to biodiversity values and especially threatened biota. Large areas of remnant woodland vegetation in better condition than that which is in the proposal site were avoided with placement of key features outside of these areas, generally within already cleared and disturbed areas. The placement of stockpiling areas to the west of the access road has purposefully minimised biodiversity impacts by avoiding remnant paddock trees (pre-1990) and an area of regrowth around some of these trees. This area has been located within currently approved operational areas or land assessed as being Category 1 – Exempt Land. A range of mitigation measure areas are also proposed, including protection of vegetation to be retained and salvage of resident fauna and habitat resources from within clearing areas

The following ecosystem credits would be required to offset the residual impacts of the proposal:

– 12 credits for Zone 1 – PCT 56 Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW – degraded
– 8 credits for Zone 2 – PCT 80 Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion – good
– 151 credits for Zone 3 (Stage 1) – PCT 248 Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey
– 36 credits for Zone 4 – PCT 76 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions – good
– 47 credits for Zone 5 – PCT 82 Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion – good
– 2 credits for Zone 6 – PCT 277 Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion – planting

No species credits are required for any candidate threatened flora or fauna species.

Up to 101 of the calculated 103 ecosystem credits associated with Stage 1 impacts to PCTs 56, 76, 80 and 82 can be satisfied though the removal of an undisturbed 2.78 hectare area of PCT 80 from the existing approved disturbance footprint. Residual Stage 1 credits after allowance for the swap area are 2 credits for PCT 56,76,80 or 82 and 2 credits for PCT 277 (i.e. a combined total of 4 credits). Credit requirements for the proposal are summarised below.

Proposal Stage	Offset obligation (credits)
Stage 1 (E31 and TSF 2 areas)	105
Stage 1 (E31 and TSF2 areas) less swap area credits	4
Stage 2 (E22 Portal)	151
Stage 3 (E22 Portal)	82

Credits associated with the E22 portal works (Stages 2 and 3) would be retired separately and subject to disturbance in each of these areas. Should any additional disturbance for the E22 portal be required in excess of Stage 2, credits for Stage 3 (Zone 3 Area 2) would need to be retired. These credits total 82 ecosystem credits for Stage 3 and are associated with PCT 248 Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW – degraded understorey.

No credits were calculated for exotic grassland, cleared areas and land mapped as Category 1 – Exempt Land as offsets are not required for impacts on non-native vegetation that does not provide habitat for threatened species or Category 1 land.

There would be potential impacts on EEC (*Grey Box* (Eucalyptus microcarpa) *Grassy Woodland and Derived Native Grasslands of South-Eastern Australia*) and three species listed as vulnerable species under the EPBC Act (Corben's Long-eared Bat, Superb Parrot and Grey-headed Flying-fox). Given the limited value of habitat to be removed, its location adjacent to an existing operational mine, relatively small area of direct impacts on this community and habitat for the threatened species in the context of the alternative potential habitat in the surrounding study area and locality, the proposal is unlikely to constitute a significant impact. No further assessment or approval or provision of biodiversity offsets is required under the EPBC Act.

There is no aquatic habitat in the proposal site that would likely provide habitat for aquatic species or biota dependent on wetland habitats. Drainage lines adjacent to the proposal site are highly disturbed, located within a cropped paddock and adjacent to the existing access road, and contain no fringing and emergent vegetation. They do not constitute key fish habitat and would not provide potential habitat for threatened fish listed under the FM Act.

Construction works associated with the proposal would be carried out according to the guidelines and protocols within Northparkes Environmental Management System (EMS). The EMS includes industry-standard measures for the management of soils, surface water, weeds and pollutants.

12. References

BOM (2021a). "Atlas of Groundwater Dependant Ecosystems." from http://www.bom.gov.au/water/groundwater/gde/map.shtml.

BOM (2021b). "Climate Data Online." from http://www.bom.gov.au/climate/averages/tables/cw_065068.shtml.

Baker-Gabb, D. (2011). NON-CURRENT National Recovery Plan for the Superb Parrot Polytelis swainsonii. Department of Sustainability and Environment, Melbourne. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-superb-parrot-polytelis-swainsonii. In effect under the EPBC Act from 21-Apr-2011. Ceased to be in effect under the EPBC Act from 01-Oct-2021.

Carter, O. (2010). National Recovery Plan for the Spiny Peppercress Lepidium aschersonii. Department of Sustainability and Environment, Melbourne. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-spiny-peppercress-lepidium-aschersonii. In effect under the EPBC Act from 13-Aug-2010.

DAWE (2021a). "Protected Matters Online Search Tool." from http://www.environment.gov.au/arcgis-framework/apps/pmst/pmst.jsf.

DAWE (2021b), Species Profile and Threats Database. Department of Agriculture, Water and the Environment, online database, URL: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl.

DAWE (2021c) *Species Profile and Threats Database -Superb Parrot.* Department of Agriculture, Water and the Environment.

DAWE (2021d) *Species Profile and Threats Database -Grey-headed Flying Fox.* Department of Agriculture, Water and the Environment.

DAWE (2021e) *Species Profile and Threats Database -Lepidium aschersonii.* Department of Agriculture, Water and the Environment.

DEC (2004). *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)*. New South Wales Department of Environment and Conservation, Hurstville, NSW.

DECC (2008a). *Descriptions for NSW (Mitchell) Landscapes Version 2*. Based on descriptions compiled by Dr. Peter Mitchell. NSW Department of Environment and Climate Change.

DECC (2008b). *NSW (Mitchell) Landscapes Version 3*. NSW Department of Environment and Climate Change.

DECC (2009). *The BioBanking Assessment Methodology*. NSW Department of Environment and Climate Change.

DECCW (2009) *Draft National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus*. Prepared by Dr Peggy Eby. Department of Environment, Climate Change and Water NSW, Sydney

DEWHA (2008a). *Directory of Important Wetlands Spatial Database including Wetlands Type and Criteria*. Australian Government Department of the Environment Water Heritage and the Arts.

DEWHA (2011) *Survey guidelines for Australia's threatened mammals – Guidelines for detecting mammals listed as threatened under the Environmental Protection and Biodiversity Conservation Act 1999.* Australian Government Department of the Environment Water Heritage and the Arts.

DEWHA (2010) *Survey guidelines for Australia's threatened birds – Guidelines for detecting birds listed as threatened under the Environmental Protection and Biodiversity Conservation Act 1999.* Australian Government Department of the Environment Water Heritage and the Arts.

DLWC (2002). *The NSW State Groundwater Dependent Ecosystem policy: A component policy of the NSW State Groundwater Policy Framework Document*. New South Wales Department for Land and Water Conservation.

DotE (2013). *Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999*. Australian Government Department of the Environment, Canberra.

DPI (2007). "Key Fish Habitat maps." from https://www.dpi.nsw.gov.au/fishing/habitat/publications/pubs/key-fish-habitat-maps.

DPI (2013). *Policy and guidelines for fish habitat conservation and management. Update 2013*. NSW Department of Primary Industries.

DPIE (2016), *Central West / Lachlan Region v1.4, 2016 VIS-ID 4468 State Vegetation Type Mapping*, State Government of NSW and Department of Planning, Industry and Environment.

DPIE (2019). *Guidance to assist a decision-maker to determine a serious and irreversible impact*. NSW Department of Planning, Industry and Environment.

DPIE (2020a). *Biodiversity Assessment Method*. NSW Department of Planning, Industry and Environment.

DPIE (2020b), *Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method*. Department of Planning, Industry and Environment.

DPIE (2020c), *NSW survey guide for threatened frogs – A guide to the survey of threatened frogs and their habitats for the Biodiversity Assessment Method*. Department of Planning, Industry and Environment.

DPIE (2021a), NSW Bionet Threatened Biodiversity Profile Data Collection. Department of Planning, Industry and Environment, online database. URL https://data.gov.au/dataset/ds-nsw-9125a0e2-a575-40d4-83b0-45d985420d0e/details?q=

DPIE (2021b). "Biodiversity Assessment Method Calculator Version 1.3.0.00." from BAM Calculator (nsw.gov.au)

DPIE (2021c), Atlas of NSW Wildlife database – licensed data for Parkes local government area, Department of Planning, Industry and Environment.

DPIE (2021d), Threatened Species: Species, Populations and Ecological Communities of NSW. Department of Planning, Industry and Environment, online database. URL:http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx.

DPIE (2021e). "NSW BioNet Vegetation Classification." Department of Planning, Industry and Environment, online database. URL:http://www.environment.nsw.gov.au/NSWVCA20PRapp/default.aspx.

DSE (2011), *National Recovery Plan for the Superb Parrot Polytelis swainsonii.* State of Victoria Department of Sustainability and Environment, on behalf of the Australian Governement. URL: National Recovery Plan for the Superb Parrot Polytelis swainsonii (environment.gov.au)

DSEWPaC (2012). *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy. October 2012*. Australian Government Department of Sustainability, Environment, Water, Population and Communities, Canberra.

DEWHA (2010). *Approved Conservation Advice for the Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-east Australia*. Canberra, ACT: Department of the Environment, Water, Heritage and the Arts. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/86-conservation-advice.pdf. In effect under the EPBC Act from 01-Apr-2010.

Higgins, P.J. (1999). Handbook of Australian, New Zealand & Antarctic Birds. Volume 4, Parrots to Dollarbird. Oxford University Press.

OEH (2016a). "South Western Slopes - subregions." *South Western Slopes*, from South Western Slopes - subregions | NSW Environment, Energy and Science

OEH (2016b). " South Western Slopes - regional history." *South Western Slopes Bioregion*, from South Western Slopes - regional history | NSW Environment, Energy and Science

OEH (2016c). " South Western Slopes - biodiversity." *South Western Slopes Bioregion*, from South Western Slopes - biodiversity | NSW Environment, Energy and Science

OEH (2017). *Biodiversity Assessment Method Calculator Users Guide*. NSW Office of Environment and Heritage.

OEH (2021) *Threatened Species: Grey-headed Flying-fox – profile.* Office of Environment and Heritage.NSW. URL: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10697

OEH (2021b) *Threatened Species: Corbens Long-eared Bat – profile.* Office of Environment and Heritage.NSW.

OEH (2021c) *Threatened Species: Lepidium aschersonii – profile.* Office of Environment and Heritage.NSW. URL: Corben's Long-eared Bat - profile | NSW Environment, Energy and Science

RBGT (2021). "PlantNET - The Plant Information Network System of The Royal Botanic Gardens and Domain Trust, Sydney, Australia." from http://plantnet.rbgsyd.nsw.gov.au.

TSSC (2010). *Commonwealth Listing Advice on Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia*. Threatened Species Scientific Committee -Department of the Environment, Water, Heritage and the Arts. Canberra, ACT: Department of the Environment, Water, Heritage and the Arts. *Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/86-listing-advice.pdf.* In effect under the EPBC Act from 01-Apr-2010.

TSSC (2016). Conservation Advice Polytelis swainsonii superb parrot. Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/738-conservation-advice-05052016.pdf. In effect under the EPBC Act from 02-May-2016.

TSSC (2015). Conservation Advice Nyctophilus corbeni south-eastern long-eared bat. Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/83395-conservation_advice-01102015.pdf. In effect under the EPBC Act from 01-Oct-2015.

Turbill, C. & M. Ellis (2006). Distribution and abundance of the south eastern form of the Greater Long-eared Bat Nyctophilus timoriensis. Australian Mammalogy. 28:1-7.

Webster, R. (1988). The Superb Parrot: a survey of the breeding distribution and habitat requirements. Australian National Parks & Wildlife Service, Canberra

Appendices

Appendix A

Likelihood of occurrence of threatened and migratory biota

Likelihood of occurrence and impact

An evaluation of the likelihood and extent of impact to threatened and migratory fauna recorded from within the Parkes Shire Council (BC Act threatened species); and within a 10-kilometre radius of the proposal site (EPBC Act threatened and migratory species). Records are from the EPBC Environmental Reporting Tool available from the Department of Agriculture, Water, and the Environment (DAWE) website, the NSW Bionet Atlas search for threatened species, and from the BAM calculator. Ecology information has been obtained from the Threatened Species Profiles on the NSW OEH website (http://www.environment.nsw.gov.au/threatenedspmajorecies/) and from the Species Profiles and Threats Database on the Commonwealth DAWE website (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl).

Status

- National - Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
- NSW - *Biodiversity Conservation Act 2016*
- E - Endangered
- CE - Critically Endangered
- EP - Endangered population
- V - Vulnerable
- Mi - Migratory

Likelihood of occurrence in study area

Recorded – The species was observed in the study area during the current survey

High – It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e., for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (within 10 kilometres) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration

Moderate – Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e.. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded

Low – It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (within 10 kilometres). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded

None – Suitable habitat is absent from the study area.

Likelihood of impact

Unlikely impact - The project would have a low possibility of impact on this species/community or its habitats..

Likely impact - The project could impact on this species/community and its habitat.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
Ecological community						
Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	E	-	Bionet Atlas search (BCD, 2021)	Community occurs on brown loam or clay, alluvial or colluvial soils on prior streams and abandoned channels or slight depressions on undulating plains or flats of the western slopes. Community often occurs upslope from River Red Gum communities above frequently inundated areas of the floodplain. It also occurs on colluvium soils on lower slopes and valley flats. Occurs on alluvial soils of the South West Slopes, Brigalow Belt South and Darling Riverine Plains Bioregions. Mainly in the Dubbo-Narromine-Parkes-Forbes area.	**None** This community is known to occur in the locality, however was not recorded within the development site. This community will not be impacted by the project
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	E	E	Predicted to occur using the PMST (DAWE, 2021) and Bionet Atlas search (BCD, 2021)	Inland Grey Box Woodland occurs predominately within the Riverina and South West Slopes regions of NSW down to the Victorian border. It includes Albury to the east and may extend out west towards Hay. This community also extends across the slopes and plains in Central and Northern NSW up to the Queensland Border. This includes Yetman and Inverell in the North, Molong to the east of the Central Slopes and plains and out towards Nymagee to the west. Inland Grey Box Woodland occurs on fertile soils of the western slopes and plains of NSW. The community generally occurs where average rainfall is 375- 800 mm pa and the mean maximum annual temperature is 22- 26°C. There is a correlation between the distribution of *Eucalyptus microcarpa* communities and soils of Tertiary and Quaternary alluvial origin, largely corresponding with the Red Brown Earths.	**Recorded** This community was recorded in the development site and would be impacted by the proposal. In total, 2.54 hectares of the community would be removed by the proposal.
Mallee and Mallee-Broombush dominated woodland and shrubland, lacking Triodia, in the NSW South Western Slopes Bioregion	Mallee and Mallee-Broombush dominated woodland and shrubland, lacking Triodia, in the NSW South Western	CE	-	Bionet Atlas search (BCD, 2021)	Mallee and Mallee-Broombush dominated woodland and shrubland, lacking Triodia, in the NSW South Western Slopes has a very highly restricted distribution, with known occurrences falling with a region of less than 4000 km2 bounded by Lake Cowal - Temora - Ardlethan - Ungarie.It is estimated that the total area remaining is around 2300 hectares within the local government areas of Bland and Temora. Most remaining areas are on private property or within roadside easements, though small areas are known from the following Natures Reserves: Buddigower, The	**None** This community was not recorded in the study area, and would not be impacted by the proposal

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
	Slopes Bioregion				Charcoal Tank, portions of South West Woodland (former Blue Mallee Flora Reserve and State Forest and Wyalong State Forest) and possibly Big Bush.	
Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	E	E	Predicted to occur using the PMST (DAWE, 2021) and Bionet Atlas search (BCD, 2021)	This ecological community is characterised by the dominance of Weeping Myall (Acacia pendula). The community is typically scattered across the eastern parts of the alluvial plains of the Murray-Darling river system. Typically, it occurs on red-brown earths and heavy textured grey and brown alluvial soils within a climatic belt receiving between 375 and 500 mm mean annual rainfall. The structure of the community varies from low woodland and low open woodland to low sparse woodland or open shrubland, depending on site quality and disturbance history. This EEC is known from parts of the Local Government Areas of Berrigan, Bland, Bogan, Carrathool, Conargo, Coolamon, Coonamble, Corowa, Forbes, Gilgandra, Griffith, Gwydir, Inverell, Jerilderee, Lachlan, Leeton, Lockhart, Moree Plains, Murray, Murrumbidgee, Narrabri, Narranderra, Narromine, Parkes, Urana, Wagga Wagga and Warren, and but may occur elsewhere in these bioregions.	**None** This community is known to occur in the locality, however was not recorded within the project site, and will not be impacted by the project
Poplar Box Grassy Woodland on Alluvial Plains		-	E	Predicted to occur using the PMST (DAWE, 2021	This ecological community is comprised of native grassy eucalypt woodland where poplar/ Bimble Box is the main tree canopy species present. Other tree species may occasionally occur depending on the characteristics of the site, these include *Callitris glaucophylla* (White Cypress Pine), *Casuarina cristata* (Belah), *Eucalyptus coolabah* (Coolibah), *Eucalyptus largiflorens* (Black Box), *Eucalyptus melanophloia* (Silver-Leaved Ironbark), *Eucalyptus microcarpa* (Inland Grey Box) and *Eucalyptus pilligaensis* (Narrow-Leaved Grey Box). This community mostly occurs as scattered patches inland of the Great Dividing Range in New South Wales and Queensland, within the Brigalow Belt North, Brigalow Belt South, Cobar Peneplain, Darling Riverine Plains, NSW South Western Slopes and Riverina IBRA bioregions.	**Low** Poplar Box Woodland occurs in the project site, and would be impacted by the project. However, Poplar Box Woodland within the site does not meet the key diagnostic characteristics in the listing advice for the community and is therefore not a TEC in the proposal site.
Sandhill Pine Woodland in the Riverina, Murray-	Sandhill Pine Woodland in the Riverina,	E	-	PMST (DAWE, 2021)	Sandhill Pine Woodland has been recorded in the far south-western portion of the NSW South Western Slopes bioregion near Urana, extending through the	**None**

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
Darling Depression and NSW South Western Slopes bioregions	Murray-Darling Depression and NSW South Western Slopes bioregions				Riverina bioregion, from the Urana – Narranderra district in the east, into the southern part of the Murray-Darling Depression bioregion, as far west as the South Australian border. In the Riverina bioregion and the far south-western portion of the NSW South Western Slopes bioregion, the community is typically associated with prior streams and aeolian source-bordering dunes, which are scattered within an extensive alluvial clay plain dominated by chenopod shrublands. Sandhill Pine Woodland typically occupies red-brown loamy sands with alkaline sub-soils on the alluvial plain of the Murray River and its tributaries, and on parts of the sandplain in south-western NSW.	This community was not recorded in the study area, and would not be impacted by the proposal
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and	CE	CE	Predicted to occur using the PMST (DAWE, 2021) and Bionet Atlas search (BCD, 2021)	Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW. Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. Commonly co-occurring eucalypts include Apple Box (*E. bridgesiana*), Red Box (*E. polyanthemos*), Candlebark (*E. rubida*), Snow Gum (*E. pauciflora*), Argyle Apple (*E. cinerea*), Brittle Gum (*E. mannifera*), Red Stringybark (*E. macrorhyncha*), Grey Box (*E. microcarpa*), Cabbage Gum (*E. amplifolia*) and others.	**Recorded** This community was recorded as a planting in the proposal stie and would therefore be impacted by the proposal. It does not however meet the diagnostic criteria for listed under the EPBC Act.
Flora						
Acacia ausfeldii	Ausfeld's Wattle			BAM calculator	Found to the east of Dubbo in the Mudgee-Ulan-Gulgong area of the NSW South Western Slopes bioregion, with some records in the adjoining Brigalow	**Low**

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					Belt South, South Eastern Highlands and the Sydney Basin bioregions. Populations are recorded from Yarrobil National Park, Goodiman State Conservation Area and there is a 1963 record from Munghorn Gap Nature Reserve. A large population is also known from Tuckland State Forest to the northwest of Gulgong.	No evidence of this species was recorded in the study are despite targeted surveys during the nominated survey period.
Androcalva procumbens	Commersonia procumbens	0	0	Predicted using the PMST (DAWE, 2021)	Mainly confined to the Dubbo-Mendooran-Gilgandra region, but also in the Pilliga and Nymagee areas and recent collections from the Upper Hunter. Grows on sandy soils, often on roadsides. Has been recorded in Tumbledown Red Gum and Mugga Ironbark communities, Broombush scrub, under mallee eucalypts with a Common Fringe-myrtle understorey, and in a recently burnt Ironbark and Callitris area. Also in *Eucalyptus fibrosa subsp. nubila*, Tumbledown Red Gum, White Box and White Cypress Pine woodlands north of Dubbo.	**Low** No suitable habitat present within proposal site
Austrostipa metatoris	A spear-grass	V	V	Predicted using the PMST (DAWE, 2021)	Most records occur in the Murray Valley with sites including Cunninyeuk Station, Stony Crossing, Kyalite State Forest (now part of Murrumbidgee Valley Regional Park) and Lake Benanee. Scattered records also occur in central NSW including Lake Cargelligo, east of Goolgowi, Condobolin and south west of Nymagee. Otherwise only known from near Bordertown in south east South Australia, where it may be locally extinct. Grows in sandy areas of the Murray Valley; habitats include sandhills, sandridges, undulating plains and flat open mallee country, with red to red-brown clay-loam to sandy-loam soils. Associated species include *Eucalyptus populnea*, *E. intertexta*, *Callitris glaucophylla*, *Casuarina cristata*, *Santalum acuminatum* and *Dodonaea viscosa*.	**Low** Species not known from the locality. No evidence of the species was recorded at the site in surveys in October and November 2020 and October 2021. Unlikely to occur due to previous and ongoing disturbance in the surrounding area during the establishment and ongoing operation of the mine site and farmed agricultural land owned by the mine
Austrostipa wakoolica	A spear-grass	E	E	4 records (BCD, 2021); Predicted using the PMST (DAWE, 2021)	Confined to the floodplains of the Murray River tributaries of central-western and south-western NSW, with localities including Manna State Forest, Matong, Lake Tooim, Merran Creek, Tulla, Cunninyeuk and Mairjimmy State Forest (now part of South West Woodland Nature Reserve). Grows on floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils; habitats include the edges of a lignum swamp with box	**Low** Proposal site is located outside the geographic limitations of the species (i.e. south of Narrandera)

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					and mallee; creek banks in grey, silty clay; mallee and lignum sandy-loam flat; open Cypress Pine forest on low sandy range; and a low, rocky rise.	
Diuris callitrophila	Oaklands Diuris	E	-	BAM Calculator	Grows in White Cypress Pine (*Callitris glaucophylla*) Woodland, either among dense grasses in flat areas with associated eucalypts, or amongst sparse grasses and forbs on low sandhills. Grows mostly on sandy loam soils.	**Low** This species nominated survey period is November, however given the favourable conditions preceding surveys with significant rainfall, other Diuris species were seen flowering earlier than their usual expected period based on annual surveys. The conditions prior to and during the survey period were determined to be suitable to detect the species if it were present. No evidence of the species was detected during surveys in October.
Diuris tricolor	Pine Donkey Orchid	V,2*	-	13 records (BCD, 2021)	Sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the north of NSW. Localities in the south include Red Hill north of Narrandera, Coolamon, and several sites west of Wagga Wagga. Condobolin-Nymagee road, Wattamondara towards Cowra, Eugowra, Girilambone, Dubbo and Cooyal, in the Central West. Pilliga SCA, Pilliga National Park and Bibblewindi State Forest in the north and Muswellbrook in the east. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Associated species include *Callitris glaucophylla*, *Eucalyptus populnea*, *Eucalyptus intertexta*, Ironbark and Acacia shrubland. The understory is often grassy with herbaceous plants such as Bulbine species.	**Low** Suitable habitat present, however no evidence of the species was recorded at the site in targeted surveys in September and October 2020 and October 2021. The species does not occur in the project site.
Eleocharis obicis	Spike-Rush	V	V	BAM Calculator	Found near Condobolin and Hay, as well as being known from an old collection from the Barrier Range near Broken Hill. The later collection was made on the Lachlan River floodplain at Micabil, near Condobolin. Grows in ephemerally wet situations such as roadside mitre drains and depressions, usually in low-lying grasslands. Sites include depressions with heavy clay soils on the Lachlan River floodplain, with *Eragrostis australasica*, *Atriplex vesicaria* and *A. nummularia* shrublands, low-lying claypans near an irrigation channel, and a shallow open ditch on a low ridge with *Eucalyptus populnea* in red sandy soil over clay.	**Low** Proposal site does not contain specific habitat constraints for the species i.e. semi-permanent/ephemeral we areas or periodically waterlogged sites.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
Lepidium aschersonii	Spiny Peppercress	V	V	BAM Calculator	Not widespread, occurring in the marginal central-western slopes and north-western plains regions of NSW (and potentially the south western plains). In the north of the State recent surveys have recorded a number of new sites including Brigalow Nature Reserve, Brigalow State Conservation Area, Leard State Conservation Area and Bobbiwaa State Conservation Area. Also known from the West Wyalong in the south of the State. Records from Barmedman and Temora areas are likely to be no longer present. Approximately 50% of the total Lepidium aschersonii recorded for Australia occurs in NSW. Found on ridges of gilgai clays dominated by Brigalow (*Acacia harpophylla*), Belah (*Casuarina cristata*), Buloke (*Allocasuarina luehmanii*) and Grey Box (*Eucalyptus microcarpa*). In the south has been recorded growing in Bull Mallee (*Eucalyptus behriana*). Often the understory is dominated by introduced plants. The species grows as a component of the ground flora, in grey loamy clays. Vegetation structure varies from open to dense, with sparse grassy understory and occasional heavy litter.	**Low** Suitable habitat present, however no evidence of the species was recorded at the site in targeted surveys in November 2020 and November 2021. The species does not occur in the project site.
Lepidium monoplocoides	Winged Peppercress	E	E	Predicted using the PMST (DAWE, 2021)	Widespread in the semi-arid western plains regions of NSW. Collected from widely scattered localities, with large numbers of historical records but few recent collections. Also previously recorded from Bourke, Cobar, Urana, Lake Cargelligo, Balranald, Wanganella and Deniliquin. Recorded more recently from the Hay Plain, south-eastern Riverina, and from near Pooncarie. Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300-500 mm. Predominant vegetation is usually an open woodland dominated by *Allocasuarina luehmannii* (Bulloak) and/or eucalypts, particularly *Eucalyptus largiflorens* (Black Box) or *Eucalyptus populnea* (Poplar Box). The field layer of the surrounding woodland is dominated by tussock grasses. Recorded in a wetland-grassland community comprising *Eragrostis australasicus*, *Agrostis avenacea*, *Austrodanthonia duttoniana*, *Homopholis proluta*, *Myriophyllum crispatum*, *Utricularia dichotoma*	**Low** Areas of suitable habitat (Poplar Box woodland) contained a degraded understory dominated by exotic species. The species is unlikely to occur in these areas and was not recorded during targeted surveys in October and November 2020 and October 2021.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					and *Pycnosorus globosus*, on waterlogged grey-brown clay. Also recorded from a *Maireana pyramidata* shrubland.	
Leptorhynchos orientalis	Lanky Buttons	E	-	BAM Calculator	Recorded from several Hay Plain and southern Riverina localities, including Willanthry east of Hillston, Zara-Wanganella via Hay, McKinley Road SW of Hillston, and "Morundah" navy land west of Buckingbong SF. A large population has most recently been recorded from Cowl Cowl Station SSW of Hillston along a TSR. Grows in woodland or grassland, sometimes on the margins of swamps. Communities include a Bimble Box plain in red-brown soil, dense Acacia pendula woodland with herbaceous understory on red clay to clay-loam, open grassland areas on red soils, and red clay plains at the edge of a Canegrass swamp.	**Low** Species not known from locality and is unlikely to occur
Prasophyllum petilum	Tarengo Leek Orchid	E,2	E	Predicted using the PMST (DAWE, 2021)	Occurs at 4 sites in NSW (Captains Flat Cemetery, Ilford Cemetery, Steves TSR at Delegate and Tarengo TSR near Boorowa). Also at Hall in ACT. Grows on relatively fertile soils in grassy woodland or natural grassland. Occurs in relatively moist, poorly drained areas.	**Low** Species not known from the locality and proposal site not within the known NSW sites
Swainsona murrayana	Slender Darling Pea	V	V	7 records (BCD, 2021); Predicted using the PMST (DAWE, 2021)	Found throughout NSW , it has been recorded in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park, near Broken Hill and in various localities between Dubbo and Moree. Occurs in grassland, herbland and open Black-box woodland. Associated with low chenopod shrubs Maireana species, wallaby-grass Austrodanthonia species and spear grass Austrostipa species. Flowers from spring to early summer. Grows on heavy grey or brown clay, loam, or red cracking clays. Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with Maireana species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated.	**Low** Suitable habitat present within the proposal site. Targeted site surveys were conducted in the proposal site in appropriate survey months during previous surveys and during suitable conditions to be able to detect the species if present during the current survey period. The species was not recorded and therefore unlikely to occur.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
Swainsona sericea	Silky Swainson-pea	V	-	3 records (BCD, 2021)	Silky Swainson-pea has been recorded from the Northern Tablelands to the Southern Tablelands and further inland on the slopes and plains. There is one isolated record from the far north-west of NSW. Its stronghold is on the Monaro. Also found in South Australia, Victoria and Queensland. Found in Natural Temperate Grassland and Snow Gum *Eucalyptus pauciflora* Woodland on the Monaro. Found in Box-Gum Woodland in the Southern Tablelands and South West Slopes.	**Low** The project site occurs outside of the species normal distribution area, and vegetation communities within the site are not typically associated with the species (Usually occurs in Box-gum woodland). The species is unlikely to occur
Tylophora linearis		V	E	Predicted using the PMST (DAWE, 2021)	Majority of records occur in the central western region. Records from Goonoo, Pillaga West, Pillaga East, Bibblewindi, Cumbil and Eura State Forests, Coolbaggie NR, Goobang NP and Beni SCA. Also has been recorded Hiawatha State Forest near West Wyalong in the south and there are old records as far north as Crow Mountain near Barraba and near Glenmorgan in the western Darling Downs. Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa*, *Eucalyptus sideroxylon*, *Eucalyptus albens*, *Callitris endlicheri*, *Callitris glaucophylla* and *Allocasuarina luehmannii*.	**Low** The project site occurs outside of the species typical range. No suitable habitat present within project site
Amphibians						
Crinia sloanei	Sloane's Froglet	V	E	BAM Calculator	Sloane's Froglet has been recorded from widely scattered sites in the floodplains of the Murray-Darling Basin, with the majority of records in the Darling Riverine Plains, NSW South Western Slopes and Riverina bioregions in New South Wales. It has not been recorded recently in the northern part of its range and has only been recorded infrequently in the southern part of its range in NSW. At a number of sites where records are verified by museum specimens, the species has not been subsequently detected during more recent frog surveys in the vicinity (e.g. Holbrook, Nyngan, Wagga Wagga and Tocumwal). The low number of sites, low number of recorded individuals per site, and the low proportion of records of this species in regional surveys all indicate that a moderately low number of mature individuals exist. The apparent loss from previous recorded sites and decline in recording rates indicates that this is not just	**Low** Species not known within the locality. There are no permanent or ephemeral wetland habitats within the proposal site or adjacent area. No evidence of the species was recorded at the site and wider study area despite targeted surveys in August.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					a rare or uncommonly encountered species, but that there has been a reduction in population size and range. It is typically associated with periodically inundated areas in grassland, woodland and disturbed habitats.	
Birds						
Actitis hypoleucos	Common Sandpiper	-	Mi	Predicted using the PMST (DAWE, 2021)	Does not breed in Australia. When in Australia it is found on all coastlines and in inland areas, but is concentrated in the north and west with important areas in WA, the NT and Qld. Utilises a wide range of coastal and inland wetlands with varying salinity levels.	**Low** No suitable aquatic habitat present within the proposal site
Anthochaera phrygia	Regent Honeyeater	CE	CE	Predicted using the PMST (DAWE, 2021)	In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	**Low** Species not known from the locality and proposal site is not within the known NSW breeding regions. No mistletoes present within the site.
Apus pacificus	Fork-tailed Swift	-	Mi	Predicted using the PMST (DAWE, 2021)	Recorded in all regions of NSW. Non- breeding, and almost exclusively aerial while in Australia. Occurs over urban and rural areas as well as areas of native vegetation.	**Low** Species not known from locality. May on occasion fly over site
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	1 record (BCD, 2021)	The Dusky Woodswallow is widespread from the coast to inland, including the western slopes of the Great Dividing Range and farther west. It is often recorded in woodlands and dry open sclerophyll forests, and has also been recorded in shrublands, heathlands regenerating forests and very occasionally in moist forests or rainforests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, often with coarse woody debris. It is also recorded in farmland, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber. The nest is an open shallow untidy cup frequently built in an open hollow, crevice or stump. Although Dusky Woodswallows have large home ranges, individuals may spend most of their time in about a 2 ha range and defend an area about 50 m	**Moderate** Proposal site contains suitable foraging habitat. Larger patches of woodland vegetation are located adjacent to the proposal site and likely to provide preferred habitat.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					around the nest. Dusky Woodswallows prefer larger remnants over smaller remnants. Competitive exclusion by Noisy Miners (Manorina melanocephala) is a significant threat to this species.	
Botaurus poiciloptilus	Australasian Bittern	E	E	Predicted using the PMST (DAWE, 2021)	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. The Species favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (Typha spp.) and spikerushes (Eleocharis spp.), it hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. The species may construct feeding platforms over deeper water from reeds trampled by the bird; platforms are often littered with prey remains.	**Low** Species not known from locality. No suitable aquatic habitat present within the proposal site.
Calidris acuminata	Sharp-tailed Sandpiper	-	Mi	Predicted using the PMST (DAWE, 2021)	Spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. In Australasia, prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. Breeds in northern Siberia.	**Low** No suitable aquatic habitat present within the proposal site
Calidris ferruginea	Curlew Sandpiper	E	Mi	Predicted using the PMST (DAWE, 2021)	The Curlew Sandpiper is distributed around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. The Curlew Sandpiper breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period, arriving in Australia between August and November, and departing between March and mid-April. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal	**Low** No suitable aquatic habitat present within the proposal site

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					swamps, lakes and lagoons on the coast and sometimes inland.	
Calidris melanotos	Pectoral Sandpiper	-	Mi	Predicted using the PMST (DAWE, 2021)	In NSW, the Pectoral Sandpiper is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. The species prefers shallow fresh to saline wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands.	**Low** No suitable aquatic habitat present within the proposal site
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	BAM Calculator	In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. In spring and summer the species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands,particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas.	**Low** No evidence of the species was recorded at the site despite targeted surveys in October and November. In addition, the PCT association for this species is a very small area of planted vegetation that the species is unlikely to utilise as habitat.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	BAM Calculator	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Inland populations feed on a wide range of sheoaks,	**Low** Woodland patches within the project site are small and isolated by the surrounding mine site and agricultural land. The areas are also subject to regular disturbance due to ongoing mine site activities and adjacent agricultural land use. It is unlikely that the species would utilise the site for breeding habitat. No evidence of the species was recorded at the site despite targeted surveys in May and August in the wider study area. Foraging habitat for the species is limited with the species known to breed near foraging resources

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					including Drooping Sheoak, *Allocasuaraina diminuta*, and *A. gymnathera*. Belah is also utilised and may be a critical food source for some populations.	
Chthonicola sagittata	Speckled Warbler^	V	-	7 records (BCD, 2021)	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	**Moderate** Species known from the locality and has been recorded during the survey period for the E44 Rocklands site. The species may occur within the project site, particularly Limestone National Forest, which provides a large area of contiguous woodland habitat preferred by the species.
Circus assimilis	Spotted Harrier	V	-	4 records (BCD, 2021)	Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Preys on terrestrial mammals (eg bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months.	**Moderate** May hunt over non-native grassland on occasion. No stick nests observed within project site.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	16 records (BCD, 2021)	Endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. Mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (Eucalyptus camaldulensis) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses. Sedentary, considered to be	**Low** The distribution of the eastern subspecies does not occur in the study area.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					resident in many locations throughout its range; present in all seasons or year-round at many sites; territorial year-round. Up to 80% of the diet is comprised of ants; other invertebrates (including spiders, insects larvae, moths, beetles, flies, hemipteran bugs, cockroaches, termites and lacewings) make up the remaining percentage; nectar from Mugga Ironbark (Eucalyptus sideroxylon) and paperbarks, and sap from an unidentified eucalypt are also eaten. Hollows in standing dead or live trees and tree stumps are essential for nesting. Breeds in pairs or co-operatively in territories which range in size from 1.1 to 10.7 ha (mean = 4.4 ha).	
Daphoenositta chrysoptera	Varied Sittella	V	-	3 records (BCD, 2021)	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.	**Moderate** Proposal site contains suitable foraging habitat. Larger patches of woodland vegetation are located adjacent to the proposal site and likely to provide preferred habitat
Falco hypoleucos	Grey Falcon	E	-	Predicted using the PMST (DAWE, 2021)	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to be extinct in areas with more than 500mm rainfall in NSW. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey.	**Moderate** May hunt over non-native grassland on occasion. Site may provide a small amount of suitable foraging habitat however no stick nests were observed within the proposal site.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
Falco subniger	Black Falcon	V	-	BAM Calculator	Mostly occurring inland NSW. Inhabits woodland, shrubland and grassland in arid and semi-arid zones including agricultural land with scattered remnant trees. Usually associated with wetlands as they look for prey, and use standing dead trees to use as lookout posts. Habitat choice is often influenced by food availability.	**Moderate** May hunt over non-native grassland on occasion. Site may provide a small amount of suitable foraging habitat, however no wetland habitat present in proposal site.
Gallinago hardwickii	Latham's Snipe	-	Mi	Predicted using the PMST (DAWE, 2021)	Latham's Snipe is a non-breeding migrant to the south east of Australia including Tasmania, passing through the north and New Guinea on passage. Latham's Snipe breed in Japan and on the east Asian mainland. Latham's Snipe are seen in small groups or singly in freshwater wetlands on or near the coast, generally among dense cover. They are found in any vegetation around wetlands, in sedges, grasses, lignum, reeds and rushes and also in saltmarsh and creek edges on migration. They also use crops and pasture.	**Low:** No suitable aquatic habitat present within the proposal site
Grantiella picta	Painted Honeyeater	V	V	Predicted using the PMST (DAWE, 2021)	Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema.	**Low** Species not known from the locality. No mistletoes present within the site.
Grus rubicunda	Brolga	V	-	BAM Calculator	The Brolga was formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. It is still abundant in the northern tropics, but very sparse across the southern part of its range. Though Brolgas often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially shallow swamps. They feed primarily on sedge roots and tuber but will also take large insects, crustaceans, molluscs and frogs. The nest comprises a platform of grasses and sticks, augmented with mud, on an island or in the water. Two eggs are laid from winter to autumn.	**Low** Species not known from locality and suitable habitat not present within proposal site.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	Mi	BAM Calculator	Distributed along the Australian coastline and well inland along rivers and wetlands, it's widespread in eastern NSW. Foraging habitat consists of coastal seas, rivers, fresh and saline lakes, lagoons, reservoirs and terrestrial habitats such as grasslands. Diet consists of waterbirds, turtles and fish. Resident pairs are territorial and occupy nesting territories of hundreds of hectares. Breeding habitat consists of large trees within mature open forest, gallery forest or woodland and reported that they avoid nesting near urban areas. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built from sticks and lined with leaves or grass.	**Low** No suitable breeding habitat. No large dams or waterways present in the area.
Hamirostra melanosternon	Black-breasted Buzzard	V	-	BAM Calculator	Distribution is sparse in areas of less than 500mm annual rainfall throughout north-western NSW, north-eastern South Australia to the east coast at Rockhampton. Occurs in a wide range of habitats, especially along timbered watercourses where it breeds. Hunts over grassland and sparsely timbered woodlands. Feeds on large eggs, small mammals, birds and reptiles. Breeds from August to October. Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands.	**Low** No suitable breeding habitat. No waterbodies, land within 40 metres of riparian woodland on inland watercourses or waterholes containing dead or dying eucalypts in the proposal site.
Hieraaetus morphnoides	Little Eagle	V	-	5 records (BCD, 2021)	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	**Moderate** May hunt over non-native grassland on occasion. Targeted surveys did not record the species and no stick nests observed within proposal site.
Hirundapus caudacutus	White-throated Needletail	-	Mi	Predicted using the PMST (DAWE, 2021)	The White-throated Needletail is widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains. A large proportion of the White-throated Needletails of the nominate subspecies would occur in Australia as non-breeding	**Low:** Species not known from locality. May on occasion fly over and forage above site, howeber this species has only been recorded in the IBRA subregion on one occasion since the year 2000 and is therefore considered a vagrant species

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					visitors. Most White-throated Needletails spend the non-breeding season in Australasia, mainly in Australia, and occasionally in New Guinea and New Zealand, though it has been suggested that some may overwinter in parts of South-East Asia. As the Needletails that occur in Australia migrate from breeding areas in the Northern Hemisphere, they would be affected by global threats.	
Lathamus discolor	Swift Parrot	E	Mi	Predicted using the PMST (DAWE, 2021)	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*.	**Low** Some suitable foraging habitat occurs within the project site and study area. The species does not breed in the locality.
Leipoa ocellata	Malleefowl	E	V	Predicted using the PMST (DAWE, 2021)	Occurs in semi-arid to arid mallee country in the south-west of NSW. Its NSW stronghold is centred on Mallee Cliffs NP, extending east to Balranald and with scattered records north to Mungo NP. There are also populations near Dubbo (Goonoo forest). Occasional records exist from the Pilliga, around Cobar and Goulburn River NP. Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300 - 450 mm mean annual rainfall) areas. Utilises mallee with a spinifex understorey, but usually at lower densities than in areas with a shrub understorey. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands with thick understorey, or in other woodlands such dominated by Mulga or native Cypress Pine species. Prefers areas of light sandy to sandy loam soils and habitats with a dense but discontinuous canopy and dense and diverse shrub and herb layers.	**Low** Species not known from locality and suitable vegetation communities not present within the proposal site.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
Lophochroa leadbeateri	Major Mitchell's Cockatoo	V	-	2 records (BCD, 2021)	In NSW Major Mitchell's Cockatoo is found across the arid and semi-arid inland and is regularly as far east as about Bourke and Griffith, and sporadically further east than that. The species inhabits a wide range of treed and treeless inland habitats, always within easy reach of water.It feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines.	**Recorded** The species was recorded adjacent to the proposal site during the survey period and is likely to utilise habitat for movement and foraging. No breeding behaviour or breeding pairs observed during targeted surveys in October and additional surveys during September and November in proposal site and wider study area. The species is unlikely to breed in the study area.
Lophoictinia isura	Square-tailed Kite	V	-	BAM Calculator	Ranges along coastal and subcoastal areas from south-western to northern Australia. Scattered records throughout NSW indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. Summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests and shows a particular preference for timbered watercourses. Observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland in arid north-western NSW.	**Low** No evidence of the species was recorded at the site despite targeted surveys in October and November. No potential nest trees for the species were identified in the proposal site or wider study area.
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	4 records (BCD, 2021)	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. However, it is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form (subspecies cucullata) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies picata. Two other subspecies occur outside NSW. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	**Moderate** Proposal site contains suitable foraging habitat. Larger patches of woodland vegetation are located adjacent to the proposal site and likely to provide preferred habitat

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	1 record (BCD, 2021)	Extends south from central Queensland, through NSW, Victoria into south eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa), Yellow Box (E. melliodora), Blakely's Red Gum (E. blakelyi) and Forest Red Gum (E. tereticornis).	**Low** Species not recently recorded from the locality. Proposal site contains marginal woodland foraging habitat. Larger patches of woodland vegetation are located adjacent to the proposal site and likely to provide preferred habitat
Motacilla flava	Yellow Wagtail	-	Mi	Predicted using the PMST (DAWE, 2021)	The Yellow Wagtail breeds in temperate Europe and Asia. They occur within Australia in open country habitat with disturbed ground and some water. Recorded in short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns.	**Low** Species not known from the locality and no suitable water present within the proposal site.
Myiagra cyanoleuca	Satin Flycatcher	-	Mi	Predicted using the PMST (DAWE, 2021)	In NSW widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests. Prefer to nest in a fork of outer branches of trees, such as paperbarks, eucalypts, and banksia. Where they breed at elevations of more than 600 m above sea level in south-eastern Australia, they breed from November to early January (Frith 1969). mainly insectivorous, preying on arthropods, mostly insects, although very occasionally they will also eat seeds. They are arboreal foragers, feeding high in the canopy and subcanopy of trees.	**Low** Species not known from the locality. Suitable heavily vegetated habitat near water not present within the proposal site.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
Ninox connivens	Barking Owl	V	-	1 record (BCD, 2021)	The Barking Owl is found throughout continental Australia except for the central arid regions. The owls sometimes extend their home range into urban areas, hunting birds in garden trees and insects attracted to streetlights. Extensive wildfires in 2019-20 reduced habitat quality further, burnt many old, hollow-bearing trees needed as refuge by prey species and reduced the viability of some regional owl populations. The species inhabit woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils. The species typically roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species.	**Moderate** Suitable foraging habitat present within the proposal site. No hollow-bearing trees in the proposal site to provide breeding habitat.
Numenius madagascariensis	Eastern Curlew	-	Mi	Predicted using the PMST (DAWE, 2021)	The Eastern Curlew is widespread in coastal regions in the north-east and south of Australia, including Tasmania, and scattered in other coastal areas. It is rarely seen inland. It breeds in Russia and north-eastern China. On passage, they are commonly seen in Japan, Korea and Borneo. Small numbers visit New Zealand. The Eastern Curlew is found on intertidal mudflats and sandflats, often with beds of seagrass, on sheltered coasts, especially estuaries, mangrove swamps, bays, harbours and lagoons.	**Low** No suitable aquatic habitat present within the proposal site
Pandion haliaetus	Eastern Osprey	V	Mi	Predicted using the PMST (DAWE, 2021)	The distribution of the species around the northern coast (south-western Western Australia to south-eastern NSW) appears continuous except for a possible gap at Eighty Mile Beach. Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia . They require extensive areas of open fresh, brackish or saline water for foraging. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes.	**Low** Species not known from locality. Suitable aquatic foraging habitat not present within/near the proposal site.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					Eastern Ospreys occur sympatrically and sometimes interact with White-bellied Sea-Eagles	
Petroica boodang	Scarlet Robin	V	-	BAM Calculator	The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps.	**Moderate** Proposal site contains suitable foraging habitat. Larger patches of woodland vegetation are located adjacent to the proposal site and likely to provide preferred habitat
Petroica phoenicea	Flame Robin	V	Mi	BAM Calculator	The Flame Robin is endemic to south eastern Australia, and ranges from near the Queensland border to south east South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense.	**Moderate** Proposal site contains suitable foraging habitat. Larger patches of woodland vegetation are located adjacent to the proposal site and likely to provide preferred habitat
Polytelis swainsonii	Superb Parrot	V	V	14 records (BCD, 2021); PMST	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. In the Riverina the birds nest in the hollows of large	**Recorded** Superb Parrot was recorded during the survey period for the E44 Rocklands Project and is likely to utilise habitat for movement and foraging. No evidence of species breeding during surveys in September, October and November. No breeding behaviour observed in proposal site or wider study area. The species is unlikely to breed in the study area.

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest.	
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	35 records (BCD, 2021)	The eastern subspecies (temporalis occurs from Cape York south through Queensland, NSW and Victoria and formerly to the south east of South Australia. This subspecies also occurs in the Trans-Fly Region in southern New Guinea. In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions.	**Recorded** Species known from the locality and was observed during the survey period for the E44 Rocklands Project. Likely to utilise habitat for breeding, movement and foraging.
Rostratula australis	Australian Painted Snipe	E	E	Predicted using the PMST (DAWE, 2021)	In NSW many records of the Australian Painted Snipe are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. The species prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	**Low** No suitable aquatic habitat present within the proposal site
Stagonopleura guttata	Diamond Firetail	V	-	5 records (BCD, 2021)	The Diamond Firetail is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Cental and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over	**Moderate** Proposal site contains suitable grassy woodland foraging habitat. Larger patches of woodland vegetation are located adjacent to the proposal site and likely to provide preferred habitat

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					the rest of NSW, though is very rare west of the Darling River. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	
Tringa stagnatilis	Marsh Sandpiper	-	Mi	Predicted using the PMST (DAWE, 2021)	The Marsh Sandpiper is found on coastal and inland wetlands throughout Australia. It is recorded in all regions of NSW but especially the central and south coasts and (inland) on the western slopes of Great Divide and western plains. The Hunter River Estuary and the Macquarie Marshes are internationally important sites for this species. The Marsh Sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes.	**Low** No suitable aquatic habitat present within the proposal site
Tyto novaehollandiae	Masked Owl	V	-	BAM Calculator	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. Lives in dry eucalypt forests and woodlands from sea level to 1100 m and often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	**Low** No evidence of the species was recorded at the site despite targeted surveys in May and August. There are only two potential nest trees within the proposal site suitable for the species.
Fish						
Maccullochella macquariensis	Trout Cod	E	E	Predicted using the PMST (DAWE, 2021)	The Trout Cod is endemic to the southern Murray-Darling river system, including the Murrumbidgee and Murray Rivers, and the Macquarie River in central NSW. The species was once widespread and abundant in these areas but has undergone dramatic declines in its distribution and abundance over the past century. The last known reproducing population of	**None** No suitable aquatic habitat present within the proposal site

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
					Trout Cod is confined to the Murray River below Yarrawonga downstream to Tocumwal.	
Maccullochella peelii	Murray Cod	-	V	Predicted using the PMST (DAWE, 2021)	Occurs throughout the Murray-Darling Basin. Can live in a wide range of habitats, from clear, rocky streams in the upper western slopes regions of New South Wales to the slow flowing, turbid rivers and billabongs of the western plains. Generally, they are found in waters up to 5m deep and in sheltered areas with cover from rocks, timber or overhanging banks. The presence of wood debris has been shown to be the primary factor determining Murray cod presence.	**None** No suitable aquatic habitat present within the proposal site
Macquaria australasica	Macquarie Perch	E	E	Predicted using the PMST (DAWE, 2021)	Occurs in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers, and in parts of the Hawkesbury and Shoalhaven catchment areas. Inhabits river and lake habitats, especially the upper reaches of rivers and their tributaries. Requires clear water with deep, rocky holes and abundant cover (including aquatic vegetation, woody debris, large boulders and overhanging banks). Spawning occurs in spring and summer in shallow upland streams or flowing sections of river systems.	**None:** No suitable aquatic habitat present within the proposal site
Mammals						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Predicted using the PMST (DAWE, 2021)	The Large-eared Pied Bat is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. The species roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. It is found in well-timbered areas containing gullies.	**Low** No caves suitable for roosting or breeding of bats are present.
Chalinolobus picatus	Little Pied Bat	V	-	11 records	The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria.	**Possible**

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
				(BCD, 2021)	Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.	May forage above the non-native grassland and box woodland. No caves or tree hollows suitable for roosting or breeding of bats are present.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	1 record (BCD, 2021; Predicted using the PMST (DAWE, 2021)	The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. The species has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. Are known to traverse their home ranges along densely vegetated creeklines.	**Low** Some marginal foraging habitat present however no suitable denning habitat present within the proposal site. Species not known to occur in locality and site is not located near densely vegetated creek lines
Nyctophilus corbeni	Corben's Long-eared Bat	V	V	Predicted using the PMST (DAWE, 2021)	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, bulloke Allocasuarina leuhmanni and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland.	**Low** Species may occur on occasion in the study area, however given the lack of records in the locality the species is unlikely to occur on a regular basis.
Petaurus norfolcensis	Squirrel Glider	V	-	BAM Calculator	The Squirrel Glider is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. The species inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	**Low** No evidence of the species was recorded at the site despite targeted surveys in better quality habitat within the study area in August.
Phascolarctos cinereus	Koala	V*	V	1 record (BCD, 2021; Predicted	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In New South Wales, koala populations are found on the central and	**Low** *E. populnea* is a koala feed tree species. However, there is no suitable breeding habitat. No core habitat present

Scientific Name	Common Name	BC Act status	EPBC Act Status	Source	Habitat Association	Likelihood of occurrence and justification
				using the PMST (DAWE, 2021)	north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range. The species inhabit eucalypt woodlands and forests, and feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	according to mapping of Areas of Regional Koala Significance (ARKS).
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	1 record (BCD, 2021); Predicted using the PMST (DAWE, 2021)	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. The species occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	**Low** No suitable breeding habitat. No breeding camps present in the area. The species may occur and forage in the site on occasion.
Saccolaimus flaviventris	Yellow-bellied sheathtail bat	V	-	8 records (BCD, 2021)	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. It forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	**Moderate** The species may forage aerially above the proposal site. No hollows suitable for roosting or breeding of bats are present
Reptile						
Aprasia parapulchella	Pink-tailed Legless Lizard	V	V	Predicted using the PMST (DAWE, 2021)	Populations occur in the Queanbeyan/Canberra district, Cooma, Yass, Bathurst, Albury and West Wyalong areas. Inhabits grassland and open woodland with substantial embedded rock cover in sunny situations. Recorded in both native and non-native grasslands. Usually recorded under small rocks (150 - 600 mm basal area) shallowly embedded in the soil (2 - 5 cm, and use ant burrows under these rocks.	**Low** No suitable rocky habitat used for sheltering is present in the proposal site.

Appendix B

Survey results

Family	Scientific Name	Common Name	BC Status	EPBC Status	Exotic	Growth Form	Recorded
Acanthaceae	Brunoniella australis	Blue Trumpet				FG	BO21
Amaranthaceae	Ptilotus semilanatus	Lambs tails				FG	BO22, BO25
Anthericaceae	Arthropodium spp.					FG	BO25
Anthericaceae	Dichopogon fimbriatus	Nodding Chocolate Lily				FG	AO17
Apiaceae	Daucus glochidiatus	Native Carrot				FG	AO17, AN3
Asphodelaceae	Bulbine bulbosa	Bulbine Lily				FG	BO20
Asteraceae	Vittadinia cuneata	A Fuzzweed				FG	BO21, BO22, BO20, BO14, BO25, AO17, AN2, low conservation grassland plot, AN3
Asteraceae	Cirsium vulgare	Spear Thistle			*	EX	BO21, BO22, BO20, BO14, BO25, AO17
Asteraceae	Calotis cuneifolia	Purple Burr-Daisy				FG	BO21, BO22
Asteraceae	Sonchus oleraceus	Common Sowthistle			*	EX	BO21, BO22, BO20, BO14, BO25, AN2, low conservation grassland plot, AN3
Asteraceae	Calotis lappulacea	Yellow Burr-daisy				FG	BO21, BO22, BO20
Asteraceae	Hypochaeris Radicata	Catsear			*	EX	BO21, BO25, low conservation grassland plot
Asteraceae	Arctotheca calendula	Capeweed			*	EX	BO21
Asteraceae	Rhodanthe corymbiflora	Small White Sunray				FG	BO22
Asteraceae	Minuria leptophylla					FG	BO22
Asteraceae	Brachyscome chrysoglossa					FG	BO22, BO25
Asteraceae	Carthamus lanatus	Saffron Thistle			*	HT	BO22, BO20, low conservation grassland plot, AN3
Asteraceae	Cymbonotus lawsonianus	Bear's Ear				FG	BO20
Asteraceae	Solenogyne dominii					FG	BO20

Family	Scientific Name	Common Name	BC Status	EPBC Status	Exotic	Growth Form	Recorded
Asteraceae	Centaurea melitensis	Maltese Cockspur			*	EX	BO20, BO14, AO17, AN2, low conservation grassland plot, AN3
Asteraceae	Calotis spp.	A Burr-daisy				FG	BO20
Asteraceae	Xerochrysum bracteatum	Golden Everlasting				FG	BO14, AO17, AN2, AN3
Asteraceae	Lactuca serriola	Prickly Lettuce			*	EX	BO14, AN2, low conservation grassland plot
Asteraceae	Conyza sumatrensis	Tall fleabane			*	EX	BO14, BO25, AN2, AN3
Asteraceae	Silybum marianum	Variegated Thistle			*	EX	BO14
Asteraceae	Senecio quadridentatus	Cotton Fireweed				FG	BO25
Asteraceae	Calotis hispidula	Bogan Flea				FG	AO17
Asteraceae	Euchiton spp.	A Cudweed				FG	low conservation grassland plot
Asteraceae	Vittadinia gracilis	Woolly New Holland Daisy				FG	AN3
Boraginaceae	Echium plantagineum	Patterson's Curse			*	EX	BO21, BO20, BO14, BO25, AO17, AN2, low conservation grassland plot, AN3
Brassicaceae	Brassica rapa subsp. Campestris	Turnip			*	EX	BO21, BO22, BO14, BO25, low conservation grassland plot
Brassicaceae	Brassica spp.	Brassica			*	EX	BO20, AN2
Brassicaceae	Rapistrum rugosum	Turnip Weed			*	EX	AO17
Brassicaceae	Capsella bursa-pastoris	Shepherd's Purse			*	EX	AO17, AN3
Brassicaceae	Lepidium spp.	A Peppercress			*	EX	AN2
Brassicaceae	Lepidium africanum	Common Peppercress			*	EX	low conservation grassland plot
Brassicaceae	Sisymbrium spp.				*	EX	AN3
Campanulaceae	Wahlenbergia gracilis	Sprawling Bluebell				FG	BO22, BO20
Campanulaceae	Wahlenbergia spp.	Bluebell				FG	BO25, low conservation grassland plot
Campanulaceae	Wahlenbergia stricta	Tall Bluebell				FG	AO17

Family	Scientific Name	Common Name	BC Status	EPBC Status	Exotic	Growth Form	Recorded
Caryophyllaceae	Petrorhagia nanteuilii	Proliferous Pink			*	EX	AO17, AN2, low conservation grassland plot, AN3
Casuarinaceae	Casuarina cristata	Belah				TG	BO25
Chenopodiaceae	Atriplex semibaccata	Creeping Saltbush				SG	BO21, BO22, BO20
Chenopodiaceae	Enchylaena tomentosa	Ruby Saltbush				SG	BO21, BO22, BO20, BO25, AO17, AN3
Chenopodiaceae	Einadia nutans	Climbing Saltbush				FG	BO21, BO22, BO20, BO14, BO25, AO17, low conservation grassland plot, AN3
Chenopodiaceae	Sclerolaena muricata	Black Rolypoly				SG	BO21
Chenopodiaceae	Sclerolaena diacantha	Grey Copperburr				SG	BO22
Chenopodiaceae	Atriplex suberecta					FG	BO22, BO25, low conservation grassland plot
Chenopodiaceae	Maireana microphylla	Small-leaf Bluebush				SG	BO22, BO25
Chenopodiaceae	Maireana enchylaenoides	Wingless Fissure-weed				FG	AO17
Chenopodiaceae	Atriplex spp.	A Saltbush				SG	low conservation grassland plot
Convolvulaceae	Dichondra repens	Kidney Weed				FG	BO22, BO20, BO14, BO25, AO17, AN2, grassland plots species , AN3
Convolvulaceae	Convolvulus arvensis	Field Bindweed			*	EX	BO22
Convolvulaceae	Convolvulus erubescens	Pink Bindweed				OG	BO20, low conservation grassland plot
Crassulaceae	Crassula colorata	Dense Stonecrop				FG	low conservation grassland plot
Cupressaceae	Callitris glaucophylla	White Cypress Pine				TG	BO21, BO22, AO17, AN2, AN3
Cyperaceae	Carex spp.					GG	BO21
Cyperaceae	Carex inversa	Knob Sedge				GG	BO22, BO20, BO25
Euphorbiaceae	Euphorbia drummondii	Caustic Weed				FG	BO22, BO20, AO17

Family	Scientific Name	Common Name	BC Status	EPBC Status	Exotic	Growth Form	Recorded
Fabaceae (Faboideae)	Medicago praecox	Small-leaved Burr Medic			*	EX	BO21, BO20, BO14
Fabaceae (Faboideae)	Trifolium glomeratum	Clustered Clover			*	EX	BO21, BO22, BO20, BO14, BO25, AO17, AN2, low conservation grassland plot, AN3
Fabaceae (Faboideae)	Trifolium arvense	Haresfoot Clover			*	EX	BO21, low conservation grassland plot
Fabaceae (Faboideae)	Medicago truncatula	Barrel Medic			*	EX	BO22, BO25, low conservation grassland plot
Fabaceae (Faboideae)	Trifolium subterraneum	Subterranean Clover			*	EX	BO14, low conservation grassland plot
Fabaceae (Faboideae)	Glycine tabacina	Variable Glycine				OG	BO14, BO25
Fabaceae (Faboideae)	Glycine clandestina	Twining glycine				OG	BO25
Fabaceae (Faboideae)	Trifolium angustifolium	Narrow-leaved Clover			*	EX	BO25
Fabaceae (Faboideae)	Trifolium campestre	Hop Clover			*	EX	BO25, AN2, AN3
Fabaceae (Faboideae)	Medicago minima	Woolly Burr Medic			*	EX	AO17
Fabaceae (Mimosoideae)	Acacia spp.	Wattle				SG	BO21
Fabaceae (Mimosoideae)	Acacia pendula	Weeping Myall, Boree				TG	BO25, AO17
Geraniaceae	Erodium crinitum	Blue Crowfoot				FG	BO14, AN2, low conservation grassland plot, AN3
Goodeniaceae	Goodenia pinnatifida	Scrambles Eggs				FG	BO22, BO20, BO25
Goodeniaceae	Goodenia fascicularis	Mallee Goodenia				FG	AO17
Juncaceae	Juncus spp.	A Rush				GG	BO20

Family	Scientific Name	Common Name	BC Status	EPBC Status	Exotic	Growth Form	Recorded
Lamiaceae	Marrubium vulgare	White Horehound			*	EX	BO21, BO22, BO20, BO14, AO17, AN2, low conservation grassland plot
Lamiaceae	Salvia verbenaca	Vervain			*	EX	BO21, AO17, AN2, low conservation grassland plot, AN3
Malvaceae	Malva parviflora	Small-flowered Mallow			*	EX	BO21
Malvaceae	Sida corrugata	Corrugated Sida				FG	BO20, BO14, AO17, AN2, AN3
Malvaceae	Abutilon spp.	Lantern-bush			*	EX	low conservation grassland plot
Myoporaceae	Eremophila debilis	Amulla				SG	BO22, BO20, BO25
Myrtaceae	Eucalyptus blakelyi	Blakely's Red Gum				TG	BO21
Myrtaceae	Eucalyptus camaldulensis	River Red Gum				TG	BO21
Myrtaceae	Eucalyptus microcarpa	Western Grey Box				TG	BO22, BO20, BO25
Myrtaceae	Eucalyptus populnea subsp. bimbil	Bimble Box				TG	BO22, BO14
Myrtaceae	Eucalyptus melliodora	Yellow Box				TG	AO17
Nyctaginaceae	Boerhavia dominii	Tarvine				FG	AO17
Oxalidaceae	Oxalis perennans					FG	BO20, BO14, BO25, AO17, low conservation grassland plot
Oxalidaceae	Oxalis pes-caprae	Soursob			*	EX	low conservation grassland plot
Pittosporaceae	Pittosporum angustifolium	Butterbush				SG	BO22, BO25
Plantaginaceae	Plantago cunninghamii	Sago-weed				FG	BO22, BO20, BO25
Plantaginaceae	Plantago turrifera	Small Sago-weed				FG	BO20, AO17
Poaceae	Anthosachne scabra	Wheatgrass				GG	AN2
Poaceae	Lolium rigidum	Wimmera Ryegrass			*	EX	BO21, BO22, BO20, BO14, BO25, AO17, low conservation grassland plot
Poaceae	Rytidosperma spp.					GG	BO21

Family	Scientific Name	Common Name	BC Status	EPBC Status	Exotic	Growth Form	Recorded
Poaceae	Walwhalleya spp.					GG	BO21, BO22, BO20, BO25
Poaceae	Panicum capillare	Witchgrass			*	EX	BO21, BO14, low conservation grassland plot
Poaceae	Avena fatua	Wild Oats			*	EX	BO21, BO20, BO14, BO25, low conservation grassland plot
Poaceae	Austrostipa bigeniculata	Yanganbil				GG	BO21, BO22, BO20, BO14, BO25, low conservation grassland plot, AN3
Poaceae	Austrostipa scabra	Speargrass				GG	BO21, BO22, BO20, BO14, AO17, AN2, low conservation grassland plot, AN3
Poaceae	Hordeum leporinum	Barley Grass			*	EX	BO22, BO20, BO14, low conservation grassland plot
Poaceae	Enteropogon acicularis	Curly Windmill Grass				GG	BO22, BO14
Poaceae	Bromus diandrus	Great Brome			*	HT	BO22, BO20, low conservation grassland plot
Poaceae	Rytidosperma setaceum	Small-flowered Wallaby-grass				GG	BO22, BO20
Poaceae	Austrostipa setacea	Corkscrew Grass				GG	BO20, BO25, AN2
Poaceae	Paspalum distichum	Water Couch				GG	BO20
Poaceae	Bromus molliformis	Soft Brome			*	EX	BO14, low conservation grassland plot
Poaceae	Bothriochloa macra	Red Grass				GG	BO25
Poaceae	Rytidosperma caespitosum	Ringed Wallaby Grass				GG	AO17, AN2, AN3
Poaceae	Vulpia bromoides	Squirrel Tail Fescue			*	EX	AN2, low conservation grassland plot
Poaceae	Cynodon dactylon	Common Couch				GG	low conservation grassland plot
Poaceae	Phalaris aquatica	Phalaris			*	HT	low conservation grassland plot

Family	Scientific Name	Common Name	BC Status	EPBC Status	Exotic	Growth Form	Recorded
Polygonaceae	Rumex spp.	Dock			*	FG	BO21, low conservation grassland plot
Polygonaceae	Rumex brownii	Swamp Dock				FG	BO20, BO14, AO17
Polygonaceae	Rumex crispus	Curled Dock			*	EX	BO25, low conservation grassland plot
Rubiaceae	Asperula conferta	Common Woodruff				FG	BO20, BO25
Sapindaceae	Alectryon oleifolius	Western Rosewood				TG	BO25
Solanaceae	Lycium ferocissimum	African Boxthorn			*	HT	BO22
Solanaceae	Solanum nigrum	Black-berry Nightshade			*	EX	BO22, BO25
Solanaceae	Solanum esuriale	Quena				FG	AN2, AN3
Verbenaceae	Verbena officinalis	Common Verbena			*	EX	BO21
Zygophyllaceae	Tribulus terrestris	Cat-head			*	EX	AN2, AN3
Juncaceae	Juncus spp.	A Rush				GG	BO21
Acanthaceae	Brunoniella australis	Blue Trumpet				FG	BO20
Asteraceae	Leptorhynchos spp.					FG	BO25
Polygonaceae	Rumex tenax	Shiny Dock				FG	BO25, AN2
Asteraceae	*Scorzonera laciniata*				*	EX	BO25

Note: All flora species identified in the table above were recorded during surveys for the proposal.

Table 34 Fauna species

Class	Family	Exotic	Scientific Name	Common Name	NSW Status	EPBC Status	Survey period recorded*
Amphibia	Myobatrachidae	0	*Crinia parinsignifera*	Eastern sign-bearing froglet	P	0	E44
Amphibia	Hylidae	0	*Litoria peronii*	Peron's Tree Frog	P	0	E44
Amphibia	Myobatrachidae	0	*Limnodynastes tasmaniensis*	Spotted grass frog	P	0	E44
Aves	Corcoracidae	0	*Struthidea cinerea*	Apostlebird	P	0	Proposal, E44
Aves	Podicipedidae	0	*Tachybaptus novaehollandiae*	Australasian grebe	P	0	E44
Aves	Artamidae	0	*Cracticus tibicen*	Australian Magpie	P	0	Proposal, E44
Aves	Motacillidae	0	*Anthus novaeseelandiae*	Australian Pipit	P	0	E44
Aves	Corvidae	0	*Corvus coronoides*	Australian Raven	P	0	Proposal, E44
Aves	Anatidae	0	*Chenonetta jubata*	Australian Wood Duck	P	0	E44
Aves	Psittacidae	0	*Northiella haematogaster*	Blue Bonnet	P	0	Proposal, E44
Aves	Meliphagidae	0	*Entomyzon cyanotis*	Blue-faced Honeyeater	P	0	E44
Aves	Phasianidae	0	*Coturnix ypsilophora*	Brown Quail	P	0	E44
Aves	Cacatuidae	0	*Nymphicus hollandicus*	Cockatiel	P	0	Proposal, E44
Aves	Columbidae	0	*Phaps chalcoptera*	Common bronzewing	P	0	Proposal, E44
Aves	Columbidae	0	*Ocyphaps lophotes*	Crested Pigeon	P	0	Proposal, E44
Aves	Psittacidae	0	*Platycercus elegans*	Crimson Rosella	P	0	Proposal, E44
Aves	Tytonidae	0	*Tyto javanica*	Eastern Barn Owl	P	0	E44
Aves	Psittacidae	0	*Platycercus eximius*	Eastern Rosella	P	0	Proposal, E44
Aves	Cuculidae	0	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	P	0	E44
Aves	Cacatuidae	0	*Eolophus roseicapillus*	Galah	P	0	Proposal, E44
Aves	Anatidae	0	*Anas gracilis*	Grey teal	P	0	E44
Aves	Pomatostomidae	0	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V,P	0	E44
Aves	Alcedinidae	0	*Dacelo novaeguineae*	Laughing Kookaburra	P	0	Proposal, E44
Aves	Corvidae	0	*Corvus mellori*	Little Raven	P	0	Proposal, E44
Aves	Monarchidae	0	*Grallina cyanoleuca*	Magpie-lark	P	0	Proposal, E44

Class	Family	Exotic	Scientific Name	Common Name	NSW Status	EPBC Status	Survey period recorded*
Aves	Cacatuidae	0	*Lophochroa leadbeateri*	Major Mitchell's Cockatoo	V,P	0	Proposal, E44
Aves	Falconidae	0	*Falco cenchroides*	Nankeen Kestrel	P	0	Proposal, E44
Aves	Meliphagidae	0	*Manorina melanocephala*	Noisy Miner	P	0	Proposal, E44
Aves	Anatidae	0	*Anas superciliosa*	Pacific black duck	P	0	E44
Aves	Artamidae	0	*Cracticus nigrogularis*	Pied Butcherbird	P	0	Proposal, E44
Aves	Psittacidae	0	*Psephotus haematonotus*	Red-rumped Parrot	P	0	Proposal, E44
Aves	Megaluridae	0	*Cincloramphus mathewsi*	Rufous Songlark	P	0	E44
Aves	Strigidae	0	*Ninox novaeseelandiae*	Southern Boobook	P	0	E44
Aves	Acanthizidae	0	*Chthonicola sagittata*	Speckled Warbler	V,P	0	E44
Aves	Pardalotidae	0	*Pardalotus punctatus*	Spotted Pardalote	P	0	E44
Aves	Pardalotidae	0	*Pardalotus striatus*	Striated Pardalote	P	0	E44
Aves	Psittacidae	0	*Polytelis swainsonii*	Superb Parrot	V,P,3	V	E44
Aves	Accipitridae	0	*Aquila audax*	Wedge-tailed Eagle	P	0	Proposal, E44
Aves	Hirundinidae	0	*Hirundo neoxena*	Welcome swallow	P	0	Proposal, E44
Aves	Acanthizidae	0	*Gerygone fusca*	Western gerygone	P	0	E44
Aves	Ardeidae	0	*Egretta novaehollandiae*	White-faced heron	P	0	E44
Aves	Ardeidae	0	*Ardea pacifica*	White-necked heron	P	0	E44
Aves	Corcoracidae	0	*Corcorax melanorhamphos*	White-winged Chough	P	0	Proposal, E44
Aves	Rhipiduridae	0	*Rhipidura leucophrys*	Willie wagtail	P	0	Proposal, E44
Aves	Acanthizidae	0	*Acanthiza nana*	Yellow thornbill	P	0	E44
Mammalia	Muridae	*	*Rattus rattus*	Black Rat	0	0	E44
Mammalia	Leporidae	*	*Lepus capensis*	Brown Hare	0	0	Proposal
Mammalia	Phalangeridae	0	*Trichosurus vulpecula*	Common Brushtail Possum	P	0	E44
Mammalia	Macropodidae	0	*Macropus giganteus*	Eastern Grey Kangaroo	P	0	Proposal, E44
Mammalia	Muridae	*	*Mus musculus*	House Mouse	0	0	E44

* Survey period recorded distinguishes between surveys conducted for the proposal and surveys conducted for the E44 project in the study area where relevant

Appendix C

Field data sheets

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BAM Site – Field Survey Form

Site Sheet no:

		Survey Name	Zone ID	Recorders			
Date	14 10 21	Mod 7	248 - degraded	L. Maloney, S. Mamo			
Zone: 55	Datum: GDA 94	Plot ID	A018	Plot dimensions	50x20	Photo #	
Easting: 598033	Northing: 6357224	IBRA region	SWS	Midline bearing from 0 m	130		
Vegetation Class						Confidence: H M L	
Plant Community Type	248	Mixed box woodland - degraded		EEC: N		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	1
	Grasses etc.	2
	Forbs	16
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	20
	Shrubs	0.1
	Grasses etc.	2.5
	Forbs	11.7
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1	1
50 – 79 cm	1	1
30 – 49 cm	0	0
20 – 29 cm	✓	x
10 – 19 cm	✓	x
5 – 9 cm	✓	x
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	12	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	5	60	50	90	20															
Average of the 5 subplots	45																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet 2 of 2		Survey Name	Plot Identifier	Recorders
Date	14 10 21	Mod. 7	A016	L Malone, S. Mann

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	Callitris glaucophylla	N	10	5		
F	Dichondra repens	N	0.3	300		
F	Vittadinia cuneata	N	2	106		
-	Cirsium vulgare	E	0.1	4		
-	Echium plantagineum	E	20	1000		
F	Daucus glochidiatus	N	0.1	1		
-	Trifolium glomeratum	E	3	300		
F	Sida corrugata	N	0.1	50		
F	Xerochrysum bracteatum	N	0.1	10		
-	Rapistrum rugosum	E	0.6	200		
-	Petrorhagia nanteuilii	E	0.5	250		
-	Centaurea melitensis	E	0.2	50		
-	Salvia verbenaca	E	0.2	150		
F	Wahlenbergia stricta	N	0.1	1		
F	Calotis hispidula	N	0.1	1		
G	Austrostipa scabra	N	2	200		
F	Dichopogon fimbriatum	N	0.1	2		
F	Goodenia fasciculatis	N	0.2	100		
F	Maireana enchylaenoides	N	0.1	3		
-	Medicago minima	E	0.2	150		
F	Einadia nutans	E	8	800		
F	Oxalis perennans	E	0.1	20		
G	Rytidosperma racemosum	N	0.5	150		
-	Marrubium vulgare	E	0.1	1		
-	Lolium rigidum	E	5	1800		
F	Euphorbia drummondii	N	0.1	2		
F	Enchylaena tomentosa	N	0.1	5		
T	Eucalyptus melliodora	N	5	1		
T	Acacia pendula	N	5	1		
-	Capsella bursa pastoris	E	0.1	1		
F	Rumex brownii	N	0.1	1		
F	Boerhavia dominii	N	0.1	2		
F	Plantago turrifera	N	0.1	15		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

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BAM Site – Field Survey Form

Site Sheet no:

Survey Name	Zone ID	Recorders
NPM-Mod 6.		MC. BT

Date		Zone	Datum	Plot ID	Plot dimensions	Photo #
13 10 21		55	GDA94	B014	20×50	

Easting	Northing	IBRA region	Midline bearing from 0 m
600236	6356107	SWS	345

Vegetation Class		Confidence: H M L
Plant Community Type	56 Poplar Box Ribbon -degraded	EEC: Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	0
	Grasses etc.	3
	Forbs	8
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	5
	Shrubs	0
	Grasses etc.	45.5
	Forbs	4.6
	Ferns	0
	Other	0.1
High Threat Weed cover		0

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	0	X
50 – 79 cm	0	X
30 – 49 cm	2	1
20 – 29 cm	✓	✓
10 – 19 cm	✓	✓
5 – 9 cm	✓	✓
< 5 cm	X	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	4m	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	5, 1, 20, 5, 20			
Average of the 5 subplots	10.2			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	13 10 21	NPM - Mod 6	B014	MC IST

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
T	Eucalyptus populnea	N	5	4		
G	Austrostipa bigeniculata	N	40	500		
-	Echium plantagineum	E	10	200		
-	Sonchus oleraceus	E	1	100		
F	Xerochrysum bracteatum	N	0.1	10		
F	Erodium cicutarium	N	2	20		
-	Cirsium vulgare	E	1	5		
-	Lactuca serriola	E	0.1	5		
F	Dichondra repens	N	1	1000		
-	Avena fatua	E	6	100		
-	Lolium rigidum	E	40	800		
-	Trifolium dubium	E	8	2000		
F	Oxalis perennans	N	0.1	20		
-	Panicum capillare		6	300		X
-	Trifolium subterraneum	E	2	1000		
G	Enteropogan acicularis		0.5	10		
F	Einadia nutans		1	40		
-	Centaurea mellatensis	E	0.5	10		
F	Sida corrugata	N	0.1	5		
-	Brassica rapa	E	0.1	1		X
-	Marrubium vulgare	E	8	100		
-	Hordeum leporinum	E	0.5	20		
G	Austrostipa scabra	N	5	200		
-	Rumex brownii	E	0.1	1		
-	Conyza sumatrensis	E	0.1	2		
-	Medicago praecox	E	0.2	30		
F	Glycine tabacina	N	0.1	3		
-	Silybum marianum	E	0.2	1		
F	Vittadinia cuneata	N	0.2	40		
-	Bromus molliformis	E	0.1	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

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BAM Site – Field Survey Form

Site Sheet no:

Survey Name	Zone ID	Recorders
NPM - Mod 7		MC, BT

Date	Zone	Datum	Plot ID	Plot dimensions	Photo #
14 10 21	55	GDA 94	8020	20×50	

Easting	Northing	IBRA region	Midline bearing from 0 m
600217	6358914	SWS.	328

Vegetation Class		Confidence: H M L
Plant Community Type 76	Inland Grey Box Woodland	EEC: / Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot. – Good.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	3
	Grasses etc.	8
	Forbs	18
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	5
	Shrubs	20.6
	Grasses etc.	40.2
	Forbs	15.7
	Ferns	0
	Other	0.1
High Threat Weed cover		0.3

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	0	x
50 – 79 cm	1	1
30 – 49 cm	11	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	x	
< 5 cm	x	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	12m	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	20 20 10 5 1			
Average of the 5 subplots	11.2			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	14 10 21	NPM - Mod 7	BO20.	MC, BT.

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
T	Eucalyptus microcarpa	N.	5	1		
-	Lolium rigidum	E	20	500		
F	Enchylaena tomentosa	N	20	200		
F	Dichondra repens	N.	1	1000		
F	Vittadinia cuneata	N.	10	300		
F	Oxalis perennans	N.	0.2	30		
F	Sida corrugata.	N.	0.1	2		
F	Euphorbia drummondii	N.	0.1	1		
F	Atriplex semibarrata.	N	0.5	50		
-	Medicago sp.	E	0.5	100		
O	Convolvulus erubescens	N	0.1	2		
F	Goodenia pinnatifida	N.	1	200.		
F	Bulbine bulbosa.	N	0.5	100		
-	Sonchus oleraceus	E	0.1	2		
F	Plantago cunninghamii	N	0.5	40.		
G	Austrostipa scabra.	N.	20	500.		
F	Einadia hastata.	N	0.1	3		
-	Bromus diandrus	HTE	0.1	10		
G	Austrostipa bigeniculata	N	10	200		
F	Cymbonotus lawsonii	N	0 1	1		
F	Calotis lappulacea	N	0.5	20		
G	Austrostipa setaceum	N.	1	50		
-	Trifolium glomeratum	E	1.	200		
G	Carex inversa	N.	0.1	1		
F	Wahlenbergia gracilis.	N.	0.1	4.		
F	Asperula conferta	N	1	50.		
-	Avena fatua	E	0.1	5		
G	Juncus sp.	N.	0.1	10.		
G	Paspalum distichum	N	2	100		—
G	Eytidosperma setaceum	N	2	100.		
G	Wahlenbergia	N.	5	200		
F	Rumex brownii	N	0.1	1		
-	Cirsium vulgare	E	0.2	5		
-	Echium plantagineum	E	0.1	2		
F	small purple thing from BO18	N	0.1	1		—
-	Capsella bursa-pastoris	HTE	0.2	15		
F	Solenogyne dominii	N.	0.1	1		
-	Brassica sp.	E	0.1	4		
-	Marrubium vulgare	E	0.1	2		
F	Eremophila debilis	N.	0.1	2		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

-	Centaurea melitensis	E	0.1	1		
F	Plantago turrifera	N	0.1	3		
-	Hordeum leporinum	E	0.1	5		
F	Calotis	N	✓ 0.1	2		

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BAM Site – Field Survey Form

Site Sheet no:

		Survey Name	Zone ID	Recorders			
Date	14 10 21	NPM-mod	7	MC, RT.			
Zone	Datum	Plot ID	B021	Plot dimensions	20 x 50	Photo #	
55	GDA94						
Easting	Northing	IBRA region	SWS	Midline bearing from 0 m	322		
600342	6358826						
Vegetation Class						Confidence: H M L	
Plant Community Type	277	BRC Yellow Box – Planting		EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	4
	Grasses etc.	6
	Forbs	6
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	8.1
	Shrubs	10.3
	Grasses etc.	17.1
	Forbs	5.3
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	0	X
50 – 79 cm	0	✓
30 – 49 cm	X	✓
20 – 29 cm	2	✓
10 – 19 cm	✓	✓
5 – 9 cm	✓	✓
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	25 5 1 1 5			
Average of the 5 subplots	7.4			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 14 10 21	NPM - mod 7	BO21	MC BT

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	Eucalyptus blakelyi	N	5	3		
T	Eucalyptus canaldulensis	N	3	2		
–	Lolium rigidum	E	40	500.		
F	Vittadinia cuneata.	N	3	80.		
S	Atriplex semibaccata	N	0.2	50.		
S	Eclylaena tomentosa	N	8	100.		
–	Medicago sp.	E	2	500.		
F	Carex sp.	N	5	200		
G	Rytidosperma sp.	N	5	200		
G	Wahlenbergia	N	5	200.		–
F	Brunonia australis.	N	0.1	2		~~pox~~
–	Echium plantagineum	E	0.1	10.		
–	Panicum capillare.	E	2	100.		
–	Brassica rapa	E	0.2	10.		
G	Juncus sp.	N	0.1	2		
F	Einadia nutans	N	1	100.		
–	Cirsium vulgare.	E	0.2	10.		
T	Callitris glaucophylla.	N	0.1	1		
–	Avena fatua	E	0.1	5		
G	Austrostipa bigeniculata	N	1	80.		
S	Acacia sp.	N	2	2		~~X~~
F	Calotis cuneifolia	N	0.1	2		
–	Marrubium vulgare	E	0.1	1		
–	Salvia reserdca	E	0.1	1		
–	Sonchus oleraceus	E	0.1	4		
F	Calotis lappulacea	N	1	50.		
~~FG~~	Rumex sp	N	0.1	2		~~pox~~
G	Austrostipa scabra	N	1	50.		
S	Sclerolaena muricata	N	0.1	2		
–	Trifolium glomeratum	E	2	200		
–	Trifolium arvense	E	2	200.		
–	Hirschfeldia incana	E	0.1	1		
F	Verbena officinalis.	N	0.1	2		~~X~~
–	Malva parviflora.	E	0.1	1		
–	Arctotheca calendula.	E	0.1	2		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

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BAM Site – Field Survey Form

Site Sheet no:

Survey Name	Zone ID	Recorders
NPM - Mod 7		MC, BT

Date	14 10 21	Plot ID	B027	Plot dimensions	20×50	Photo #	
Zone 55	Datum GDA94						
Easting 600295	Northing 6358792	IBRA region	SWS.	Midline bearing from 0 m	132		

Vegetation Class			Confidence: H M L
Plant Community Type 82	Western Grey Box Poplar Box WLP - Good	EEC:	Confidence: H M L

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	6
	Grasses etc.	6
	Forbs	14
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	38.2
	Shrubs	11.7
	Grasses etc.	39.2
	Forbs	10.9
	Ferns	0
	Other	0
High Threat Weed cover		1.3

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1	1
50 – 79 cm	2	1
30 – 49 cm	✓	X
20 – 29 cm	✓	X
10 – 19 cm	✓	X
5 – 9 cm	X	X
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	9m	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	40 35 1 1 20			
Average of the 5 subplots	19.4			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	14 10 21	NPWM - Moat	BO22	MC ST

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	Eucalyptus microcarpa	N	35	4		
T	Eucalyptus tereticornis	N	3	1		
G	Austrostipa bigeniculata	N	25	500		
E	Enchylaena tomentosa	N	10	200		
-	Lolium rigidum	E	20	500		
-	Sonchus oleraceus	E	0.2	50		
S	Sclerolaena diacantha	N	1	80		✓
G	Wahlenbergia sp.	N	2	40		✓
F	Calotis lappulacea	N	0.5	80		
F	Vittadinia cuneata	N	5	200		
F	Atriplex semibaccata	N	0.2	20		
-	Medicago truncatula	E	0.5	100		✓
F	Einadia nutans	N	0.5	30		
-	Brassica rapa	E	0.1	5		
-	Hordeum leporinum	E	0.1	10		
F	Eremophila debilis	N	0.1	1		
F	Dichondra repens	N	1	1000		
G	Austrostipa scabra	N	10	300		
-	Marrubium vulgare	E	0.1	2		
F	Plantago cunninghamii	N	0.5	100		
-	Lycium ferocissimum	HTE	1	1		
-	Cirsium vulgare	E	0.1	3		
-	Solanum nigrum	E	0.1	2		
F	Atriplex suberecta	N	0.2	10		
G	Enteropogon acicularis	N	0.1	10		
-	Convolvulus erubescens	E	0.1	2		
-	Bromus diandrus	HTE	0.2	50		
F	Calotis cuneifolia	N	0.2	80		
G	Carex inversa	N	0.1	10		
F	Goodenia pinnatifida	N	2	200		
T	Pittosporum angustifolia	N	0.2	1		✓
F	Euphorbia drummondii	N	0.1	3		
F	Rhodanthe corymbiflora	N	0.5	100		
-	Trifolium glomeratum	-	0.2	50		
F	Dianella leptophylla	N	0.1	4		✓
F	Wahlenbergia gracilis	N	0.1	5		
F	Brachyscome rigidula	N	0.1	20		✓
G	Rytidosperma setaceum	N	2	100		
S	Maireana microphylla	N	0.2	1		
F	Ptilotus semilanatus	N	0.1	6		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

-	Carthamus lanatus	HTE	0.1	5
T	Callitris glaucophylla	N	0.2	4

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BAM Site – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Zone ID	Recorders			
Date	15 10 21	APM - Mod 6		MC, BT			
Zone	Datum	Plot ID	B025	Plot dimensions	20×50	Photo #	
55	GDA 94						
Easting	Northing	IBRA region	SWS	Midline bearing from 0 m	95		
598906	6357909						
Vegetation Class						Confidence: H M L	
Plant Community Type	80	Grey Box, WCP – good.		EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	4
	Shrubs	4
	Grasses etc.	5
	Forbs	15
	Ferns	0
	Other	2
Sum of Cover of native vascular plants by growth form group	Trees	43.5
	Shrubs	1.3
	Grasses etc.	55.5
	Forbs	5.4
	Ferns	0
	Other	0.2
High Threat Weed cover		0

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	2	1
50 – 79 cm	0	X
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	30m	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	20	40	40	15	5			
Average of the 5 subplots	24							

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 15 10 21	Npm - Mod 6	B025	MC, BT.

GF Code	Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable	N, E or HTE	Cover	Abund	stratum	voucher
T	Eucalyptus microcarpa	N	40	6		
T	Acacia pendula	N	1	10		
T	Casuarina cristata	N	2	3		
F	Asperula conferta	N	1	100.		
F	Leptorhynchos sp.	N	0.2	10.		✓
—	Carum vulgare	E	0.2	10.		
—	Lolium rigidum	E	30	1000.		
G	Walwahlya sp.	N	10	200.		✓
G	Carex inversa	N	20	300.		
F	Plantago cunninghamii	N	2	200		
—	Trifolium glomeratum	E	0.1	5		
F	Brachyscome chrysoglossa	N	0.1	1		
F	Vittadinia cuneata ✓	N	0.1	5		
—	Sonchus oleraceus	E	0.1	10.		
G	Austrostipa bigeniculata	N	10	100.		
F	Goodenia pinnatifida	N	0.5	40.		
—	Orig. herbaceous	E	0.1	5		
F	Einadia nutans	N	0.2	20		
S	Atriplex suberecta	N	0.1	1		
—	Echium plantagineum	E	0.1	10.		
—	Brassica rapa	E	0.1	2		
F	Dichondra repens	N	0.1	5		
—	Avena fatua	E	0.1	10.		
—	Hypochaeris radicata.	E	0.1	10.		
S	Maireana microphylla.	N	0.2	2		
—	Solanum nigrum	E	0.1	2		
T	Alectryon oleifolius	N	0.5	2		
S	Pittosporum angustifolia	N	0.5	1		
F	Calocephalus clandestina	N	0.1	1		
F	Arthropodium sp.	N	0.1	5		
—	Conyza ✓ sumatrensis.	E	0.1	2		
F	Rumex tenax ✓	N	0.5	10.		~~prev~~
—	Medicago truncatula	E	0.1	3		
F	Senecio quadridentatus	N	0.2	4		
F	Eremophila debilis.	N	0.5	20.		
F	Ptilotus semilanatus	N	0.1	3		
F	Wahlenbergia sp.	N	0.1	5		✓
—	Scorzonera laciniata.	E	0.1	2		prev
—	Rumex crispus	E	0.1	1		
—	Trifolium angustifolia.	E	0.1	3		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

—	Trifolium campestre	E	0.1	2		
G	Bothriochloa macra	N	0.5	50		
G	Austrostipa setacea	N	15	200.		
F	Enchylaena tomentosa	N	0.1	3		
F	Cullen tenax	N	0.1	2		

Carthamus lanatus HTE 0.1 1
Bromus diandrus HTE 0.1 3

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BAM Site – Field Survey Form

Site Sheet no:

		Survey Name	Zone ID	Recorders			
Date	22 11 21	NPM-Mod6		MC, BT			
Zone	Datum	Plot ID	AN2	Plot dimensions		Photo #	
55	GDA 94						
Easting	Northing	IBRA region	SWS	Midline bearing from 0 m	198°		
597920	6357254						
Vegetation Class						Confidence: H M L	
Plant Community Type 248		mixed Box Woodland - degraded		EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	0
	Grasses etc.	4
	Forbs	7
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	25
	Shrubs	0
	Grasses etc.	2-3
	Forbs	11.5
	Ferns	0
	Other	0
High Threat Weed cover		0

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm	✓	
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	2	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	10 5 60 40 10			
Average of the 5 subplots				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 22 11 21	NPM - mod 6	AN2	MC, BT

GF Code	*Top 3 native species in each growth form group: Full species name mandatory. All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
T	Callitris glaucophylla	N	25	35		
–	Salvia verbenaca	E	25	500		
–	Petrorhagia nanteuilii	E	5	300		
–	Echium plantagineum	E	40	1000		
F	Sida corrugata	N	5	500		
F	Vittadinia cuneata	N	0.1	5		
F	Rumex tenax	N	0.2	10		
–	Vulpia bromoides	E	0.1	1		
–	Marrubium vulgare	HTE	0.2	10		
–	Lactuca serriola	E	0.1	1		
C	Austrostipa scabra	N	2	200		
C	Austrostipa setacea	N	0.1	10		
–	Sonchus oleraceus	E	0.2	30		
F	Dichondra repens	N	5	1000		
–	Trifolium glomeratum	E	5	1000		
F	Xerochrysum bracteatum	N	1	80		
–	Centaurea melitensis	E	5	300		
–	Tribulus terrestris	E	0.1	1		
G	Anthosachne scabra	N	0.1	1		
G	Rytidosperma caespitosum	N	0.1	5		
–	Lepidium sp.	E	0.1	1		
–	Brassica rapa	E	0.2	10		
–	Conyza sumatrensis	E	0.1	1		
–	Trifolium campestre	E	0.2	30		
F	Solanum esuriale	N	0.1	5		
F	Erodium crinitum	N	0.1	5		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

-This document has not been endorsed or approved by Office of Environment and Heritage or Muddy Boots Environmental Training-

BAM Site – Field Survey Form

Site Sheet no:

Date	22/1/21	Survey Name	NPM-Mod1	Recorders	MC, BT		
Zone 55	Datum GDA94	Plot ID	AN3	Plot dimensions	20×50	Photo #	
Easting 597908	Northing 6357107	IBRA region	SWS.	Midline bearing from 0 m	202°		
Vegetation Class						Confidence: H M L	
Plant Community Type	248	Mixed Box Woodland -degraded		EEC:		Confidence: H M L	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	1
	Grasses etc.	3
	Forbs	9
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	20
	Shrubs	0.1
	Grasses etc.	10.3
	Forbs	6.3
	Ferns	0
	Other	0
High Threat Weed cover		0.1

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	—	
50 – 79 cm	—	
30 – 49 cm	✓ 1	
20 – 29 cm	✓ 11	
10 – 19 cm	✓	
5 – 9 cm	✓	
< 5 cm	✓	n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)	6	

Counts apply when the **number of tree stems** within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. **Tree stems must be living.**

For **hollows**, count only the presence of a stem containing hollows. For a **multi-stemmed tree**, only the largest stem is included in the count/estimate. **Stems may be dead and may be shrubs.**

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	5 20 25 5 30			
Average of the 5 subplots				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			
Cultivation (inc. pasture)			
Soil erosion			
Firewood / CWD removal			
Grazing (identify native/stock)			
Fire damage			
Storm damage			
Weediness			
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date: 22 11 21	NPM-Mod 6	AN 3	MC, BT

GF Code	*Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable*	N, E or HTE	Cover	Abund	stratum	voucher
T	Callitris glaucophylla	N	20	25		
–	Centaurea melitensis.	E	20	400		
–	Echium plantagineum	E	30	500		
F	Dichondra repens	N	5	3000		
G	Austrostipa scabra	N	10	500		
G	Austrostipa bigeniculata.	N	0.2	50		
F	Sida corrugata.	N	0.5	100		
F	Solanum esuriale	N	0.1	5		
–	Sonchus oleraceus.	E	0.2	50		
F	Einadia nutans	N	1	80		
F	Erodium crinitum	N	0.1	5		
–	Tribulus terrestris.	E	0.1	3		
–	Capsella bursa-pastoris	E	0.1	1		
–	Sisymbrium sp.	E	0.1	5		
–	Conyza sumatrensis	E	0.1	5		
–	Salvia verbenaca	E	2	200		
–	Trifolium glomeratum	E	1	200		
F	Xerochrysum bracteatum	N	0.2	20		
–	Petrorhagia nanteuilii	E	1	100		
F	Vittadinia gracilis	N	0.1	5		
G	Rytidosperma caespitosum	N	0.1	5		
F	Dianella glochidiatus.	N	0.1	1		
–	Trifolium campestre	E	5	1000		
F	Vittadinia cuneata	N	0.1	1		
–	Carthamus lanatus	HTE	0.1	2		
F	Enchylaena tomentosa	N	0.1	1		

GF Code: see Growth Form definitions in Appendix 1 **N:** native, **E:** exotic, **HTE:** high threat exotic **GF – circle code** if 'top 3'.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Appendix D

BAM Calculator data

plot	pct	area	Patch size	Condition class	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	strucShrub	strucGrass	strucForbs	strucFerns	strucOther	funLargeTrees	funHollowtrees	funLitterCover	funLenFallenLogs	funTreeStem5to9	funTreeStem10to19	funTreeStem20to29	funTreeStem30to49	funTreeStem50to79	
Stage 1																														
BO21	277	0.073	496	Planting	55	600342	6358826	322	3	4	6	6	0	0	8.1	10.3	17.1	5.3	0	0	0	0	7.4	0	1	1	1	0	0	1
BO22	82	1.11	496	Good	55	600295	6358792	132	3	6	6	14	0	0	38.2	11.7	39.2	10.9	0	0	3	2	19.4	9	0	1	1	1	1	1
BO20	76	1.43	496	Good	55	600217	6358914	328	1	3	8	18	0	1	5	20.6	40.2	15.7	0	0.1	1	1	11.2	12	0	1	1	1	1	0
BO14	56	0.73	2	degraded	55	600236	6356107	345	1	0	3	8	0	1	5	0	45.5	4.6	0	0.1	0	1	10.2	4	1	1	1	1	0	0
BO25	80	0.19	35	good	55	598906	6357909	95	4	4	5	15	0	2	43.5	1.3	55.5	5.4	0	0.2	2	1	24	30	1	1	1	1	0	1
AO17	248	6.19	94	degraded	55	598033	6357224	130	3	1	2	16	0	0	20	0.1	2.5	11.7	0	0	2	2	45	12	1	1	1	0	1	1
AN2	248	6.19	94	degraded	55	597920	6357254	198	1	0	4	7	0	0	25	0	2.3	11.5	0	0	0	0	25	2	1	1	0	0	0	1
AN3	248	6.19	94	degraded	55	597908	6357107	202	1	1	3	9	0	0	20	0.1	10.3	6.3	0	0	0	0	17	6	1	1	1	1	0	1
Stage 2																														
AO17	248	3.38	94	degraded	55	598033	6357224	130	3	1	2	16	0	0	20	0.1	2.5	11.7	0	0	2	2	45	12	1	1	1	0	1	1
AN2	248	3.38	94	degraded	55	597920	6357254	198	1	0	4	7	0	0	25	0	2.3	11.5	0	0	0	0	25	2	1	1	0	0	0	1
AN3	248	3.38	94	degraded	55	597908	6357107	202	1	1	3	9	0	0	20	0.1	10.3	6.3	0	0	0	0	17	6	1	1	1	1	0	1

Appendix E

EPBC Act assessments of significance

Grey Box (Eucalyptus microcarpa) Grassy Woodlands and derived native grasslands of South-eastern Australia – endangered ecological community

Diagnostic features

This community is a grassy woodland dominated by dominated or co-dominated by Grey Box (*Eucalyptus microcarpa*). The community also includes grassland understorey derived from the historic clearing of the woody components of the woodland. Both the grassy woodland and the derived native grassland provide vital support to a diverse range of native flora and fauna that are important to retaining regional, state and national biodiversity.

In grassy woodland occurrences, the shrub layer is variable, ranging from absent in areas of intense grazing, to moderately dense cover. In many situations, regrowth of the canopy trees may also be present in the mid layer. This community is heavily influenced by landscape factors and past land management practices. The ground layer varies in compositions, with a combination of grasses, herbs and smaller chenopods.

This community supports fauna species from a variety of conditions, ranging from wetter forest and woodland ecosystems further east and south to the semi-arid environment to the west and north. The Grey Box Grassy Woodlands have a strong influence on bird assemblage composition and provides foraging, roosting and breeding habitat. Larger mammals such as kangaroos and wallabies often utilise this community for grazing and arboreal species such as possums utilise tree-hollows for shelter and breeding (TSSC, 2010).

Geographic distribution

The Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia occurs from central NSW, through northern and central Victoria into eastern South Australia (TSSC, 2010)

Extent

This community was once widespread throughout south-eastern Australia but now, across its national range, only 10 to 15 per cent of the original extent remains. The community is found in wheat-sheep belt of eastern Australia and as a result has been extensively cleared since European settlement. It is estimated that the extent of the ecological community has declined from between 1.8 to 2.0 million hectares to a present extent between 300 000 and 330 000 hectares in NSW. Most of the remaining areas of this ecological community occur on private land. At present, less than one per cent of what remains of the community in NSW is in formal conservation reserves (TSSC, 2010).

Threats

The Grey Box ecological community is listed as an endangered ecological community due to the significant loss of integrity throughout much of its extent. This includes both vegetation and fauna components, combined with weed invasion, fragmentation and degradation of habitat. Clearing of this community continues to pose serious threats to the Grey Box Grassy Woodlands ecological community. Unfavourable management practices and a lack of protection in reserves are also highlighted as key threats for this ecological community (DEWHA, 2010).

Occurrence in the study area

Within the study area the community occurs in the north-western corner of the proposal site, on the edge of the existing mine site and is 2.54 hectares in size and is comprised of predominantly native species such as *Dichondra repens* (Kidney Weed), *Vittadinia cuneata* (Fuzzweed), *Austrostipa scabra* (Speargrass) and *Enchylaena tomentosa* (Ruby Saltbush). Some exotic species such as Wimmera Ryegrass, *Trifolium glomeratum* (Clustered Clover) and *Medicago praecox* (Small-leaved Burr Medic) were also recorded in this patch. It is connected to a large patch to the north and east, which occurs along Bogan Road and within adjacent agricultural land.

In total. 2.54 hectares of the community requires removal from the proposal site.

Table 35 Assessment of significance – Grey Box Woodland

Criteria	Discussion
According to the DotE (2013) 'significant impact criteria', an action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	
Reduce the extent of an ecological community	The proposal will result in the removal of 2.54 hectares of the Grey Box ecological community from a small remnant patch in the north-east of the proposal site. Minimal remnant Grey Box woodland remains within the study area, as the site has been cleared previously during the construction of the mine site, and for agricultural purposes. About four hectares of the patch are outside of the impact area and would be retained. Extensive (about 240 hectares) of woodland is connected to the proposal site, extending to the north and east through agricultural land, and along Bogan Road. At least part of this connected woodland patch is known to contain good quality Grey Box Woodland. The removal of 2.54 hectares of this community from the about 240 hectares of connected woodland represents the loss of about 1 per cent of the extent of the woodland in the community. The vegetation to be removed occurs across two separate patches within the proposal site, both of which have been modified extensively, and isolated by the construction of the mine, and agricultural land in the adjacent area. The community is known to occur in roadside patches and on private property in the wider locality especially to the north-east and south-east where the community is wide-spread in the roadside reserves of Five Chain Lane and Adavale Lane, and within the TSR adjacent to Bogan Road to the east. The listing advice for this community estimates the extent of the community to be between 300,000 to 330,000 hectares. Using a conservative estimate of 300,000 hectares remaining, the removal of 2.54 hectares represents about 0.001 per cent of the remaining extent of the community in NSW.
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The proposed clearing will result in further fragmentation of the patch of Grey Box woodland ecological community. This community is already highly fragmented due to historical clearing throughout NSW and within the study area and locality. The patch of vegetation to be impacted by the works is currently fragmented due to the existing Northparkes Mine activity in the proposal site and study area, and adjacent agricultural landuse activities. The patch occurs in a highly fragmented and modified landscape surrounded by the existing Northparkes Mine site and high intensity agriculture. Remaining patches of native vegetation are mostly restricted to roadside linear corridors and small remnant patches within agriculture land. The vegetation to be removed occurs as part of a larger patch of Grey Box woodland, occupying up to 240 hectares (which occurs to the north and the west within the road reserve and TSR). The proposal will result in the removal small linear strip on the edge of the patch, adjacent to the existing mine site. Given the removal of only a small proportion of woodland from the edge of the already disturbed patch, the proposal would only result in a minor increase of fragmentation, unlikely to impact the larger widespread community in the study area and locality. For the reasons described above, it is unlikely that disturbance as a result of construction will significantly increase fragmentation.
Adversely affect habitat critical to the survival of an ecological community	No critical habitat has been listed for the Grey Box Woodland ecological community under the EPBC Act 1999. Habitat critical to the survival of a species or ecological community also refers to areas that are necessary: – For activities such as foraging, breeding, roosting or dispersal – For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) – To maintain genetic diversity and long term evolutionary development, or – For the reintroduction of populations or recovery of the species or ecological community (DoE, 2013) Due to the limited area of Grey Box Woodlands remaining across the landscape, this patch of vegetation is important and its removal will contribute to the

Criteria	Discussion
	reduction of geographical extent of this community in NSW, especially given this patch occurs at the northern extent of the species distribution in NSW. However, it is unlikely that the proposal will damage habitat necessary for dispersal, maintenance, genetic diversity or recovery of Grey Box Woodlands as the areas to be impacted occur as part of a larger patch and connected linear roadside corridors and therefore is not critical to the survival of the community.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	The proposal will involve earthworks as part of the construction of the proposal and may alter local surface drainage flows within the proposal site. However, it is unlikely to cause substantial alterations of surface water drainage patterns where the community occurs that are necessary for the long-term survival of the ecological community. The earthworks have the potential to cause soil erosion in the proposal site which may run off into the study area, with the potential to impact on surface water quality to the remnant patches of Grey Box woodland. Additionally, vehicle and machinery traffic could cause compaction of soil, which can lead to increased surface run-off and hence greater erosion potential. Although the proposal may result in soil disturbance and surface water quality, as discussed, it is unlikely to significantly modify abiotic factors critical to the long-term survival of the community
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	The proposal will remove 2.54 hectares of the community from the locality. The occurrence of the overall patch will be retained but the proposal is likely to fragment the patch and increase edge impacts; these may have long-term impacts on the condition of the understorey and species composition of retained areas of this community. Vegetation that occurs on the edges of the proposal may be subject to increased weed invasion and it is possible that any weeds that are introduced may change the composition of the ecological community by outcompeting native understorey, resulting in a loss of functionally important species. By implementing mitigation measures outlined in section 9, the proposal would reduce the severity of these impacts on the community. As such, it is unlikely that the proposal would result in the introduction or spread of weeds to an extent that results in the loss of functionally important species from the community.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: **-assisting invasive species, that are harmful to the listed ecological community, to become established, or**	The Grey Box ecological community is listed as an endangered ecological community due to the significant loss of integrity throughout much of its extent. This includes both vegetative and faunal components, combined with weed invasion, fragmentation and degradation of habitat. The surrounding area within the proposal site and study area has undergone severe degradation and modification due to the operation of the mine site and adjacent agricultural activities. This includes the introduction of a variety of invasive and agricultural weeds which have degraded locally occurring woodlands and tree plantings within the mine site. The proposal will result in the removal of 2.54 hectares of this community, exacerbating the impacts of edge effects and weed invasion. Connected patches of this community would remain in the roadside reserve of Adavale Lane and the TSR to the east of the proposal site along Bogan Road. Additionally, smaller remnant patches of Grey Box woodland occur throughout nearby agricultural land and provide small areas of partially connected woodland habitat.
-causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants in to the ecological community which kill or inhibit the growth of species in the ecological community	Construction of the proposal has the potential to result in the mobilisation of contaminated sediments or chemical spill from vehicles or plants. The introduction of pollutants into the surrounding environment, if uncontrolled, could impact on surrounding areas of Grey Box Woodlands.
Interfere with the recovery of an ecological community	There is no national recovery plan for this ecological community. Given the occurrence of this community in the proposal site as mostly roadside vegetation and small isolated patches of the community in agricultural land, the proposal is unlikely to interfere with the recovery of the community due to the patches being impacted by fragmentation from other linear and residential infrastructure and agricultural development. Priority recovery and threat abatement actions listed in the approved conservation advice relevant to the proposal include:

Criteria	Discussion
	Enabling recovery of additional sites. This would occur through future biodiversity offsets required for the proposal and impacts to this community. Protecting remnants of the listed ecological community through the development of conservation agreements and covenants. Spread of invasive species as a result of clearing is a threat that may be exacerbated by the proposal. The remaining larger patches of woodland in the study area and locality would likely be protected from this due to their distance from the proposal site, and they would likely still function as viable patches and contribute to the recovery of the ecological community.
Conclusion	The proposal is not likely to have a significant impact on the endangered Grey Box Woodland ecological community given: – The small area to be removed (about 2.54 hectares) from two already highly modified and fragmented patches of the community – The area to be removed represents less than 0.001 per cent of the occurrence of the community in NSW. The community has a relatively widespread although patchy and fragmented distribution around the proposal site. The proposal will remove 2.54 hectares (about 0.001 per cent) of the community in NSW. The remaining small patches that would be fragmented after the proposal are likely to still remain as viable patches due to the connectivity to other vegetation. However, it is acknowledged that the proposal: – Is likely to increase the fragmentation of the patch in general which is already highly fragmented by the surrounding mine site and agricultural land. – Has potential to result in a reduction in the quality of the community, by increasing the risk of establishment of potentially invasive species harmful to the community. These risks would be managed through the implementation of construction and operational mitigation measures as part of the proposal.

Superb Parrot (*Polytelis swainsonii*) – vulnerable species

Distribution

The Superb Parrot is found in NSW and northern Victoria, where it occurs on the inland slopes of the Great Divide and on adjacent plains, especially along the major river-systems; vagrants have also been recorded in southern Queensland (DAWE 2021c).

Habitat requirements

The breeding range of the Superb Parrot is divided into three main areas: the first, along the Murray and Edward Rivers; the second, along the Murrumbidgee River; and the third, in a triangle bounded by Molong, Yass and Young (TSSC, 2016). Superb Parrots breed in either River Red Gum forests and woodlands or box woodlands (Webster 1998).

At least part of the population of the Superb Parrot undertakes regular seasonal movements, vacating the breeding area after the conclusion of the breeding season, and then returning in spring, while others remain in the breeding areas throughout the year. In central New South Wales, movements are said to occur when eucalypts flower, and when food becomes scarce due to drought and birds seek alternative sources of food (Higgins 1999).

The species seasonally occurs in box-pine (*Callitris*) and Boree (*Acacia pendula*) woodlands (Webster 1998).The Superb Parrot feeds mainly on the ground, on the seeds of grasses as well as cereal crops and spilt grain. They also eat the seed-pods of many understorey species of wattles, and flowers and fruits of eucalypts, berries of mistletoe and lerps (DAWE 2021c).

Habitat in the study area

Small flocks, pairs and individuals of the species were recorded at various times and locations within the proposal site and wider study area. Superb Parrots were recorded regularly along Five Chain Lane, and are likely foraging within woodland in the roadside. Targeted surveys for the species were conducted during the breeding season for the species and no breeding behaviour was observed. The species does not use habitat within the proposal site as breeding habitat. Superb Parrots in the study area and locality are likely to use woodland habitat within the proposal site for foraging and movement.

No areas mapped as ‘breeding likely to occur’ are located in the study area, however there are scattered records of birds breeding outside these mapped areas (Baker-Gabb 2011). Based on the lack of known breeding habitat in the study area, an important population is not considered to be present.

Table 36 Assessment of significance for the Superb Parrot

Criteria	Discussion
According to the DotE (2013) ‘significant impact criteria’, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	No areas mapped as ‘breeding likely to occur’ are located in the study area (Baker-Gabb 2011). Individuals that occur are likely to be non-breeding visitors to the areas. Based on the lack of known breeding habitat in the study area, an important population is not considered to be present.
Lead to a long-term decrease in the size of an important population of a species	The proposal would not impact any known breeding habitat for the species. Species that occur in the area would be non-breeding visitors. Construction would require the permanent removal of a maximum area of 13.6 hectares of native vegetation, including woodland and associated native groundcover vegetation from within the proposal site. Clearing of this woodland vegetation would permanently remove potential foraging resources for the species. The Superb Parrot is nomadic, moving large distance between breeding and non-breeding areas. The small nature of clearing for the proposal is unlikely to affect movement of this species, as vegetation removal would be limited to a few 100 metres in width, a distance which is easily traversed by the species. Large patches of vegetation occur in the surrounding study area and would be retained throughout this foraging range. Birds are at risk of vehicle and machinery strike as they forage for seed on the ground, and the risk of vehicle strike may be elevated during times

Criteria	Discussion
	of construction when vehicle and machinery movements are increased. However, given the slow speeds of machinery and vehicles around the site and during construction, this is unlikely to be substantial. Given the lack of impact on breeding habitat, and the small nature of clearing throughout scattered foraging habitat, the proposal is unlikely to lead to a long-term decrease in the size of an important population of a species.
Reduce the area of occupancy of an important population	The Superb Parrot occurs through the inland slopes and plains of New South Wales (including the Australian Capital Territory) to northern Victoria (Baker-Gibb 2011). Most birds undertake regular seasonal movements between breeding and non-breeding areas. The proposal would not reduce the area of occupancy of an important population given the lack of impact on breeding habitat.
Fragment an existing important population into two or more populations	Most Superb Parrots undertake regular seasonal movements between breeding and non-breeding areas. The proposal site would result in the loss of 13.6 hectares of potential foraging and connectivity habitat from the proposal site. Vegetation loss would occur to small and isolated patches of remnant woodland vegetation remaining within the mine site area. The proposal would not result in the removal of entire patches of vegetation, and connected woodland would remain in the study area. The loss of vegetation would not increase the gaps in canopy across the site by more than 100 metres. Given the high mobility of the species, and large area of NSW in which it occurs, and the minor loss of habitat vegetation and an already, the proposal is unlikely to fragment an important population into two or more populations.
Adversely affect habitat critical to the survival of a species	Habitat critical to the survival of the species comprises breeding and foraging habitat (Baker-Gibb 2011). No breeding habitat occurs in the proposal site. After breeding, different populations move to different foraging grounds. Most of the breeding population from the inland slopes appears to move to the eucalypt-pine woodlands on the plains of west-central and north-central New South Wales (Webster 1988). The proposal would remove scattered patches of habitat within and already modified proposal site, resulting in the loss of some foraging and connectivity habitat. Given the lack of impact on breeding habitat, and minimal nature of clearing through scattered foraging habitat, the proposal is unlikely to adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of an important population	No breeding habitat occurs in or near the proposal site. Clearing of scattered patches of potential foraging habitat would not affect the ability of the species to move between breeding and non-breeding areas. As such, the proposal would not disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Construction would require the permanent removal of a maximum area of 13.6 hectares of woodland and forest habitat from within and adjacent to the existing mine site. Given the availability of extensive, higher quality habitat for the species in the study area and locality, it is unlikely that the loss of these areas of fragmented and disturbed foraging habitat patches would impact the species to an extent that they are likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Operation of the proposal has the potential to spread weeds and pests which could degrade the species foraging habitat. The proposal site is already subject to degradation by weed species such as African Boxthorn and agricultural weeds like Patterson's Curse and Spear Thistle. In addition, pest species such as starlings, foxes and rabbits are already known to occur throughout the study area, and the proposal is unlikely to increase the likelihood of pest species becoming newly, or further established at the site. Given that mitigation measures outlines in Section

Criteria	Discussion
	9 are adhered to, the spread of weed species is likely to be minimal, and the establishment of new weed species (not already present) at the site is unlikely.
Introduce disease that may cause the species to decline	Psittacine beak and feather disease is a common and potentially deadly disease of parrots. Susceptibility to the infection may be influenced by environmental factors, such as climate, nutrition, habitat quality and social factors (DEH 2005). The proposal is unlikely to introduce Psittacine beak and feather disease, however cumulative impacts of further land clearing and impacts on habitat has the potential to increase susceptibility of individuals.
Interfere substantially with the recovery of the species	The long-term objective of recovery is to minimise the probability of extinction of the Superb Parrot in the wild, and to increase the probability of important populations becoming self-sustaining in the long term (Baker-Gibb 2011). Priority management areas are focused on breeding habitat for the species. Other priority actions include the identification and protection of key movement corridors. The proposal would not impact any breeding habitat for this species. Construction of the proposal would remove foraging habitat and some minor woodland habitat likely to provide connectivity and movement habitat for the species through the study area. Risk of vehicle strike is low given the relatively low traffic around the site, and the low vehicle speed enforced throughout the site. Individuals that occur in the study area are most likely to be non-breeding vagrants, and the proposal is unlikely to interfere substantially with the recovery of the species, given that no breeding habitat is likely to be removed and the linear nature of clearing through scattered foraging habitat.
Conclusion	The proposal is unlikely to have a significant impact on the Superb Parrot as: – No breeding habitat would be impacted – Clearing of patches of potential foraging habitat would not affect the ability of the species to move across and through the study area – Loss of foraging habitat involves small patches from the proposal site, which are easily traversable to larger areas of foraging habitat in the locality – The proposal would create small gaps in but is not likely to substantially disrupt the movement of the species between potential breeding areas (outside of the proposal site) and foraging areas given the high mobility of the species and the already highly cleared nature of the locality.

Grey-headed Flying Fox (*Pteropus poliocephalus*) – vulnerable species

Distribution

The Grey-headed Flying Fox is generally found in the coastal belt (within 200 kilometres of the eastern coast of Australia), from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortage they may travel inland to forage resources accordingly. The species only occurs within a small part of its range (based on resource availability) at any given time, and their relative abundance and distribution varies widely between seasons and years. (OEH 2021)

Habitat requirements

The species requires both foraging resources and roosting sites. The species is a canopy-feeding frugivore and nectivore, which uses vegetation communities including rainforests, open forests and closed and open woodlands. It will also feed on fruit crops and introduced trees. None of the feed resources utilised by the species occur year-round, and as such, the species has developed complex migration traits in response to ephemeral and patchy foraging resources. (DAWE 2021d)

Habitat in the study area

The proposal site does not contain any roost sites or breeding camps, and breeding activity does not occur in the study area. The proposal site and study area may provide temporary foraging resources (up to 2.71 hectares) for the species during times of feed scarcity for the species in its usual coastal range.

Table 37 Assessment of significance for the Grey-headed Flying Fox

Criteria	Discussion
According to the DotE (2013) 'significant impact criteria', an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	No known breeding camps or roost sites occur within the study area. Individuals that occur are likely to be non-breeding visitors to the areas. Based on the lack of known breeding habitat in the study area, an important population is not considered to be present.
Lead to a long-term decrease in the size of an important population of a species	The proposal would not impact any known breeding habitat for the species. Species that occur in the area would be non-breeding visitors. Construction would require the permanent removal of a maximum area of 2.71 hectares of native vegetation, including woodland from within the proposal site. Clearing of this woodland vegetation would permanently remove potential foraging resources for the species. The Grey-headed Flying Fox is known to range large distances in search of foraging resources in times of food scarcity. The small nature of clearing for the proposal is unlikely to affect movement of this species, as vegetation removal would be limited to a few 100 metres in width, a distance which is easily traversable by the species. Large patches of vegetation occur in the surrounding study area and would be retained throughout this foraging range. Additionally, the loss of only a small amount of foraging resources from the site, given the wider availability of alternant foraging resources is unlikely to determinately impact the species. Given the lack of impact on breeding habitat, and the small nature of clearing through scattered, ephemeral foraging habitat, the proposal is unlikely to lead to a long-term decrease in the size of an important population of a species.
Reduce the area of occupancy of an important population	The Grey-headed Flying Fox typically occurs within 200 kilometres of the coast, however they have been known to travel large distances inland in search of foraging resources in times of feed scarcity. Given the migratory nature of their potential occurrence at the proposal site, the proposal would not reduce the area of occupancy of an important population of the species given the lack of impact on breeding habitat.
Fragment an existing important population into two or more populations	The proposal site would result in the loss of 2.71 hectares of potential foraging and connectivity habitat from the proposal site. Vegetation loss would occur to small and isolated patches of remnant woodland vegetation remaining within the mine site area. The proposal would not

Criteria	Discussion
	result in the removal of entire patches of vegetation, and connected woodland would remain in the study area. The loss of vegetation would not increase the gaps in canopy across the site by more than a few 100 metres. Given the variable occurrence of the species inland, the high mobility of the species, the large area of NSW in which it occurs, and the minor loss of potential habitat, the proposal is unlikely to fragment an important population into two or more populations.
Adversely affect habitat critical to the survival of a species	Habitat critical to the survival of the species comprises roosting and foraging habitat (DECCW 2009). No roosting or breeding habitat occurs in the proposal site. All foraging habitats have the potential to be productive during general food shortages, and to therefore provide a resource critical to the survival of the species The proposal would remove scattered patches of habitat within an already modified proposal site, resulting in the loss of some foraging and connectivity habitat. Given the lack of impact on breeding habitat, and minimal nature of clearing through scattered foraging habitat, the proposal is unlikely to adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of an important population	No breeding habitat occurs in or near the proposal site or locality. The proposal would not disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Construction would require the permanent removal of a maximum area of 2.71 hectares of woodland and forest habitat from within and adjacent to the existing mine site that may provide seasonal foraging habitat for the species. Given the availability of extensive, higher quality habitat for the species in the study area and locality, and the species intermittent use of foraging habitat inland, it is unlikely that the loss of these areas of fragmented and disturbed foraging habitat patches would impact the species to an extent that they are likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Operation of the proposal has the potential to spread weeds and pests which could degrade the species foraging habitat. Given that mitigation measures outlines in Section 9 are adhered to, the spread of weed species is likely to be minimal. As the species would only use the proposal site and study area on a temporary and transient basis, it is unlikely that the proposal would result in the establishment of invasive species likely to impact the species.
Introduce disease that may cause the species to decline	The Grey-headed Flying Fox is known to be a carrier for the Australian bat lyssavirus (ABL), which can cause clinical disease and mortality in the species. The incidence of the disease in the species is low (<1 per cent), and generally the virus appears to be in equilibrium with the population, however when the species undergoes significant ecological stress, the disease can increase to a degree that the population is impacted. The proposal is unlikely to result in ecological stress significance enough to result in the disease impacting the species, however cumulative impacts of further land clearing and impacts on habitat has the potential to increase susceptibility of individuals in the case of future ecological disturbance.
Interfere substantially with the recovery of the species	The long-term objective of recovery is to reduce the impacts of threatening processes on the species, and to arrest the decline throughout the species range. Priority management areas are focused on critical foraging habitat and roosting habitat for the species. The proposal would not impact any breeding or roosting habitat for this species. Construction of the proposal would remove some potential foraging habitat and some minor woodland habitat which could provide connectivity and movement habitat for the species through the study area.

Criteria	Discussion
	Individuals that occur in the study area are most likely to be non-breeding vagrants in search of ephemeral foraging resources. This is only likely to occur in times of resource shortage in the species usual coastal habitats. The proposal is unlikely to interfere substantially with the recovery of the species, given that no breeding habitat is likely to be removed and the linear nature of clearing through scattered foraging habitat.
Conclusion	The proposal is unlikely to have a significant impact on the Grey-headed Flying Fox as: – No breeding habitat would be impacted – Loss of ephemeral foraging habitat involves small patches from the proposal site, which are easily traversable to larger areas of similar potential foraging habitat in the locality The proposal would create small gaps in but is not likely to substantially disrupt the movement of the species between foraging areas given the high mobility of the species and the already highly cleared nature of the locality.

Corben's Long-eared Bat (*Nyctophilus corbeni*) – vulnerable species

Distribution

Distribution of the species coincides approximately with the Murray Darling Basin, with the Pilliga Scrub region being the distinct stronghold for this species (OEH 2021b).

Habitat requirements

Corben's Long-eared Bat inhabits a variety of vegetation types, including mallee, Bulloke (*Allocasuarina leuhmanni*) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. It roosts in tree hollows, crevices, and under loose bark (TSSC 2015). The species avoids roosting in commercially thinned stands and selected old regrowth (Law et al 2016) and prefers larger remnants with a well-developed understorey (Turbill and Ellis 2006).

Habitat in the study area

The proposal site contains 10.88 hectares of remnant and planted woodland vegetation which could provide suitable foraging habitat for Corben's Long-eared Bat. In addition, 32 hollow-bearing trees were recorded scattered throughout the woodland patches in the proposal site, which may provide roosting habitat for the species. In particular, abundant hollow-bearing trees were present in woodland patches to the eastern edge of the mine site within Grey Box and Poplar Box woodland, and in the small patch of woodland to be removed by the proposal. from Limestone National Forest on the western edge of the proposal site.

Table 38 Assessment of significance for Corben's Long-eared Bat

Criteria	Discussion
According to the DotE (2013) 'significant impact criteria', an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	The species was not recorded during site surveys using Anabat detection, however due to the presence of hollow-bearing trees in the proposal site, it is considered possible that potential breeding habitat occurs within the site. Based on the lack of known breeding habitat in the study area, an important population is not considered to be present.
Lead to a long-term decrease in the size of an important population of a species	The proposal would require the removal of 10.88 hectares of potential foraging habitat and up to 32 hollow-bearing trees that may be utilised by the species as roosting or breeding habitat. Corben's Long-eared Bat is known to forage for insects over woodland and treed landscapes, and roosts in dead trees and hollows in living trees. Generally, it is thought that most roost sites are used for a single day, and large distances are travelled at night (TSSC 2015) Given the high mobility of the species, and the small nature of clearing for the proposal is unlikely that the removal of woodland within the proposal site would affect movement of this species, as vegetation removal would be limited to about 100 metres in width, a distance which is easily traversable by the species. Large patches of vegetation occur in the surrounding study area and would be retained throughout this foraging range. The loss of only a small amount of resources the species forages above given the wider availability of alternant foraging habitat is unlikely to determinately impact the species. The removal of hollow-bearing trees would reduce the availability of roosting and potential breeding sites for the species in the proposal site. Given the lack of known breeding habitat, and in the absence of information to suggest an important population occurs on the site, the proposal is unlikely to lead to the decrease in the size of an important population of Corben's Long-eared Bat.
Reduce the area of occupancy of an important population	Corben's Long-eared Bat occurs in a wide range of habitats, but is more common within box/ ironbark and cypress pine woodlands, Buloke woodlands and Brigalow woodlands. Typically it is more abundant in extensive stands of vegetation in comparison to smaller woodland patches.

Criteria	Discussion
	The proposal would result in the removal of 10.88 hectares of woodland, occurring as small, disconnected and scattered patches of woodland across the existing mine site. In addition to the loss of woodland habitat, the proposal would result in the removal of 32 hollow-bearing trees from across these patches. Site surveys using Anabat detection have not recorded the species at the site. In addition, as woodland patches to be removed are small, fragmented and disconnected from one another (do not form a large connected patch of habitat for the species) it is unlikely that the species would occur within woodland In the absence of specific information about a breeding population of the species within the proposal site, which is unlikely to occur, an important population of the species is not considered likely to occur.
Fragment an existing important population into two or more populations	The proposal site would result in the loss of 10.88 hectares of foraging and connectivity habitat from the proposal site, and 32 hollow-bearing trees which may provide breeding and roosting habitat. Vegetation loss would occur to small and isolated patches of remnant woodland vegetation remaining within the mine site area. The proposal would not result in the removal of entire patches of vegetation, and connected woodland would remain in the study area. The loss of vegetation would not increase the gaps in canopy across the site by more than about 100 metres. Given the high mobility of the species, the large area of NSW in which it occurs, and the minor loss of foraging and potential roosting vegetation, the proposal is unlikely to fragment an important population into two or more populations.
Adversely affect habitat critical to the survival of a species	No information is available on habitat critical to the survival of the species, however hollow-bearing tree habitat (roosting) and woodland vegetation (foraging) is considered important. Hollow-bearing trees may provide roosting habitat within the proposal site, however breeding habitat is unlikely to occur due to the degraded and fragmented condition of the site. The proposal would remove scattered patches of habitat within and already modified proposal site, resulting in the loss of some foraging, roosting and connectivity habitat. Given the lack of impact on breeding habitat, and minimal nature of clearing through scattered foraging habitat, the proposal is unlikely to adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of an important population	No breeding habitat is known to occur in or near the proposal site or locality. An important population of the species is not known, or considered likely to occur. The proposal would not disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Construction would require the permanent removal of a maximum area of 10.88 hectares of woodland and forest habitat from within and adjacent to the existing mine site, which may provide foraging habitat for the species. Given the availability of extensive, higher quality habitat for the species in the study area and locality, it is unlikely that the loss of these areas of fragmented and disturbed foraging habitat patches would impact the species to an extent that they are likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Operation of the proposal has the potential to spread weeds and pests which could degrade the species foraging habitat. Given that the species forages above the canopy on insects, this is unlikely to impact on the species habitat. Clearing of vegetation may result in the easier establishment of pest species (i.e feral cats and foxes) which may prey on the species, however given the occurrence of these feral species in the landscape already, this is considered unlikely to be enhanced to a degree that would impact on the species further than it already has. It is unlikely that the proposal would result in the establishment of invasive species likely to impact the species.
Introduce disease that may cause the species to decline	The proposal is unlikely to introduce disease into the Pilliga that may cause the species to decline.

Criteria	Discussion
Interfere substantially with the recovery of the species	The long-term objective of recovery is to reduce the impacts of threatening processes on the species, and to arrest the decline throughout the species range. Priority management areas are focused on critical foraging habitat and roosting habitat for the species. The proposal would not impact any known or critical breeding habitat for this species. Construction of the proposal would remove some potential foraging and roosting habitat and some minor woodland habitat which could provide connectivity and movement habitat for the species through the study area. Individuals that occur in the study area are most likely to occur on a temporary basis, and use the site as foraging habitat and temporary roosting sites. As such, the proposal is unlikely to interfere substantially with the recovery of the species, given that no breeding habitat is likely to be removed and the linear nature of clearing through scattered foraging habitat.
Conclusion	The proposal is unlikely to have a significant impact on Corben's Long-eared Bat as: – No known breeding habitat would be impacted – An important population would not be impacted – Loss of minor foraging habitat involves small patches from the proposal site, which are easily traversable to larger areas of foraging habitat in the locality The proposal would create small gaps in but is not likely to substantially disrupt the movement of the species between foraging areas given the high mobility of the species and the already highly cleared nature of the locality.

Appendix F

Biodiversity credit report

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00027634/BAAS18127/21/00027635

Proposal Name
Northparkes Mines Modification 6 - Stage 1

BAM data last updated *
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* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	277-Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
Species		

Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Climacteris picumnus victoriae / Brown Treecreeper (eastern subspecies)
Dasyurus maculatus / Spotted-tailed Quoll
Anthochaera phrygia / Regent Honeyeater
Grantiella picta / Painted Honeyeater

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
277-Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	0.1	0	2	2
82-Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	1.1	47	0	47
76-Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	1.4	36	0	36
56-Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW	Not a TEC	0.7	12	0	12
80-Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	0.2	8	0	8

56-Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

	Floodplain Transition Woodlands This includes PCT's: 56, 74, 76, 80, 81, 82, 237, 244, 248, 251, 628	Floodplain Transition Woodlands >=70% and <90%	56_degraded	Yes	12	Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
76-Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions This includes PCT's: 76, 80, 81, 82, 101, 110, 237, 248	-	76_Good	Yes	36	Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

76-Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions

80-Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions This includes PCT's: 76, 80, 81, 82, 101, 110, 237, 248	-	80_good	Yes	8	Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

82-Western Grey Box - Poplar Box - White Cypress Pine tall woodland on red loams mainly of the eastern Cobar Peneplain Bioregion	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions This includes PCT's: 76, 80, 81, 82, 101, 110, 237, 248	-	82_Good	Yes	47	Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
277-Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New	-	277_Planting	No	2	Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee. or Any IBRA subregion that is within 100 kilometers of the outer edge of the

	England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698					impacted site.

BAM Biodiversity Credit Report (Like for like)

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
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Proposal Name
Northparkes Mines Modification 6 - Stage 2

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Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
248-Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW	Not a TEC	6.2	151	0	151

BAM Biodiversity Credit Report (Like for like)

248-Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Floodplain Transition Woodlands This includes PCT's: 56, 74, 76, 80, 81, 82, 237, 244, 248, 251, 628	Floodplain Transition Woodlands >=70% and <90%	248_degraded	Yes	151	Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

BAM Biodiversity Credit Report (Like for like)

Proposal Details

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Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Climacteris picumnus victoriae / Brown Treecreeper (eastern subspecies)
Grantiella picta / Painted Honeyeater

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
248-Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW	Not a TEC	3.4	82	0	82

BAM Biodiversity Credit Report (Like for like)

248-Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Floodplain Transition Woodlands This includes PCT's: 56, 74, 76, 80, 81, 82, 237, 244, 248, 251, 628	Floodplain Transition Woodlands >=70% and <90%	248_degraded	Yes	82	Lower Slopes, Bogan-Macquarie, Inland Slopes, Lachlan Plains, Murray Fans, Murrumbidgee and Nymagee. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

No Species Credit Data

Credit Retirement Options

Like-for-like credit retirement options

Appendix G

Land category mapping report

umwelt
Environmental & Social Consultants



NORTHPARKES MINE

Local Land Services Act 2013
Land Category Mapping

FINAL

September 2021

NORTHPARKES MINE

Local Land Services Act 2013
Land Category Mapping

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
CMOC Northparkes

Project Director:	David Holmes
Project Manager:	David Holmes
Report No.	20272/R05
Date:	September 2021

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Document Status

Rev No.	Reviewer		Approved for Issue	
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Final	David Holmes	30/09/2021	David Holmes	30/09/2021

Table of Contents

1.0 Introduction 1

1.1 Definition of Category 1-Exempt Land 1

1.1.1 Meaning of 'cleared' 2

1.1.2 Native Vegetation Identified as Regrowth in a Property Vegetation Plan Under the Repealed *Native Vegetation Act 2003* 3

1.1.3 Low Conservation Value Groundcover 3

1.1.4 Land bio-certified under the BC Act. 4

1.2 Category 2-Regulated Land 4

2.0 Methodology 7

2.1 Mapping of Category 1-Exempt Land 7

2.2 Category 2-Regulated Land Exclusion Process 12

3.0 Land Category Mapping 13

3.1 Excluded Areas 13

3.1.1 Sensitive Regulated Land 13

3.1.2 Vulnerable regulated land 13

3.1.3 Additional Category 2- regulated land (s 60I(2)(n) LLS Act and Clause 113 LLS Regulation) 13

3.2 Category 1 and 2 land within the Project Area 16

4.0 Metadata List 19

Figures

Figure 2.1 Approved Operational Area under PA11_0060 8

Figure 2.2 Land Use Mapping Northparkes Project EIS August 1990 9

Figure 2.3 Land Use 2013 10

Figure 2.4 Land Use 2017 11

Figure 3.1 LLS Act Land Category Mapping, PA11_0060 Project Area (2018 Imagery) 17

Figure 3.2 LLS Act Land Category Mapping, PA11_0060 Project Area (1991 Aerial Photography) 18

Tables

Table 3.1 Northparkes development consents and project approvals 14

Table 4.1 Images/Aerial Photography reviewed 19

Table 4.2 Spatial Data Provided 19

Appendices

Appendix A Approval Disturbance Area Mapping Report

1.0 Introduction

Section 6.12 of the *Biodiversity Conservation Act 2016* (BC Act) requires a Biodiversity Development Assessment Report (BDAR) to be prepared in accordance with the Biodiversity Assessment Method (BAM) which is established under Section 6.8 of the BC Act.

Relevantly, section 6.8(3) of the BC Act provides:

> *(3) The biodiversity assessment method is to exclude the assessment of the impacts of any clearing of native vegetation and loss of habitat on category 1-exempt land (within the meaning of Part 5A of the Local Land Services Act 2013), other than any impacts prescribed by the regulations under section 6.3.*
>
> ***category 1-exempt land** means areas of the State to which this Part applies designated as category 1-exempt land on the native vegetation regulatory map.*
>
> ***category 2-regulated land** means areas of the State to which this Part applies designated as category 2-regulated land on the native vegetation regulatory map (including category 2-vulnerable regulated land that is so designated).*
>
> ***60E Purpose of native vegetation regulatory map***
>
> *The purpose of the native vegetation regulatory map is to designate areas of the State to which this Part applies—*
>
> *(a) where the clearing of native vegetation is not regulated under this Part (**category 1-exempt land**), and*
>
> *(b) where the clearing of native vegetation is regulated under this Part (**category 2-regulated land**), and*
>
> *(c) where the clearing of native vegetation is regulated under this Part but (because of its vulnerability) is subject to additional restrictions and extended to the clearing of dead and non-native plants (**category 2-vulnerable regulated land**).*

The Native Vegetation Regulatory Map has not been finalised and the mapping of Category 1 land has not been released to the public. As such, landholders are responsible for determining the categorisation of their land in accordance with the *Local Land Services Act 2013* (LLS Act).

This report describes the processes of mapping Category 1 and Category 2 land within the PA 11_0060 Project Area for the purposes of determining the Development Footprint for the purposes of the preparation of Biodiversity Development Assessment Reports to support applications to modify PA 11_0060

1.1 Definition of Category 1-Exempt Land

Category 1-exempt land is defined in Part 5A, Division 2 of the LLS Act. Subject to certain exceptions, Category 1-exempt land is broadly defined as being:

- land cleared of native vegetation as at 1 January 1990 or lawfully cleared after 1 January 1990 (but before 25 August 2017)
- low conservation grasslands
- land containing only low conservation groundcover (not being grasslands)

- native vegetation identified as regrowth in a Property Vegetation Plan under the repealed *Native Vegetation Act 2003*
- land bio-certified under the BC Act.

Land meeting the above criteria is not considered to be Category 1-exempt land if certain exceptions apply. These exemptions are discussed further in the following sections below.

1.1.1 Meaning of 'cleared'

Based on the Land Categorisation Fact Sheet, clearing has been interpreted as any areas where there has been a lawful removal of all native vegetation (all strata) prior to the commencement of Part 5A of the LLS Act, being 25 August 2017.

114 Determining whether native vegetation has been significantly disturbed or modified (s 60J (2))

(1) Native vegetation that comprises grasslands or other non-woody vegetation is taken to have been significantly disturbed or modified (and therefore cleared) only if:

(a) there has been a detectable variation (from information obtained from aerial or satellite imagery) in the structure or composition, or both, of non-woody vegetation, and

(b) that variation is consistent with management of pasture or crops for agricultural purposes, and

(c) that variation has been sustained for at least 12 months on more than one occasion before the commencement of Part 5A of the Act, and

(d) that variation has not been caused only by grazing on the land, and

(e) that variation occurred (from information obtained from aerial or satellite imagery) between 1 January 1990 and the date of commencement of Part 5A of the Act.

(2) During the transitional period referred to in section 60F of the Act, the information that may be used for the purposes of this clause includes information obtained from a source other than from aerial or satellite imagery, but only if the landholder has prepared a record of the information and a map showing the areas to which it applies. The landholder is required to retain the record and map for at least 5 years after any clearing that is carried out in reliance on that information.

60B Meaning of "native vegetation"

*(1) For the purposes of this Part, **native vegetation** means any of the following types of plants native to New South Wales—*

(a) trees (including any sapling or shrub or any scrub),

(b) understorey plants,

(c) groundcover (being any type of herbaceous vegetation),

(d) plants occurring in a wetland.

(2) A plant is native to New South Wales if it was established in New South Wales before European settlement. The regulations may authorise conclusive presumptions to be made of the species of plants native to New South Wales by adopting any relevant classification in an official database of plants that is publicly accessible.

(3) For the purposes of this Part, native vegetation extends to a plant that is dead or that is not native to New South Wales if—

(a) the plant is situated on land that is shown on the native vegetation regulatory map as category 2-vulnerable regulated land, and

(b) it would be native vegetation for the purposes of this Part if it were native to New South Wales.

(4) For the purposes of this Part, native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). A declaration under section 14.7 of the Biodiversity Conservation Act 2016 that specified vegetation is or is not marine vegetation also has effect for the purposes of this Part.

60C Meaning of "clearing" native vegetation

*For the purposes of this Part, **clearing** native vegetation means any one or more of the following—*

(a) cutting down, felling, uprooting, thinning or otherwise removing native vegetation,

(b) killing, destroying, poisoning, ringbarking or burning native vegetation.

Complete removal of native vegetation has been interpreted for the purposes of the mapping as being areas where complete removal of ground cover has occurred, namely:

- areas that were cropped/ploughed or significantly disturbed (see clause 114 of the LLS Regulation) for agricultural purposes
- areas disturbed by approved mining (or other) approved activities.

While it is reasonably straight forward to classify land that has had all vegetation removed since 1990 by identifying land were surface disturbance activities have taken place, the legislation provides little clarity on what is meant by 'cleared as at 1 January 1990'. This is particularly important in the present case where there is a long history of disturbance within the Project Area associated with agriculture. This process is complicated in the present conditions by the absence of any high resolution aerial photography of the Project Area in 1990. The methodology for assessing areas 'cleared' of native vegetation is set out in **Section 2.1**.

1.1.2 Native Vegetation Identified as Regrowth in a Property Vegetation Plan Under the Repealed *Native Vegetation Act 2003*

Although the *Native Vegetation Act 2003* was repealed in 2017, Property Vegetation Plans approved before the repeal of the Act remain valid and the obligations to manage and maintain the associated offset areas continue. There are no valid Property Vegetation Plans relevant to the Project Area.

1.1.3 Low Conservation Value Groundcover

The method of determining whether or not grassland areas constitute low conservation value grasslands or other cover is described in clause 110 of the LLS Regulation

110 Determining conservation value of grasslands or other groundcover (s 60H (5))

(1) For the purposes of section 60H (5) of the Act, land contains low conservation value grasslands for the purposes of Division 2 of Part 5A of the Act if the land is determined to contain low conservation value grasslands under the "Interim Grasslands and other Groundcover Assessment Method" published by the Minister for the Environment in the Gazette on 25 August 2017.

(2) For the purposes of clause 109, land contains low conservation value groundcover (not being grasslands) if the land is determined to contain low conservation value groundcover (other than grasslands) under the "Interim Grasslands and other Groundcover Assessment Method" published by the Minister for the Environment in the Gazette on 25 August 2017.

(3) A determination referred to in this clause is not required under the published methods if the Environment Agency Head reasonably believes that an independent field assessment undertaken before the commencement of Part 5A of the Act has determined that the land contains high conservation value grasslands or other groundcover.

In all but a few areas, woodland areas have been removed entirely and the resultant land has a long history of cropping and/or grazing. The presence of exotic grassland and herb species in grassland areas (and the understory of remnant vegetation which has been grazed) is widespread and historical vegetation surveys and plot work indicated exotic species dominate most cleared areas where these are not actively cropped (see for example Umwelt 2013). At the time of preparing this assessment, survey of grassland and understorey areas was constrained by workplace health and safety concerns related to the COVID 19 Pandemic. Accordingly, formal assessment of Low Conservation Value Groundcover in accordance with the "Interim Grasslands and other Groundcover Assessment Method" has not been undertaken, however, in the area around the approved E31N and E31 pits, the interpretation of plot data for the understorey of similar vegetation in a near plot has been relied upon to support an assessment of likely vegetation in this area (noting that this grassland area was also mapped as being 'exotic grassland' in the Flora and Fauna Assessment of the Northparkes Mines Step Change Project Environmental Assessment (Umwelt, 2013) Further field work in some areas mapped as being Category 2 land in this report may result in a reclassification of Category 2 land as Category 1 land. This applies in particular to grassland areas which have been mapped as being exotic grasslands (see for example Umwelt 2013) or 'grazing modified pastures' in NSW Land Use 2013 and 2017 mapping.

1.1.4 Land bio-certified under the BC Act.

The land within the Project Area is not subject to bio-certification under the BC Act.

1.2 Category 2-Regulated Land

Category 2-regulated land is divided into:

Regulated land, which is any Category 2 land that is not vulnerable or sensitive regulated land, includes:

- land not cleared as at 1 January 1990 or unlawfully cleared after 1 January 1990
- native vegetation grown with the assistance of public funds (but clearing under the Land Management Code is not permitted on such land while the agreement providing the funds is in force)
- land that was subject to a Private Native Forestry Property Vegetation Plan that is no longer in force
- grasslands that are neither low nor high conservation grasslands
- travelling stock reserves, apart from travelling stock reserves in the Western Division
- land that is (or was previously) subject to a Private Native Forestry Plan or Private Native Forestry Property Vegetation Plan
- land that is of a kind prescribed by the LLS Regulation as being Category 2- regulated land (clauses 108 and 113 of the LLS Regulation).

Vulnerable regulated land (clause 108 LLS Regulation), which is land where clearing of native vegetation may not be permitted under the Land Management (Native Vegetation) Code 2018 and includes:

- steep or highly erodible land
- protected riparian areas
- land susceptible to erosion, or land that is otherwise environmentally sensitive.

Additional Category 2 regulated land (Clause 113 LLS Regulation), which is where clearing is not permitted and includes:

- land subject to a private land conservation agreement
- land set aside under the Land Management Code
- land subject to a bio-certification conservation measure
- land comprising an offset under a Property Vegetation Plan or set aside under a code under the *Native Vegetation Act 2003*
- coastal wetlands and littoral rainforests (*Coastal Management Act 2016*)
- high conservation grasslands
- core koala habitat identified in a plan of management (State Environmental Planning Policy No 44 (Koala Protection))
- critically endangered plants and critically endangered ecological communities
- Ramsar wetlands (EPBC Act)
- land subject to remedial action or conservation measures under the BC Act
- land subject to a property, trust or conservation agreement
- land recommended for listing as an Area of Outstanding Biodiversity Value
- Conservation Areas under the Southern Mallee Land Use Agreement
- native vegetation that must be retained under the *Plantation and Reafforestation Act 1999*
- land subject to a condition of development consent requiring the land to be set aside for conservation purposes under the *Environmental Planning and Assessment Act 1979* (EP&A Act)
- rainforest and old-growth forest.

Clauses 108 and 113 of the LLS Regulation prescribe additional land as being eligible as being Category 2-regulated land. Of these, only the LLS Regulation Clause 113 (1)(i) appears to be potentially relevant to the Project Area (***emphasis added***):

> *(1) Land is also to be designated as category 2-regulated land if the Environment Agency Head reasonably believes that:*

*(i) the land is, by a condition of a development consent or approval under the Environmental Planning and Assessment Act 1979 that has been notified to the Environment Agency Head, required to **be set aside** for nature conservation, for re-vegetation of native vegetation or as a native vegetation offset*

The assessment area includes areas of vegetation planted by Northparkes since 1990 and areas of partly rehabilitated land established on areas disturbed by approved mining activities since 1990. We understand that none of these areas were grown or conserved with the assistance of public funds (Section 60I(2)(a)) nor, with the exception of the land added to Limestone State Forest as an offset for impacts within Limestone State Forest, are they offsets under either the *Environmental Planning and Assessment Act 1999* (EP&A Act) or the *Native Vegetation Conservation Act 1995*. A review of all past development consent provisions and commitments under past and existing consents does not reveal any obligation under a condition of consent to set aside any areas (other than the identified biodiversity offset areas in Schedule 3 Condition 26 of PA11_0026). There is no specific commitment in PA11_0060 to establish a set area of rehabilitated woodland vegetation. Accordingly, these planted areas, where they are located on land that would otherwise be Category 1 land, are considered to retain Category 1 -exempt land status despite now being planted to native vegetation.

All Category 2-regulated land mapping available on the Native Vegetation Regulatory Map has been applied to the definition of Category 1-exempt land and is discussed further in **Section 3.2**.

2.0 Methodology

The process for identifying Category 1-exempt land has adopted the following basic process:

- identify land that had been disturbed and could meet the requirements of Category 1-exempt land on this basis
- exclude land that meets the requirements of Category 2-regulated land, vulnerable regulated land or sensitive regulated land

2.1 Mapping of Category 1-Exempt Land

Category 1-exempt land areas were identified through the following process:

- Areas approved for disturbance under PA11_0060 (refer to **Figure 2.1**) were excluded from the area mapped. A separate report has been prepared to accurately identify the extent of approved mining disturbance under PA11_0060 and is attached as **Appendix A** for reference).
- Aerial photography/satellite imagery from 1991, 2005, 2006, 2010, 2013 and 2015 was reviewed
- Areas which were identified as having been lawfully cleared/disturbed as set out above were then mapped using geo-rectified imagery.

A full list of the imagery and detailed metadata is set out in **Section 4.0**.

'Cleared as at 1990' has been interpreted as areas where there is clear evidence of the complete removal of all vegetation or evidence of compositional change in the grassland prior to 1990 and in which shrubs or trees had not regrown prior to 1990. It should be noted that for the purposes of this assessment an aerial photo from 1991 has been used for this purpose as the 1990 aerial was not available and satellite imagery from 1990 was of insufficient resolution for mapping purposes.

Complete removal of native vegetation has been interpreted for the purposes of the mapping as being areas where complete removal of ground cover has occurred, namely:

- areas that were cropped/ploughed or significantly disturbed (see clause 114 of the LLS Regulation) for agricultural purposes
- areas disturbed by approved mining (or other) approved activities.

The presence of remnant paddock trees in paddocks that have been cleared and cropped does not preclude these areas from being assessed as having been cleared (subject to restriction around the treatment of remnant paddock trees themselves). Only areas that retain trees in relatively close proximity to each other such that they may still be characterised as being a woodland community have been considered as not being cleared where there is evidence of removal of vegetation in and around these trees. Aerial photo interpretation of groundcover texture has been used to inform the assessment of likely disturbance, with a comparison of grassland 'texture' in areas of uncertainty compared to areas where past disturbance is clear to inform the mapping of 'cleared areas.

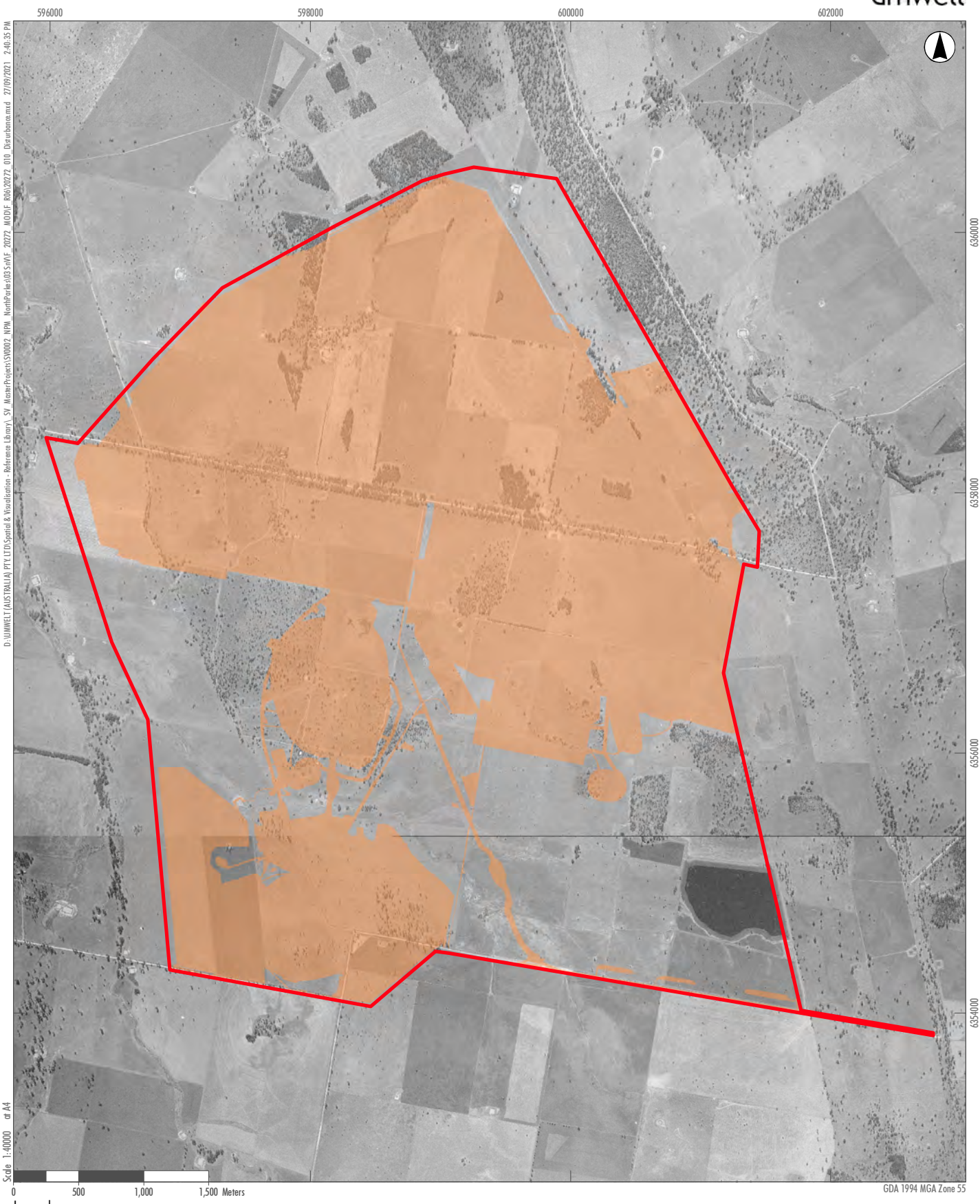


FIGURE 2.1

Approved Operational Area under PA11_0060

Image source: NSW Government - Historical Imagery (1991) Data source: NPM (2021); Umwelt (2021)

Mapping of land use provided in Figure 17 of the 1990 Northparkes Environmental Impact Assessment (NSR Environmental Consultants, 1990) was also used to verify areas where cropping had occurred where this was not entirely verifiable from imagery. Figure 17 from the 1990 EIS is reproduced in **Figure 2.2**. This has also be cross checked against aerial photos from 1974 and 1982 to verify this historical mapping of cropping.

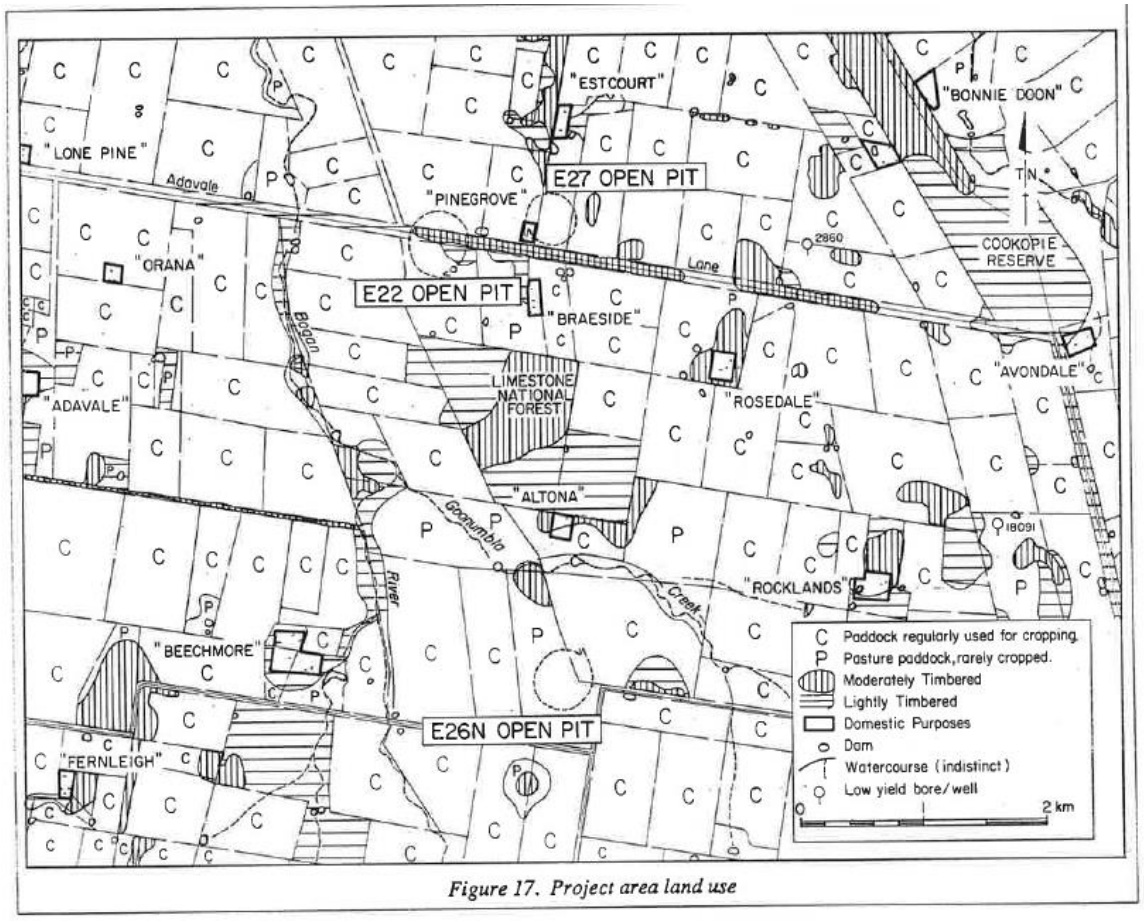


Figure 2.2 Land Use Mapping Northparkes Project EIS August 1990

Change in composition has been identified through evidence of comparison of sequential aerial photographs which indicate a clear change in the form of the grassland and that change is sustained for at least an additional subsequent image. It is noted that the NSW Land Use 2013 (refer to **Figure 2.3**) and Land Use 2017[1] (refer to **Figure 2.4**) mapping of cropping land is largely accurate and the mapping of 'Grazing modified pastures is also largely reflective of areas where it can be demonstrated that cropping in the period 1990 to 2017 has occurred. While this mapping has been used as a guide with land mapped as 3.2.0, 3.3.0 and 4.3.0 being indicative of land likely to be Category 1 land, the mapping of Category 1 and Category 2 land for the purposes of this assessment has not relied on this mapping, and instead has independently verified disturbance (or evidence of disturbance) that would demonstrate complete removal of ground cover satisfying Category 2 disturbance requirements.

Areas disturbed as a result of mining related disturbance have been checked against historical approvals to confirm the disturbance of these areas was lawful. The identification of these areas is set out in **Appendix A.**

[1] The Land Use 2017 mapping however misidentifies large areas of land as 5.8.0 Mining, including areas outside the Approved Operational Area – refer to **Figure 2.1**.



Legend

PA11_0060 Project Area

Landuse

- 1.3.0 Other minimal use
- 2.1.0 Grazing native vegetation
- 2.2.0 Production forestry
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 5.4.0 Residential and farm infrastructure
- 5.8.0 Mining

FIGURE 2.3

Land Use 2013

Image source: ESRI Basemap (2021) Data source: NPM (2021); NSW DFSI (2013)

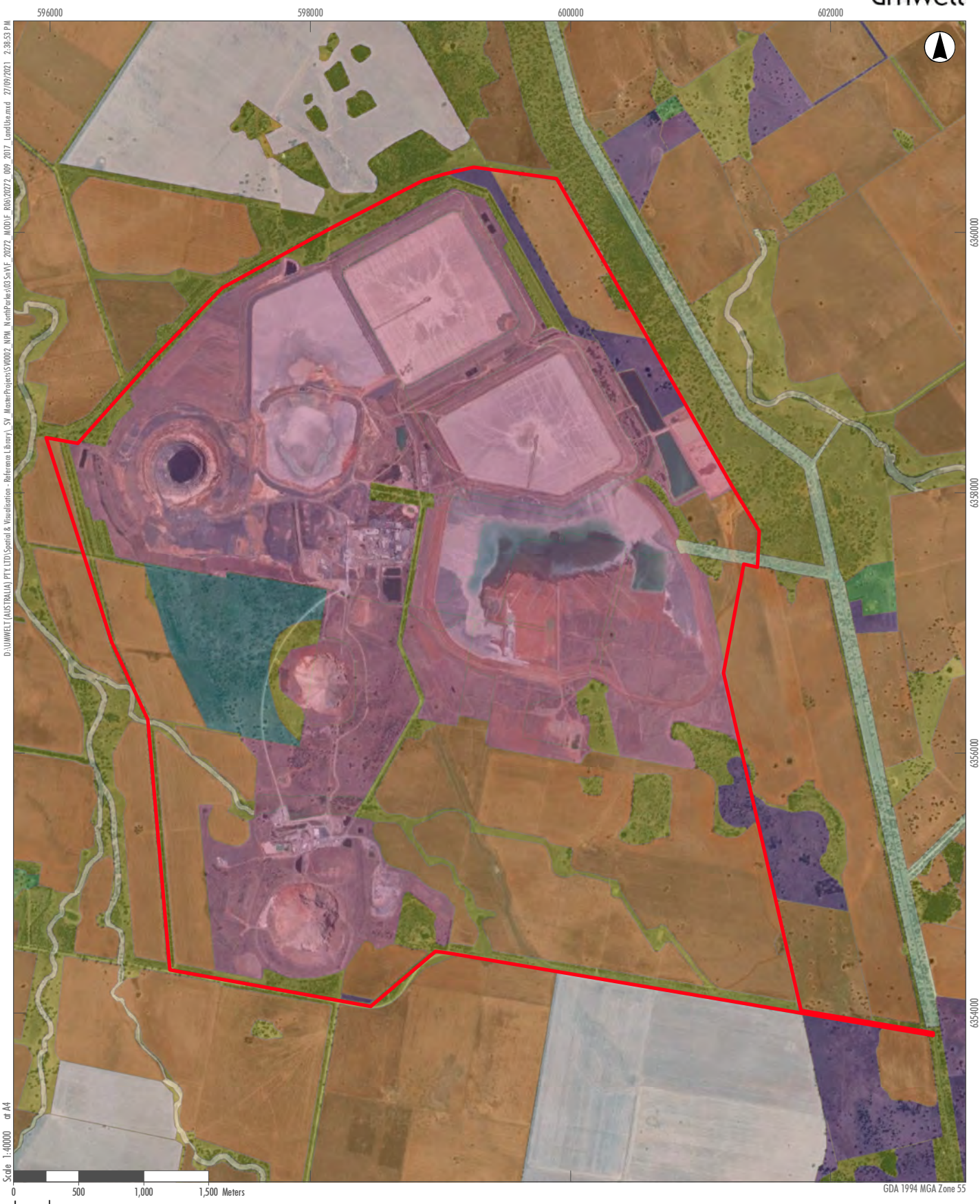


FIGURE 2.4

Land Use 2017

Image source: ESRI Basemap (2021) Data source: NPM (2021); NSW DFSI (2017)

2.2 Category 2-Regulated Land Exclusion Process

The Category 2-sensitive regulated land and vulnerable regulated land layers from the DPIE SEED data portal have been applied to the Project Area in order to exclude Category 2-regulated land from the areas mapped as being Category 1-exempt land. The data layers are applied to aerial photography to illustrate where the landscape has changed by mining, to identify where the Category 2-regulated land mapping layer no longer applies, (refer to **Section 3.2**).

Biodiversity offset areas established under development consents in the area are also considered in **Section 3.2**.

The characterisation of planted areas within the Project Area as either Category 1 or Category 2 land (or part of the approved operational area) is considered in **Section 3.2**.

3.0 Land Category Mapping

3.1 Excluded Areas

The DPIE SEED mapping identifies the Limestone National Forest as land excluded from the LLS Act. Impacts to land within Limestone State Forest. There is no other excluded land within the Assessment Area.

3.1.1 Sensitive Regulated Land

There is no mapped sensitive regulated land within the Project Area.

3.1.2 Vulnerable regulated land

There are areas mapped as vulnerable regulated land associated with Goonumbla Creek.

The vulnerable regulated land mapping obtained from SEED appears to be based on historical terrain data as mining voids have been mapped as being vulnerable land, likely due to a slope filter being applied to define vulnerable regulated land. As mining voids would not typically be considered vulnerable regulated land, these have been excluded from further consideration. Similarly, areas impacted by mining related disturbance (e.g. waste rock dumps) have altered the terrain and some of these areas have also been identified as vulnerable regulated land in the SEED data. Accordingly, apart from creek lines, these areas are not considered as being vulnerable regulated land.

3.1.3 Additional Category 2- regulated land (s 60I(2)(n) LLS Act and Clause 113 LLS Regulation)

As discussed in **Sections 1.2** and **2.2**, The Northparkes Project Area includes areas of planted native vegetation. These plantings all post -date 1990 (as evidenced by the 1991 aerial photography) and have been planted by Northparkes.

Significant areas of these plantings (and rehabilitation) were undertaken during the periods covered by development consents that have now been surrendered. Many obligations under these consents have been carried through to PA 11_0060, however specific obligations under these surrendered consents to undertake these planting and/or set them aside for conservation purposes would also render specifically identified planted areas as Category 2 – regulated land.

A review of historical consents, the current Northparkes Consent PA 11_0060 and currently approved management plans for the Northparkes operations including the Biodiversity Management Plan and Mining Operations Plan has been undertaken to identify areas of vegetation planted since 1990 that may satisfy the requirements of clause 113(1)(i). The consents reviewed are set out in **Table 3.1**.

Table 3.1 Northparkes development consents and project approvals

Development Consent/Project Approval	Date of Grant	Description	Comments
DA504_90	7 August 1991 (Modified on 23 March 1993	Open cut mining of three copper/gold deposits with underground mining at a later date and associated building works.	Granted by NSW Land and Environment Court following objector appeal against consent granted by Parkes Shire Council – Surrendered under PA06-0026
DA836_95	21 March 1995	Development of 2 Open Cut Mines and Haul Road	Granted by Parkes Shire Council – Lapsed
DA895_95	19 June 1996	Development of No 2 Tailings Impoundment (TSF2)	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA976_96	3 September 1996	Water Supply Augmentation	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA00204	17 January 2001	Clay Borrow Pit	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA03079	1 July 2003	Additions to Northparkes Mines (Estcourt Retention Pond)	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA03107	23 September 2003	In-Pit Tailings Disposal (E22 and E27 Voids)	Granted by Parkes Shire Council – Surrendered under PA06-0026
PA06-0026 (as modified)	28 February 2007 (Modified on 6 October 1009, 28 October 2009)	Northparkes E48 Project	Granted by Minister for Planning – Surrendered under PA 11_0060
DA11092	31 January 2012)	Training Centre	Granted by Parkes Shire Council – Surrendered under PA11_0060
PA 11_0060 (as modified)	16 July 2014 (Modified on 16 June 2015, 31 March 2016, 22 September 2017, 6 September 2018, 30 August 2019)	Northparkes Mine Step Change Project	Granted by Minister for Planning and Environment

With the exception of the Limestone National Forest Offset Area, none of the planted areas within the Northparkes Project Area under PA11_0060 (i.e the Assessment Area) are *required* to be *'set aside'* under any conditions of consent or currently approved management plans. Accordingly, planted areas outside the approved disturbance area do not fall within the definition of Category 2-regulated land as extended by clause 113 of the LLS Regulation. This includes the section of planted vegetation present adjacent to the Northparkes Access Road which is considered further in **Section 3.1.3.1** below.

Additionally, there are a number of small areas of land which were clearly cropped land in 1991 which have subsequently had scattered areas of woody regrowth. These areas have not been set aside under the terms of any consent and do not meet the criteria defined in clause 113(1)(i). Accordingly, these areas remain characterised as being Category 1 land.

The presence of individual paddock trees present in 1991 does not prevent land from being classified as Category 1 – exempt land.

3.1.3.1 Specific Consideration of planted areas adjacent to access road

In undertaking this assessment, particular focus was placed on the areas of planted trees along the Access Road into the Northparkes operational area. These trees are a narrow (approximately 1-2 rows) mixed species planting which appears to have been planted for landscaping/ visual screening purposes in the mid-1990s. Sections of this planted area have been removed/ disturbed over the past decade to enable construction of infrastructure, including the upgrade to the Access Road itself which is located to the immediate west of this area. A review of the 1991 aerial indicates that these trees were planted in an area that had been cropped and/or planted to pasture prior to 1991 and there were no trees present in this area at all in 1991 (Land Sat imagery from 1985 is also strongly indicative of this area having been cropped prior to 1990). A review of conditions of historical consents does not reveal a requirement to either plant these specific trees for offsetting or conservation purposes, nor maintain these trees for conservation purposes.

The 2011-2015 Mining Operations Plan in force immediately prior to the grant of PA 11-0060 identifies these trees as being planted native vegetation and they are included in the 'Conceptual Final Landform' in Figure 17 of the 2011-2015 MOP. However. The 2011-2015 MOP notes that this plan will be refined through the life of mine planning process and clause 5.1.2 provides:

> *5.1.2 Revegetation Plan*
>
> *At the completion of mining, the infrastructure and plant areas not required by future landowners will be restored to farming (cropping/grazing).*
>
> *The final vegetation plan will involve input from various stakeholders. The options for revegetation are farming, native habitat, and vegetation designed for long term stability of the remaining post mining landforms.*

The development covered by the 2011-15 MOP has been superseded by the development approved under PA11_0060. The conditions of PA11_0060 and the EIS supporting the development application do not include any specific (or even general) commitments or requirements to retain this vegetation. While parts of this area are identified as being intended to have a 'Proposed Final Land Use' of 'Native Vegetation' in Appendix 9, Condition 39 of Schedule 3 clearly identifies these land uses as being 'shown conceptually'.

Of note, neither the currently approved Biodiversity Management Plan nor the Rehabilitation Management Plan identify this vegetation as being set aside or retained for conservation purposes.

In the currently approved 2020-2022 MOP, this area is identified as being within the Secondary Domain G Rural Land Capability Classification I – viii. This area is not included in the Woodland Secondary domain.

There has been ongoing disturbance to these treed areas as a result of both farming operations and mining related infrastructure and disturbance. Based on the ongoing active management of this area, the currently approved MOP commitments, and lack of any specific requirements to set aside this vegetation, this planted area is considered to retain the Category 1 – Exempt Land classification associated with it status as cropped land as at 1990.

3.1.3.2 Other Planted Areas

As noted above, with the exception of the Limestone National Forest Offset, there are no specific offsetting obligations related to vegetation within the Assessment Area[2].There are however areas within the Project Area (include some areas previously disturbed by mining activities) that have a conservation purpose, including areas which have been planted in what would otherwise be Category 1 land, due either to approved mining related disturbance or their status as at 1990 (as evidence by the 1991 aerial). However, in the absence of a trigger under the LLS Act which would render these areas Category 2 regulated Land, these areas are considered to remain as Category 1. These plated areas have been specifically identified in the land classification mapping as Category 1 – Planted.

3.2 Category 1 and 2 land within the Project Area

Figure 3.1 shows the mapping of Category 1 and Category 2 land within the Project Area against 2018 Google imagery (as being representative of 2017 conditions). **Figure 3.2** shows the mapping of Category 1 and Category 2 land within the Project Area against the 1991 LPI Historical Aerial Photography of the area.

The mapping of these areas as Category 1 land in September 2019 is considered to be an accurate reflection of LLS Act and Regulation criteria for Category 1 Land. While areas identified as Category 1 – planted are currently mapped as being Category 1 land, the categorisation of these planted areas may change in the future if management and land use commitments under management plans or PA11-0060 (or future consents) change.

As noted in **Section 1.1.3**, the mapping of grassland and pasture areas as Category 2 Regulated Land should not be considered definitive for future assessment purposes and further groundcover survey may identify that some of the land mapped as being Category 2 land is Low Conservation Value Grassland. Based on recent vegetation ground truthing undertaken by GHD and past mapping by Umwelt (Umwelt 2013), it is considered likely that some Category 2 land would be characterised as being Category 1 land with further field work.

[2] The Estcourt Tailings Storage Facility Offset Area and the Kokoda Biodiversity Offset Area are both located outside the PA11_0060 Project Area.



FIGURE 3.1

LLS Act Land Category Mapping, PA11_0060 Project Area (2018 Imagery)

Image source: ESRI Basemap (2021) Data source: NPM (2021); Umwelt (2021)

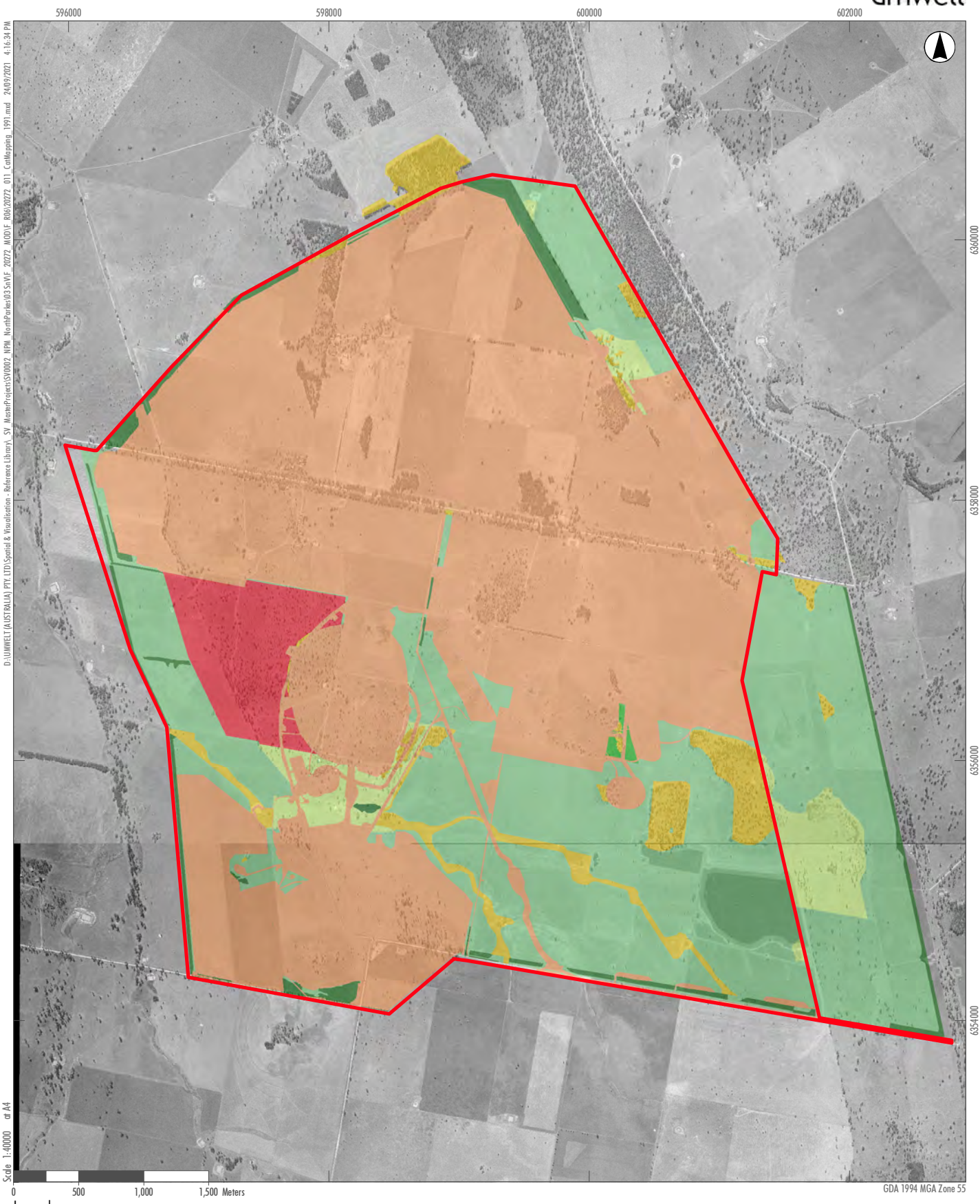


FIGURE 3.2

LLS Act Land Category Mapping, PA11_0060 Project Area (1991 Aerial Photography)

Image source: NSW Government - Historical Imagery (1991) Data source: NPM (2021); Umwelt (2021)

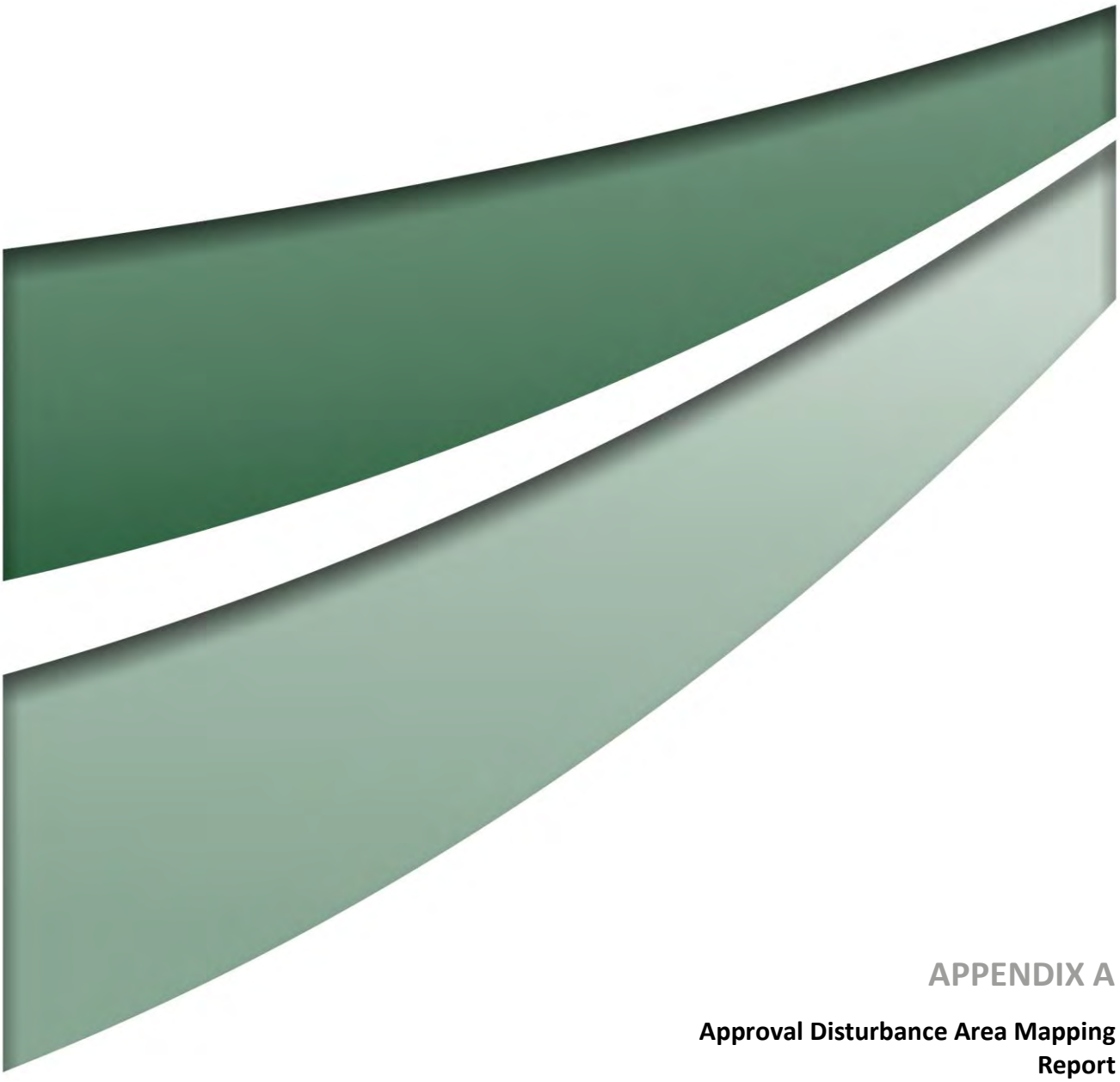
4.0 Metadata List

Table 4.1 Images/Aerial Photography reviewed

Images	Date	Source
1991 LPI Georectified Aerial Image	31/05/1991	Portal.spatial.nsw.gov.au Historical Imagery
2006 Google Earth (Maxar Technologies)	27/1/2006	Google Earth 2021
2018 Google Earth Image (CNES/Airbus)	15/10/2018	Google Earth 2021
2020 Northparkes Site Image	25/12/2020	CMOC Mining Pty Ltd

Table 4.2 Spatial Data Provided

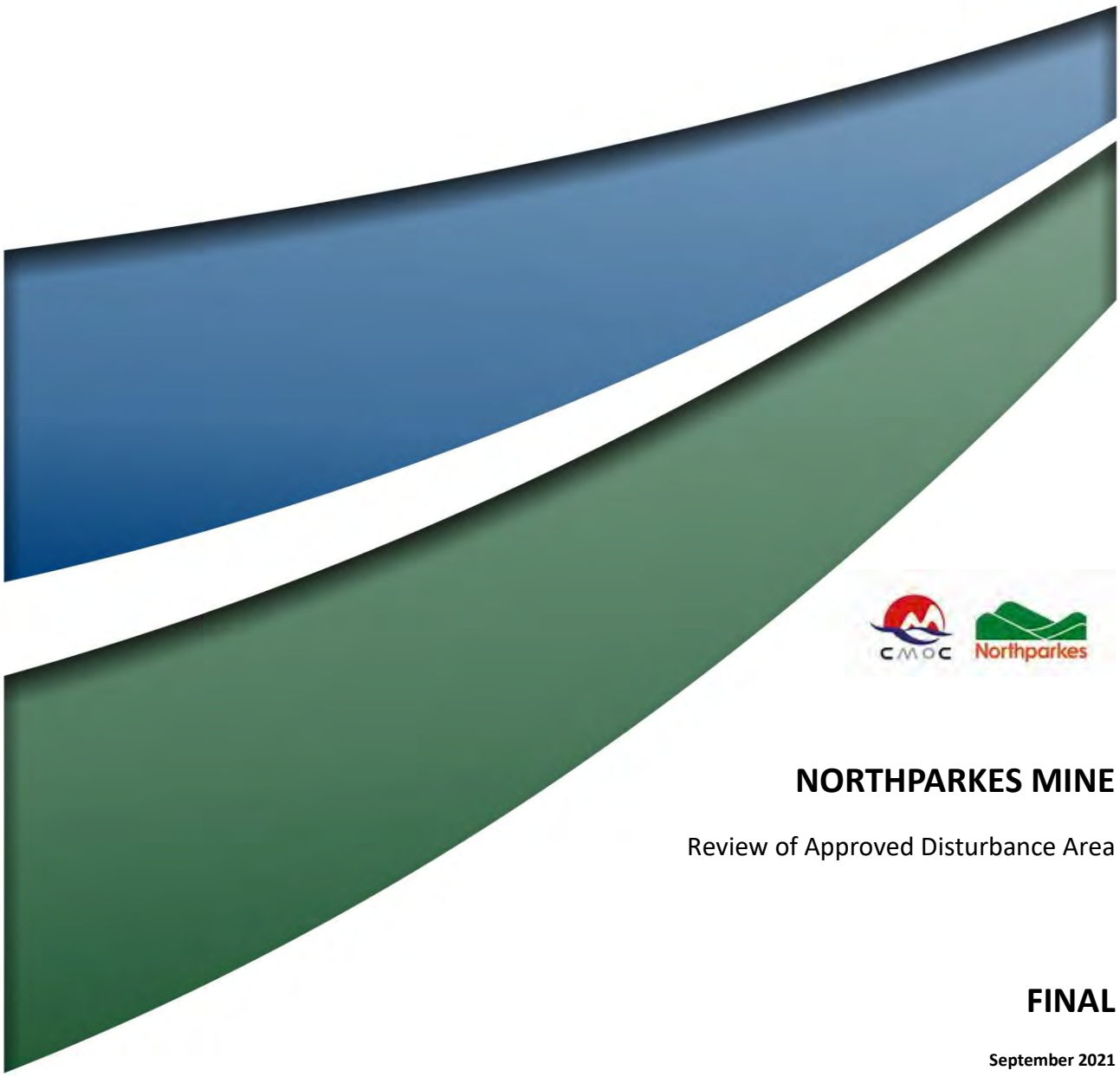
File Name	Date	Description
NPM_Approved_Operational_Area_ Mapping-PA11_0060-20210924	24/09/2021	Shapefile showing location of approved disturbance areas under PA11_0060
NPM_LLS_Category_Mapping -20210924	24/09/2021	Shapefile showing mapped LLS Act Category Mapping for North Parkes landholdings in and around PA11_0060 Project Area.



APPENDIX A

Approval Disturbance Area Mapping Report

umwelt
Environmental & Social Consultants



CMOC Northparkes

NORTHPARKES MINE

Review of Approved Disturbance Area

FINAL

September 2021

NORTHPARKES MINE

Review of Approved Disturbance Area

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
CMOC Northparkes

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Report No.	20272/R05
Date:	September 2021

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	David Holmes	30/9/2021	David Holmes	30/9/2021

Table of Contents

1.0 Introduction 1

1.1 2006 E48 Project Approval 2

1.2 Step Change Project 7

1.3 PA11_0060 Modification 3 Application 9

1.4 Northparkes Mining Operations Plan 11

2.0 Mapping of Approved Disturbance for future 13

2.1 Mining Disturbance 13

2.2 Road Realignment Disturbance 28

2.3 Mining Disturbance around approved E31N footprint 28

2.3.1 Disturbance west of the E31N footprint 28

2.3.2 Disturbance East of the E31N footprint 28

2.4 Agricultural Disturbance 30

3.0 References 31

Figures

Figure 1.1 Description of Northparkes Approved Operation Pre-PA06-0060 4

Figure 1.2 E48 Project Components 6

Figure 1.3 Figure 5.9 from Step Change EA 8

Figure 1.4 Figure 3 from PA11_0060 Modification 3 Application 10

Figure 1.5 Plan 2 from Northparkes Mine MOP 2020-2022 12

Figure 2.1 Additional Identified Disturbance Areas – Area 1 15

Figure 2.2 Additional Identified Disturbance Areas – Area 2 17

Figure 2.3 Additional Identified Disturbance Areas – Area 3 20

Figure 2.4 Additional Identified Disturbance Areas – Area 4 23

Figure 2.5 Additional Identified Disturbance Areas – Area 5 25

Figure 2.6 Consolidated Approved Operational Area 27

Figure 2.7 Disturbance adjacent to approved E31N disturbance area 29

Tables

Table 1.1 Northparkes development consents and project approvals 1

Table 2.1 Additional Identified Disturbance Areas – Area 1 16

Table 2.2 Additional Identified Disturbance Areas – Area 2 18

Table 2.3 Additional Identified Disturbance Areas – Area 3 21

Table 2.4 Additional Identified Disturbance Areas – Area 4 24

Table 2.5 Additional Identified Disturbance Areas – Area 5 26

1.0 Introduction

CMOC-Northparkes Mines (Northparkes) is a copper and gold mine located 27 km north-west of Parkes, in the Central West of New South Wales, Australia. Northparkes is a joint venture between China Molybdenum Co., Ltd (CMOC) (80%) and the Sumitomo Groups (20%).

Mining at Northparkes has been undertaken for over 25 years with operations commencing in 1993 following approval of Development Consent DA504/90 by the Land and Environment Court in August 1991.

A full list of consents historically applicable to the site (excluding consents which were not commenced) is set out in **Table 1.1**.

Table 1.1 Northparkes development consents and project approvals

Development Consent/ Project Approval	Date of Grant	Description	Comments
DA504_90	7 August 1991 (Modified on 23 March 1993)	Open cut mining of three copper/gold deposits with underground mining at a later date and associated building works.	Granted by NSW Land and Environment Court following objector appeal against consent granted by Parkes Shire Council – Surrendered under PA06-0026
DA836_95	21 March 1995	Development of 2 Open Cut Mines and Haul Road	Granted by Parkes Shire Council - Lapsed
DA895_95	19 June 1996	Development of No 2 Tailings Impoundment (TSF2)	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA976_96	3 September 1996	Water Supply Augmentation	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA00204	17 January 2001	Caloola Clay Borrow Pit	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA03079	1 July 2003	Additions to Northparkes Mines (Estcourt Retention Pond)	Granted by Parkes Shire Council – Surrendered under PA06-0026
DA03107	23 September 2003	In-Pit Tailings Disposal (E22 and E27 Voids)	Granted by Parkes Shire Council – Surrendered under PA06-0026
PA06-0026 (as modified)	28 February 2007 (Modified on 6 October 2009, 28 October 2009)	Northparkes E48 Project	Granted by Minister for Planning – Surrendered under PA 11_0060
DA11092	31 January 2012	Training Centre	Granted by Parkes Shire Council – Surrendered under PA11_0060

Development Consent/ Project Approval	Date of Grant	Description	Comments
PA 11_0060 (as modified)	16 July 2014 (Modified on 16 June 2015, 31 March 2016, 22 September 2017, 6 September 2018, 30 August 2019)	Northparkes Mine Step Change Project	Granted by Minister for Planning and Environment

Up until the 2013 Step Change Project Environmental Assessment, the approvals documentation (including consent documents) did not contain any mapping of the extent of the approved disturbance footprint for operations. The following summarises the disturbance mapping contained in key approval documents:

1.1 2006 E48 Project Approval

The E48 Project Approval consolidated all previous approvals for the Northparkes operation under a single Part 3A Project Approval (PA06-0026) and all preceding Council Consents were surrendered.

In the 2006 Environmental Assessment for the E48 Project (R.W Corkery & Co, 2006) (E48 Project EA), Part B described the existing approved operations which were to be carried through under the consolidated E48 Project Approval. As noted in Table 1 above, all of the development consents covering operations approved to that date were surrendered following the grant of PA06-0026. The existing activities approved under the existing consents which were surrendered were described in Table A2 as follows and shown in Figure B34 of the E48 Project EA (reproduced in **Figure 1.1**) as follows:

Existing Site Components and Activities (to continue for the remainder of the mine life).

- E26 Underground Mine, associated subsidence zone and waste rock/clay dumps.
- E26 Underground Mine Portal, Hoisting Shaft and Exhaust Fan.
- E26 Underground Mine Surface Infrastructure and Services.
- Overland Conveyer and E26 Service Road.
- Processing Plant and Rill Tower Stockpile (for underground ore) and ROM Pad (for open cut ore).
- Tailings Storage Facilities 1 and 2 and Return Water Dam.
- Administration and Training Buildings, Car Parks and various infrastructure and services.
- Process Water Dam, Caloola and Estcourt Borrow Pits and Water Storages.
- Various open cut waste rock/clay stockpiles and dumps.
- Mine Access Road and various internal roads and tracks.
- E22 Open Cut Mine (continued mining envisaged and subsequent tailings disposal - approved for tailings disposal).
- E27 Open Cut Mine (mining completed – used for water storage and approved for tailings disposal).

- Various compounds for equipment storage and services.
- Sound Bund and numerous tree lots.

As can be seen from **Figure 1.1**, only the general outline of key features is shown. There is no mapping of existing approved disturbance areas[1] and, in particular, topsoil and subsoil stockpiles are not mapped. Figure B10 from the E48 Project EA includes mapping of some existing infrastructure and services including power lines and supply water pipeline as well as sealed and unsealed roads and tracks however the scale of the figure and detail shown is not sufficient to define the extent of disturbance associated with these activities. Also not included were historical construction laydown areas (most of which will also be required for post-mining decommissioning works). Several other figures in Part B show elements of approved operations, however, as with Figure B10, these are not of sufficient detail to define the extent of existing and approved disturbance under the historical consents. A further complication is that there are internal access roads and water management infrastructure that is associated with ongoing agricultural operations but also utilised by mining operations. There is no demarcation between these activities as being mine related or farming related in the E48 Project EA.

[1] High level disturbance mapping was contained in Figure 4 of the Aboriginal Heritage Assessment (Part 8 of the Specialist Studies Compendium, Australia Archaeological Survey Consultants Pty Ltd dated August 2006) however a review of this mapping indicates that it does not show all areas that were clearly disturbed by approved mining activities and, in some cases, identifies areas that had not been disturbed but were identified as such. As such, these boundaries have not been relied on as being definitive of approved disturbance areas.

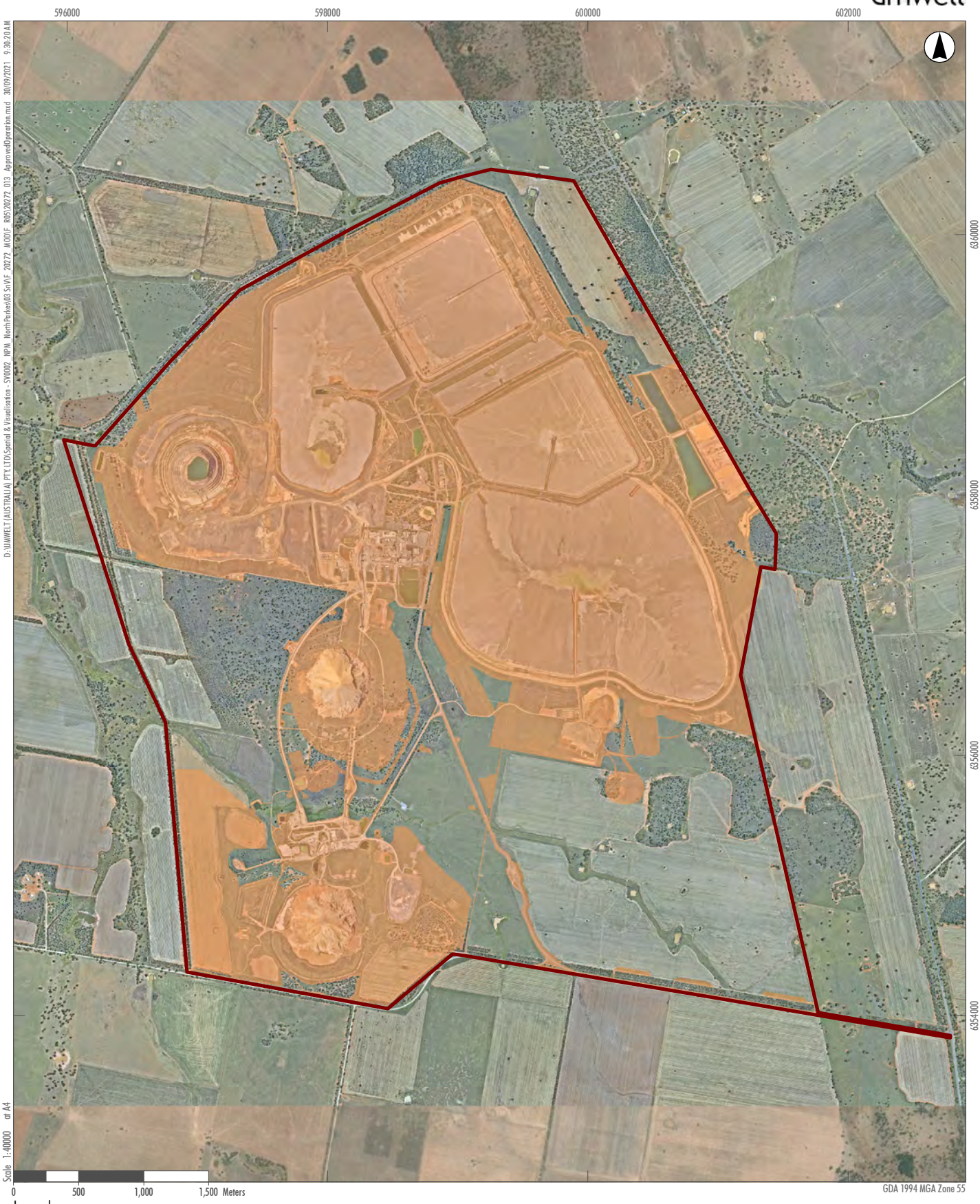


FIGURE 1.1

Approved Operational Area under PA11_0060

Image source: NSW Government - Historical Imagery (1991) Data source: NPM (2021); Umwelt (2021)

The additional features approved under PA06_0060 were:

- E48 Underground Mine, associated subsidence zone and waste rock stockpile.
- E48 Underground Mine Portal (Existing E26 Mine Portal).
- E48 Underground Mine Surface Infrastructure and Services (same as for E26).
- E48 Overland Conveyor/Service Corridor.
- Tailings Storage Facility 3 (Cells A and B) and Return Water Dam.
- Infill between Tailings Storage Facilities 1 and 2.
- Rosedale Borrow Pit.
- Various internal roads and tracks.
- A 45ha addition to Limestone National Forest (as a land swap).
- Various ancillary components and activities to the above components.

The location of the key features was shown on Figure C2 of the E48 Project EA (reproduced in **Figure 1.2**). As can be seen in **Figure 1.2**, only the key features are shown and there is no mapping of internal roads and tracks associated with the approved operation (and in particular, those associated with the construction and operation of the E48 Overland Conveyor, TSF 3, the Return Water Dam and the construction and use of material from the Rosedale Borrow Pit), nor are the locations of soil stockpiles associated with the construction of TSF3 and the Rosedale Borrow Pit identified.

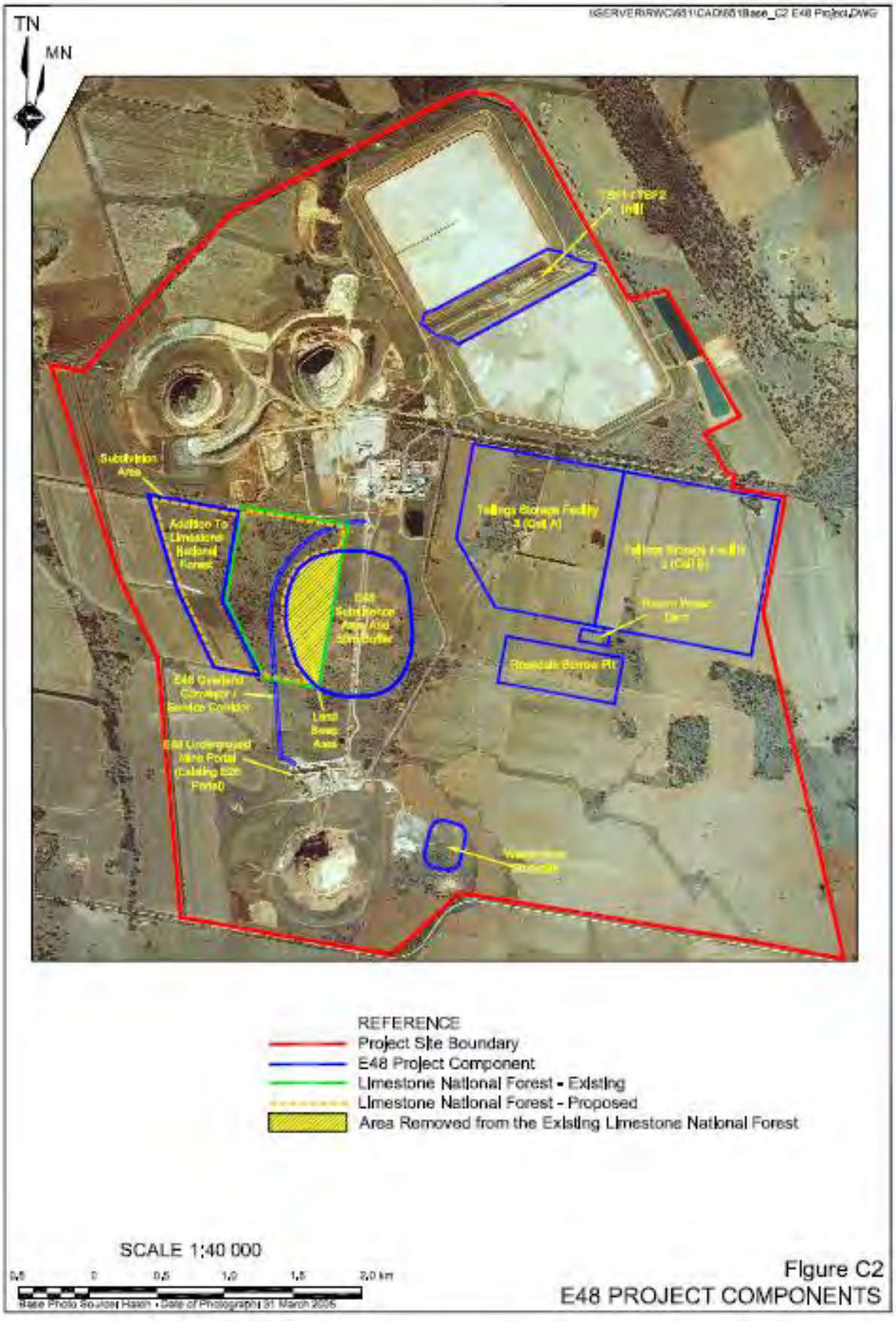


Figure 1.2 E48 Project Components

(R.W. Corkery & Co, 2006)

1.2 Step Change Project

In addition to retention of existing approved operations under PA06_0026, the Step Change Project (PA11_0060) included the following key physical elements:

- expansion of approved open cut mining in the E26 resource and associated waste rock emplacement areas
- Mining of four small open cut pits, E31, E31N, E28N and E28
- Development of block cave mining in the E22 resource (below the existing approved open cut)
- Augmentation of approved (but at the time, not yet constructed) TSF 3
- Construction of an upgraded site access road and upgrades to McClintocks Lane.

Figure 5.9 of the Step Change EA (Umwelt 2012) (reproduced in **Figure 1.3**) identified the 'Proposed Disturbance Area'. This figure however relied on the broad feature mapping of existing approved operations from the 2006 E48 Project EA and save for some access roads, underground infrastructure and the general 'as built' alignment of the E48 Project Conveyor realignment, did not pick up a range of historically approved disturbance nor the ancillary activities associated with the construction of TSF 3 (referred to as the Rosedale TSF in the Step Change EA). A conceptual layout only of the proposed access road was provided.



Figure 1.3 Figure 5.9 from Step Change EA

Notably, several key features of development approved in the E48 Project EA and identified as part of the proposed operations in Figure 2.8 to 2.11 were not captured by Figure 5.9 in the Step Change EA including:

- The approved E48 Subsidence footprint and associated 50m buffer zone
- Part of the clay stockpile located close to the existing ore processing facility
- A low grade ore stockpile to the southwest of the E26 open cut/subsidence zone.

Disturbance associated with other features of approved operations which were to be carried through to the Step Change Project which were not captured in the proposed disturbance area mapped in Figure 5.9 of the Step Change EA include:

- disturbance associated with utilities infrastructure including power lines and water supply pipeline (refer to Figure 2.7 in the Step Change EA)
- existing soil stockpiles and areas available for stockpiling topsoil and subsoil material from the TSF3 (Rosedale TSF) Area
- water management infrastructure (drains and pipelines) associated with existing approved operational areas (including waste rock stockpiles associated with E26, E22 and the approved TSFs (including TSF3)
- historical construction laydown areas and associated site facilities
- underground ventilation facilities.

Additionally, while the map captured the 'as built alignment' for the E48 Project conveyor, it did not fully capture associated disturbance, including the maintenance road.

Other features not identified in the proposed and approved disturbance area stockpiles were:

- topsoil and subsoil stockpiles associated with the Rockdale TSF, Rockdale Borrow pit area and newly approved open cut pits
- access and maintenance roads associated with top soil stockpiles and construction activities
- disturbance associated with water management works required for the redesigned Rosedale TSF, new open cut pits and expanded E26 waste stockpile areas.

1.3 PA11_0060 Modification 3 Application

Modification 3 to PA11_0060 sought changes to the approved underground mining operations in the E26 resource. As part of the Modification 3 application documentation, Figure 3 (reproduced in **Figure 1.4**) contained a replication of the approved Disturbance Area for PA11-0060 and an 'as built' disturbance area for the Access Road and associated Access Control area. A review of the approved disturbance shown in Figure 3 and areas approved for disturbance under historical consents which have been carried through to PA11_0060 indicates that this mapping of approved disturbance is incorrect and does not capture all approved disturbance areas. Observable in Figure 3, but not captured in the disturbance area mapping are:

- a number of subsoil and topsoil stockpile areas associated with the pre-stripping activities for the Rosedale TSF as specified in the Step Change EA and
- water management drains identified in the Surface Water Assessment for the Step Change Project (Appendix 11 of the Step Change EA).
- features identified as missing in the Step Change EA mapping discussed in **Section 1.2** above.

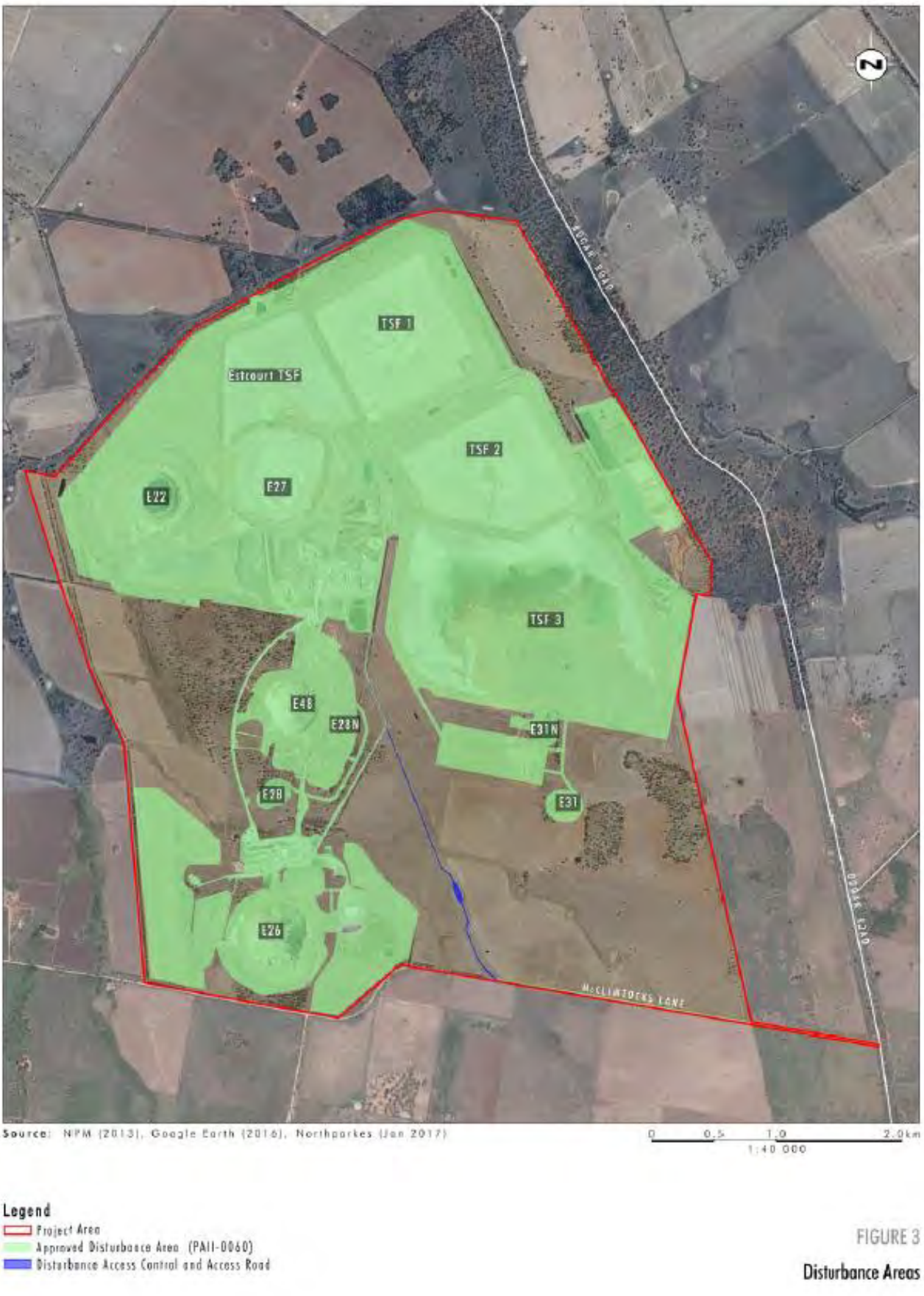


Figure 1.4 Figure 3 from PA11_0060 Modification 3 Application

1.4 Northparkes Mining Operations Plan

Notwithstanding the lack of detail regarding certain disturbance activities, in particular water management, access roads and soil stockpiles, in the environmental assessment documentation, the Mining Operations Plan for Northparkes has shown these features and considered them in operational environmental management processes and rehabilitation planning. Plan 2 from the Current Northparkes Mines Mining Operations Plan 2020-2022 is reproduced in **Figure 1.5**. This plan does not however fully capture all historical and approved but not yet constructed disturbance.

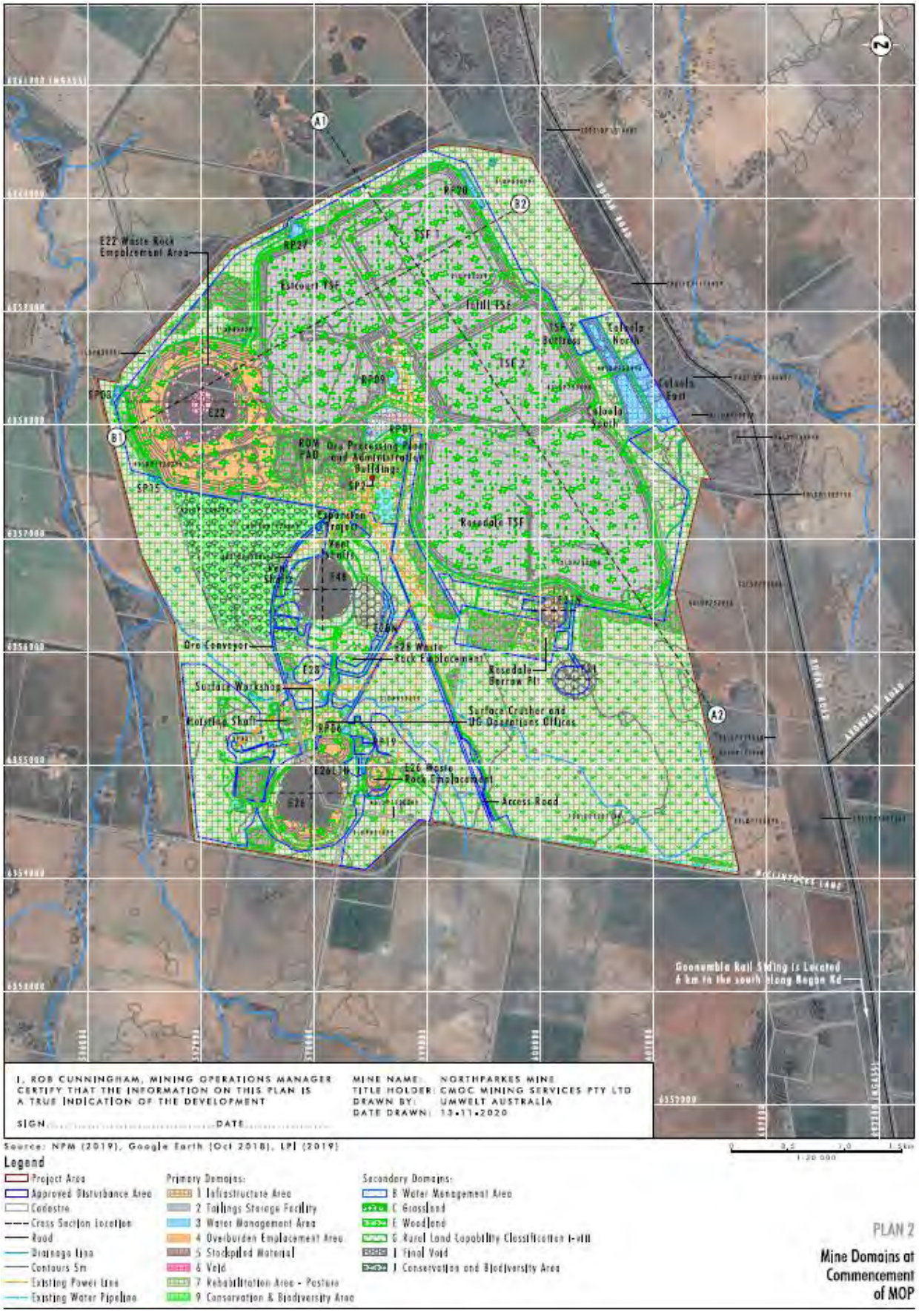


Figure 1.5 Plan 2 from Northparkes Mine MOP 2020-2022

2.0 Mapping of Approved Disturbance for future

2.1 Mining Disturbance

As part of the proposed PA11_0060 Modification 6 assessment, Umwelt has been engaged to fully document all historically approved and proposed future disturbance to provide a baseline against which future applications can assess proposed changes to approved operations. This mapping has been limited to the PA11_0060 Project Area.

In order to do this, Umwelt has undertaken the following steps:

1. Starting with the 'Disturbance Area' shown in Figure 3 of the PA11_0060 Modification 3 Environmental Assessment, added in the following omissions from key features approved in and prior to PA06_0026:
    - clay stockpile area north of E48
    - low grade ore stockpile to the southwest of E26
    - E48 subsidence management zone.
2. Reviewed aerial and satellite imagery available to identify areas of historical disturbance that was attributable to mining related activities
3. Assessed whether areas of identified disturbance were approved under consents at the time the disturbance was undertaken or was part of approved operations under surrendered consents that has been caried through to PA11_0060 and
4. Mapped areas of existing disturbance and approved but not yet undertaken disturbance.

As part of the above processes, a detailed review of 'As Built' features such as the Site Access Road and the E48 Conveyor which are identified conceptually in approval documentation was undertaken to ensure that the disturbance associated with this approved infrastructure accurately captured final built alignment and ancillary disturbance such as earthworks, table drains, maintenance roads and construction laydown areas.

Where identifiable from aerial imagery, construction laydown areas and ancillary construction disturbance have also been captured as similar areas will be required for closure works and, where possible, these existing disturbed areas should be used for these areas during closure (and maintenance) activities.

In a number of areas, the existing mapping of 'approved disturbance areas' includes small fragments of land between approved and existing disturbance areas that will necessarily be impacted by either water management works or works associated with rehabilitation works. These omissions in being mapped as approved disturbance have been identified where appropriate. It is noted that, almost without exception, these small 'infill' areas have a long history of agriculture disturbance. A review of available assessment documentation applicable to the activities impacting these areas indicates that heritage and ecological impacts in these areas have been considered. Accordingly, their omission from being mapped as 'approved disturbance' in historical assessment documentation does not mean that the impacts associated with their disturbance has not been assessed.

Disturbance associated with power lines, pipelines and telecommunications was only undertaken where this disturbance was evident in the imagery reviewed. The ongoing maintenance of this infrastructure and its removal post mining is approved under the current consents however the disturbance associated with these works is difficult to capture in disturbance mapping. Future disturbance associated with the maintenance of this infrastructure will be minimised and avoidance of remnant trees avoided where possible. Disturbance associated with the removal of this infrastructure as part of mine closure planning processes will be detailed in the Mine Closure Planning Process

Figure 2.1 to **Figure 2.5** show the areas of disturbance additional to those areas identified in the PA11_0060 Modification 3 mapping. The justification for including particular areas is detailed in **Table 2.1** to **Table 2.5**.

A consolidated 'Approved Operational Area' is mapped in **Figure 2.6**. **Figure 2.1** also includes the alignment of existing powerlines and water pipelines which will also require some future disturbance activities to undertake maintenance during operations and removal as part of the mine closure planning processes.



Legend

Disturbance Category

- As Built
- Mod 3 Mapping
- Updated



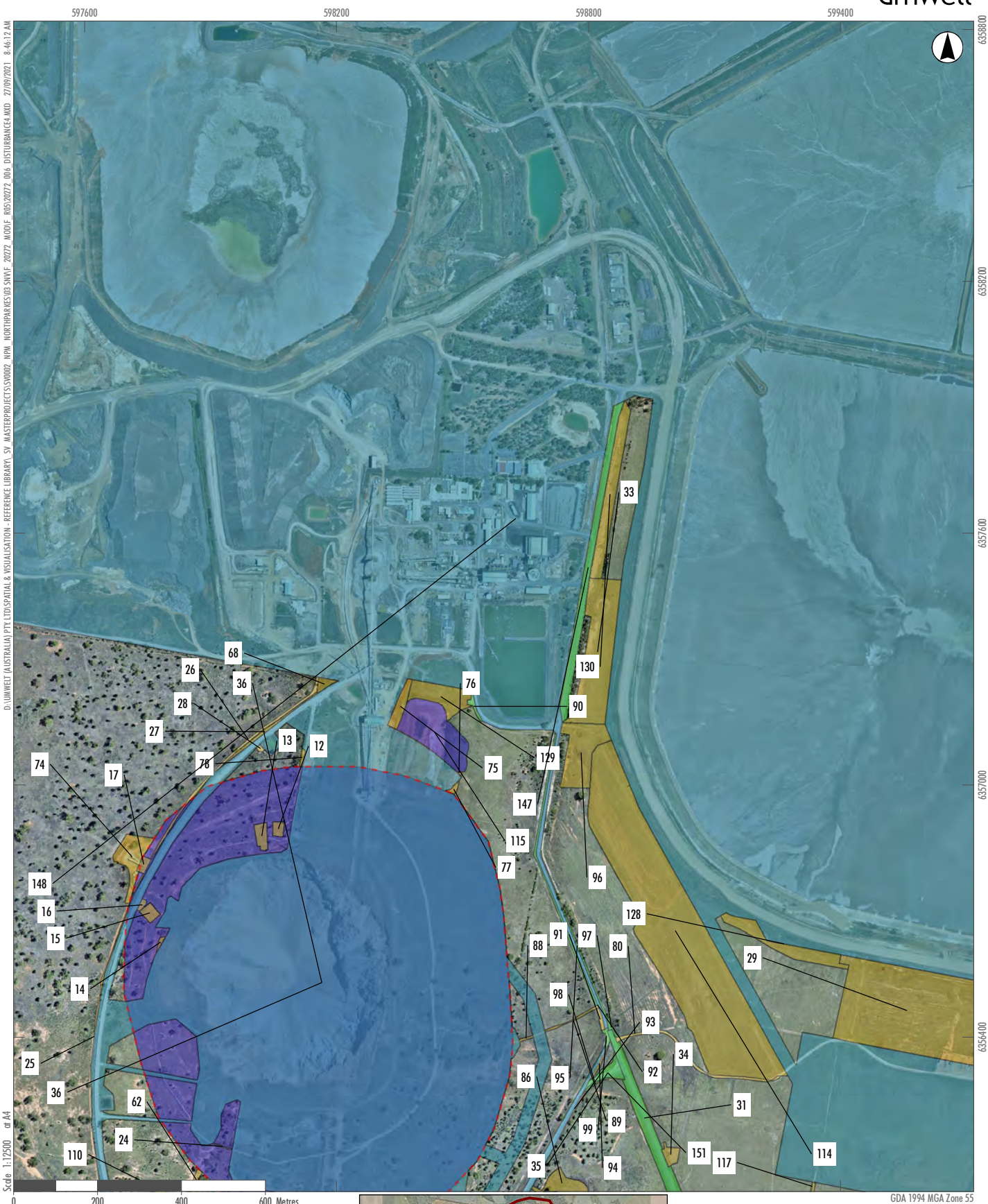
FIGURE 2.1

Additional Identified Disturbance Areas

Image Source: NPM (2020) Data source: NPM (2021); Umwelt (2021)

Table 2.1 Additional Identified Disturbance Areas – Area 1

Figure ID	Nature of approved disturbance	Relevant consent where approved
10	Internal Access Road (also used for farming purposes)	PA11_0060
11	Access Road (as built)	PA11_0060
29	Vegetation/Soil stockpile (Rosedale TSF and E31N)/Rosedale TSF construction laydown area	PA11_0060/PA06_0026
31	Access Road (as built)	PA11_0060
32	Access Road (as built)	PA11_0060
34	Access Road (construction laydown area)	PA11_0060
44	Internal Access Road (also used for farming purposes)	Farming road – ability to be used for E31 operations approved under PA11_0060
45	Internal haul road – soil stockpiles	PA06-0026/PA11_0060
46	Soil Stockpile	
47	Supply Pipeline alignment/Internal Access Road. Also used for farming purposes	DA976_96/PA06-0026/PA11_0060
48	Supply Pipeline alignment/Internal Access Road. Also used for farming purposes	DA976_96/PA06-0026/PA11_0060
59	Access Road (construction laydown area)	PA11_0060
63	Disturbance mapping omission	PA11_0060
80	Internal Access Road	PA06-0026/PA11_0060
84	Soil stockpile and ancillary disturbance area/ haul road	PA06-0026/PA11_0060
85	Soil Stockpile (Rosedale TSF)	PA06-0026/PA11_0060
87	Access Road (as built)	PA11_0060
114	Soil Stockpile (Rosedale TSF)	PA06-0026/PA11_0060
117	Supply Pipeline alignment/Internal Access Road. Also used for farming purposes	DA976_96/PA06-0026/PA11_0060
118	Topsoil strip – McClintocks Lane Upgrade Works	PA11_0060
119	Topsoil strip – McClintocks Lane Upgrade Works	PA11_0060
120	Topsoil strip – McClintocks Lane Upgrade Works	PA11_0060
124	Internal haul road – soil stockpiles	PA06-0026/PA11_0060
125	Internal haul road – soil stockpiles	PA06-0026/PA11_0060
126	Internal haul road – soil stockpiles	PA06-0026/PA11_0060
127	Soil stockpile – ancillary disturbance area	PA06-0026/PA11_0060
128	Ancillary disturbance, Rosedale TSF construction and maintenance	PA06-0026/PA11_0060
133	Access Road – ancillary construction disturbance	PA11_0060
142	Soil stockpile – ancillary disturbance area	PA06-0026/PA11_0060
144	Soil stockpile access road	PA11_0060
145	Soil stockpile access road	PA11_0060
146	Soil stockpile access road	PA11_0060
148	'Approved Disturbance Area' as identified in PA11_0060 Modification 3 EA.	PA11_0060
149	McClintocks Lance Upgrade Works	PA11_0060
152	Internal haul road – soil stockpiles	PA06-0026/PA11_0060



Legend

Disturbance Category

- As Built
- Correct Omission
- Mod 3 Mapping
- Updated
- E48 Approved Subsidence Footprint



FIGURE 2.2

Additional Identified Disturbance Areas

Image Source: NPM (2020) Data source: NPM (2021); Umwelt (2021)

Table 2.2 Additional Identified Disturbance Areas – Area 2

Figure ID	Nature of approved disturbance	Relevant consent where approved
12	Construction laydown area	PA06-0026 or earlier consent (within E48 Subsidence management zone)
13	Construction laydown area	PA06-0026 or earlier consent (within E48 Subsidence management zone)
14	Ancillary mining disturbance	PA06-0026 or earlier consent (within E48 Subsidence management zone)
15	Water management infrastructure	PA06-0026 (within E48 Subsidence management zone)
16	Ancillary Conveyor construction disturbance	PA06-0026 (within E48 Subsidence management zone)
24	Internal access road (within E48 Subsidence Zone)	PA06-0026
25	Conveyor maintenance Road	PA06-0026
26	Conveyor/Ventilation fan infrastructure	PA06-0026 (within E48 Subsidence management zone)
27	Conveyor maintenance Road	PA06-0026
29	Vegetation/ Soil stockpile (Rosedale TSF and E31N)/ Rosedale TSF construction laydown area	PA11_0060/PA06_0026
31	Access Road (as built)	PA11_0060
33	Ancillary disturbance (Rosedale TSF Construction, Water management, Infrastructure)	PA06-0026 /PA11_0060
34	Access Road (construction laydown area)	PA11_0060
36	E48 Subsidence Management Zone (purple areas are omissions from mapped disturbance)	PA06-0026 (As shown in Figure 1.3 of Step Change EA but omitted from disturbance mapping)
62	Internal Access Road	PA06-0026
74	Ventilation Fan and associated infrastructure	PA06-0026/PA11_0060 (partly within E48 Subsidence Zone)
75	Ancillary disturbance/ construction area	PA06-0026 or earlier consent
76	Ancillary Disturbance - stockpiles	Approved pre 2006.
77	Ancillary Disturbance - stockpiles	Approved pre 2006.
78	Construction Laydown Area for Conveyor	PA06-0026
80	Internal Access Road	PA06-0026/PA11_0060
86	Soil stockpile	PA06-0026
88	Internal Access Road	Approved pre 2006.
90	Internal Access Road	Approved pre 2006.
91	Internal Access Road	Approved pre 2006.
92	Internal access road (former farm road)	Various
93	Internal Access Road	Approved pre 2006.
94	Internal Access Road	PA06-0026 or earlier consent
95	Access Road (as built)	PA11_0060
96	Rosedale TSF ancillary construction disturbance, infrastructure (power and telecommunications) and TSF infrastructure, soil stockpile ancillary disturbance.	PA06-0026/PA11_0060

Figure ID	Nature of approved disturbance	Relevant consent where approved
97	Access Road (as built)	PA11_0060
98	Access Road (as built)	PA11_0060
99	Internal Access Road	PA06-0026 or earlier consent
110	Soil Stockpile	PA06-0026
114	Soil Stockpile	PA06-0026/PA11-0060
115	Clay Stockpile (purple areas are omissions from mapped disturbance)	Approved pre 2006. Identified as existing approved feature in E48 Project EA (PA06-0026)
117	Supply Pipeline alignment/Internal Access Road. Also used for farming purposes	DA976_96/PA06-0026/PA11_0060
128	Ancillary disturbance, Rosedale TSF construction and maintenance	PA06-0026/PA11_0060
129	Infrastructure management/construction area (powerlines)	Approved pre 2006.
130	Infrastructure (powerlines and telecommunications) and Access Road construction	PA11_0060
147	Access road	Originally approved in DA504_90. Upgraded with Access Road works under PA11_0060
148	'Approved Disturbance Area' as identified in PA11_0060 Modification 3 EA.	PA11_0060
151	Access Road (as built)	PA11_0060

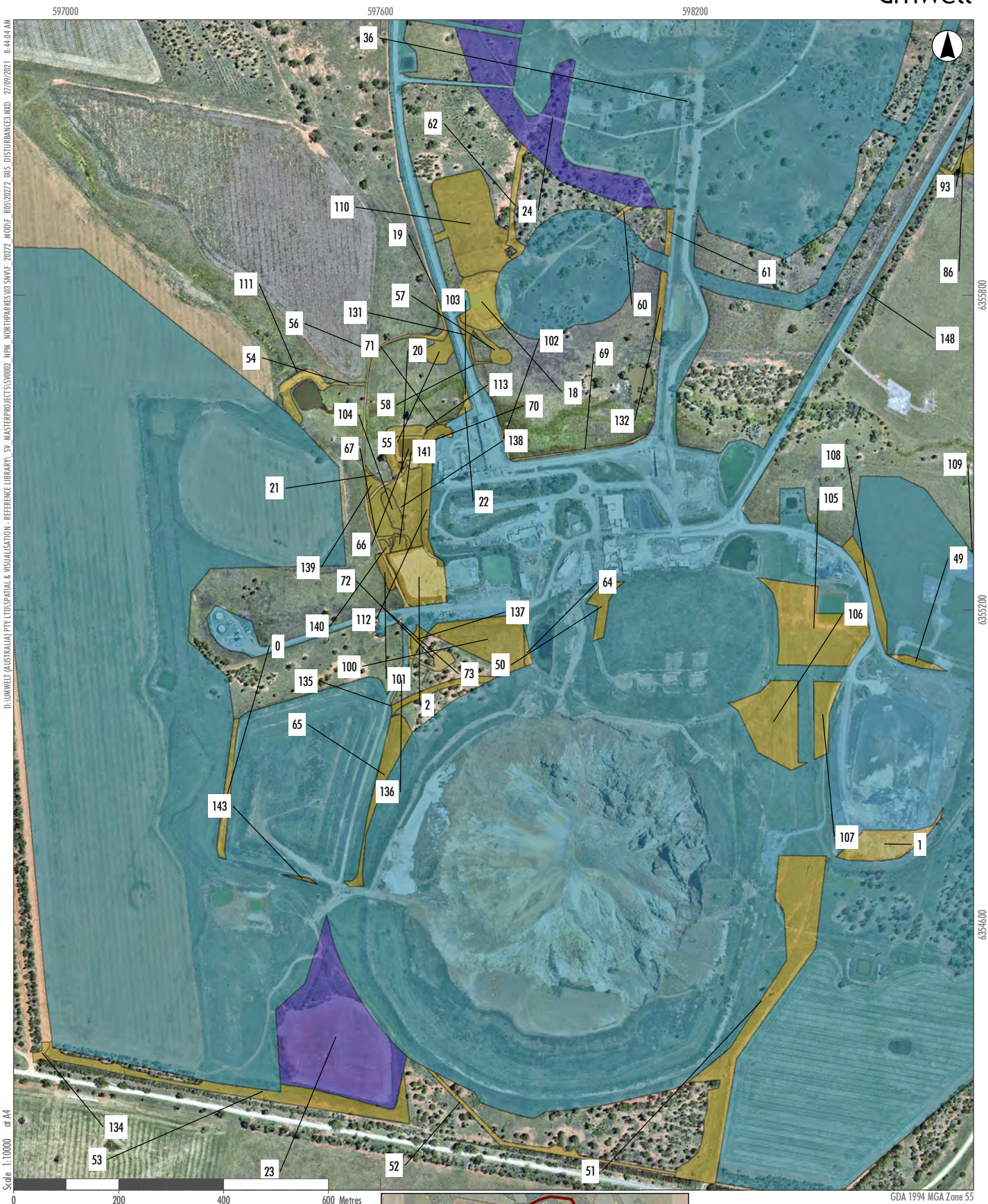


FIGURE 2.3

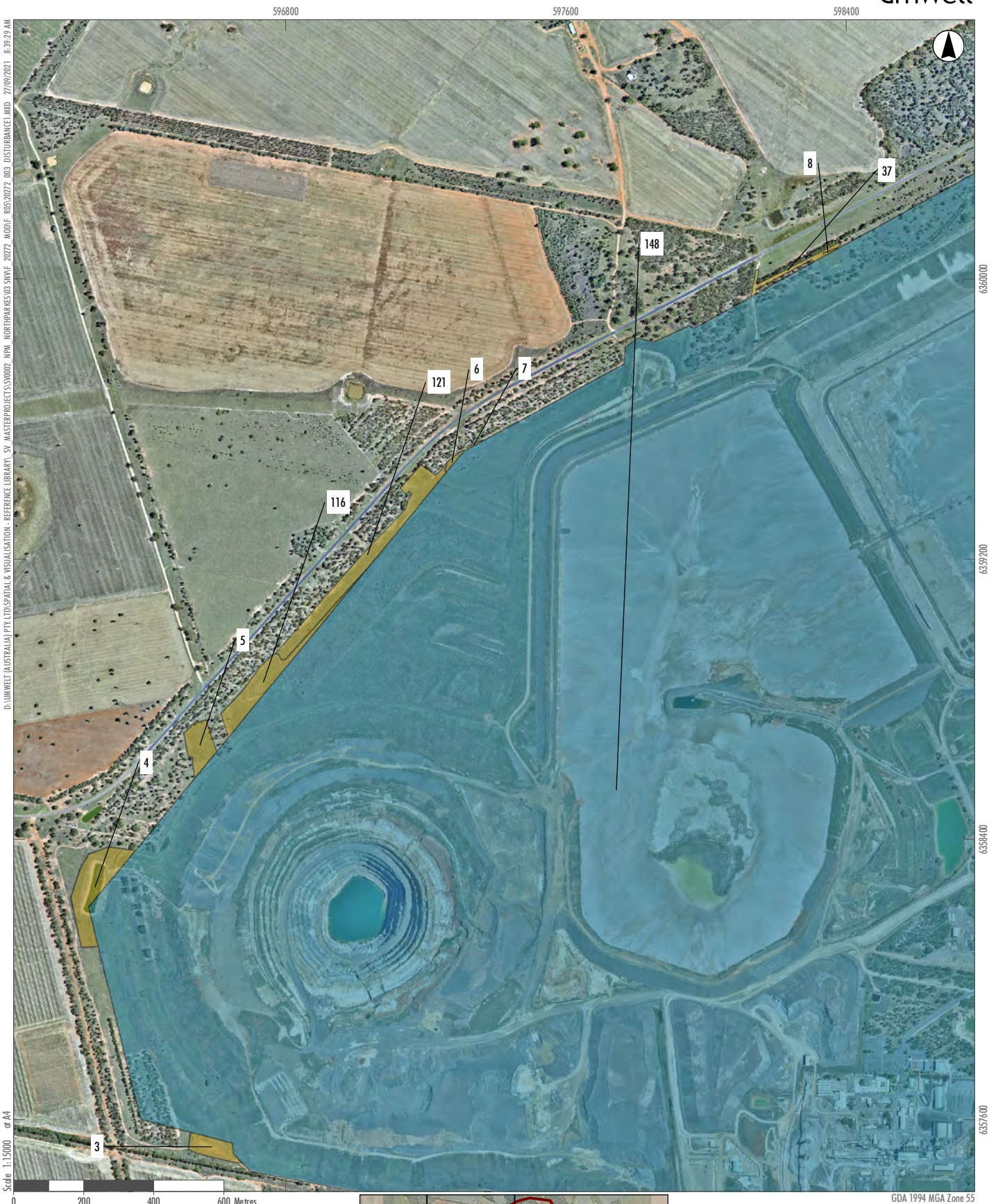
Additional Identified Disturbance Areas

Image Source: NPM (2020) Data source: NPM (2021); Umwelt (2021)

Table 2.3 Additional Identified Disturbance Areas – Area 3

Figure ID	Nature of approved disturbance	Relevant consent where approved
0	Ancillary Disturbance	DA504_90
1	Waste Stockpile	DA504_90. General outline captured in PA06-0026 but general area also identified as mine water management area in PA06_0026.
2	Water Treatment Facility	PA11-0060
18	Water Management Infrastructure	Approved pre 2006.
19	Internal Access Road	DA504_90
20	Internal Access Road	DA504_90
21	Access Road	DA504_90
22	Ancillary Disturbance	DA504_90
23	Low Grade Ore Stockpile (purple areas are omissions from mapped disturbance)	DA504_90 (As shown in Figure 1.3 of Step Change EA but omitted from disturbance mapping)
24	Internal access road (within E48 Subsidence Zone)	PA06-0026
36	E48 Subsidence Management Zone (purple areas are omissions from mapped disturbance)	PA06-0026 (As shown in Figure 1.3 of Step Change EA but omitted from disturbance mapping)
49	Ancillary disturbance/ water management	DA504_90/PA06-0026/PA11-0060
50	Waste Stockpile	DA504_90
51	Ancillary Disturbance – E26	DA504_90
52	Internal Access Road	DA504_90
53	Soil Stockpile	DA504_90
54	Internal Access Road	DA504_90
55	Construction/maintenance pad (powerlines)	DA504_90
56	Internal Access Road	DA504_90
57	Construction/maintenance pad (powerlines)	DA504_90
58	Internal Access road (former farming road)	PA06-0026
60	Internal Access Road	PA06-0026
61	Internal Access Road/ Ancillary construction/demolition disturbance	DA504_90
62	Internal Access Road	PA06-0026
64	Water Management	DA504_90
65	Soil Stockpile	DA504_90
66	Water Management	DA504_90
67	Internal Access Road	DA504_90
69	Ancillary disturbance	DA504_90
70	Soil Stockpile	DA504_90
71	Ancillary disturbance	DA504_90
72	Construction Pad	PA11_0060 (within area generally identified as waste stockpile under DA504_90)
73	Internal Access Road	PA06-0026

Figure ID	Nature of approved disturbance	Relevant consent where approved
86	Soil Stockpile	PA06-0026
93	Internal Access Road	Approved pre 2006.
100	Soil Stockpile	DA504_90
101	Soil Stockpile	DA504_90
102	Ancillary Disturbance	DA504_90
103	Internal Access Road/ Ancillary construction	PA06-0026
104	Soil stockpile	DA504_90
105	Water management/ Ancillary disturbance	DA504_90
106	Water Management/ Internal Access Road/ Ancillary disturbance	DA504_90
107	Water Management	DA504_90
108	Ancillary disturbance/ water management	DA504_90/PA06-0026/PA11-0060
109	Water Management Infrastructure	PA06-0026/PA11-0060
110	Soil Stockpile	DA504_90
111	Soil Stockpile/ Water Management Infrastructure	Approved pre 2006.
112	Soil Stockpile	DA504_90
113	Soil Stockpile	DA504_90
131	Ancillary Disturbance/ Construction/Water Management	PA06-0026
132	Internal Access Road/ Ancillary construction/demolition disturbance	DA504_90
134	Internal Access Road (also used for farming)	DA504_90
135	Internal Access Road	DA504_90
136	Internal Access Road/Ancillary disturbance	DA504_90
137	Ancillary Disturbance	DA504_90
138	Ancillary Disturbance	DA504_90
139	Ancillary Disturbance	DA504_90
140	Ancillary Disturbance	DA504_90
141	Ancillary Disturbance	DA504_90/PA11_0060
143	Ancillary Disturbance	DA504_90
148	'Approved Disturbance Area' as identified in PA11_0060 Modification 3 EA.	PA11_0060



Legend

Disturbance Category

- Mod 3 Mapping
- Updated



FIGURE 2.4

Additional Identified Disturbance Areas

Image Source: NPM (2020) Data source: NPM (2021); Umwelt (2021)

Table 2.4 Additional Identified Disturbance Areas – Area 4

Figure ID	Nature of approved disturbance	Relevant consent where approved
3	Water Management Infrastructure	DA504_90
4	Water Management Infrastructure	DA504_90
5	Soil Stockpile	DA504_90
6	Soil Stockpile	DA 03079
7	Soil Stockpile	DA 03079
8	Water Management Infrastructure	DA504_90/DA 03079
37	Internal Access Road	Various/ Farming
116	Soil Stockpile	DA504_90/DA 03079
121	Water Management Infrastructure (Clean Water)	DA504_90
148	'Approved Disturbance Area' as identified in PA11_0060 Modification 3 EA.	PA11_0060





FIGURE 2.5

Additional Identified Disturbance Area

Image Source: NPM (2020) Data source: NPM (2021); Umwelt (2021)

Table 2.5 Additional Identified Disturbance Areas – Area 5

Figure ID	Nature of approved disturbance	Relevant consent where approved
9	Water Management Infrastructure	PA11_0060
10	Internal Access Road (also used for farming purposes)	PA11_0060
30	Soil Stockpile	PA06-0026
38	Soil Stockpile	DA895_95
39	Vegetation/ Soil Stockpile	PA11_0060
40	Internal Access Track (formerly farming)	PA11_0060/Farming
41	Ancillary Disturbance – Water management and soil stockpiles	PA06-0026/ PA11_0060
42	Internal Access Track (formerly farming)	PA11_0060/Farming
43	Internal Access Track (formerly farming)	PA11_0060/Farming
79	Water Management Infrastructure	DA504_90/DA895_95/PA06-0026
81	Water Management Infrastructure	DA504_90/DA895_95/PA06-0026
82	Soil Stockpiles	DA895_95/DA00204
83	Ancillary Disturbance – Vegetation and Soil Stockpile	PA11_0060
122	Water Management Infrastructure	DA504_90/DA895_95/PA06-0026
123	Soil Stockpile	DA895_95
148	'Approved Disturbance Area' as identified in PA11_0060 Modification 3 EA.	PA11_0060

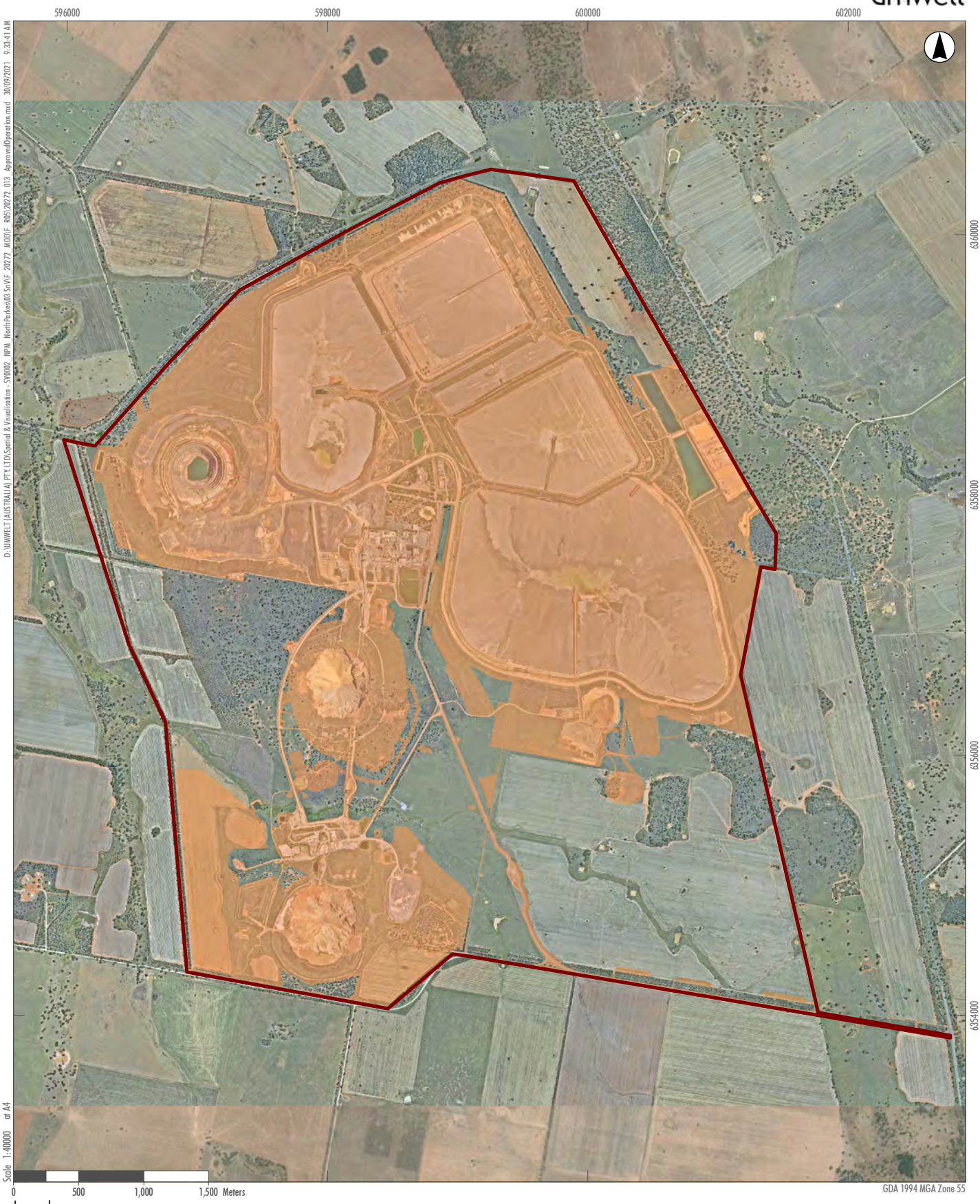


FIGURE 2.6

Approved Operational Area

Image source: NSW Government - Historical Imagery (1991) Data source: NPM (2021); Umwelt (2021)

2.2 Road Realignment Disturbance

As part of the approval requirements for DA504_90, Northparkes realigned part of McClintocks Lane, part of Adavale Lane and constructed a new road between McClintocks Lane and Adavale Lane running along the western boundary of the Northparkes Project Area. McClintock Lane was also upgraded as part of PA11_0060. With the exception of the upgrades to McClintocks Lane associated with its use as the primary access route for the Northparkes Mine (refer to **Figure 2.1** and **Table 2.1**), disturbance associated with these roadworks has not been mapped.

2.3 Mining Disturbance around approved E31N footprint

A review of the aerial imagery has identified an area around the approved E31N pit area that was disturbed by mining in 2018-20 but is outside the area mapped as being part of the approved disturbance footprint. Due to the focus of the assessment on additional impacts from the approval of the E31N open cut pit in this area as part of the Step Change Project assessment, these two areas have been reviewed in detail to ascertain whether the disturbance was approved under the approved works under PA06-0026 carried through to PA11_0060 (i.e. ancillary disturbance related to the use and construction of the Rosedale TSF Return Dam, TSF 3 Construction, Rosedale Borrow Pit or soil stockpiles associated with these activities).

2.3.1 Disturbance west of the E31N footprint

A small area to the west of the E31N footprint has been disturbed for activities associated with roads between the Rosedale Borrow Pit, area identified as the TSF Return Water Dam in PA06-0024 and the Rosedale TSF associated with the construction of the Rosedale TSF. As identified in **Figure 2.1** and **Table 2.1** the disturbance within this area is considered to be consistent with the activities approved under PA06_0026 and has therefore been mapped as part of the approved disturbance area. Part of this area has also been used for sourcing clay material for the Rosedale Borrow Pit construction. As the sourcing of this material is within the area disturbed by ancillary approved activities and is broadly within the approved E31N footprint, the use of this area for extraction of clay material is considered to be 'generally in accordance with' the development described in the Step Change Project EA. It is noted that this area would also be considered to be Category 1 – exempt land under the *Local Land Services Act 2013* (LLS Act) land due to the history of cropping in this area up to and after 1990.

2.3.2 Disturbance East of the E31N footprint

An approximately 0.73Ha area of land on the eastern side of the area of E31N Approved Disturbance (as identified in the PA11_0060 Modification 3 EA) has been disturbed from activities associated with preparatory works for the E31N open cut pit (Teal coloured area in **Figure 2.7**). This disturbance has removed approximately 0.24 Ha of PCT56 – Poplar Box – Belah woodland on clay loam soils of the alluvial plains of north-central NSW. Ground truthing of similar quality vegetation to the immediate south of the area removed indicates this vegetation is degraded. The remaining approximately 0.49 Ha has been identified as Category 1 – exempt land for the purposes of the LLS Act due to a history of cropping prior to and in 1990-1991 and indications from previous ecological field work that the grassland is exotic and likely to be Low Conservation Value Grassland. It is noted that two paddock trees which were present in this area in 1990 have also been removed.

While this disturbance is ancillary to the mining of E31N (i.e. necessary for the construction of safety bunds, water management and general access around the pit, the impacts associated with these activities were not assessed in the Step Change Project EA and the disturbance activities undertaken are not considered to be ancillary to the activities approved under PA06-0026. While it is arguable that this disturbance could be considered to be 'generally in accordance with the 'EA' as defined in PA11_0060, this small area of mining related disturbance has conservatively been mapped as ***not being*** part of the approved disturbance area under PA11_0060.

Due to the small and largely incidental nature of this disturbance, it is recommended that an adjustment to the approved disturbance area be pursued as part of the PA11_0060 Modification 6 application in an area that has not yet been disturbed and is not required for future disturbance to compensate for the loss of the vegetation in the Category 2 land in this area. This adjustment should remove an equivalent area of similar or higher conservation value woodland, preferably in an area that retains a reasonable level of connectivity to vegetation outside of the area identified as being the part of the 'Approve Operation Area' (refer to **Figure 2.6**).

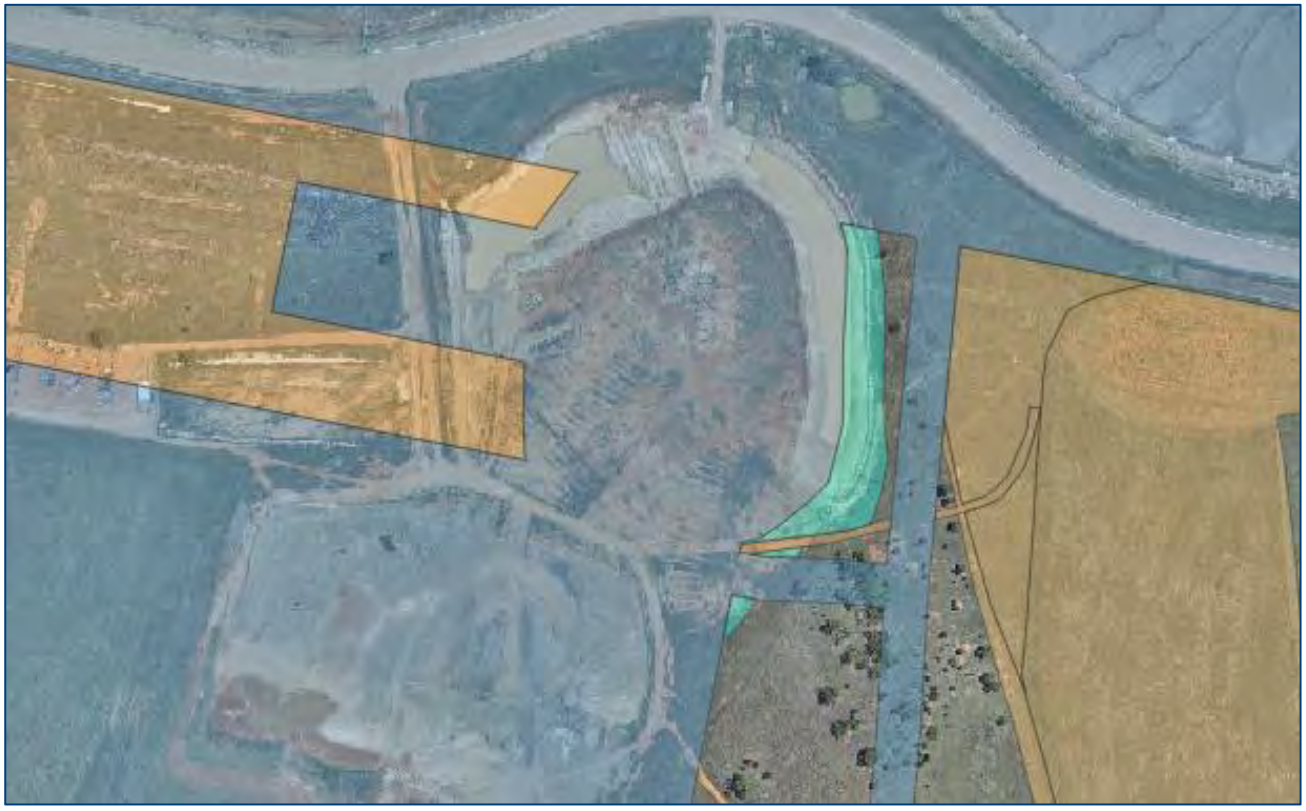


Figure 2.7 Disturbance adjacent to approved E31N disturbance area

2.4 Agricultural Disturbance

Northparkes continues to manage parts of the PA11_0060 Project Area for agricultural uses. Ongoing disturbance of these areas associated with cropping activities, farm access roads and general land management practices (including dams and drainage management) continues to be undertaken. Disturbance associated with these activities has not been mapped except for some access roads which are used for both mining and farming purposes (including farm access roads which have been realigned around approved mining disturbance areas).

While some of the drainage management works on these properties is utilised as part of the mine water management system (predominately clean water diversions and drainage lines for design overflow from sediment dams), this has not been mapped except where the predominate use of these works is associated with mine related activities and future disturbance associated with final landform re-establishment works is likely to be required. The main examples where this disturbance has been mapped is the area around the E26 void and approved waste dumps and some areas around the Rosedale TSF and the approved E31 and E31N pit areas.

3.0 References

Australia Archaeological Survey Consultants Pty Ltd (2006) *Northparkes Mines – E48 Project: Aboriginal Heritage Assessment* (Part 8 in Northparkes Mines – E48 Project Environmental Assessment (RW Corkery & Co (2006))

R.W Corkery & Co (2006), *Northparkes Mines – E48 Project Environmental Assessment*

Umwelt (2013), *Environmental Assessment: Northparkes Mines Step Change Project*



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NORTHPARKES MINES

Local Land Services Act 2013
Land Category Mapping - Addendum

FINAL

March 2022

NORTHPARKES MINES

Local Land Services Act 2013
Land Category Mapping - Addendum

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
CMOC Northparkes

Project Director: David Holmes
Project Manager: Lauren Evans
Report No. 20272/R06_Addendum
Date: March 2022

Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which Northparkes Mines operates, the Wiradjuri people, and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

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Document Status

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Table of Contents

1.0 Introduction 1

2.0 Revised LLS Category Mapping 2

2.1 Planted Vegetation east of TSF2 2

2.2 Revised Mapping of Area West of E22 Pit 8

3.0 Revised Disturbance Area Changes 10

4.0 Extension of Mapping 12

5.0 Metadata List 14

Figures

Figure 2.1 Location of Planted Vegetation 3

Figure 2.2 1985 LandSat imagery of area east of TSF2 4

Figure 2.3 1991 Aerial Image and location of planted vegetation 5

Figure 2.4 Revised LLS Category Mapping relative to 1991 aerial photography 6

Figure 2.5 Revised LLS Category Mapping relative to 2020 imagery 7

Figure 2.6 Revised Road Reserve Land Category Mapping 9

Figure 3.1 Updated LLS Category Mapping associated with revised disturbance area mapping 11

Figure 4.1 LLS Act Land Category Mapping for PA 11_0600 13

Tables

Table 4.1 Images/Aerial Photography reviewed 14

Table 4.2 Spatial Data Provided 14

1.0 Introduction

The 'Northparkes Mine Local Land Services Act 2013 Land Category Mapping' Report dated September 2021 (Umwelt, 2021) (September 2021 LLS Mapping Report) describes the processes of mapping Category 1 and Category 2 land within the PA 11_0060 Project Area for the purposes of determining the Development Footprint for the Biodiversity Development Assessment Reports to support applications to modify PA 11_0060. This mapping extended to most, but not all, of the PA 11_0060 Project Area and some land immediately adjacent to the Project Area.

Subsequent to the finalisation of the September 2021 LLS Mapping Report, the need for a number of minor adjustments to the mapping has been identified. These mapping adjustments are summarised below and discussed in further detail in **Sections 2.0** and **3.0:**

Re-characterisation of a small area of planted vegetation to the east of TSF2 as being Category 1 Land (Planted)

Re-characterisation of an area of remnant vegetation as Category 2 Land and a refinement of Category 1 land in this area

Adjustments associated with revisions to the mapping of Approved Disturbance Area (refer to 'Approved Disturbance Area Mapping – Addendum' (Umwelt 2022)

Extension of LLS mapping to the entire Project Area and some additional adjoining areas.

The methodology applied to the characterisation of the land remain the same as detailed in the September 2021 LLS Mapping Report.

With the exception of the re-characterisation of the planted vegetation to the east of TSF2, the revised LLS Category Mapping does not impact on the 'Development Footprint' for the purposes of the BDAR prepared for the Project.

2.0 Revised LLS Category Mapping

2.1 Planted Vegetation east of TSF2

Subsequent to the finalisation of the September 2021 LLS Mapping Report, the survey of an area of vegetation to the east of TSF 2 as part of Modification 6 identified some of the vegetation in this area as being planted. At the time of the original classification using aerial photography interpretation (API) alone and no ground truthing, the planted nature of this vegetation was not apparent. This prompted a review of whether this land had been incorrectly mapped as being Category 2 land in the September 2021 LLS Mapping Report. The area of planted vegetation is shown in **Figure 2.1** against a 2020 aerial image of the site.

A further review of satellite imagery from 1985 (Landsat) and aerial photography from 1991 indicates that part of this area was historically cropped and would meet the criteria as having been 'cleared as at 1 January 1990'. **Figure 2.2** shows the area in question with the bright green area showing a cropped paddock to the east of a remnant patch of vegetation. Part of this remnant vegetation remains to the west of the planted areas.

Due to the poor resolution of the LandSat imagery and difficulties with accurate georectification on the scale required, the use of the LandSat imagery to define the extent of the potential Category 1 land was considered inappropriate. Instead, a closer review of 1991 aerial imagery was used to define the extent of historical cropping by aligning paddock boundary lines which are more visible in the more recent imagery. **Figure 2.3** shows the identified boundary of the cropped paddock visible in the 1984 LandSat imagery and the location of the planted vegetation mapped as PCT 277. As can be seen from **Figure 2.3**, the extent of the cropped areas remains visible in the 1991 aerial photograph and can be used to define the extent of the Category 1 Land in this area.

Figure 2.4 shows the revised Land Category Mapping in this area against the 1991 Aerial Photograph. **Figure 2.5** shows the same mapping against the 2020 imagery of the same area. Note that the revised mapping does not recategorize all of the planted area mapped as being PCT 277 as being Category 1 land as a small part of this planted area remains within land mapped as being Category 2 land.



Legend

- Approved Northparkes Mine Site
- Category 1 (Planted - Not Category 2)



FIGURE 2.1

Location of Planted Vegetation

Image source: NPM Aerial Imagery (2020) Data source: NPM (2021)



FIGURE 2.2

1985 LandSat imagery of area east of TSF2

Image source: Landsat Imagery (1985) Data source: NPM (2021)

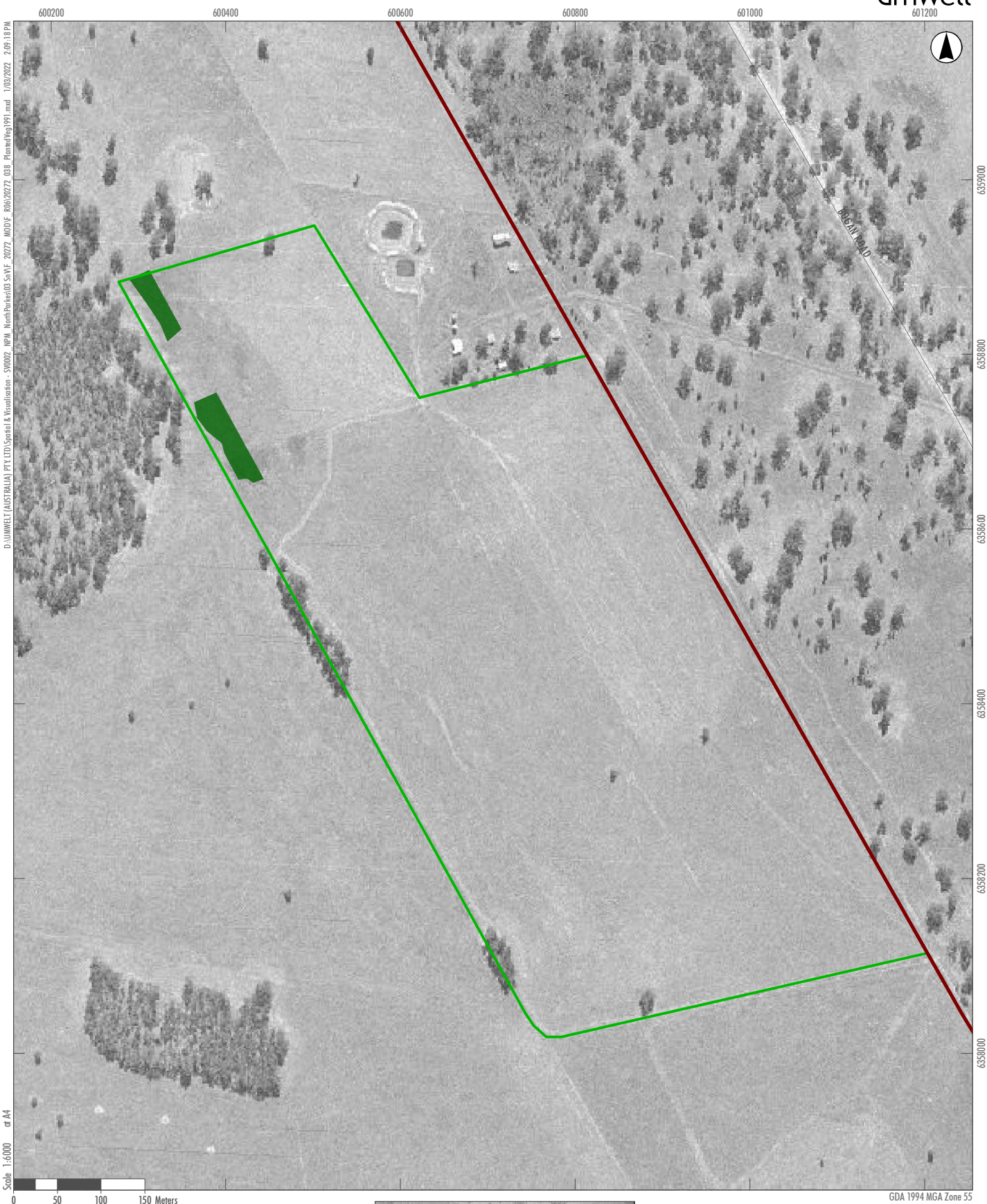
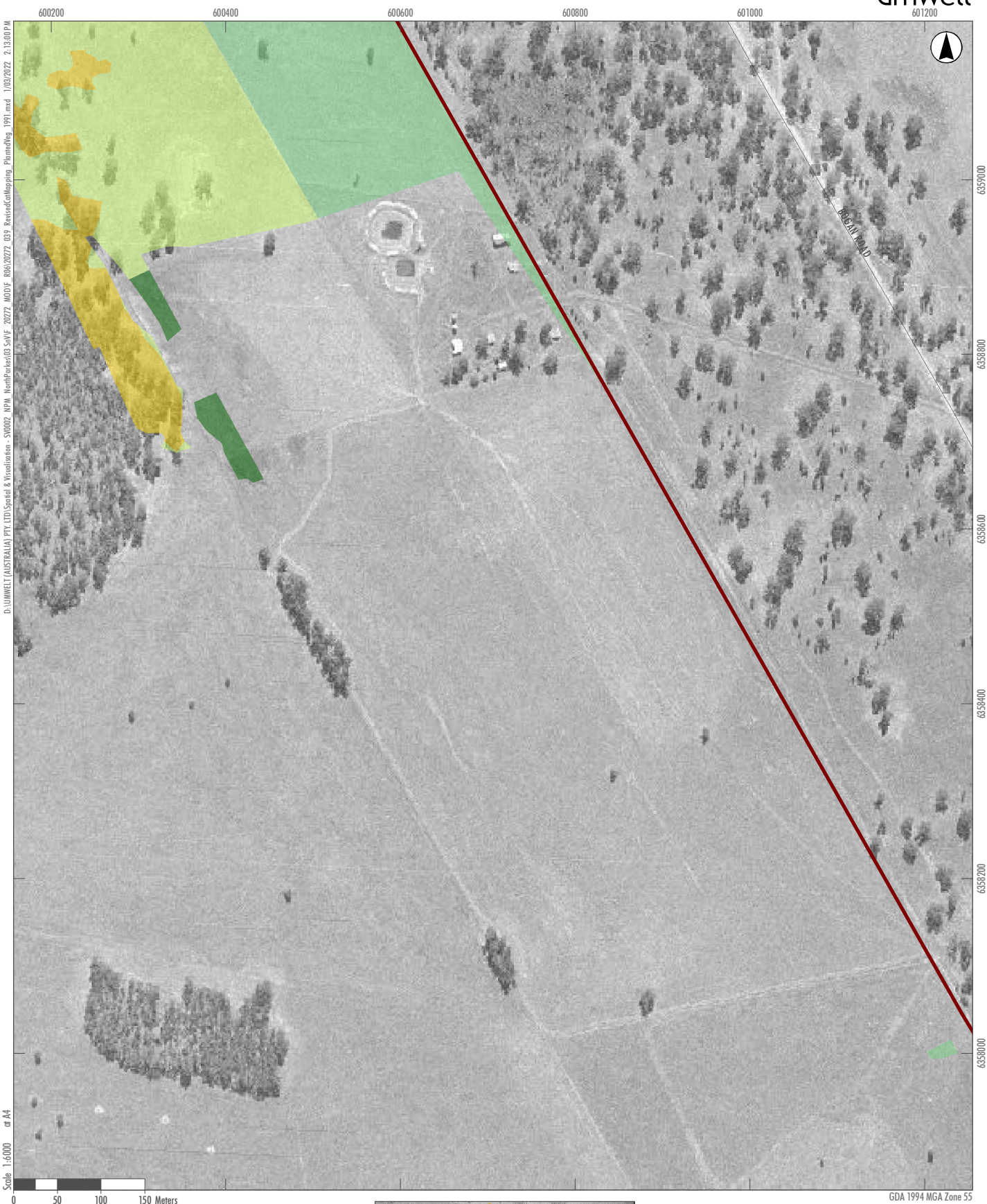




FIGURE 2.3

1991 Aerial Image and location of planted vegetation

Image source: NSW Government - Historical Imagery (1991) Data source: NPM (2021)



Legend

- Approved Northparkes Mine Site
- Category 1
- Category 1 (Low Conservation Grassland)
- Category 1 (Planted - Not Category 2)
- Category 2
- Category 2 (Likely includes LCG)
- Exempt
- Road

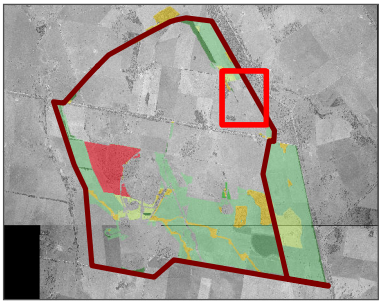
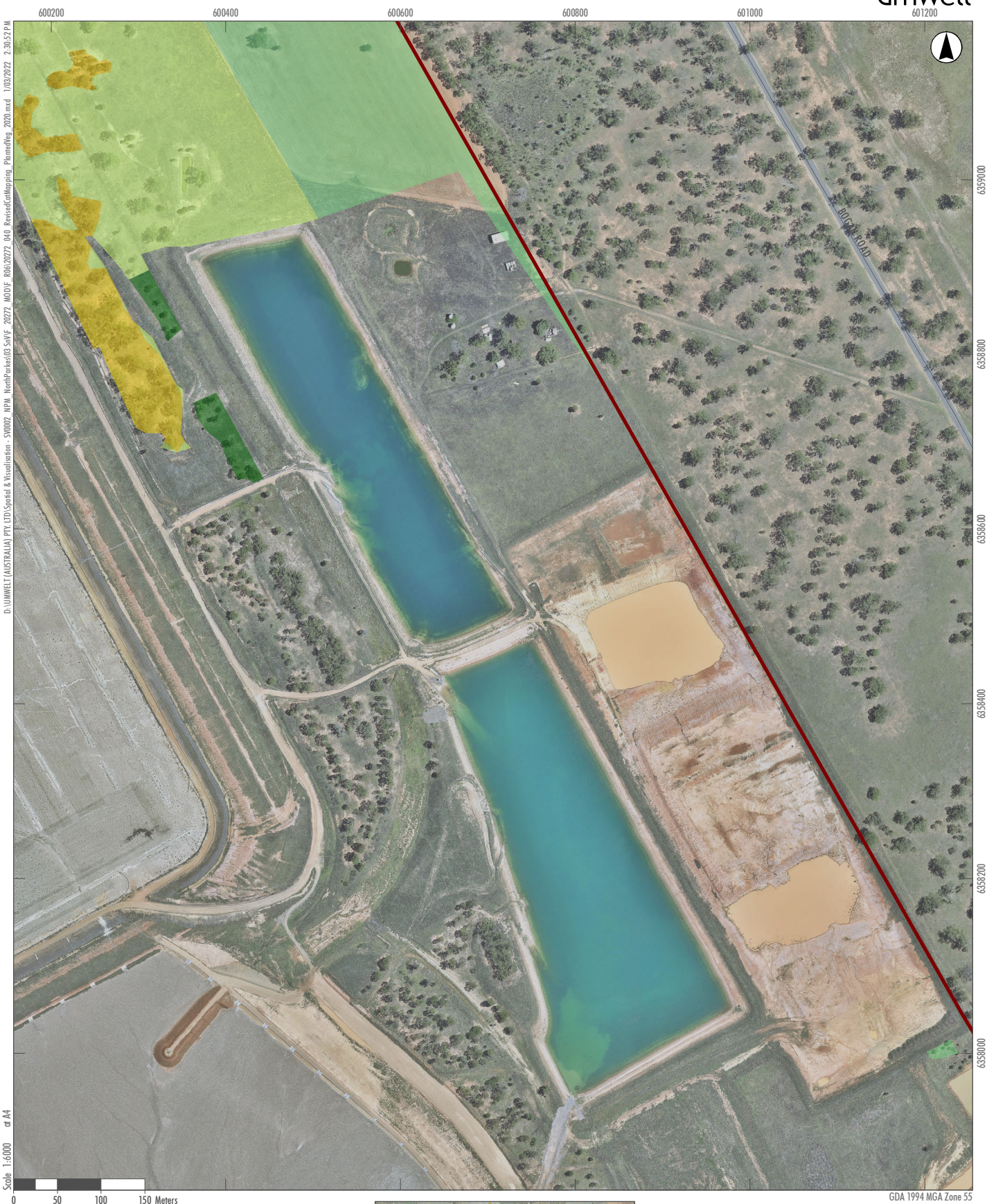


FIGURE 2.4

Revised LLS Category Mapping relative to 1991 aerial photography

Image source: NSW Government - Historical Imagery (1991) Data source: NPM (2021)



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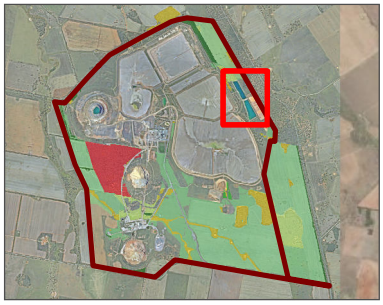


FIGURE 2.5

Revised LLS Category Mapping relative to 2020 imagery

Image source: NPM Aerial Imagery (2020) Data source: NPM (2021)

2.2 Revised Mapping of Area West of E22 Pit

As part of the processes of extending the LLS Land Category mapping to the entire Project Area (refer to **Section 4.0**), an omission in the mapping to the west of the E22 Pit was identified. Additionally, a small area of remnant (pre-1990) vegetation within the former Adavale Road road reserve was identified as being incorrectly mapped as being Category 1-planted.

Figure 2.6 shows the revised LLS Land Category Mapping in this area.

Minor adjustment to the LLS mapping were also required in an area to the north of this remapped Category 2 land to align with the Approved Operational Area mapping of an existing soil stockpile area constructed in the late 1990s/ early 2000s. These changes did not affect any Category 2 land. The area of updated LLS category mapping associated with this change is shown on **Figure 2.6**.



Legend

- Approved Northparkes Mine Site
- Category 1
- Category 1 (Low Conservation Grassland)
- Category 1 (Planted - Not Category 2)
- Category 2
- Category 2 (Likely includes LCG)
- Exempt
- Road



FIGURE 2.6

Revised Road Reserve Land Category Mapping

Image source: NPM Aerial Imagery (2020) Data source: NPM (2021)

3.0 Revised Disturbance Area Changes

An error associated with the mapping of the Approved Disturbance Area around the Pine Donkey Orchid Management Area (refer to Approved Disturbance Area Mapping – Addendum (Umwelt 2022) located to the east of E28NE required a review of the LLS Category mapping in this area.



FIGURE 3.1

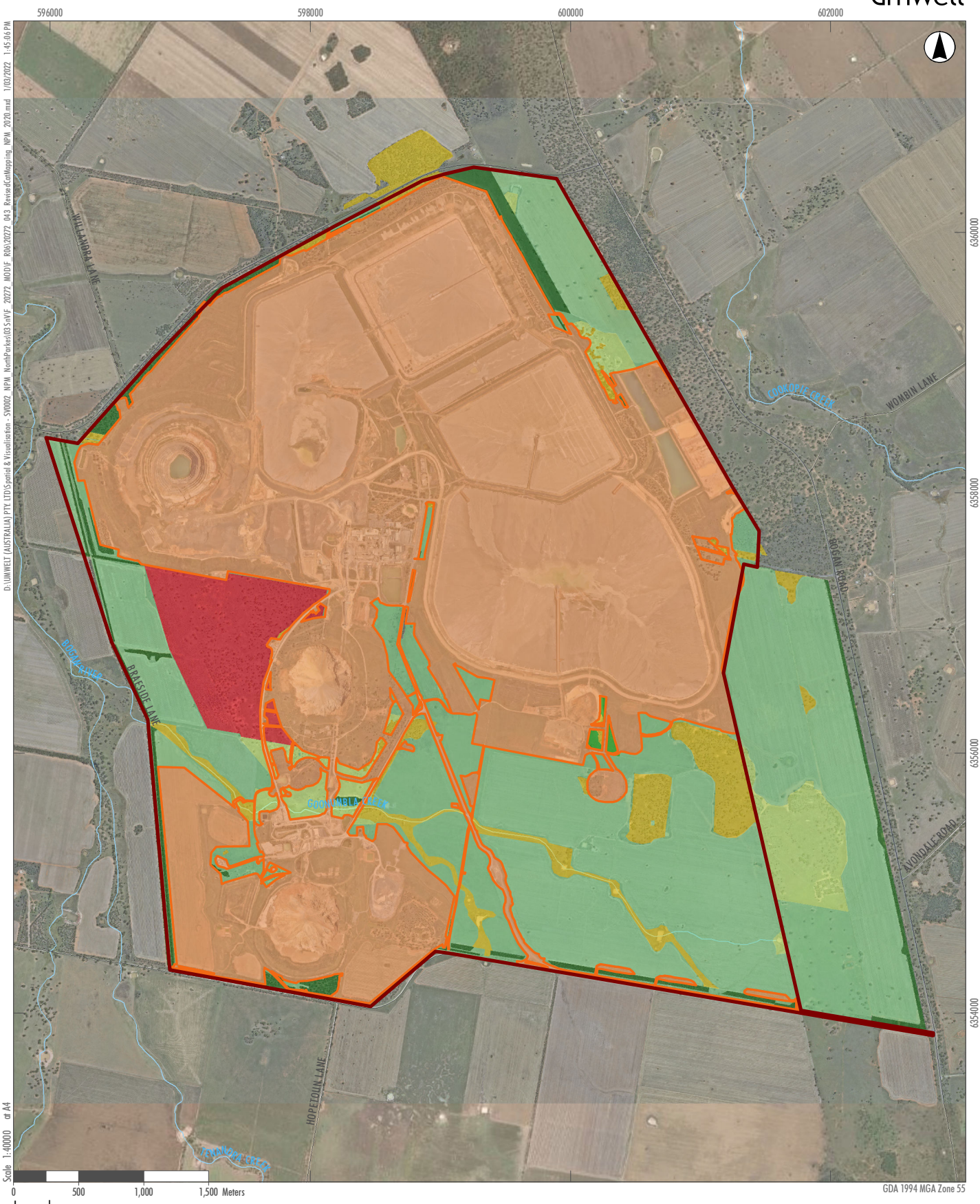
Updated LLS Category Mapping associated with revised disturbance area mapping

Image source: NPM Aerial Imagery (2020) Data source: NPM (2021)

4.0 Extension of Mapping

The extent of the LLS Category mapping has been extended to the full extent of the Northparkes PA 11_0060 Project Area. The methodology used for this infill mapping is the same as detailed in the September 2021 LLS Mapping Report.

Figure 4.1 below shows the updated mapping of LLS Act Categorised land and the Approved Operational Area within the Northparkes PA 11_0060 Project Area.



Legend

- Approved Northparkes Mine Site
- Approved Operational Area
- Category 1
- Category 1 (Low Conservation Grassland)
- Category 1 (Planted - Not Category 2)
- Category 2
- Category 2 (Likely includes LCG)
- Exempt
- Road
- Drainage Line

FIGURE 4.1

LLS Act Land Category Mapping for PA 11_0600

Image source: NPM Aerial Imagery (2020) Data source: NPM (2021); Umwelt (2021)

5.0 Metadata List

Table 5.1 Images/Aerial Photography reviewed

Images	Date	Source
1991 LPI Georectified Aerial Image	31/05/1991	Portal.spatial.nsw.gov.au Historical Imagery
1985 LandSat/Coppernicus	31/12/1985	LandSat/Coppernicus
2020 Northparkes Site Image	25/12/2020	CMOC Mining Pty Ltd

Table 5.2 Spatial Data Provided

File Name	Date	Description
NPM_Approved_Operational_Area_Mapping-PA11_0060 -Consolidated	24/09/2021	Shapefile showing location of approved disturbance areas under PA11_0060
NPM_LLS_Category_Mapping -Addendum	24/09/2021	Shapefile showing mapped LLS Act Category Mapping for North Parkes landholdings in and around PA11_0060 Project Area.



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Review of Approved Disturbance Area - Addendum

FINAL

March 2022

NORTHPARKES MINES

Review of Approved Disturbance Area - Addendum

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
CMOC Northparkes

Project Director:	David Holmes
Project Manager:	Lauren Evans
Technical Director:	David Holmes
Report No.	20272/R05-Addendum
Date:	March 2022

Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

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	Name	Date	Name	Date
Final	Lauren Evans	2/3/2022	David Holmes	2/3/2022

Table of Contents

1.0 Updated E28 Haul Road Alignment 1

2.0 References 4

Figures

Figure 1.1 Figure 3.4 from Step Change RTS Addendum 1
Figure 1.2 Revised 'Approved Operational Area' east of approved E28NE pit 2
Figure 1.3 Northparkes Mine PA 11_0060 Approved Operational Area 3

1.0 Updated E28 Haul Road Alignment

In September 2021, a consolidated mapping of the Approved Operational Area was undertaken and documented in the Report 'Northparkes Mine Review of Approved Disturbance Area' (Umwelt 2021). (Approved Disturbance Report). This Addendum has been prepared to correct a minor error in this mapping.

The Approved Disturbance Report used the mapping of 'Disturbance Areas' contained in Figure 3.4 from the PA11_0060 Modification 3 Application which reflected the 'Proposed Disturbance Area' mapping (Figure 5.9) from the Step Change EA. Unfortunately, Figure 3.4 did not capture the revised footprint for the E28 Haul Route to minimise impacts on a population of the Pine Donkey Orchid (*Diuris tricolor*) located to the east of the proposed (and now approved) E28NE open cut footprint. This revised footprint is shown in Figure 3.4 of the *Northparkes Mine Step Change Project Response to Submissions – Addendum* (Umwelt 2013) (Step Change RTS – Addendum) which is reproduced in **Figure 1.1** below.



Figure 1.1 Figure 3.4 from Step Change RTS Addendum

© Umwelt, 2013

The Approved Operational Area mapping has been updated to reflect the revised E28 haul route and associated buffer area where disturbance associated with road construction works was also approved. The updated Approved Operational Area in this area is shown in **Figure 1.2**.

The consolidated 'Approved Operational Area' is shown in **Figure 1.3**.



FIGURE 1.2

Revised 'Approved Operational Area'

Image source: NPM Aerial Imagery (2020) Data source: NPM (2021)

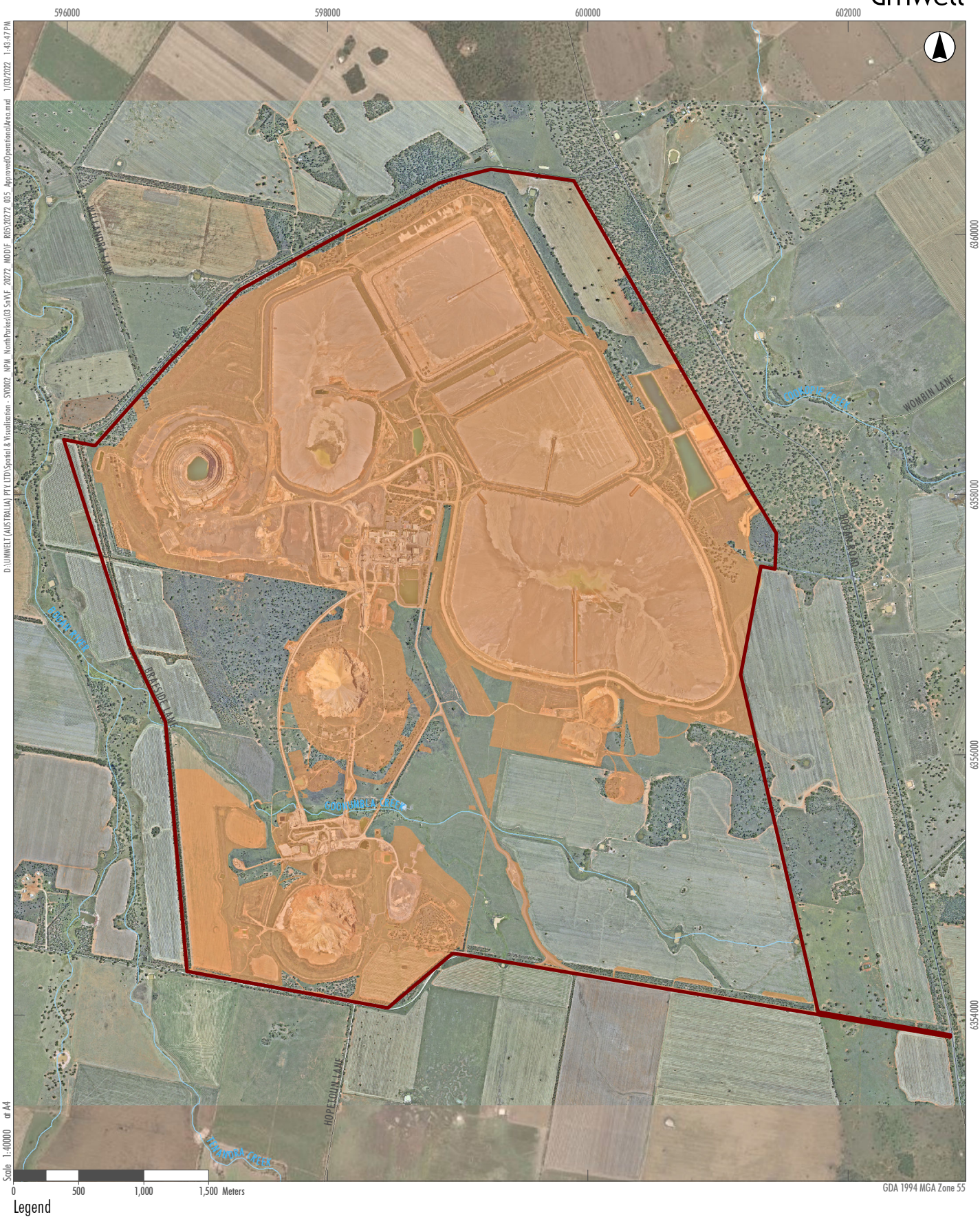


FIGURE 1.3

Northparkes Mine PA 11_0060
Approved Operational Area

Image source: NPM Aerial Imagery (2020) Data source: NPM (2021)

2.0 References

Umwelt (2013), Environmental Assessment: Northparkes Mines Step Change Project Response to Submissions - Addendum, dated November 2013

Umwelt (2021) Northparkes Mine Review of Approved Disturbance Area, dated September 2021



umwelt
Environmental & Social
Consultants

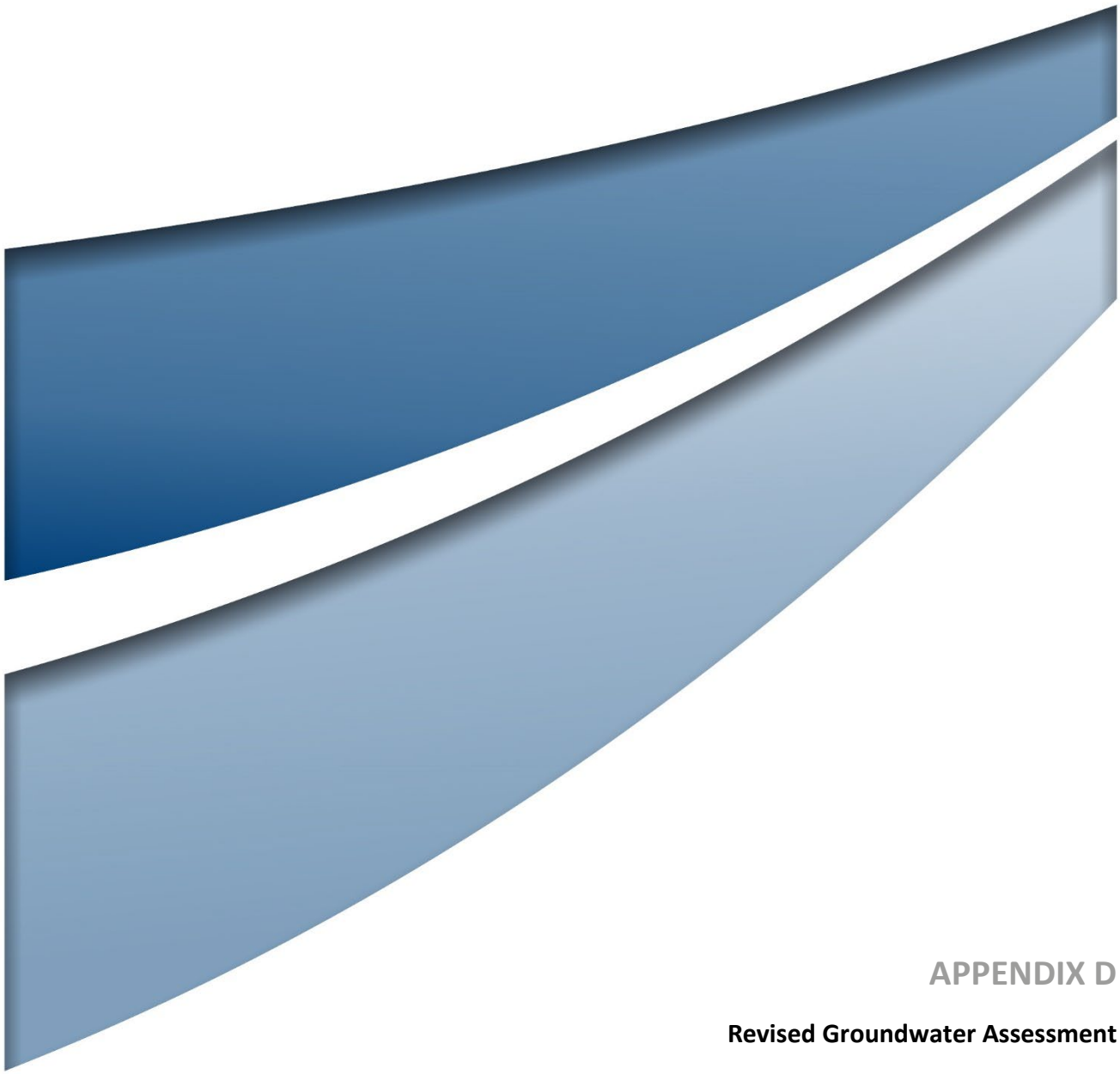
Umwelt (Australia) Pty Limited

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au

Appendix H

Estimated Biodiversity Conservation Fund payment price

Disturbance area	Credit class	Price per credit	Number of credits required	Final credit price
	Ecosystem credits			
	Stage 1			
E31	56 – Poplar Box - Belah woodland on clay-loam soils on alluvial plains of north-central NSW (zone 1)	$3,962.83	12	$47,553.95
E31	80 – Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion (zone 2)	$4,123.14	8	$32,985.14
TSF2	76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions (zone 4)	$4,123.14	36	$148,433.13
TSF2	82 – Western Grey Box – Poplar Box – White Cypress Pine tall woodland on red loams (zone 5)	$4,123.14	47	$193,787.70
TSF2	277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (zone 6)	$8,532.95	2	$17,065.91
	Total Stage 1			**$439,825.83 (excl. GST)**
	Stage 2			
E22	248 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW (zone 3 Area 1)	$3,962.83	151	$598,387.21
	Total Stage 2			**$598,387.21 (excl. GST)**
	Stage 3			
E22	248 – Mixed box eucalypt woodland on low sandy-loam rises on alluvial plains in central western NSW (zone 3 Area 2)	$3,962.83	82	$324,951.99
	Total Stage 3			**$324,951.99 (excl. GST)**
	SUBTOTAL (excl. GST) (Stage 1 and Stage 2)			***$1,038,213.04***
	GST			**$103,821.30**
	TOTAL (incl. GST)			**$1,142,034.34**



APPENDIX D

Revised Groundwater Assessment

Australasian Groundwater & Environmental Consultants

2 February 2022 (v05.01)

CMOC Mining Services Pty Ltd
Northparkes
PO Box 995, Parkes NSW 2870 Australia

Attention: Chris Higgins | Environment and Farm Superintendent
via email: Chris.Higgins@au.cmoc.com

Dear Chris,

Northparkes Mine Modification 6 Application – Preliminary Groundwater Assessment

1 Introduction

Umwelt (Australia) Pty Ltd (Umwelt) has been engaged to prepare and manage the assessment process for a modification to Project Approval (PA) 11_0060, which covers the approved operations at Northparkes Mine (NPM), located near Parkes in NSW.

The modification application (MOD 6) will be progressed concurrently with the Northparkes E44 Rocklands assessment processes. The proposed alterations to PA 11_0060 in Modification 6 (MOD 6) include changes to approved open cut pits E31 and E31N. A review of the mine design of E31 and E31N has identified that minor adjustments to the E31 and E31N pits are required. These changes include variation to disturbance areas and an increase in mining depths in both pits. This increase in mining depths has the potential to increase groundwater inflows, and as such, a groundwater assessment is required.

Australasian Groundwater & Environmental Consultants Pty Ltd (AGE) are currently engaged to prepare a Groundwater Impact Assessment (GIA) for the E44 Rocklands Project. Given the synergy between the GIA and MOD 6, CMOC Mining Services Pty Ltd (CMOC) (Northparkes) have requested AGE to undertake a preliminary desktop level and qualitative groundwater assessment to support the application process for MOD 6 being managed by Umwelt.

AGE have prepared this letter report using mainly client supplied information to consider the potential incremental impacts of MOD 6 on the local groundwater regime. The assessment included a review of approved mining at the E31 and E31N pits, and an evaluation of the potential impacts that may arise due to the proposed changes to mining.

1.1 Proposed Modification

The Proposed MOD 6 includes (refer to Figure 1):

- construction and use of a new underground portal access (and associated infrastructure) for E22 underground mining operations;
- TSF2 embankment buttressing (including associated amendments to the approved disturbance area);
- changes to TSF construction within the approved disturbance footprint associated with increased safety requirements for TSFs since first approved ;
- minor changes to the E31 and E31N open cut pits, including:
  - minor adjustments to disturbance areas for the approved pits and associated infrastructure (roads, safety bunds, water management etc) ; and
  - minor increases to maximum approved mining depths;
- relocation of waste rock stockpile areas for the E31 and E31N pits to avoid unnecessary material re-handling in the future due to the proposed Rocklands TSF;
- relocation of rehabilitation material stockpiling areas to facilitate future development of the proposed Rocklands TSF;
- establishment of clay and filter material borrow pits for TSF construction and lifts ;
- relocation of contractor facilities (eg. site offices, crib huts and a workshop);
- realignment of a tailings pipeline to Rosedale TSF (TSF3) ;
- realignment of the primary water supply pipeline to the western side of the Access Road to avoid conflict with the proposed E31 waste rock stockpile area and proposed Rocklands TSF; and
- clarification regarding approved disturbance boundaries and the location of ancillary infrastructure within the E31 Precinct.

A more detailed description of the modification is provided in the Modification Report.

1.2 Approved and proposed mine plan alterations and planned sequence of extraction

The E31 and E31N pits are located directly south of the Rosedale Tailings Storage Facility (TSF) as shown in Figure 1. The E31 and E31N pits are approved for disturbance areas of approximately 6.3 hectares (ha) and 5.4 ha, respectively. The E31 pit is approved to a depth of around 80 m below ground level, and the E31N pit is approved to a depth approximately 70 m below ground level. The MOD 6 application involves: increasing the approved mining depths in both E31 and E31N pits to approximately:

- 110 m below ground level in the E31 pit (an increase of approximately 30 m); and
- 95 m below ground level in the E31N pit (an increase of approximately 25 m).

It is noted that the mining of the E31 and E31N pits will occur concurrently with approved underground mining operations at Northparkes but the E26 open cut mining and E28 and E28N pits approved under the Step Change Project has not yet occurred and will not commence until after mining in the E31 and E31N pits has finished. The period of mining the E31 pits will also occur over a shorter timeframe of 2 to 4 years.

In terms of groundwater impacts, the proposed increase in mining depth in the E31 and E31N open cut pits has the potential to increase groundwater inflows, relative to previous predictions (Golder Associates, September 2013).

1.3 Objectives and scope of work

The objective of this preliminary groundwater impact assessment is to assess the potential impacts to groundwater associated with the proposed changes to mining depths for E31 and E31N. The scope of work included a qualitative desktop level assessment of groundwater impacts relating to increasing of pit depths in E31 and E31N, having regard to:

- likely changes to previous inflow predictions;
- likely impacts on groundwater levels; and
- relevant requirements of the NSW Aquifer Interference Policy.

To meet the project objective, a review of currently approved mining for E31 and E31N was undertaken. Subsequently, the proposed changes to mining were examined, which informed the assessment of potential impacts in line with changes to inflows, groundwater levels and quality, and relevant assessment considerations.

This Groundwater Assessment is limited to the proposed changes to the E31 and E31N pits.

1.4 Predicted groundwater impacts

The assessment of groundwater impacts for the Approved (PA) 11_0060 GIA Northparkes Mine is primarily based on predictions from a numerical model of the groundwater system around the Northparkes Mine developed by Golder Associates (GIA, 2013) and a subsequent Technical Memorandum for responses to review comments (Golder, 2013b). The Golder (2013) report includes an assessment of potential impacts on:

- groundwater levels and groundwater inflow during mine operation (the groundwater modelling had not assessed the groundwater take after mine closure);
- groundwater flow directions;
- groundwater quality;
- groundwater licensing; and
- registered production bores.

The sections below provide a summary of impacts predicted in the Golder 2013 GIA and assess how these impacts are likely to change based on the currently planned mine sequencing and proposed revisions to the mining depth described in Section 1.2.

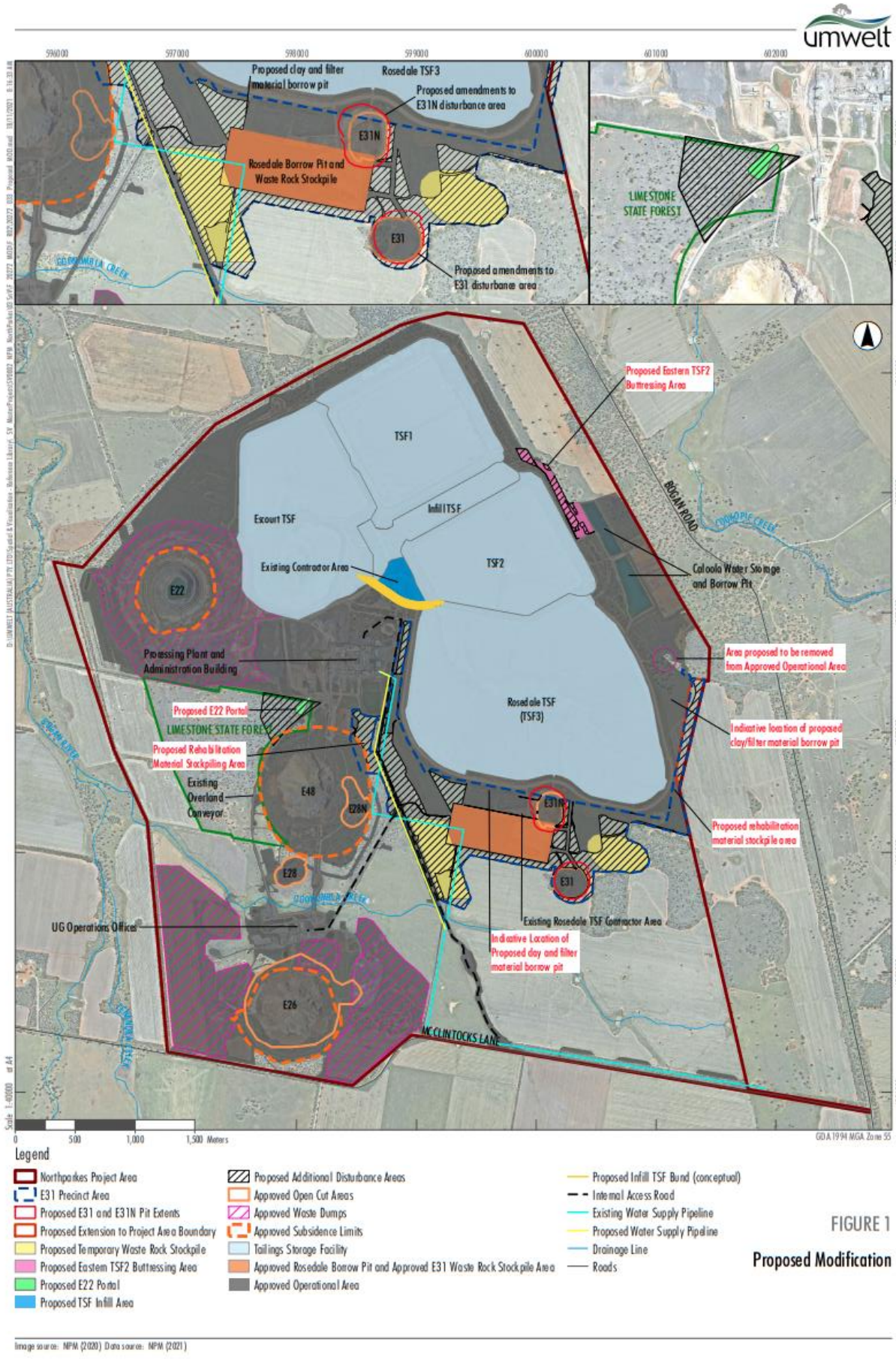


Image source: NPM (2020) Data source: NPM (2021)

Figure 1 Proposed Modification

2 Mine inflows

2.1 Approved (PA) 11_0060 GIA

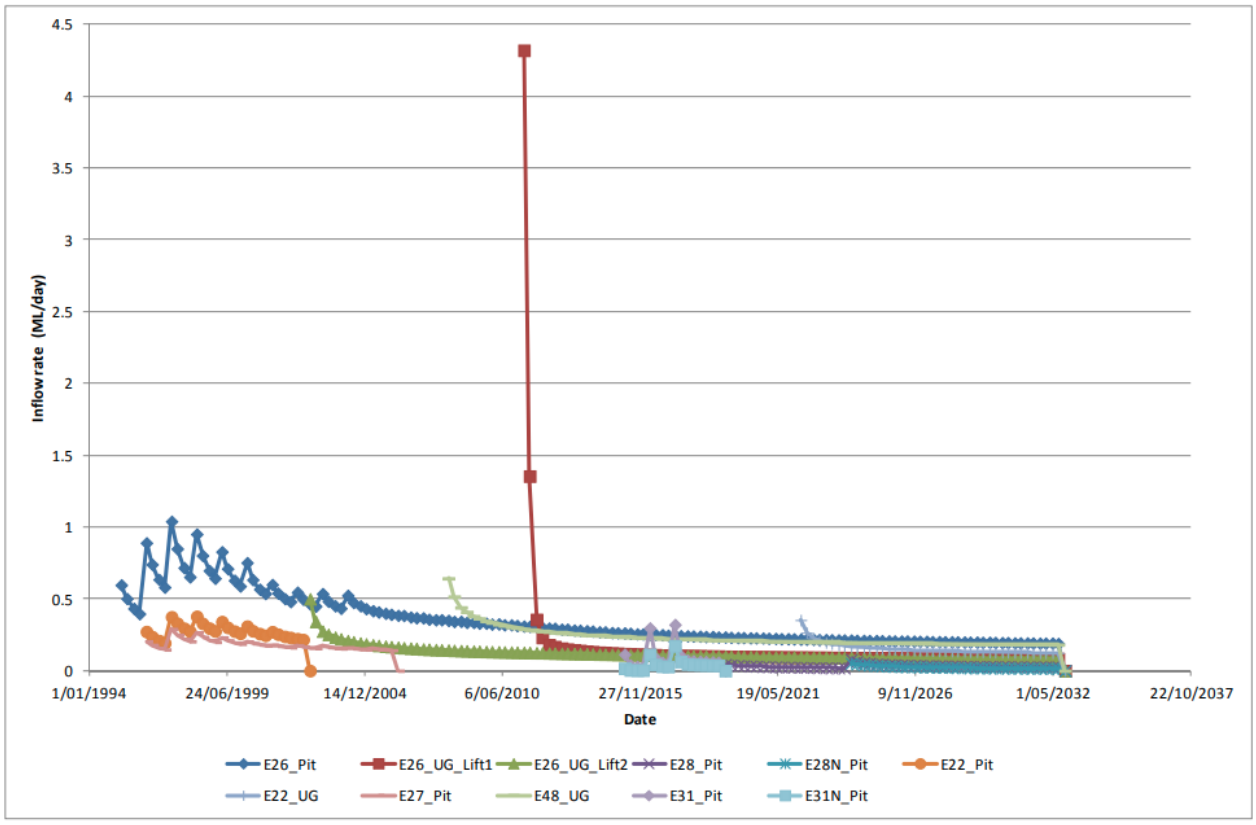
Predicted mine inflows for E31 and E31N pits based on the approved mining plan (Golder 2013b) is summarised in Table 1. The predicted range of pit inflows is between 0.03 and 0.32 ML/day. This was based on an assumed timing of mining in E31 and E31N of approximately 2018-2019 and 2014-2017 respectively. The numerical groundwater model applied maximum dewatering depths of 210 mAHD for mine pit E31 and 220 mAHD for mine pit E31N.

Table 1 Predicted N31 and N31N inflows (Golder, 2013b)

Model Time		E31	E31N
Days	Dd/mm/yy	(ML/d)	(ML/d)
7773	14/04/15	0.11	0.02
7856	6/07/15	0.04	0.00
7956	14/10/15	0.03	0.00
8039	4/01/16	0.03	0.00
8139	13/04/16	0.30	0.11
8222	5/07/16	0.09	0.04
8322	13/10/16	0.06	0.03
8404	4/01/17	0.05	0.03
8504	14/04/17	0.32	0.17
8587	5/07/17	0.10	0.06
8687	13/10/17	0.07	0.05
8770	4/01/18	0.07	0.04
8870	14/04/18	0.07	0.04
8952	6/07/18	0.06	0.04
9052	14/10/18	0.06	0.04
9135	5/01/19	0.06	0.04
9235	15/04/19	0.00	0.00

The results of hydrogeological modelling undertaken for all the mine workings as part of the Northparkes Mines Step Change Project (Golder Associates, 2013, 2013b) shows that modelled inflows peaked in 2011 at approximately 4.3 ML/day (Figure 2). Groundwater inflows are predicted to decline from 0.40 ML/day during 2019 to less than 0.3 ML/day by 2032. Actual observed inflows have been lower than predicted (Golder, 2013b).

GHD completed the 2020 water balance review, including water balance model calibration (GHD, 2020), and it indicates that the total mine inflow rate for the 2019/2020 water year is 150 ML/year (0.41 ML/day). The forecast for 2021 is 144 ML/year (0.39 ML/day).



Notes: The model simulated peak inflow rate to E22 Lift 1 of 4.3 ML/day in April 2011 is an artefact of the modelling. The modelled peak inflow rate to E26 Lift 1 during the initial stages of development is reasonably estimated between 1 ML/day and 2 ML/day. For the remainder of the operation period, the modelled inflow rate to E26 Lift 1 is projected to be less than 0.3 ML/day for most of the time

Figure 2 Predicted inflow estimates to each mining area (~20%) (Golder, 2013b)

2.1.1 Incremental impacts of MOD 6

Golder (2013) indicates that increased fracturing in the mineralised zones has resulted in increased hydraulic conductivity (approximately 2x10-6 m/s to 5x10-8 m/s) in comparison to the bedrock. The hydraulic conductivity for the mineralised zones decreases notably from about 125 m depth.

MER (2006) concludes from these investigations that, of the 98 bores drilled into this area, only a handful encountered water bearing zones below 30 to 40 metres below ground level (mbgl), resulting in low potential storage in this area.

Based on the historical information and the predicted water balance figures, it is not expected that large changes in groundwater inflows will occur based on the mine pits' proposed deepening. The predicted range (Table 1) is unlikely to be exceeded.

2.1.2 Assumptions and limitations

The volume of water taken as a result of mining activities (including the dewatering from open pits and the inflow volumes to the mine) was modelled prior to project approval (refer to the Golder 2013, GIA). The numerical groundwater model has not been validated since 2013 with updated and measured groundwater inflow rates and volumes.

As mentioned earlier, the groundwater assessment for MOD 6 is qualitative and no additional field work or numerical groundwater validation was undertaken to evaluate the 2013 model predictions against recently measured data.

Consistent with existing approvals and the mining modelled the E31 and E31N mine pits remain as final voids after mining has stopped. The proposed deepening of the voids is unlikely to have an observeable impact on post closure recovery of groundwater systems due to the relatively minor changes proposed and the nature of the local and regional geology. The underground workings in the E22, E26 and E48 will remain the primary groundwater sink.

2.2 Groundwater flow and licencing impacts

2.2.1 Approved WALs

The area within the site boundary is covered by the NSW Murray Darling Basin (MDB) Fractured Rock Groundwater Sources Water Sharing Plan (WSP), which regulates extractions from the saprock, saprolite and fractured bedrock aquifers. As defined by this WSP the site is within the Lachlan Fold Belt MDB Groundwater Source.

The Lachlan Unregulated and Alluvial Water Sources WSP regulate the extraction of alluvial groundwater within the site boundary. As defined under this WSP the site is within the Upper Lachlan Alluvial Groundwater Source. Table 2 identifies the water access licences (WALs) currently held by NPM under the WM Act, the annual extraction limit and the WSP covering the WAL.

Table 2 Existing Water Management Act 2000 Licences

Water Access Licence Number	Extraction Limit (ML/year)	Water Sharing Plan	Description
34955	232	NSW Murray Darling Basin Fractured Rock Groundwater Sources	Dewatering of E22, E26, E27and E48 underground and open cut mining areas.
31850	500	Lachlan Unregulated and Alluvial Water Sources	Aquifer
31863	634	Lachlan Unregulated and Alluvial Water Sources	Aquifer
31930	600	Lachlan Unregulated and Alluvial Water Sources	Aquifer
31963	700	Lachlan Unregulated and Alluvial Water Sources	Aquifer
31969	1 728	Lachlan Unregulated and Alluvial Water Sources	Aquifer
32004	1 600	Lachlan Unregulated and Alluvial Water Sources	High security licence (Avondale Bores 6 and 7).
32120	1 050	Lachlan Unregulated and Alluvial Water Sources	High security licence (Dawes Bore 8).
32138	1 110	Lachlan Unregulated and Alluvial Water Sources	Aquifer

Source: GWMP, GHD, 2014.

2.2.1 Incremental impacts of MOD 6

As discussed in Section 2.1.1 since the modified mine plan is not expected to result in any material increase to maximum inflows then no additional licences are likely to be required. Furthermore, recent actual inflows to the mine have been substantially less than predicted (Section 2.1) and hence the licenses currently held by NPM (refer to WAL 34955 and extraction limit of 232 ML/year in Table 2) should be more than sufficient to account for the predicted impacts.

2.3 Potential impacts on groundwater levels

2.3.1 Approved (PA) 11_0060 GIA

Open cut mining results in drawdown of groundwater levels as mining intercepts shallow aquifers that are pumped out of the open cut workings. Development of any open cut mining in E28, E28N, E31 and E31N or E26 will likely result in groundwater drawdown in the vicinity of the workings. Drawdown will continue as long as open cut areas continue to be dewatered. As dewatering ceases, it is anticipated groundwater levels will slowly re-stabilise.

The Golder 2013b technical memorandum indicates that the closest private groundwater bore to the NPM is GW002860. Based on the maximum computed groundwater drawdown extent, this bore is not within the 2 m-drawdown[1] zone. Based on the modelled results, there will not be a drawdown in the water table or pressure head of greater than the cumulative 2 m at any existing private bores. The modelled drawdown cone is predicted to be at its maximum extent in 2032 because the dewatering of the mining areas is assumed to extend to this year. Figure 3 (Golder, 2013) shows the contours of 2 m predicted drawdown for Year 2032 in Layer 2 (Bedrock Saprock). Locations of registered groundwater users within the 8 km radius search area are also shown in this figure.

2.3.1 Incremental impacts of MOD 6

As discussed in Section 2.1.1 since the modification is unlikely to materially affect either maximum inflow rates or the cumulative volume of water extracted then no additional groundwater level impacts are anticipated.

[1] The NSW Aquifer Interference Policy ((DPI-Water, 2012) minimal impact criteria of 2 metres. The proponent is required to make good any impact once it has occurred.

595000
600000
605000
6365000
6360000
6355000
6350000
GW002810
GW034030
8km
GW002488
GW002526
5km
GW800009
MB02
GW800007
MB03
GW001668
W20
W21
MB10
GW804799
MB05
GW804798
MB11
MB04
GW801224
GW804800
GW801223
MB12
MB16
GW801225
GW804801
W24
MB07
GW801226
MB13
MB14
MB17
GW803936
MB18
GW803937
GW018091
GW070442
GW803934
GW803935
P102
P145
WRIGHT
GW021708
P103
FAR HILLIER
Moss #1
P101
GW801222
GW044455
P100
GW002767
GW801378
LONG PADDOCK
SOUTH HILLIER
Moss #2
GW034607
GW002311
GW002337
GW035199
GW002867
GW044456
GW002754
GW002647
GW002722
GW049323
GW026862
GW035011
GW034262
GW026863
GW034261
GW034263
GW034768
GW058224
GW058225
GW064387
GW028560
GW050126
GW045589
GDA94, Zone 55
1:100,000
0 1000 2000 3000 4000 m

LEGEND

Northparkes Project Boundary
2m drawdown layer (model result of 2032)
Radius contours (after Golder (2013))
Drainage

Monitoring bores

Stock and domestic bores
Water supply bores
Monitoring bores registered

Mine monitoring bores

Groundwater Monitoring Locations

NPM2103 - MOD6 GIA letter

Registered bore locations in the proximity of NPM and modelled drawdown (Golder, 2013)

AGE

DATE 02/02/2022

FIGURE No: **3**

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Source: 1 second SRTM Derived DEM-S - © Commonwealth of Australia (Geoscience Australia) 2011.; GEODATA TOPO 250K Series 3 - © Commonwealth of Australia (Geoscience Australia) 2006.;
G:\Projects\NPM2103.001.Northparkes_E44_Rocklands_GIA\3_GIS\Workspaces\002_Deliverable2\04.06_NPM2103_Rocklands TSF groundwater bores.qgs

3 Groundwater quality

To assess the potential for the acid rock drainage (ARD) from the mining activities on groundwater quality, a reference was made in the Golder (2013) report to the ARD prediction and control and ARD Risk Review reports prepared by Rio Tinto (Rio Tinto, 2011). The assessment provided a review of NPM operations with respect to acid rock drainage and concluded that there is no significant risk in relation to acidic drainage and the ARD is unlikely to adversely impact regional groundwater quality. The mobility of metals in the groundwater system within the NPM area is limited due to the low hydraulic conductivity and the presence of clays, which has a high capacity for adsorption and/or exchange of metals in groundwater. Hydrogeochemical modelling indicated that metal species are distributed mostly as insoluble metal carbonates, sulphates, sulphides, oxides and hydroxides. Considering the conclusion reached by previous investigations (Rio Tinto, 2011; Mackie Environmental Research, 2006), it is envisaged that leachate generated from TSF3 will unlikely adversely impact the regional groundwater quality.

The waste rocks that are from the weathered units contain lower levels of intact sulphide minerals than the waste from the underground development drives (deeper bedrock). The mine dewatering can create a zone of groundwater drawdown and exposure of mineralisation in the aquifer to oxygen. The oxidation products will enter the groundwater system when the groundwater flows into these areas and solubilise the oxidation products. This impact may cause elevated TDS, sulphate and metal/metalloid concentrations at neutral pH in groundwater, which can enter the groundwater system.

3.1 Incremental impacts of MOD 6

The proposed 25% increase in pit size will result in additional waste rock material, particularly in the E31N pit. The majority of this additional waste rock is likely to be unoxidized. It is likely that slight increases in TDS and sulfate will be experienced in the monitoring bores within the direct vicinity of the E31 and E31N waste rock areas during operations. Any observed changes in groundwater quality are expected to be retained within the direct vicinity of the waste rock dumps due to the low permeability of the shallow clay material. The shallow clay layers act as a buffer for seepage to the shallow weathered aquifer system.

Consistent with approved operations and practices, this material will be used for TSF construction and material not used for TSF construction will be relocated to existing approved waste rock stockpile areas. This material and proposed handling is considered to present a low groundwater contamination risk. Low grade ore will be stockpiled within existing low grade ore stockpile areas as per existing approved operations.

4 Conclusions

In summary, we do not anticipate any material changes to the predicted groundwater impacts due to the proposed mining plan alterations. Overall, since the mining footprint is largely unchanged with mining depths increasing with approximately 25% in similar rock material and anticipated similar aquifer properties, then the total volume of water extracted is not expected to be increased significantly by the Modification. If anything, long-term groundwater level and flow impacts may be slightly reduced, since the proposed mine sequence and life of mine of E31 and E31N will be slightly shorter (approximately 24 months in duration if mining of the two pits occurs concurrently).

Mining the E31 and E31N pits deeper will result in increased generation of the deeper horizons of waste rock material and potential slight changes to groundwater quality. The groundwater monitoring plan for the open cut mining areas will inform any changes in groundwater quality.

Yours faithfully,



Pieter Labuschagne
Principal Hydrogeologist
Australasian Groundwater and Environmental Consultants Pty Ltd

5 References

GHD, 2014. Northparkes Mines Groundwater Management Plan.

GHD, 2020. Northparkes Northparkes Mines Site water balance.

Golder, 2013. Northparkes Mine Step Change Project Groundwater Impact Assessment Report. Report Number 117626007-007-Rev1.

Golder, 2013b. Northparkes Mine Step Change Project – Respobces to Review Comments. Technical Memorandum, PROJECT No. 117626007-023-REV1.

MER, 2006. Northparkes Mines E48 Project: Groundwater Studies. In Northparkes Mines E48 Project Environmental Assessment, R.W. Corkery, 2006. Mackie Environmental Research , April 2006.

Rio Tinto Technology and Innovation (RTTI), 2011; ARD (Acid Rock Drainage) Risk Review – Northparkes. Dated 22 August 2011.

APPENDIX E

Site Water Balance



Northparkes

Northparkes Mines

Site water balance

February 2022

Table of contents

1. Introduction....1
   - 1.1 Background....1
   - 1.2 Purpose of this report....1
   - 1.3 Scope and limitations....1
2. Water management....4
   - 2.1 Hydrological setting....4
   - 2.2 Clean water management....4
   - 2.3 Contaminated and dirty water management....4
   - 2.4 Raw water management....4
   - 2.5 Potable and wastewater water management....4
   - 2.6 Water management features....5
3. Data....12
   - 3.1 Precipitation and evaporation....12
   - 3.2 Catchments....14
   - 3.3 Storages....17
   - 3.4 Production....18
   - 3.5 Operations....18
   - 3.6 Groundwater....22
   - 3.7 Monitoring data....22
4. Modelling method....23
   - 4.1 Mass balance....23
   - 4.2 Rainfall variability....23
   - 4.3 Hydrologic model....23
   - 4.4 Geometric approximation....24
   - 4.5 Conceptual tailings model....24
   - 4.6 Numerical implementation....25
5. Modelling validation....26
6. Modelling results....30
   - 6.1 Interpretation of results....30
   - 6.2 Qualification of predictions....30
   - 6.3 Water balance....31
7. Conclusion and recommendations....34
8. References....35

Table index

Table 2-1 Water management features 8
Table 3-1 Summary of data sources 12
Table 3-2 Catchment areas 15
Table 3-3 Storage geometry 17
Table 3-4 Production parameters 18
Table 3-5 Operating parameters- Operational potable demand 18
Table 3-6 Operating parameters - Ore and product moisture 19
Table 3-7 Operational pumping 20
Table 4-1 AWBM parameters 24
Table 4-2 Parameterisation of Australian Water Balance Model 24
Table 6-1 Annual water balance 31

Figure index

Figure 1-1 Locality plan 3
Figure 2-1 Water management features 6
Figure 2-2 Site water schematic 7
Figure 3-1 Annual rainfall and evaporation totals at Northparkes Mines 13
Figure 3-2 Average monthly rainfall and evaporation totals at Northparkes Mines 14
Figure 3-3 Assumed groundwater inflows 22
Figure 4-1 AWBM model schematic 23
Figure 4-2 Conceptual tailings model 25
Figure 5-1 Validation of total site water inventory 26
Figure 5-2 Validation of E22 void 27
Figure 5-3 Sensitivity test to fraction released per TSF 28
Figure 5-4 Sensitivity test on seasonal scaling 29
Figure 6-1 Annual water transfers – 2019 32
Figure 6-2 Annual water transfers – 2021 33

1. Introduction

1.1 Background

CMOC Mining Services Pty Ltd (Northparkes) engaged GHD Pty Ltd (GHD) to update the site water balance for Northparkes Mines, a copper and gold mine located 27 kilometres north-west of Parkes, in the Central West of NSW, as shown in Figure 1-1.

1.2 Purpose of this report

The purpose of this report is to describe the site water balance for Northparkes Mines. The site water balance has been analysed using a site water balance model. This report describes the input data, the model methodology and presents and interprets the results of the model.

1.3 Scope and limitations

GHD has developed the site water balance for Northparkes Mines based on information supplied by Northparkes and external data sources. Where data was not available, GHD has made assumptions as appropriate.

Data used to develop the model are categorised as follows:

- Relatively reliable data: SILO rainfall data, BOM evaporation data, surface catchment areas based on topographic maps.
- Less reliable data: runoff volumes from impervious, disturbed and natural catchments, operational precedence for transfers between storages, storage geometry, salinity parameters.

The items identified as ‘less reliable data’ present a risk that the model predictions are inaccurate. The accuracy may be improved as additional site data is gathered. This additional data will allow refinement of the model inputs and hence increase the reliability of the model predictions. The adoption of historical rainfall and evaporation data within the detailed water balance model does not take into account the potential impacts of climate change.

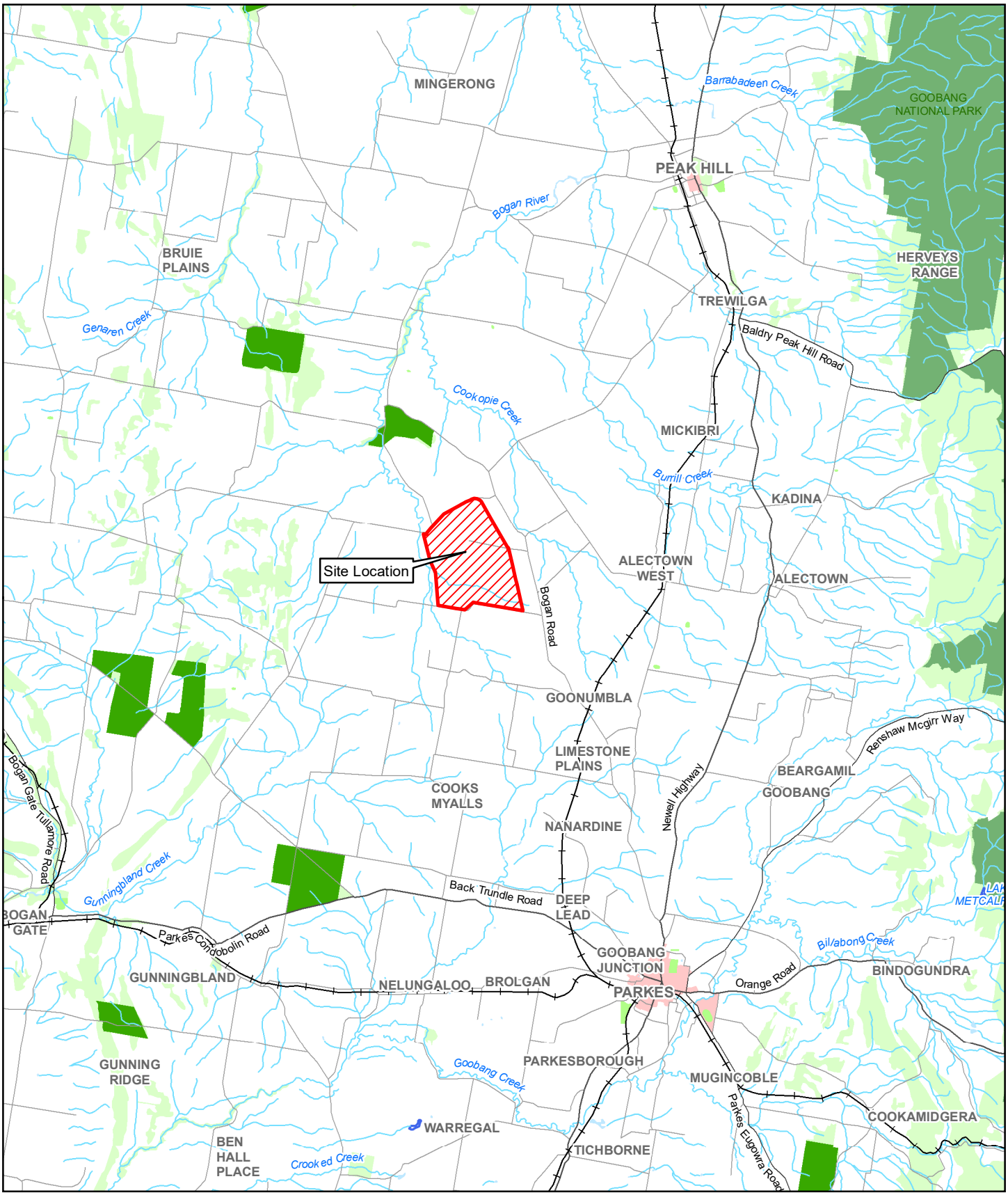
This water and salt balance considers the effect of rainfall variation on the results of the model, based on a historical rainfall record. This approach assumes that the historical rainfall record is characteristic of future rainfall variability and does not consider inter-annual climate patterns such as the El Niño Southern Oscillation or long term trends such as climate change.

This report has been prepared by GHD for Northparkes and may only be used and relied on by Northparkes for the purpose agreed between GHD and the Northparkes as set out in this report. GHD otherwise disclaims responsibility to any person other than Northparkes arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

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LEGEND

- Principal Road
- Secondary Road
- Minor Road
- Railway
- Waterway
- Built Up Area
- Recreation Area
- State Forest
- National Park
- Forest Or Shrub
- Site Boundary

Paper Size A4

0 1 2 4 6 8

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Northparkes Mines
Water Management Plan

Job Number 12516285
Revision 0
Date 15 July 2020

Locality plan

Figure 1-1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

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Data source: Geoscience Australia: 250k Topographic Data Series 3 2006. Created by: fmackay

2. Water management

The site water balance is conceptualisation of the water management system. The purpose of this section is to describe the relevant part of the water management system and how the conceptual site water balance has been developed.

2.1 Hydrological setting

Northparkes Mines lies within the Macquarie-Bogan River Catchment. The Project Area spans along Bogan River catchment and its three subcatchments- Tenandra Creek, Goonumbla Creek and Cookopie Creek. An underground block cave pit is located in both catchments of Bogan River and Goonumbla Creek. Parkes Shire Council (PSC) supplies potable water for administration and office facilities.

The inflow of water to the surface and underground components of the Northparkes Mines include:

- Direct rainfall onto surface water storages
- Catchment runoff onto surface water storages
- Groundwater inflows
- Raw water supplied from the Lachlan River and Lachlan Borefield

The outflows of water from Northparkes Mines include:

- Evaporation from surface water storages
- Potential off-site discharges of water
- Losses from operations and concentrate
- Water retained in tailings

2.2 Clean water management

A series of diversion drains minimise the volume of runoff intercepted at Northparkes Mines. Clean water is not considered in the site water balance.

2.3 Contaminated and dirty water management

For the purpose of the site water balance, contaminated and dirty water management are similar, with catchment runoff being contained in water storages that are all generally dewatering back to the Process Water Dam for reuse.

2.4 Raw water management

Raw water is supplied from the Lachlan River and Lachlan Borefield via Parkes. Raw water is reports to the raw water tank, and is used for underground mining operations. During times of low site water inventory, any surplus water is used to supplement recycled water for ore processing.

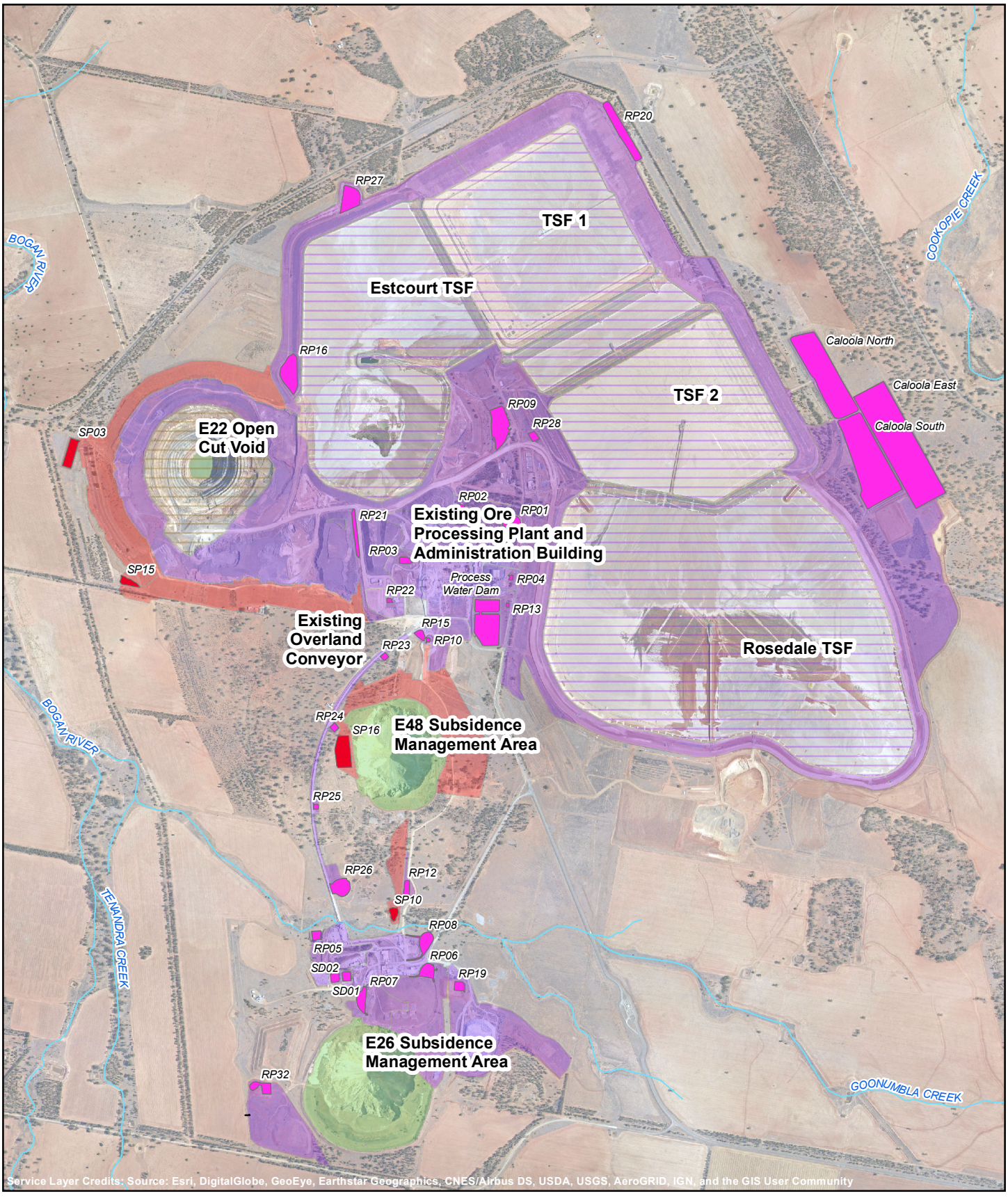
2.5 Potable and wastewater water management

Potable water is processed from raw water at the on-site Water Treatment Plant. Wastewater from the administration and office facilities is treated on-site in a sewage treatment plant with effluent being pumped to the Contaminated Water System for reuse in the processing plant.

2.6 Water management features

The existing water management system at Northparkes Mines was conceptualised as a network of water management features representing surface water storages, operational processes, and receiving waters. Each water management feature was defined by its connection to other water management features by inflows and outflows of water. The water management features considered are summarised in Table 2-1. All surface water storages receive direct rainfall and catchment runoff and lose water by evaporation, which, for brevity, is not included in Table 2-1.

The water management features are shown in Figure 2-1. An overall site water schematic is shown in Figure 2-2.



LEGEND

- Watercourse
- Contaminated Water Storage
- Dirty Water Storage
- Contaminated water catchment
- Dirty water catchment
- Open cut void
- Subsidence area
- Tailings storage facility

Paper Size A4

0 0.2 0.4 0.6 0.8

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Northparkes Mines
Site Water Balance

Surface water management

Job Number	12516285
Revision	0
Date	19 June 2020

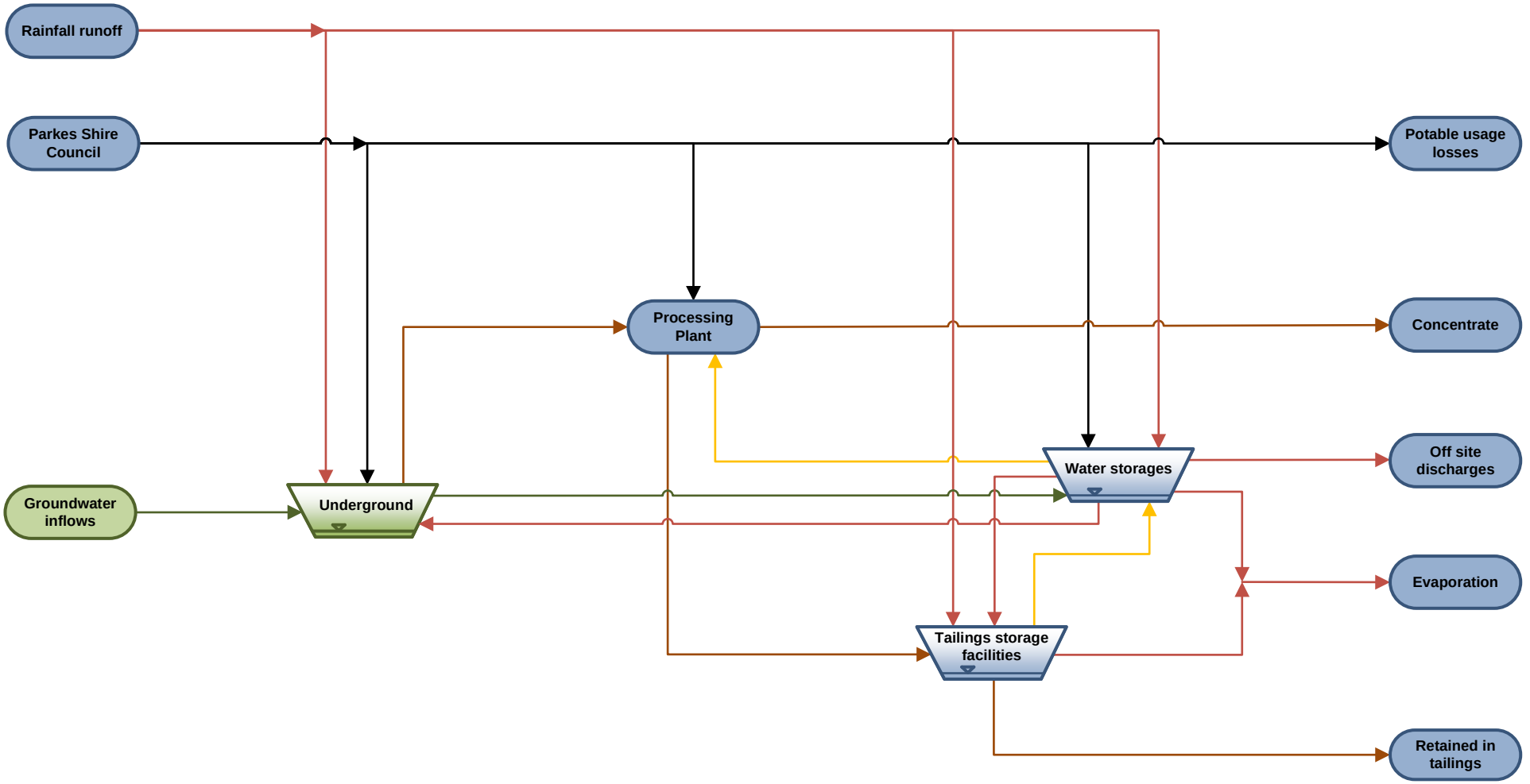
Figure 2-1

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Data source: NPM: Aerial 2014; LPI: DCDB & DTDB 2012. Created by: fmackay



Legend

- Underground storage
- Underground process
- Surface storage
- Surface process
- Raw water flow
- Groundwater flow
- Ore moisture and tailings flow
- Mining site water flow
- Process water flow

CMOC Mining Services Pty Ltd
Northparkes Mines
Site water balance assessment

Water management schematic
Annual water transfers

Project No. 12516285
Revision No. 0
Date 14/07/2020

FIGURE 2-2

Created by: Tyler Tinkler

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Print date: 16/02/2022 07:39

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Table 2-1 Water management features

Water management feature	Surface water catchment	Inflows	Outflows
Caloola East	Yes	Overflow from Caloola South	Pump to Caloola South
Caloola North	Yes	Pump from RP09 Pump from RP20 Pump from TSF2 Pump from TSF3 Estcourt	Pump to PWD
Caloola South	Yes	Pump from Caloola East Pump from RP09 Pump from TSF Infill Pump from TSF4 Rosedale	Pump to E22 void Pump to PWD Overflow to Caloola East
E22 void	Yes	Pump from Caloola South Pump from RP09 Pump from SP03 Overflow from RP21	Pump to PWD
Potable Water Tank	No	Pump from Water Treatment Plant	Pump to Amenities Pump to Concrete Plant Pump to Contractors Yard Pump to Processing Plant Pump to Rill Tower Pump to Truckfill Pump to Washdown Pump to Underground

Water management feature	Surface water catchment	Inflows	Outflows
Process Water Dam (PWD)	Yes	Pump from Conveyor Area Pump from Caloola South Pump from Caloola North Pump from E22 void Pump from Process Area Pump from RP09 Pump from Surge Dams Pump from TSF Infill Pump from TSF3 Estcourt Pump from TSF4 Rosedale Pump from Wastewater System Overflow from Raw Water Tank Overflow from Surge Dams	Pump to Processing Plant Overflow to RP09
Raw Water Tank	No	Pump from Parkes Shire Council	Pump to Water Treatment Plant Overflow to PWD
RP01	Yes		Pump to Process Area to PWD Overflow to RP09
RP02	Yes		Pump to Process Area to PWD Overflow to RP09
RP03	Yes		Pump to Process Area to PWD Overflow to RP21
RP04	Yes		Pump to Process Area to PWD Overflow to RP09
RP05	Yes		Pump to Surge Dams
RP06	Yes	Overflow from RP19	Pump to Surge Dams Overflow to RP07
RP07	Yes	Overflow from RP06	Overflow to Underground (E26)
RP08	Yes	Pump from RP12	Pump to Surge Dams
RP10	Yes		Pump to Process Area to PWD Overflow to RP21
RP12	Yes		Pump to RP08

Water management feature	Surface water catchment	Inflows	Outflows
RP13	Yes		Pump to Process Area to PWD Overflow to RP09
RP15	Yes		Pump to Process Area to PWD Overflow to RP21
RP19	Yes		Pump to Surge Dams Overflow to RP06
RP20	Yes	Overflow from RP27	Pump to Caloola North
RP21	Yes		Overflows to E22 void
RP22	Yes		Pump to Process Area Overflow to RP21
RP23	Yes		Pump to Conveyor Area to PWD Overflow to RP24
RP24	Yes	Overflow from RP23	Pump to Conveyor Area to PWD Overflow to RP25
RP25	Yes	Overflow from RP24	Overflow to RP26
RP26	Yes	Overflow from RP25	Pump to Surge Dams
RP27	Yes		Pump to TSF3 Estcourt Overflow to RP20
RP32	Yes		Pump to Surge Dams
SP03	Yes	Overflow from SP15	Pump to E22 void
SP15	Yes		Overflow to SP03
SP16	Yes		Overflow to Underground (E48)
Surge Dams	Yes	Pump from RP05 Pump from RP06 Pump from RP08 Pump from RP19 Pump from RP26 Pump from RP32 Overflow from Underground	Pump to PWD Overflow to PWD
TSF1	Yes	Tailings from Processing Plant	Overflow to TSF Estcourt

Water management feature	Surface water catchment	Inflows	Outflows
TSF2	Yes	Tailings from Processing Plant	Pump to Caloola North
TSF Estcourt	Yes	Tailings from Processing Plant Pump from RP27 Overflow from TSF1	Pump to Caloola North Pump to PWD Pump to RP09
TSF Rosedale	Yes	Tailings from Processing Plant	Pump to Caloola South Pump to PWD
TSF Infill	Yes	Tailings from Processing Plant	Pump to Caloola South Pump to PWD Pump to RP09
Underground	Yes	Groundwater inflows Infiltration through subsidence zones Water supplied for underground mining	Dewater to Surge Dams

3. Data

The site water balance for Northparkes involve the collation and interpretation of data from various sources. The purpose of this section is to summarise the data used. The sources of data used are shown in Table 3-1.

Table 3-1 Summary of data sources

Data	Source
Historical rainfall record	SILO (DSITI 2019)
Site rainfall record	Provided by Northparkes
Average monthly evaporation	SILO (DSITI 2019)
Catchment areas and landuse	Interpreted from contours and aerial imagery provided by Northparkes
Storage geometry	Interpreted from contours and aerial imagery provided by Northparkes
Operational process	Developed in consultation with Northparkes
Operational pumping	Developed in consultation with Northparkes
Groundwater inflows	Groundwater assessment for Northparkes Step Change Project (Golder 2013)
Monitoring data	Provided by Northparkes

3.1 Precipitation and evaporation

A historical record of daily rainfall depths was obtained in the form of a patched point data set from the Scientific Information for Land Owners (SILO) database operated by the Queensland Department of Environment and Science (DES). SILO patched point data is based on observed historical data from a particular Bureau of Meteorology (BOM) station with missing data 'patched in' by interpolating with data from nearby stations (DSITI, 2017).

For this assessment, SILO data was obtained for the Goonumbla (Coradgery) station (station number 50016), which is located approximately 4 km south of the site at an elevation of 295 m AHD. This station was chosen based on proximity to the site and similarity of elevation. The period of rainfall data used for this assessment extended from 1 January 1889 to 17 November 2019 (a total of 130 years).

Site rainfall data was obtained from ALS for the gauge NPAWS001 on 30 October 2019, for the period from 01 January 2017 to 30 October 2019. This gauge is located approximately 3.7 km south of the pit top, however is considered to have adequate proximity to be representative of rainfall at the pit top.

The cumulative frequency of annual total rainfall and evaporation from the SILO dataset between January 1889 and January 2019 are compared in Figure 3-1. In addition, the figure also presents the comparison between SILO rainfall to site-based rainfall recorded between 2017 to 2019.

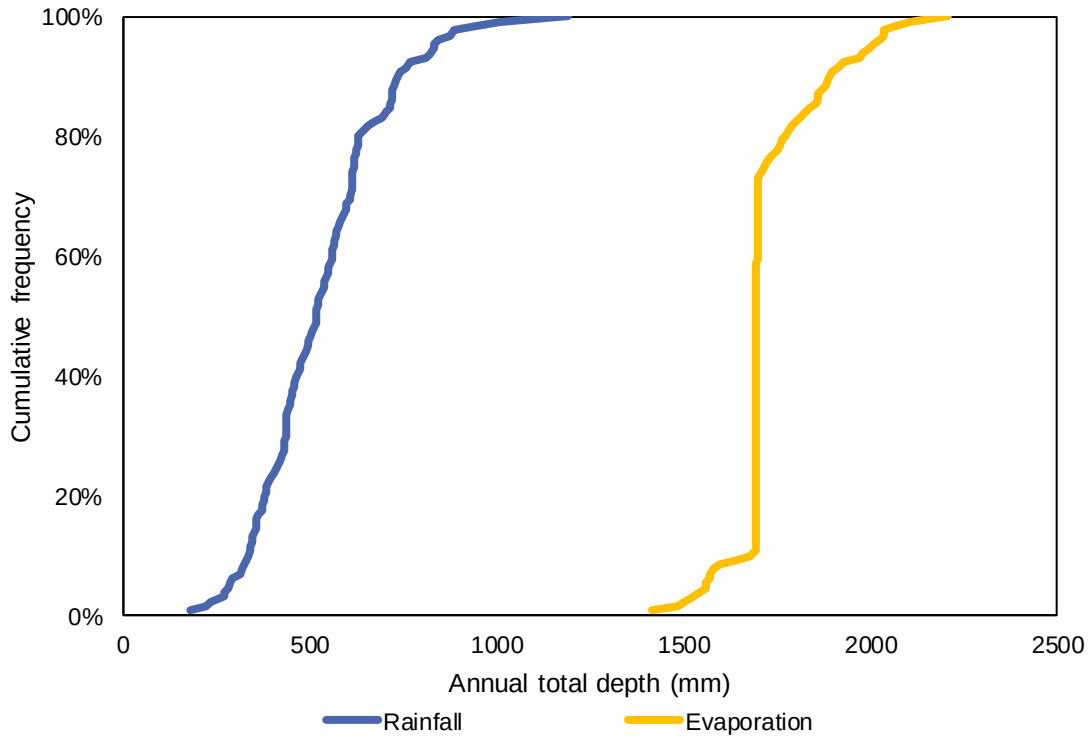


Figure 3-1 Annual rainfall and evaporation totals at Northparkes Mines

The annual statistics associated with the SILO data presented in Figure 3-1 are:

- Minimum rainfall total – 141 mm in 2006
- Median rainfall total – 516.2 mm
- Average rainfall total – 527.6 mm
- Maximum rainfall total – 1191.9 mm in 1950

A plot of average monthly pan evaporation is compared to average monthly rainfall from the historical record in Figure 3-2.

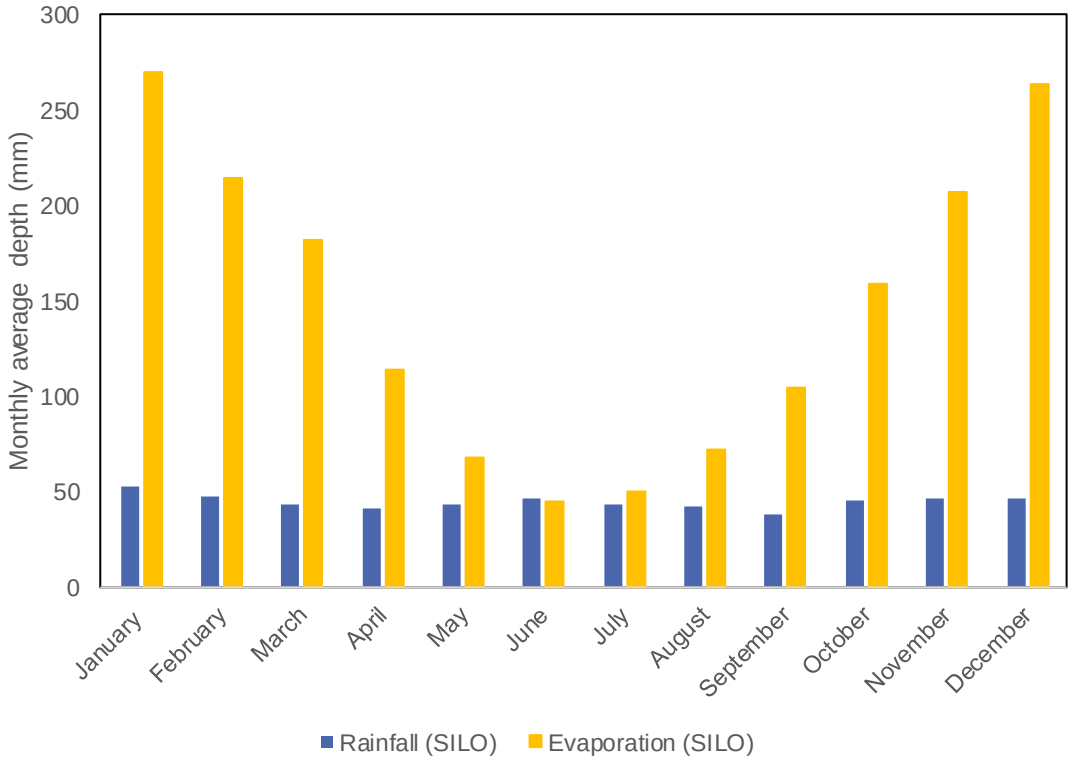


Figure 3-2 Average monthly rainfall and evaporation totals at Northparkes Mines

Figure 3-2 show that evaporation varies seasonally, having higher records in summer compared in winter. The site has an average monthly net rainfall deficit in all parts of the year except during the month of June.

3.2 Catchments

The catchment areas and land uses for each water management feature were estimated from aerial imagery and contours. The land use of the site was characterised into five different classes:

- Vegetated: all undisturbed bush land and grassed areas
- Hardstand: roads and working pad areas
- Tailings: areas of with by-product of mining operations
- WREA:
- Subsidence: sinks caused by mining operations

Catchment areas are summarised in Table 3-2.

Table 3-2 Catchment areas

Water management feature	Vegetated portion	Hardstand portion	Tailings portion	WREA portion	Subsidence portion	Total catchment area (ha)
Caloola Dams	74%%	26%	0%	0%	0%	89.1
E22 void	0%	0%	0%	100%	0%	135.41
Process Water Dam	0%	0%	0%	0%	0%	0
RP01	51%	49%	0%	0%	0%	7.8
RP02	15%	85%	0%	0%	0%	22.8
RP03	0%	100%	0%	0%	0%	4.3
RP04	0%	100%	0%	0%	0%	3.2
RP05	45%	55%	0%	0%	0%	5.9
RP06	100%	0%	0%	0%	0%	20.8
RP07	100%	0%	0%	0%	0%	5.2
RP08	0%	100%	0%	0%	0%	1.3
RP09	79%	17%	0%	4%	0%	99.9
RP10	100%	0%	0%	0%	0%	5.2
RP12	100%	0%	0%	0%	0%	0.9
RP13	100%	0%	0%	0%	0%	2.8
RP15	0%	100%	0%	0%	0%	0.4
RP16	100%	0%	0%	0%	0%	2.1
RP19	58%	0%	0%	42%	0%	6.2
RP20	100%	0%	0%	0%	0%	41.8
RP21	100%	0%	0%	0%	0%	0.3
RP22	0%	100%	0%	0%	0%	2.6
RP23	100%	0%	0%	0%	0%	0.1
RP24	100%	0%	0%	0%	0%	0.2
RP25	100%	0%	0%	0%	0%	0.1
RP26	100%	0%	0%	0%	0%	0.9
RP27	100%	0%	0%	0%	0%	38.2

Water management feature	Vegetated portion	Hardstand portion	Tailings portion	WREA portion	Subsidence portion	Total catchment area (ha)
RP32	100%	0%	0%	0%	0%	5.3
SP03	100%	0%	0%	0%	0%	26.9
SP04	100%	0%	0%	0%	0%	16.6
SP10	100%	0%	0%	0%	0%	4.3
SP15	100%	0%	0%	0%	0%	19.6
SP16	100%	0%	0%	0%	0%	25.8
Surge Dams	0%	100%	0%	0%	0%	1.0
TSF1	0%	0%	100%	0%	0%	97.7
TSF2	0%	0%	100%	0%	0%	95.1
TSF3 Estcourt	0%	0%	100%	0%	0%	134.1
TSF4 Rosedale	0%	0%	100%	0%	0%	269.0
TSF5 Infill	0%	0%	100%	0%	0%	35.0
Underground	0%	0%	0%	0%	100%	56.9

3.3 Storages

The capacity of surface water storages was provided by Northparkes and the maximum surface areas were estimated from aerial imagery and contours. The geometric properties of the surface water storages are summarised in Table 3-3.

Table 3-3 Storage geometry

Water management feature	Water storage capacity (ML)	Maximum surface area (m2)
Caloola Dams	1440	31.9
E22 void	14000	25.5
Process Water Dam	200	3.3
RP01	8.7	0.5
RP02	1.0	0.1
RP03	3.6	0.2
RP04	0.4	0.1
RP05	5.0	0.2
RP06	7.4	0.6
RP07	7.7	0.6
RP08	17.9	0.8
RP09	76	1.9
RP10	0.1	0.1
RP12	4.8	0.3
RP13	0.5	0.1
RP15	2.5	0.2
RP19	21.0	0.7
RP20	41.0	1.9
RP21	0.1	0.3
RP22	0.5	0.1
RP23	1.4	0.1
RP24	2.1	0.1
RP25	1.1	0.1
RP26	12.0	0.4
RP27	58.3	1.2
RP32	9.6	0.9
SP03	14.5	0.9
SP15	4.5	0.4
SP16	12.0	1.5
Surge Dams	10.0	0.5
TSF1	0	99.7
TSF2	872.1	95.1
TSF Estcourt	1157.0	134.1
TSF Rosedale	4149.0	269.0
TSF Infill	194.9	35.0

3.4 Production

Production parameters were developed in consultation with Northparkes. The parameters shown in Table 3-4 are the key drivers of water retained or lost from tailings, which is the predominant operational influence on raw water demands.

Table 3-4 Production parameters

Parameter	Input	Source/assumptions
Annual ore extraction/ production rate	5.0-6.8 Mtpa	From input spreadsheet- average production rate from 2018- 2019.
Initial settled tailings dry density	1.06 tonne/m^3	Within the range identified by KP (Ed Tuplin, December 2017). This is equivalent to 30% release of water at 55% tailings solid density.
Solids proportion of tailings	55%	From input spreadsheet- average rate for both MOD1 and MOD2 for 2002-2014. This average accounts for operational variability in solids content, including line flushing.

3.5 Operations

Operational rules and parameters were developed in consultation Northparkes. The operational potable demands, ore and product moisture, pumping rules for the purpose of the site water balance are summarised in Table 3-5, Table 3-6 and Table 3-7 respectively.

Operational potable demands that are only important to raw water demand in controlling the loss of water from operational processes. For example, so long as underground potable demand is less than total site water demand, most of water used in the underground will eventually report to the plant for reuse. The raw water demands will only be sensitive to the amount of water lost (mainly to evaporation).

Table 3-5 Operating parameters- Operational potable demand

Water management feature	Input	Source/assumptions
Losses from underground operations	5 %	Assumption
Truck fill potable water demand for dust suppression	4.5 L/s	From input spreadsheet – average rate for 2009-2014
Admin potable water demand	2.7 L/s	From input spreadsheet – average rate for 2009-2014
Rill towers dust suppression potable water demand	0.6 L/s	Balance of demands (with concrete batching plant demand) from the Water Treatment Plant using average rates for 2009-2014 from the input spreadsheet
Truck washdown potable water demand	0.4 L/s	Balance of demands from the Potable Water Tank using average rates for 2009-2014 from the input spreadsheet
Contractor's yard potable water demand	0.1 L/s	From input spreadsheet – average rate for 2009-2014
Proportion of water recovered from admin and contractor's yard	95%	Assumed value based on previous experience
Underground operations potable demand	21.1 L/s	From input spreadsheet (UGSupplyTank_Mine_H) – average rate for 2011-2014

Water management feature	Input	Source/assumptions
Gland potable water demand	1 L/s	Plant water balance summary provided by NPM (John Neale, November 2017)
Floc potable water demand	1 L/s	From input spreadsheet – used average rate for floc and gland water for 2009-2014 is 1.2 L/s and proportions in 'future demand' tab of spreadsheet
Crusher potable water demand	0.4 L/s	Assumed rate –10% of rate in future 'demand tab' of spreadsheet based on results of gland and floc demand

Table 3-6 shows ore and product moisture that affect the net tailings demand, but are relatively minor compared to losses from tailings.

Table 3-6 Operating parameters - Ore and product moisture

Water management feature	Input	Source/assumptions
Ore moisture content	4%	From input spreadsheet – constant rate
Proportion of ore going to product by mass	2 %	From input spreadsheet – average rate
Concrete batching plant potable water demand	4.5 L/s	From input spreadsheet - based on the balance of water treatment plant average rates for 2009 to 2014
Product moisture content	16 %	From input spreadsheet – average rate for both MOD1 and MOD2 for 2012-2013

Table 3-7 shows operational pumping rates. Raw water demands are not sensitive to internal pump rates, so long as internal pumping does not limit the ability to return water to the plant.

Table 3-7 Operational pumping

Pumped transfer		Pump rate (L/s)	Pump trigger on	Pump trigger off
From	To			
Caloola North	Caloola South	80 L/s	(Caloola North storage above 22.5 and Caloola South storage below 27.3 ML) Or (Caloola North storage above 2 ML TSF Infill decant pump off and Caloola South storage below 2 ML)	(Caloola North storage below 22.5 Caloola South storage above 27.3 ML) Or (Caloola North storage below 2 ML TSF Infill decant pump on Caloola South storage above 2 ML)
	PWD	80 L/s	(Caloola North storage above 22.5 and RP09 storage below 2 ML) Or (Caloola North storage above 2 ML TSF Infill decant pump off and RP09 storage below 2 ML)	(Caloola North storage below 22.5 RP09 storage above 2 ML) Or (Caloola North storage below 2 ML TSF Infill decant pump on RP09 storage above 2 ML)
Caloola South	PWD	110 L/s	Caloola South storage above 2 ML and PWD storage below 180 ML	Caloola South storage above 2 ML PWD storage below 180 ML
	E22 Void	110 L/s	Caloola South storage above 27.3 ML and E22 Void storage below 13,000 ML	Caloola South storage below 27.3 ML E22 Void storage above 13,000 ML
E22 Void	PWD	50 L/s	E22 Void storage above 2 ML and PWD storage below 190 ML	E22 Void storage below 2 ML PWD storage above 190 ML
R09	PWD	320 L/s	RP09 storage above 66 ML and PWD storage below 180 ML	RP09 storage below 66 ML PWD storage above 180 ML
	Caloola South	320 L/s	RP09 storage above 66 ML Caloola South storage below 27.3 ML TSF Infill decant pump on RP09 to PWD pump off TSF3 Estcourt flood pump off	RP09 storage below 66 ML Caloola South storage above 27.3 ML TSF Infill decant pump off RP09 to PWD pump on TSF3 Estcourt flood pump on

Pumped transfer		Pump rate (L/s)	Pump trigger on	Pump trigger off
From	To			
	Caloola North	320 L/s	R09 storage above 66 ML Caloola North storage below 22.5 ML TSF Infill decant pump off R09 to PWD pump off R09 to Caloola South pump off TSF3 Estcourt flood pump off	R09 storage below 66 ML Caloola North storage above 22.5 ML TSF Infill decant pump on R09 to PWD pump on R09 to Caloola South pump on TSF3 Estcourt flood pump on
TSF2	Caloola North	400 L/s	TSF2 water depth above 1.5 m and Caloola North storage below 419.5 ML	TSF2 water depth below 1.5 m Caloola North storage above 419.5 ML
TSF3 Estcourt	Caloola North	700 L/s	TSF3 Estcourt water depth above 1.5 m and Caloola North storage below 419.5 ML	TSF3 Estcourt water depth below 1.5 m Caloola North storage above 419.5 ML
	PWD	90 L/s	TSF3 Estcourt water depth above 0.2 m and PWD storage below 190 ML	TSF3 Estcourt water depth below 0.2 m PWD storage above 190 ML
	RP09	90 L/s	TSF3 Estcourt water depth above 0.2 m RP09 storage below 66 ML and TSF Estcourt to PWD pump off	TSF3 Estcourt water depth below 0.2 m RP09 storage above 66 ML TSF Estcourt to PWD pump on
TSF4 Rosedale	PWD	450 L/s	TSF4 Rosedale water depth above 0.2 m and PWD storage below 190 ML	TSF4 Rosedale water depth below 0.2 m PWD storage above 190 ML
	Caloola South	700 L/s	TSF4 Rosedale water depth above 1.5 m and Caloola South storage below 350.2 ML	TSF4 Rosedale water depth below 1.5 m Caloola South storage above 350.2 ML
TSF Infill decant	PWD	160 L/s	TSF Infill water depth above 0.2 m and PWD storage below 190 ML	TSF Infill water depth below 0.2 m PWD storage above 190 ML
	Caloola South	160 L/s	TSF Infill water depth above 0.2 m Caloola North storage below 22.5 ML and TSF Infill decant to PWD pump off	TSF Infill water depth below 0.2 m Caloola North storage above 22.5 ML TSF Infill decant to PWD pump on
	RP09	160 L/s	TSF Infill water depth above 0.2 m and RP09 storage below 66 ML TSF Infill decant to PWD pump off TSF Infill decant to Caloola South pump off	TSF Infill water depth below 0.2 m PWD storage above 66 ML TSF Infill decant to PWD pump on TSF Infill decant to Caloola South pump on

3.6 Groundwater

The results of hydrogeological modelling undertaken for Northparkes Mines Step Change Project: Groundwater Impact Assessment Report (Golder Associates, 2013a, 2013b) were used to estimate the future groundwater inflows into underground workings, as shown in Figure 3-3.

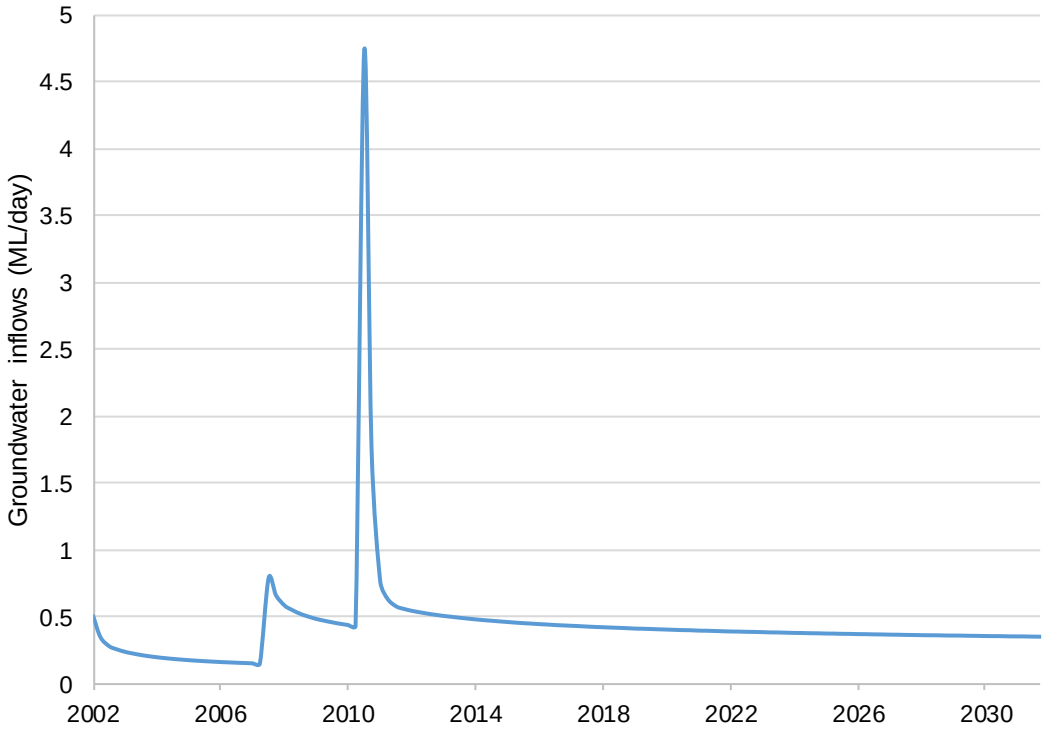


Figure 3-3 Assumed groundwater inflows

Figure 3-3 shows that modelled inflows peaked on 2011 at approximately 4.7 ML/day. Groundwater inflows are predicted to decline from 0.42 ML/day during 2019 to 0.35 ML/day by 2032. Actual observed inflows have lower than the predictions.

3.7 Monitoring data

Water monitoring data were obtained from onsite monitoring equipment. Observations considered for the site water and salt balance include:

- Monthly time series of Caloola North storage volume
- Monthly time series of Caloola South storage volume
- Monthly time series of E22 void storage volume
- Monthly time series of PWD storage volume
- Monthly time series of RP09 storage volume

4. Modelling method

4.1 Mass balance

The site water balance for Northparkes Mines was modelled as a semi-distributed mass balance, considering the water management features, as described in Section 2.6.

4.2 Rainfall variability

Rainfall variability was considered in the site water balance by sampling simulated rainfall from the historical rainfall record (refer to Section 3.1). A series of simulations were performed, each beginning in a different year of the historical rainfall record and proceeding consecutively through the record (and looped where required).

4.3 Hydrologic model

The Australian Water Balance Model (AWBM) (Boughton & Chiew, 2003) was used to estimate the runoff contributing to the surface water storages. The AWBM was adopted as it:

- Is widely used throughout Australia, especially for mining application
- Has been verified through comparison with large amounts of recorded streamflow data
- Has literature available to assist in estimating input parameters
- Considers soil moisture retention state when determining runoff

The AWBM is a soil moisture water balance model that calculates runoff from rainfall after allowing for losses and storage. Figure 4-1 is a schematic of the model, which shows that the model consists of three storage elements (with surface areas A_1, A_2 and A_3) representing soil moisture.

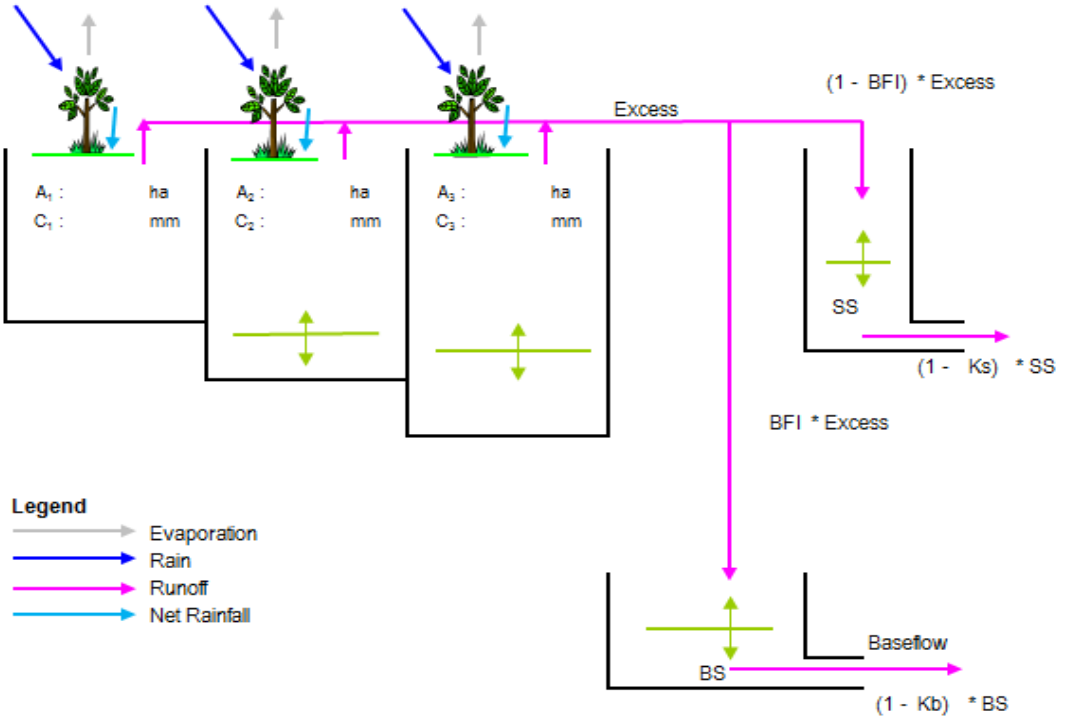


Figure 4-1 AWBM model schematic

Rainfall enters these storages and when a storage element is full, any additional rainfall is considered to be excess rainfall. Of this excess rainfall a proportion is routed to the baseflow storage (BS) while the remainder is routed to the surface storage (SS). The discharge from the baseflow storage and surface storage is estimated as a proportion of the volume of the storages at the end of each day. The total runoff is the combined volume of water discharged from these two storages. The parameters of the AWBM are summarised in Table 4-1.

Table 4-1 AWBM parameters

Parameter	Description
A1, A2, A3	The partial areas of the overall catchment contributing to each storage
C1, C2, C3	The capacity of storages 1, 2 and 3 respectively
BFI	The proportion of excess rainfall flowing to the baseflow
Kb	The proportion of the volume of the baseflow storage remaining in the storage
Ks	The proportion of the surface storage remaining in the storage

The site-specific land uses (refer to Section 3.2) were characterised with different sets of AWBM parameters.

The AWBM parameters adopted for the water balance model are summarised in Table 4-2.

Table 4-2 Parameterisation of Australian Water Balance Model

Parameter	Vegetated	Hardstand	Tailings	WREA	Subsidence
A1, A2, A3	0.134, 0.433, 0.433	0.134, 0.433, 0.433	0.134, 0.433, 0.433	0.134, 0.433, 0.433	0.134, 0.433, 0.433
C1, C2, C3 (mm)	17.91, 182.9, 365.8 (Cave = 240 mm)	2.99, 30.48, 60.97 (Cave = 40 mm)	0.37, 3.81, 7.62 (Cave = 5 mm)	4.48, 45.73, 91.45 (Cave = 60 mm)	2.99, 30.48, 60.97 (Cave = 40 mm)
BFI	0.2	0.0	0.0	0.4	0.9
Ks	1.0	1.0	1.0	1.0	1.0
Kb	0.98	0.98	0.98	0.98	0.98

The parameters used to characterise the land uses are typical hydrologic parameters for such areas. The parameters were validated as part of a validation of the entire model against site observations, as described in Section 4.

4.4 Geometric approximation

In the absence of survey or design stage storage relationships, the geometry of the surface water storages was estimated using a power law approximation after Brooks and Hayashi (2002), where the depth d of a solid of revolution was related to its volume V as:

$$d = d_{max}\left(V\frac{1+{}^{2}/_{p}}{A_{max}d_{max}}\right)^{\frac{p}{p+2}}$$

where d_{max} was the maximum depth, V_{max} was the capacity of the storage, A_{max} was the maximum surface area of the storage and p was dimensionless shape parameter.

4.5 Conceptual tailings model

The geometry of the decant pond of Tailings storage facility were approximated as an inverted cone, with a uniform beach slope. The volume of decant pond was used to estimate the total inundated surface area. Any surface area not simulated to be inundated by the decant pond contributed as a catchment runoff.

Direct rainfall, catchment runoff and evaporation were simulated individually for each Tailings storage facility. The slurry of fine coal rejects were assumed to consolidated instantaneously, with the release water reporting to decant pond. Seasonal variability was taken into account in estimating release water by multiplying a scale factor k = 0.04 day/mm using the function:

$$Release\ water = 1 - (\%\ retained * (1 + k * (Daily\ evaporation - average\ evaporation)))$$

This results to higher release water during winter and lower release water during summer.

The conceptual tailings model is summarised schematically in Figure 4-2.

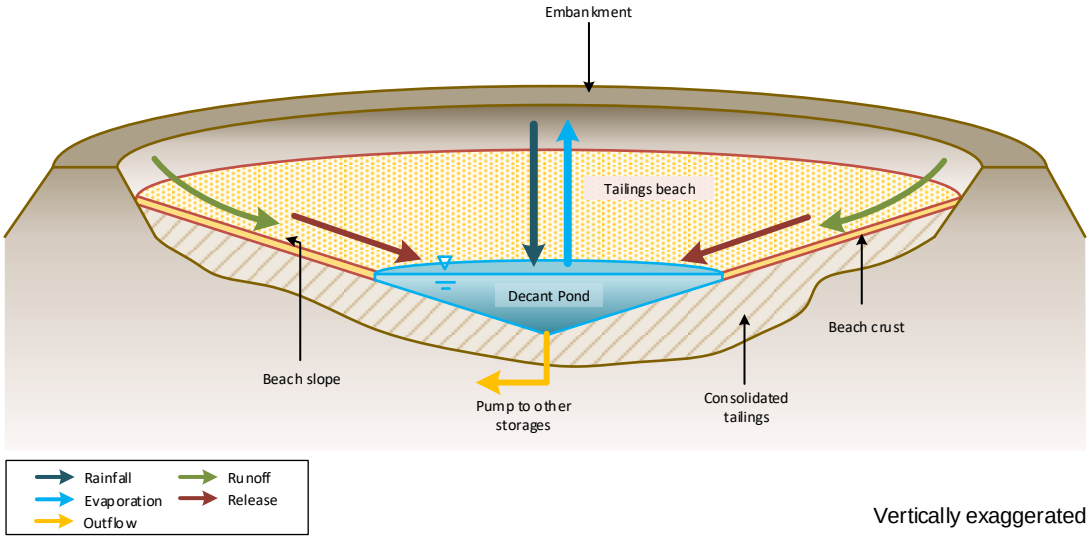


Figure 4-2 Conceptual tailings model

4.6 Numerical implementation

The operation of the water cycle for site conditions was modelled in GoldSim (version 12.1). This software is a graphical object orientated system for simulating either static or dynamic systems. It is like a 'visual spreadsheet' that allows the visual creation and manipulation of data and equations representing system behaviour.

GoldSim solves the mass conservation equations using an explicit scheme. A daily time step was used, consistent with the daily rainfall data. GoldSim uses the forward Euler method to solve the mass conservation equations described in Section 4.1.

5. Modelling validation

The water and salt balance model for the project was simulated from 1 October 2018 to 1 November 2019 (the validation period). The simulation used observed site rainfall and operated under the existing conditions. The purpose of validation is to test whether the model is of adequate accuracy for the purpose of making forecasts (refer to Section 6).

The model was initialised with all storage volumes at their normal operational volumes and all soil moisture storages in the hydrologic model (refer to Section 4.3) empty. Observed and modelled behaviour were compared using cumulative volumes over the validation period. This approach smooths out day to day operational decisions that are not relevant to average water demands. Cumulative observed and modelled total site water inventory and E22 void storage volume are shown in Figure 5-1 and Figure 5-2 respectively.

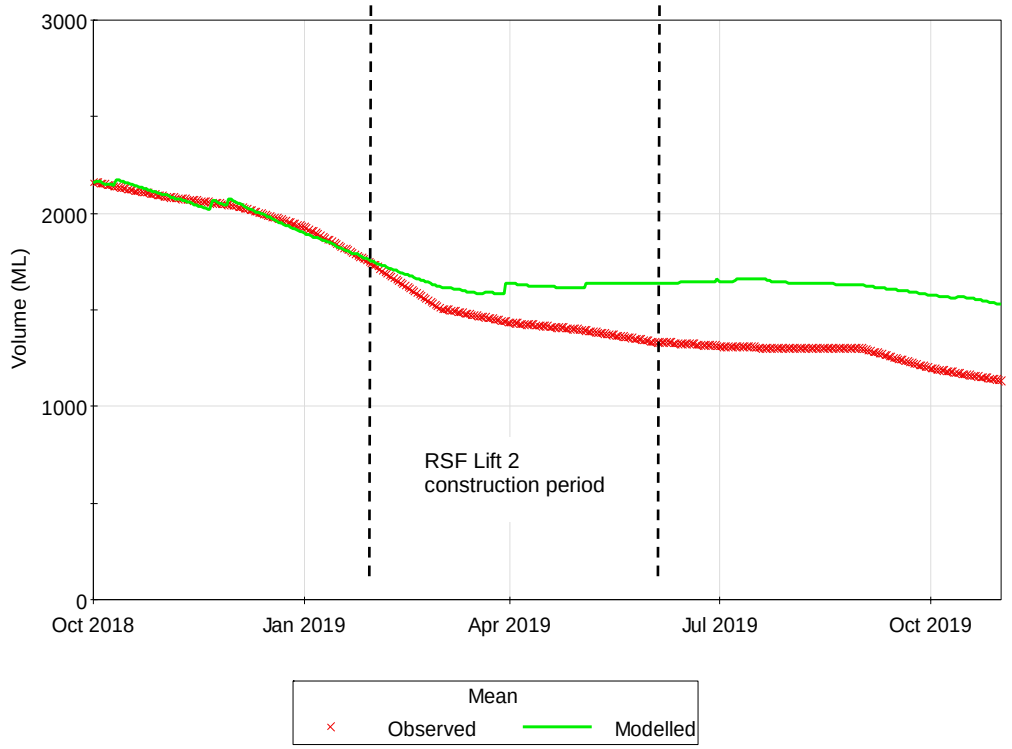


Figure 5-1 Validation of total site water inventory

Figure 5-1 shows the total site water inventory based on total observed volumes from input spreadsheet compared to the modelled total water storage volumes. The plot shows that observed site water inventory were initially about 2100 ML in late 2018 and declined until late 2019. The model was able to replicate the downward trend in water storage until the start of 2019 but tend to overestimate the on site water inventory for the remainder of the validation period by about 300 ML overall. This may be attributable to the unaccounted water used for construction activities in Rosedale TSF Lift 2 from February to June 2019.

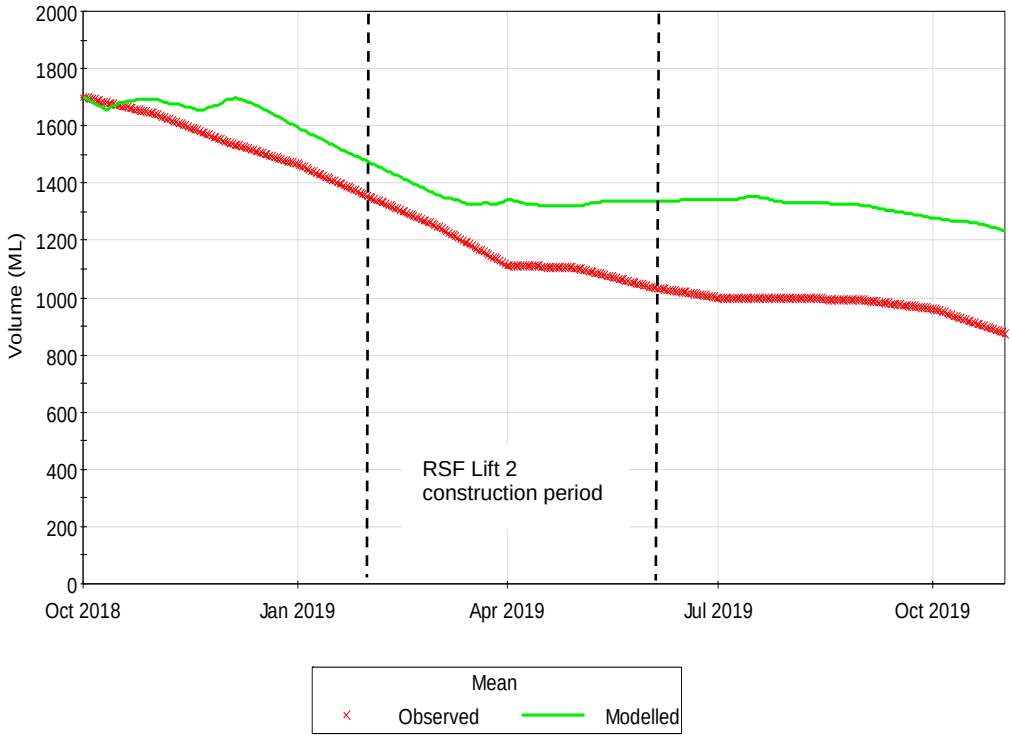


Figure 5-2 Validation of E22 void

Figure 5-2 shows that water storage volume of E22 void forms a steep decline from 1700 ML of late 2018 to 1117 ML by first quarter of 2019, then starts to gradually decrease to 874 ML by late 2019. The validation suggest that the model is able to replicate the steep decline trend of E22 void but tends to delay the decline. Similar with total site water inventory, model tends to overestimate E22 total volume by approximately 300 ML.

Sensitivity test

The sensitivity of the site water inventory to two key parameters, water fraction released (for individual TSFs) and seasonal scaling of fraction released on all TSF, were tested to identify the sensitivity of the parameters.

The sensitivity test on fraction released per TSF was conducted using the base case model with a minimum fraction released of 22% during summer and a maximum fraction released of 38% during winter. Fraction released of the three largest active: TSF Estcourt,, TSF Rosedale and TSF1, were assessed by changing each TSF's fraction released factor by an average of 7% increase and decrease compared to base case model to determine the level of model sensitivity.

Sensitivity test on seasonal scaling of fraction released on all TSF was performed by comparing the base case model with a scale factor k of 0.04 day/mm (as discussed in Section 4.5) to two scenarios, no seasonal scaling applied and using 75% higher scaling factor.

Figure 5-3 and Figure 5-4 presents sensitivity test plot results for fraction released per TSF and seasonal scaling of fraction released on all TSF respectively.

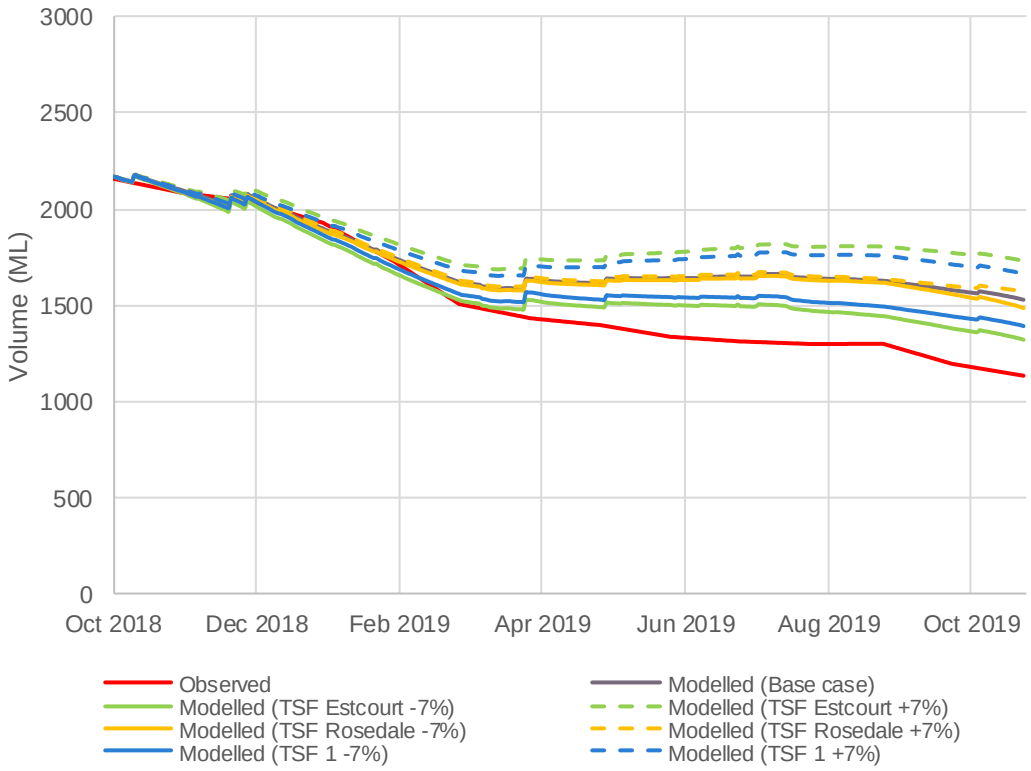


Figure 5-3 Sensitivity test to fraction released per TSF

Figure 5-3 confirms that the site water inventory is sensitive to fraction of water released. The results shows that changes to fraction released of TSF Escourt and TSF1 resulted in noticeable differences in the modelled total site water inventory by approximately 200 ML and 140 ML, respectively, by the end of validation period. However, as this difference was minor compared to the overall difference of the base case of 300 ML, this does not support a change in parameterisation.

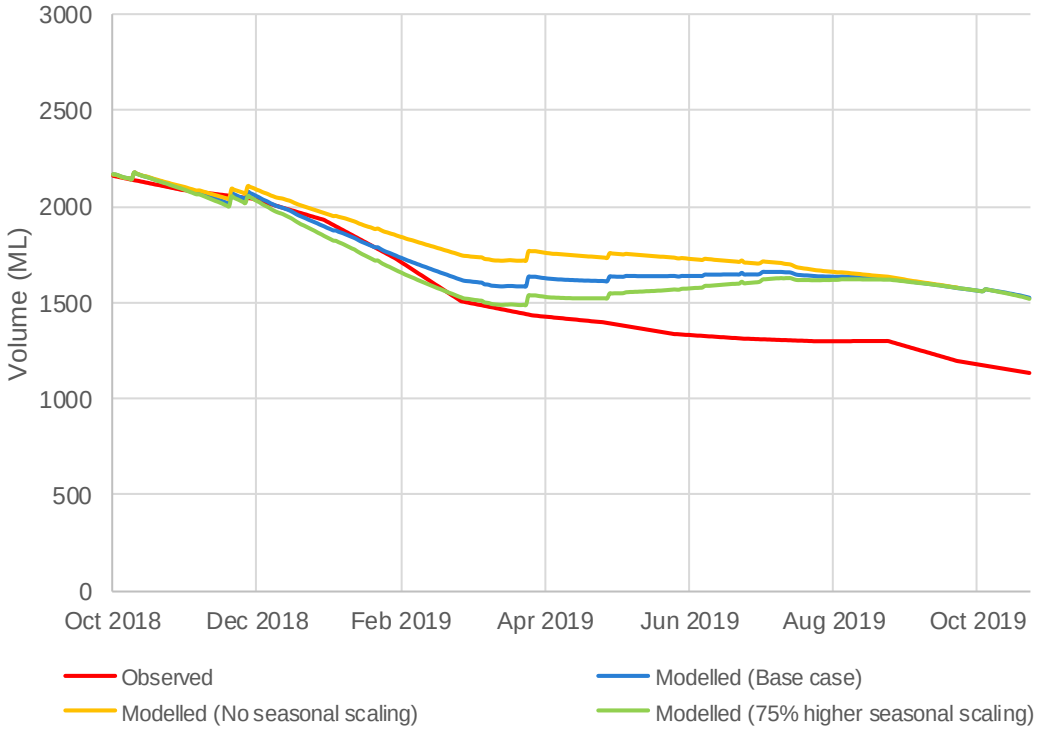


Figure 5-4 Sensitivity test on seasonal scaling

Figure 5-4 confirms that the site water inventory is sensitive to seasonal scaling on fraction released of tailings storages. Test shows that effect of seasonal scaling is mostly noticeable on periods between summer and winter. It can be observed that use of seasonal scaling tend to decrease simulated water storage during summer creating a concave shape on the following months. Therefore the seasonal scaling was adopted as it was more physically realistic and matched the observed trends, notwithstanding the 300 ML difference over the validation period.

6. Modelling results

The site water balance model for Northparkes Mines was simulated over the existing year 2019 to forecast year 2021.

The model was initialised based on the data and assumptions described in Section 3 and validated against the key observations as described in Section 5. In addition to these data, it was assumed that:

- Average production rate varies based on observed data
- No unplanned stoppage of the raw water supply from Parkes Shire Council occurred

Raw water was assumed to be supplied to site at the maximum rate if the simulated total water volume on site was less than the site water inventory target. If the simulated total water volume is greater than the target, sufficient water was supplied only for the potable water demands. The effect of this strategy is to maximise the average supply of raw water, by pumping more raw water than required for immediate demands during wet periods, in order to build up an onsite inventory than can be drawn down during dry periods.

The total site water inventory was initialised at 1921 ML, based on observed water storage volumes. The volumes of the other surface water storages were assumed to be initially empty. The validated model was used to estimate the annual water transfers in the site water balance, which are presented in Section 5.

6.1 Interpretation of results

To consider potential climate variability, a total of 130 different rainfall patterns were simulated (as described Section 0). The results presented show the average, 10th percentile and 90th percentile values. The purpose of displaying the three results is to indicate both the average value and the likely possible range. The 10th percentile represents the value at which 10% of the modelled outputs were less than this value. Similarly, the 90th percentile represents the value at which 90% of the modelled outputs were less than this value.

The 10th and 90th percentile values have been used rather than minimum and maximum values to exclude infrequent extreme wet and dry conditions. The set of 10th or 90th percentile values do not necessarily all correspond to the same rainfall series, that is, they do not correspond to a 10th percentile “dry” or 90th percentile “wet” year.

6.2 Qualification of predictions

GHD has developed the water balance model for Northparkes Mines based on information supplied by Northparkes and external data sources. Where data was not available, GHD has made assumptions as appropriate.

Data used to develop the model are categorised as follows:

- Relatively reliable data: SILO rainfall and evaporation data, surface catchment areas based on topographic maps
- Less reliable data: runoff volumes from catchments, operational precedence for transfers between storages, storage geometry

The items identified as ‘less reliable data’ present a risk that the model predictions are inaccurate. The accuracy may be improved as additional site data is collected. This additional data will allow refinement of the model inputs and hence increase the reliability of the model predictions. The adoption of historical rainfall and evaporation data within the detailed water balance model does not take into account the potential impacts of climate change.

6.3 Water balance

The annual water balance for Northparkes Mines for existing year 2019 and forecast year 2021 are shown in Figure 6-1 and Figure 6-2. Results are summarised in Table 6-1.

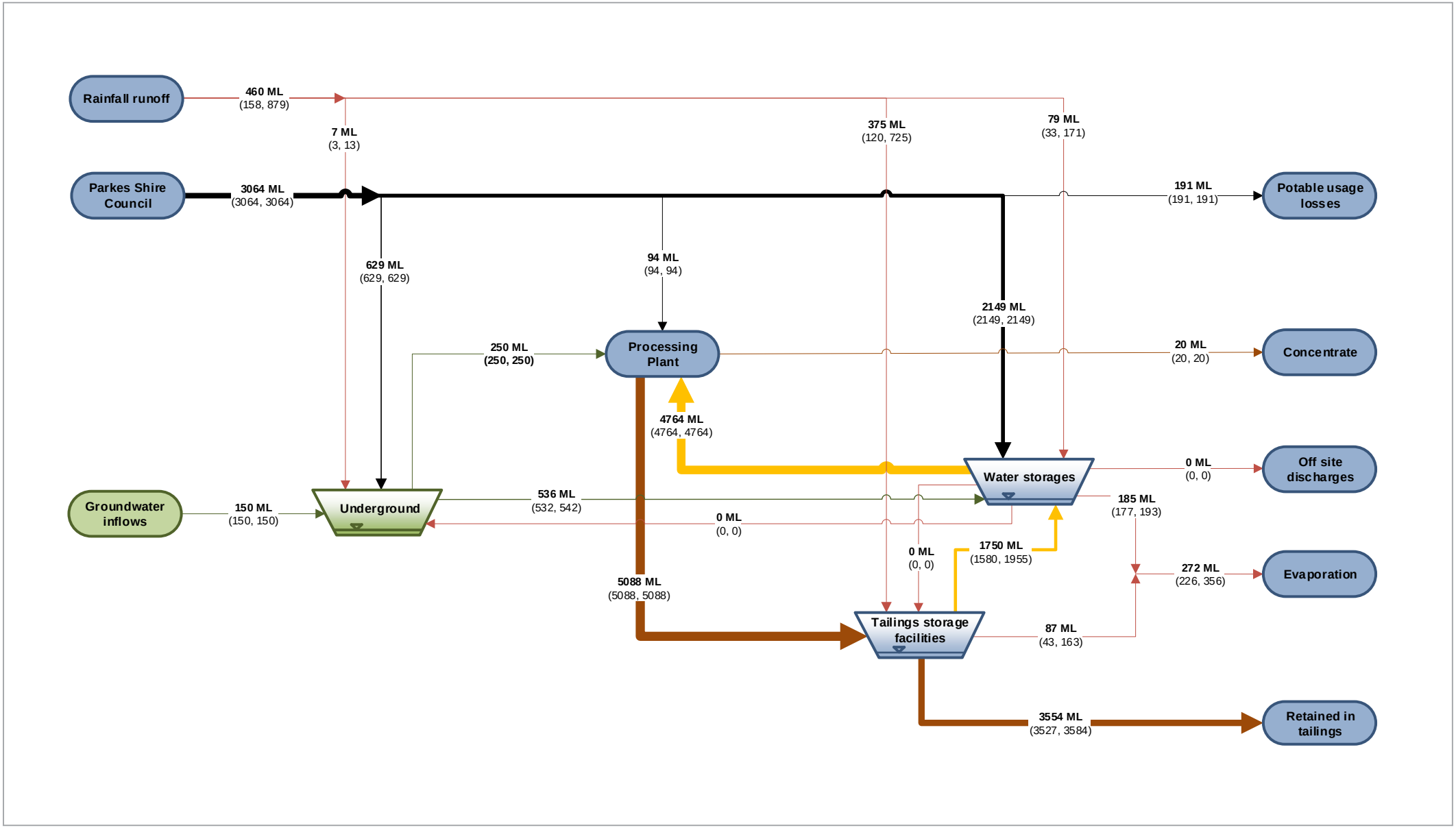
Table 6-1 Annual water balance

Element	Existing conditions (2019) (ML/year)	Forecast conditions (2021) (ML/year)
Rainfall-runoff	460	2145
Potable water supply	3064	2385
Groundwater inflows	150	144
TOTAL INPUTS	**3674**	**4674**
Evaporation	272	660
Potable usage losses	191	191
Concentrate	20	20
Off-site discharges	0	5
Entrained in tailings	3554	3574
TOTAL OUTPUTS	**4037**	**4451**
Surface water storages	-363	224
TOTAL CHANGE IN STORAGE	**-363**	**224**
Inputs – outputs – change in storage	0	0

Table 6-1 shows that majority of the inflows at Northparkes Mines come from its potable water supply approximately 84% of total inflows for 2019. This is mostly lost as entrained in tailings, around 88% of total outflows. A relatively minor volume of total inflow is estimated to be lost discharges via evaporation or potable usage losses. Results indicate that the site water inventory was significantly decreased by an estimated 360 ML for year 2019.

Modelling forecasts an annual average offsite discharge volume of 5 ML. This reflects the forecast discharge, predominately from dirty water storages, in very wet simulated years, averaged over the entire set of forecast simulation. This is consistent with the site being nil discharge for contaminated water, up to the relevant design criteria.

Model forecast for year 2021 suggests that, on average, inflows are expected to predominantly come from potable water supply and site rainfall runoff, approximately 51% and 45% of total inflows respectively. Similar to 2019, around 80% of total outflows are forecast to be lost through entrainment in tailings. For forecast conditions, an average increase of about 225 ML of water inventory was estimated, as the site was simulated to import more raw water to achieve the site water inventory target.



Legend

- Underground storage
- Underground process
- Surface storage
- Surface process
- Raw water flow
- Groundwater flow
- Ore moisture and tailings flow
- Mining site water flow
- Process water flow
- X (X,X) Mean (10th percentile, 90th percentile)

CMOC Mining Services Pty Ltd
Northparkes Mines
Site water balance assessment

Water management schematic
Annual water transfers
Existing conditions

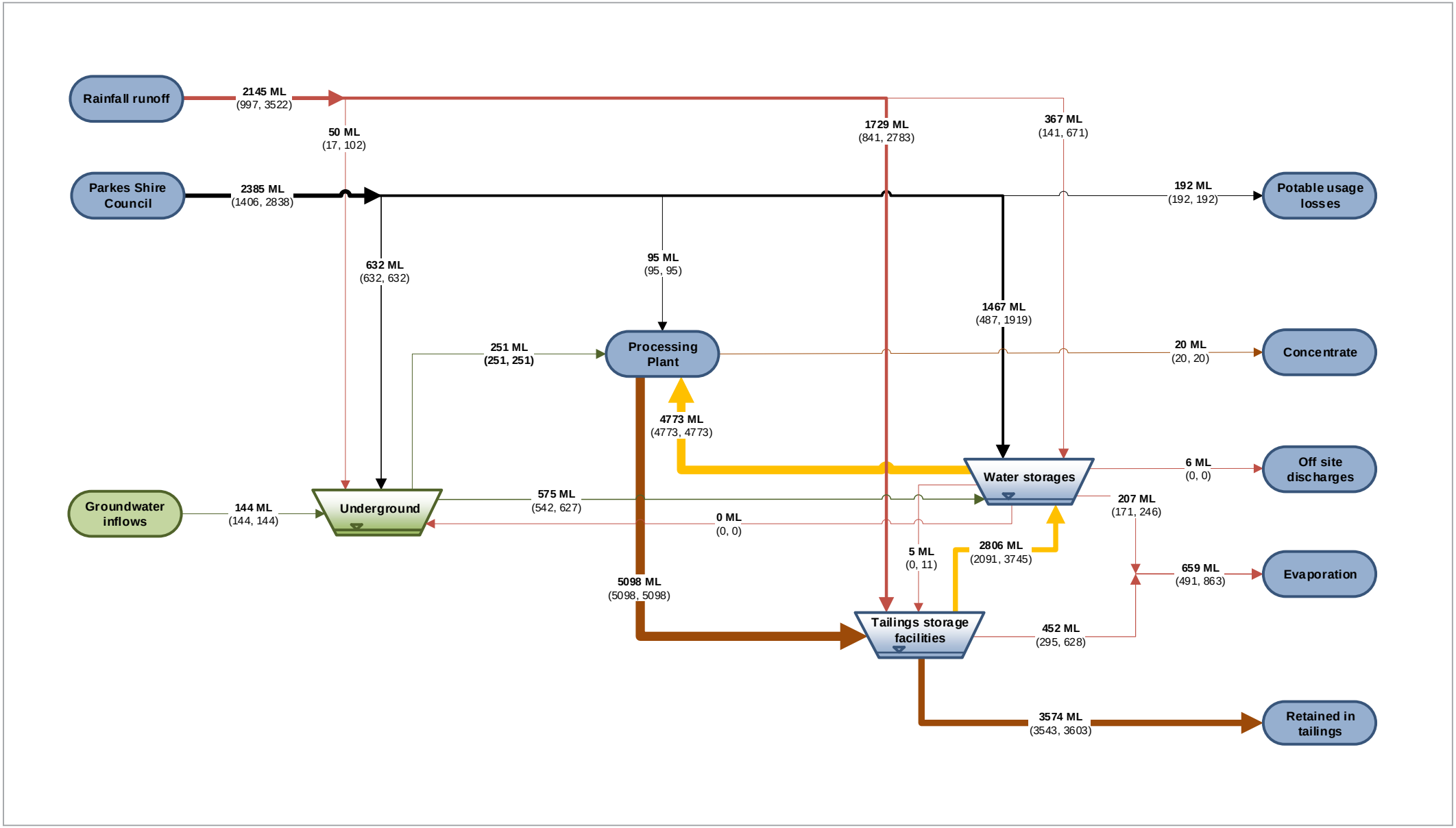
Project No. 12516285
Revision No. A
Date 14/07/2020

FIGURE 6-1

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Legend

- Underground storage
- Underground process
- Surface storage
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- Raw water flow
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- Ore moisture and tailings flow
- Mining site water flow
- Process water flow
- X (X,X) Mean (10th percentile, 90th percentile)

CMOC Mining Services Pty Ltd
Northparkes Mines
Site water balance assessment

Water management schematic
Annual water transfers
Forecast conditions

Project No. **12516285**
Revision No. **A**
Date **14/07/2020**

FIGURE 6-2

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7. Conclusion and recommendations

The previously prepared water balance model for Northparkes was updated and a limited validation was undertaken based on available data. Validation on total site water inventory shows that model overestimated a total of approximately 300 ML during TSF Rosedale Lift 2 construction period. This may be attributable to the unaccounted construction water use during said period. The modelling results are found sensitive to tailings fraction released and use of seasonal scaling factor.

It is recommended that NPM:

- Continue to monitor production rates, site rainfall, raw water supply, potable water supply, tailings slurry and tailings return flow rates.
- Continue to monitor water levels in tailings decant ponds, Caloola Dams and E22.
- Ensure all pumped inflows to the process water dam are monitored. If flow meters are not practical, records of pump flow rates and hours of pump operation are a suitable alternative.
- Undertake validation of the water balance model on an annual basis to compare observed data against model predictions.
- Monitor all construction water use to account for the water loss during construction activities in the site.

8. References

Boughton & Chiew (2003), *Calibration of the AWBM for use on Ungauged Catchments*, Technical Report 03/15 Cooperative Research Centre for Catchment Hydrology.

Department of Science, Information Technology and Innovation (DSITI) (2017), *SILO Data Drill*, Queensland Government. Retrieved from http://www.longpaddock.qld.gov.au/silo/ on 2 August 2017.

GoldSim Technology Group (2017). *GoldSim* Version 12.0.

Ladson (2008) *Hydrology: An Australian Introduction*. Oxford University Press, Melbourne, Australia.

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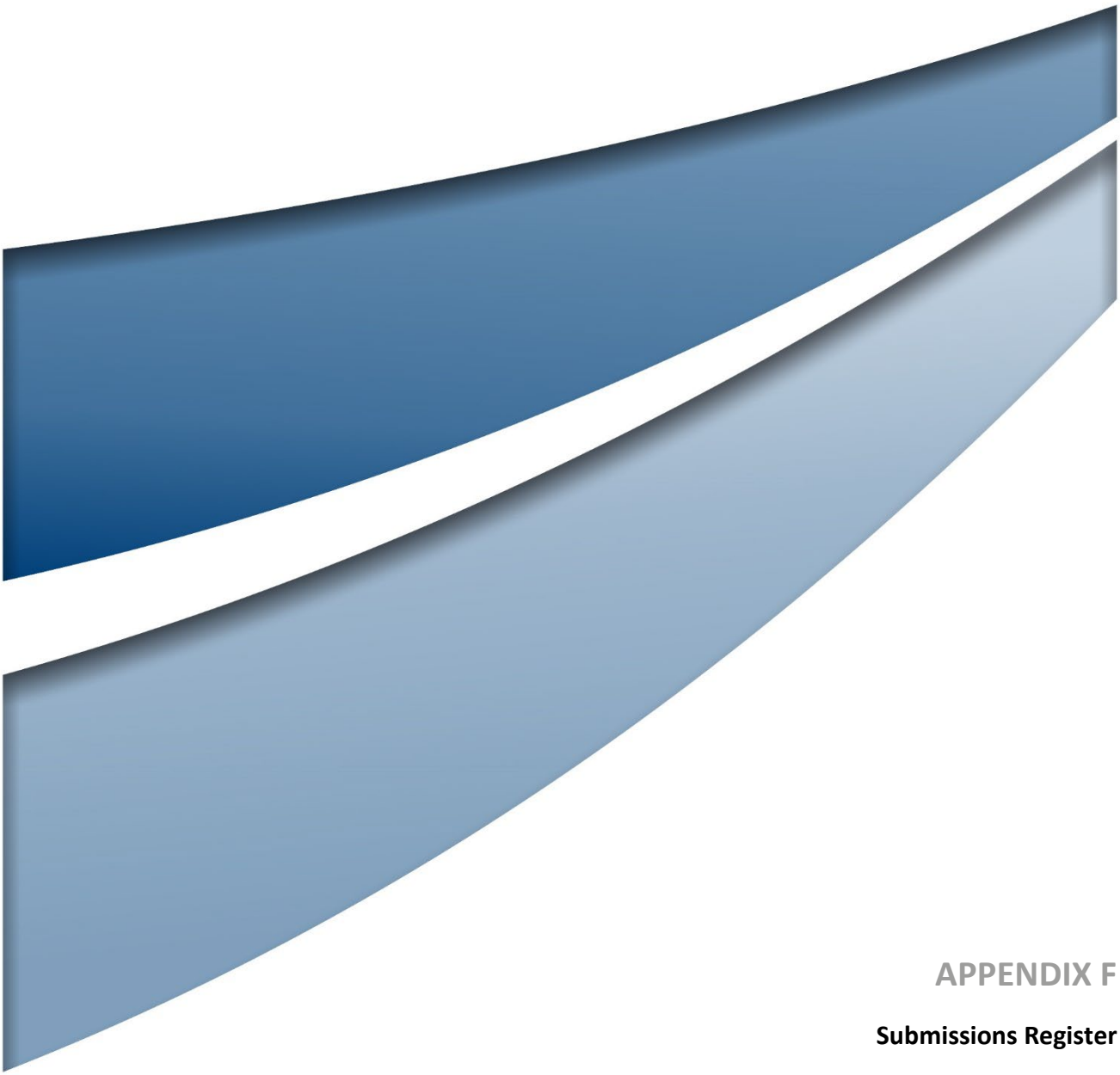
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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	J Macatanong	T Tinkler		S Gray		17/02/2022

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APPENDIX F

Submissions Register

Submissions Register

Table F1 identifies all submissions received in relation to the Proposed Modification and references the relevant section of the Submissions Report in which key issues have been addressed.

Table F1 Submission Register

Group	Name	Section where issues are addressed in Submissions Report
Public Authorities	**Biodiversity, Conservation and Science Directorate**	Section 4.1.1
	Department of Planning and Environment - Water	Section 4.1.2
	Resources Regulator	Section 4.1.3
	Mining, Exploration and Geoscience	Section 4.1.4
	Environment Protection Authority	Section 4.1.5
Council	**Parkes Shire Council**	**N/A - no comment**
Individuals	**Nil**	**N/A – no submissions received**
Organisations	**Nil**	**N/A – no submissions received**



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