Management Plan

Biodiversity Offset

Risk Statement: High

This document will be reviewed on a one yearly basis, unless a process change occurs earlier than this period. This Management Plan has been developed to comply with Condition 29 of NSW Development Consent (DC11_0060) and to comply with the Northparkes Mines Step Change Project Preliminary Documentation as conditioned under the Commonwealth Project Approval (EPBC 2013/6788).

Doc No.	Version No.	Next Review Date	Owner
PLN-0065	7	25/06/2021	Environment & Farms Superintendent

Revision Summary

First Issue	Issue Date	Implementation Requirements	Approved By
1	30 Nov 14	Biodiversity Management Plan prepared by Umwelt for compliance with NSW Project Condition (PA11_0060)	Environment and Farms Superintendent

Version No.	Revision Date	Summary of Revision Details	Approved By
2	22 Sep 15	Biodiversity Management Plan updated to: • Incorporate comments received from the Department of Planning and Environment • Reformatted into Northparkes document style • Renamed Biodiversity Offset Management Plan (BOMP) rather than Biodiversity Management Plan (BMP) • Removed references to Pine Donkey Orchid management from main document and included in Appendix 3 – Species Management Plan for the Pine Donkey Orchid	Environment and Farms Superintendent
3	26 Jul 16	BOMP updated to include comments from OEH. Reformatted document into new Northparkes template.	PSE Manager
4	28 Oct 16	BOMP updated to include comments from OEH, following meeting with OEH on 19 October 2016.	Environment and Farms Superintendent
5	24 Nov 16	BOMP updated following response from OEH	Environment and Farms Superintendent
6	25 Feb 20	Updated to new DCS	M Row
7	23 Jun 20	Review following submission of Annual Review. Changes made to management strategy timeframes as a result of a delayed registration of the Voluntary Conservation Agreement.	Environment and Farms Superintendent

Consultation Required	Hard Copy Locations
Not Applicable	Northparkes Website

Associated Documents to be Reviewed
Not Applicable

Table of Contents

1. OVERVIEW

1.1 Background

CMOC Mining Services Pty Limited (CMOC) is the manager of the Northparkes Joint Venture, an unincorporated joint venture between CMOC Mining Limited (80%); Sumitomo Metal Mining Oceania Pty Ltd (13.3%) and SC Mineral Resources (6.7%). Northparkes is a copper-gold operation in Goonumbla, situated 27 kilometres north-west of the town of Parkes.

Construction of the ore processing plant and associated facilities began in 1993. Open cut mining commenced on the E22 and E27 ore bodies in late 1993. Development of the E26 lift 1 block cave underground mine began in 1994, with full scale production commencing in 1997.

1.1.1 Mining Context

Operations at Northparkes primarily comprises underground mining from multiple ore sources that feed a processing plant with a capacity of 6.5 million tonnes per annum (Mtpa). The underground mine is accessed via a decline ramp from the surface for people and materials with ore transported to the surface via inclined conveyors and a hoisting shaft, with a nominal capacity of 7.2 Mtpa. Northparkes utilises low cost block and sub-level cave mining and exploits industry leading technology, such as semi-autonomous loaders and various cave monitoring systems.

The ore processing operation consists of four stages: crushing, grinding, flotation and thickening / filtering. In addition to producing concentrate, the ore processing team also manages tailings disposal. The concentrator was constructed in two modules. Each module consists of its own grinding circuit with a single flotation circuit, concentrate thickener and filter. After extracting the copper and gold bearing minerals, the tailings are combined in a single tailings thickener before being deposited in the active tailings storage facility.

Northparkes' copper concentrate is transported to a rail siding at Goonumbla where it is then transported by rail to Port Kembla, for shipping to overseas customers.

1.1.2 Biodiverstiy Offset

The Northparkes Mines (Northparkes) Biodiversity Offset Management Plan (BOMP) has been prepared to guide the ongoing management of the Kokoda Offset Site for biodiversity conservation and enhancement purposes. The Kokoda Offset Site has been established as a biodiversity offset for the ecological impacts of the Northparkes Mines Step Change Project (the Project). The 350 hectare Kokoda Offset Site is located in the Mandagery locality of the Central West Slopes of NSW (refer to Figure 1), approximately 52 kilometres south-east of the Project Area. In addition the BOMP incorporates the existing approved biodiversity offset management plans for the existing Limestone National Forest Offset (refer to Appendix 1) and Estcourt Tailings Storage Facility Offset (refer to Appendix 2) as established in accordance with the previous project approval (PA06_0026 as modified) at Northparkes.

The BOMP has been prepared in accordance with the NSW Development Consent (DC11_0060) requirements and Commonwealth Project Approval (EPBC 2013/6788) requirements issued for the Project and provides a framework for the implementation of ecological management actions, regeneration strategies, controls and monitoring programs for the Kokoda Offset Site.

2. SCOPE

This document applies to all activities undertaken by Northparkes including mining and exploration activities, processing of copper / gold ore resources, project development, maintenance activities, mine closure, logistics, associated service and support functions, bore fields, farming operations and products.

3. OBJECTIVES

The objective of the BOMP is to facilitate the long term conservation and enhancement of the ecological values of the Kokoda Offset Site. The BOMP broadly focuses on manging woodland for conservation and assisting derived native grassland (DNG) areas to return to woodland form of key targeted vegetation communities.

The specific objectives of the BOMP are to:

- Identify and describe the area of land that will be required to be managed in accordance with this BOMP;
- Provide clear and concise instructions for the management of the Kokoda Offset Site in accordance with the biodiversity management plan objectives;
- Provide a working schedule for the implementation of BOMP activities, including:
    - Manage remnant vegetation and fauna habitat;
    - Restore the DNG component of the Grey Box Grassy Woodland EEC to woodland community;
    - Intergrate the implementation of the biodiversity offset strategies to the greatest extent practicable with the rehabilitation of the site (where relevant); and
    - Manage and maintain the populations of Pine Donkey Orchid located to the North of the project area (near Avadale Road) and near E48 subsidence zone.
- Describe monitoring, performance evaluation and reporting procedures that are informative, practical and achievable.

4. RESPONSIBILITIES

General role responsibilities are outlined in the Health, Safety and Environment Responsibilities and Accountabilities Procedure (PRO-0080). Personnel carrying out work under this document must be familiar with and comply with it in full. The following persons have specific responsibility:

Table 1: Responsibilities

Role	Responsibility
All Personell	– ensure staff and contractors accessing the Kokoda Offset Site are informed and trained where relevant in relation to controls on activities within the Offset Sites; – receive training regarding controls on activities within the Kokoda Offset Site; – observe boundaries of the Kokoda Offset Site when undertaking work on site; and – undertake activities in the Kokoda Offset Site in line with directions from the Operations Manager and People, Safety and Environment Manager.
Environment and Farm Superintendent	– report unauthorised access by stock or vehicles to the Kokoda; and – report on any fencing or track maintenance works required to prevent stock access to the Kokoda Offset Site.
PSE Manager	– co-ordinate the day to day implementation of the BOMP, including the implementation of all management activities; – undertake biannual inspections of the Kokoda Offset Site; – analyse and collate documentation for inclusion in the Annual Review; – assess the effectiveness of the management strategies and instigate the adaptive management process as required; – ensure all internal and external reporting requirements are met; – ensure that all relevant records are effectively maintained on site; – periodically review progress against targets and performance indicators; – review this managmement plan on a three yearly basis – ensure that personnel involved in the carrying out and monitoring of the BOMP activities and values are appropriately qualified, licensed and experienced to undertake the task; – manage/control access to the Kokoda Offset Site;

Role	Responsibility
Managing Director	– ensure that sufficient time and resources are allocated to allow for the implementation of biodiversity management and monitoring strategies as outlined in the BOMP; – authorise internal and external reporting requirements as well as subsequent revisions of this BOMP; and – oversee implementation of the BOMP to ensure compliance with approval requirements.

5. DEFINITIONS

Table 2: Definitions

Key Word	Definition
BOMP	Biodiversity Offset Management Plan
CEEC	Critically Endangered Ecological Community
DNG	Derived Native Grassland
DoE	Commonwealth Department of the Environment
EEC	Endangered Ecological Community
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
ha	Hectares
LFA	Landscape Function Analysis
OEH	NSW Office of Environment and Heritage
DoPI&E (the Department)	NSW Department of Planning, Industry and Environment
TEC	Threatened Ecological Community
BC Act	Biodiversity Conservation Act 2016 (NSW)

6. DESCRIPTION OF THE KOKODA OFFSET SITE

The following sections provide a summary of the characteristics and biodiversity values of the Kokoda Offset Site as relevant to this BOMP. Further description of the baseline condition and environment of the Kokoda Offset is provided in the Environmental Assessment and the Preliminary Documentation (Umwelt 2013a and 2013b). In addition, a description of the Limestone National Forest and Estcourt Offset area are provided in Appendix 1 and Appendix 2, respectively.

6.1 Location

The Kokoda Offset Site is strategically located along a north-south potential corridor of remnant woodland and forest vegetation that runs along ridges and hills from north of Eugowra in the south, to east of Narromine in the north. The north-south potential corridor includes Goobang National Park, the largest conserved remnant of woodland and forest vegetation in the Central West region of NSW.

The Kokoda Offset Site is located approximately 12 kilometres north-west of Nangar National Park, approximately 8 kilometres south of Goobang National Park, approximately 12 kilometres west of Mandagery State Forest, approximately 17 kilometres east of Cookamidgera State Forest, and approximately 20 kilometres east of Back Yamma State Forest (refer to Figure 1).

The Kokoda Offset Site comprises lower fertility soils in the northern sections, predominately cleared for grazing, and dense woodland covered slopes and ridge lines in the south of the property. Sheep and cattle grazing has been undertaken across the entire property since ecological surveys began in 2013 and is likely to have been the predominant land use for many years. Northparkes removed all stock from the Kokoda Offset Site in early 2015, following purchase of the property.

To the north of the Kokoda Offset Site, the predominant land use is agriculture, primarily cropping but also grazing. This agricultural area is largely confined to the lower and flatter areas, occurring between Goobang National Park and the southern portion of the Kokoda Offset Site.

6.2 Land tenure and conservation mechanism

The Kokoda property was purchased and secured under a Voluntary Conservation Agreement (VCA) to ensure, in perpetuity, the long-term conservation and enhancement of the offset values. Following the final sign off by the Chief Executive in February 2018, Northparkes commenced undertaking management actions in accordance with the relevant permissions and guidelines of the agreement.

6.3 Key ecological values

The Kokoda Offset Site provides conservation of 109 hectares of Grey Box Grassy Woodland EEC (including 96 hectares of DNG that will be returned to woodland form), 2.2 hectares of White Box – Yellow Box – Blakely's Red Gum Woodland EEC/CEEC, known habitat areas for the grey-crowned babbler, little lorikeet and eastern bentwing-bat and potential habitat for a number of threatened fauna species. Further details of the ecological values of the Kokoda Offset Site are provided in the following sections.

6.3.1 Vegetation communities and Threatened Ecological Communities

A total of 11 vegetation communities have been recorded in the Kokoda Offset Site, three of which are Threatened Ecological Communities (TECs). Figure 2 shows the location of the vegetation communities recorded on the Kokoda Offset Site. These vegetation communities are also listed in Table 3 below.

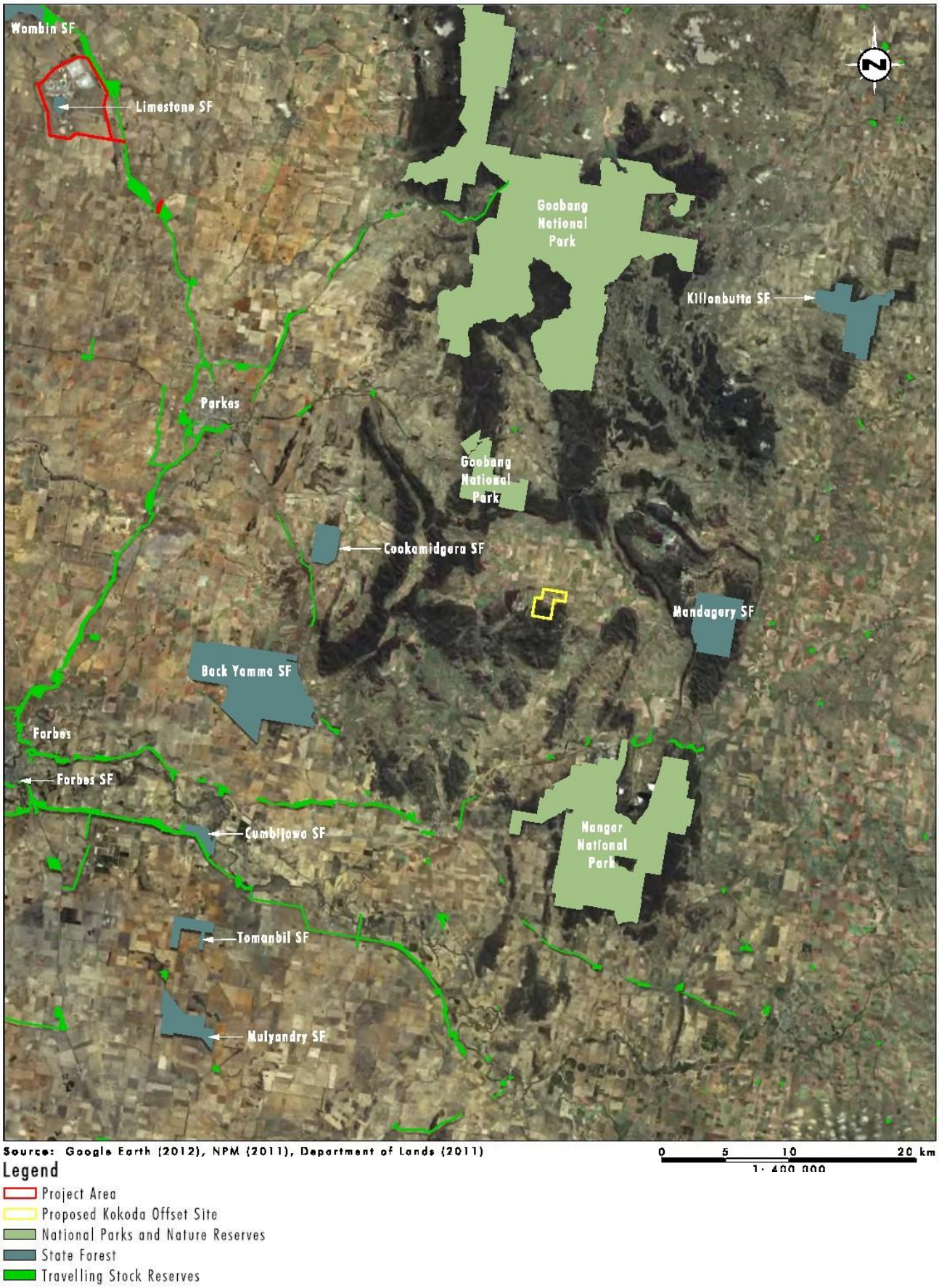

Figure 1: Location of Kokoda Biodiversity Offset

Table 3: Vegetation communities of the Kokoda Offset Site

Vegetation Community	BC Act Status	EPBC Act Status	Vegetation within Kokoda Offset Site (ha)
Grey Box Grassy Woodland	EEC	EEC	13
Grey Box Grassy DNG	EEC	EEC	96
White Box Grassy Woodland	EEC	CEEC	2.2
Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest			150
Rocky Rise Shrubby Woodland			26
Grey Box – Ironbark Woodland			25
Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine DNG			15
Dwyer's Red Gum Creekline Woodland			9.4
Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Woodland Low Quality			8.6
Mugga Ironbark Woodland			1.9
Farm Tracks and Dams – Disturbed Land			2.5
Total			350[1]

1 = Rounding of totals applied (numbers less than 1 – 2 decimal places, numbers between 1 and 10 – 1 decimal place, and greater than 10 - no decimal places)
CEEC = Critically Endangered Ecological Community
EEC = Endangered Ecological Community
EPBC Act = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
BC Act = NSW *Biodiversity Conservation Act 2016*
DNG = Derived Native Grassland
ha = Hectares

The 13 hectares of Grey Box Grassy Woodland and 96 hectares of Grey Box DNG on the Kokoda Offset Site conforms to the BC Act listed *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* EEC and the EPBC Act listed *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia* EEC.

The 2.2 hectares of White Box Grassy Woodland on the Kokoda Offset Site conforms to the BC Act listed White Box – Yellow Box – Blakely's Red Gum Woodland EEC and the EPBC Act listed White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC.

The 96 hectares of Grey Box Grassy Woodland DNG and 15 hectares of Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine DNG within the Kokoda Offset Site will be managed back to woodland form. The recovery potential of these areas was assessed resulting in the delineation of six vegetation management areas (refer to Figure 2). These management areas identify those parts of the DNG predicted to respond well to assisted natural regeneration strategies and those predicted to potentially require active management. Further detail on these vegetation management areas is included in Section 9.7.

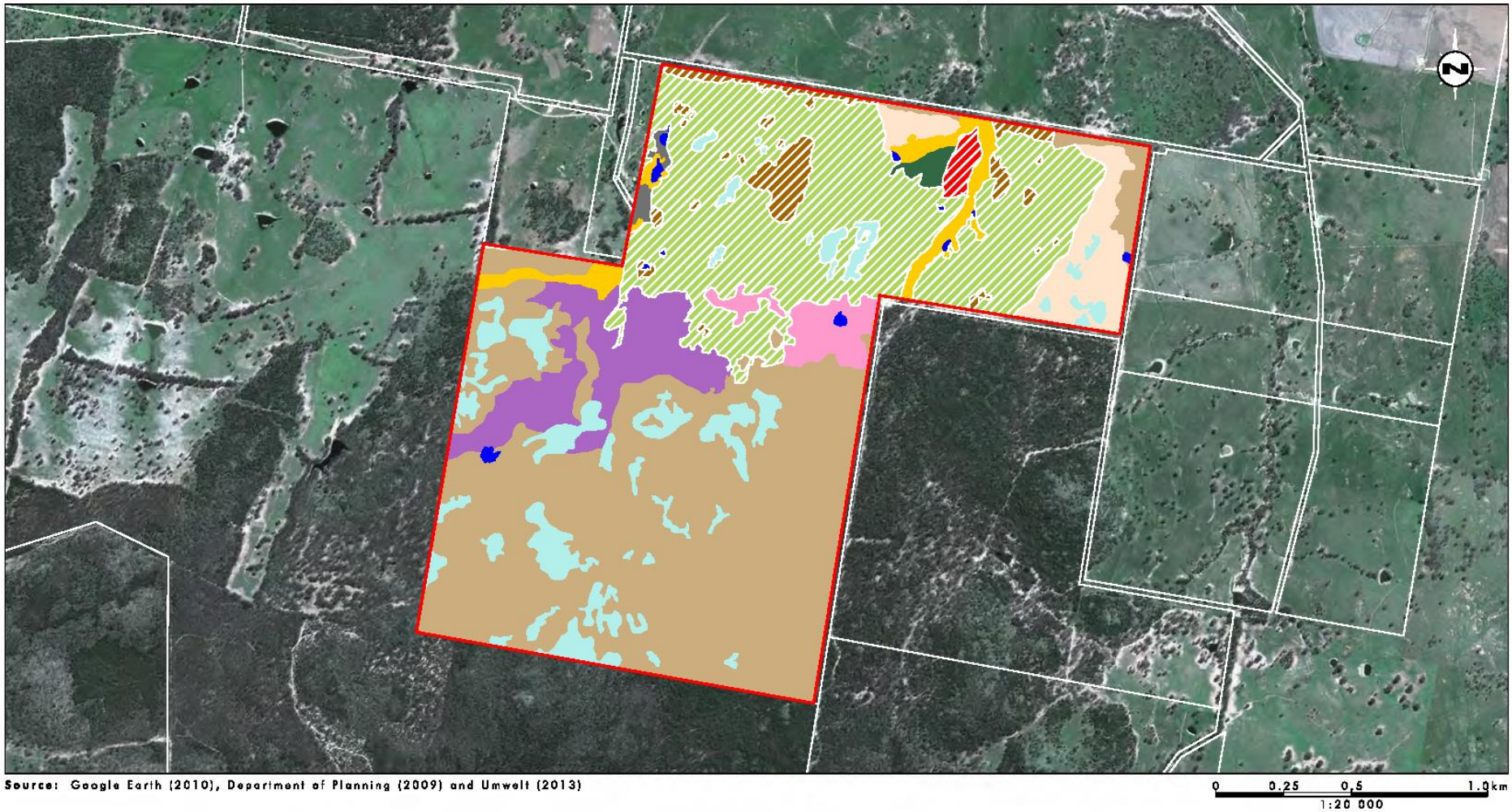

Figure 2: Vegetation communities

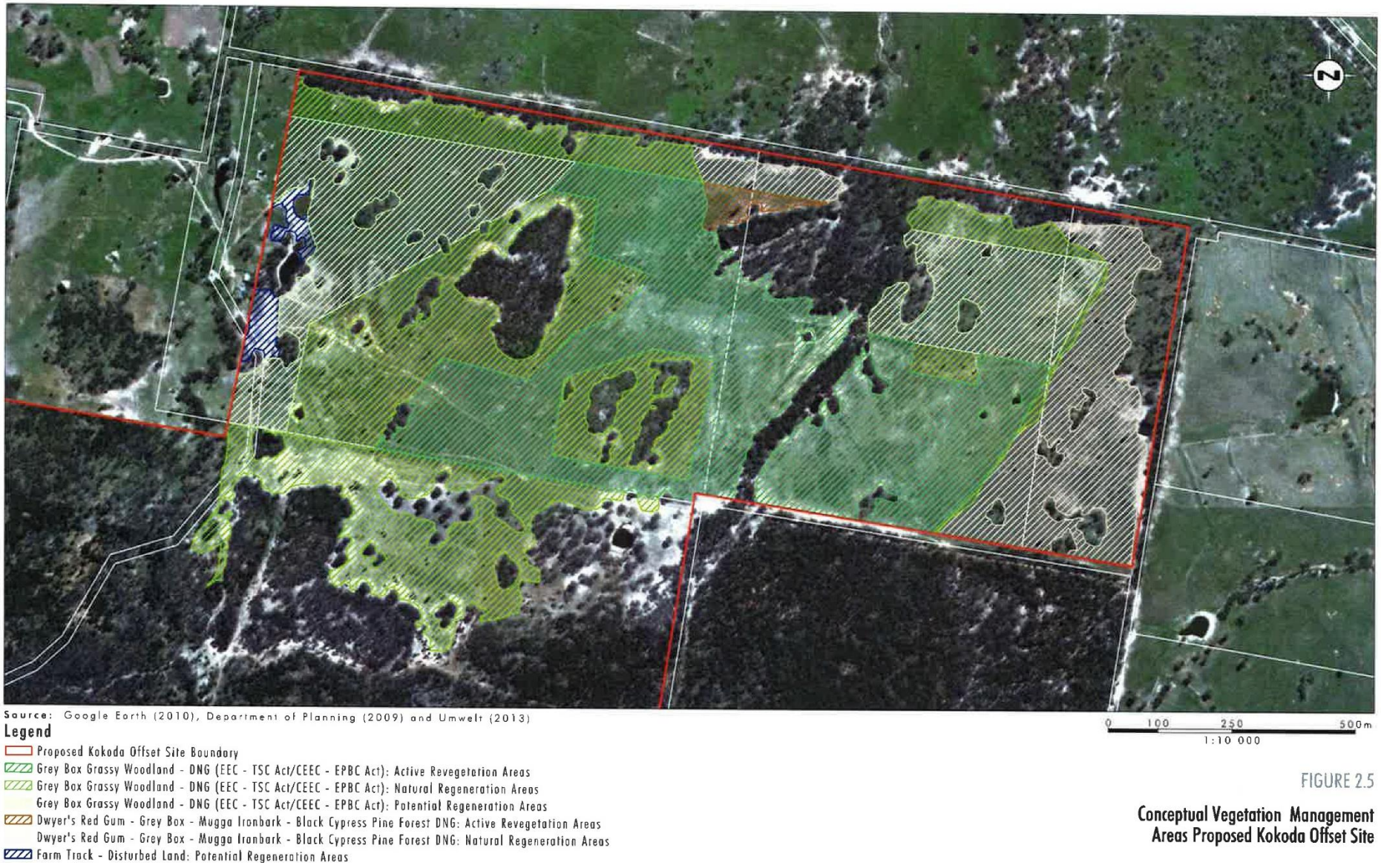

Figure 3: Conceptual vegetation management area with Landscape Function Analysis monitoring locations

6.3.2 Baseline Threatened Species

No threatened flora species were recorded in the Kokoda Offset Site during baseline surveys.

Twelve threatened fauna species were recorded in the Kokoda Offset Site and are listed in Table 4 below and shown on Figure 4.

Table 4: Threatened fauna species recorded within the Kokoda offset site

Common Name	Scientific Name	Status		No. of individuals/ locations
		BC Act	EPBC Act	
Glossy black-cockatoo	*Calyptorhynchus lathami*	V		2/1
Superb parrot	*Polytelis swainsonii*	V	V	162/23
Little lorikeet	*Glossopsitta pusilla*	V		25/2
Brown treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V		18/10
Speckled warbler	*Chthonicola saggitatus*	V		13/9
Hooded robin (south-eastern form)	*Melanodryas cucullata cucullata*	V		1/1
Grey-crowned babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V		95/20
Varied sittella	*Daphoenositta chrysoptera*	V		2/2
Diamond firetail	*Stagonopleura guttata*	V		8/3
Eastern bentwing-bat	*Miniopterus schreibersii oceanensis*	V		-/2
Little pied bat	*Chalinolobus picatus*	V		-/2
Yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*	V		-/2

V = Vulnerable Species
BC Act = *Biodiversity Conservation Act 2016*
EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*

The grey-crowned babbler, brown treecreeper and the superb parrot were the most commonly recorded threatened fauna species across the Kokoda Offset Site. The grey-crowned babbler and the brown treecreeper are both sedentary birds and will utilise the site across all seasons whereas the superb parrot is a seasonally nomadic species which will largely utilise the Kokoda Offset Site for foraging during spring and summer. Given the array of varied habitats within the site, there is a high potential that other threatened fauna species may occur within the Kokoda Offset Site.

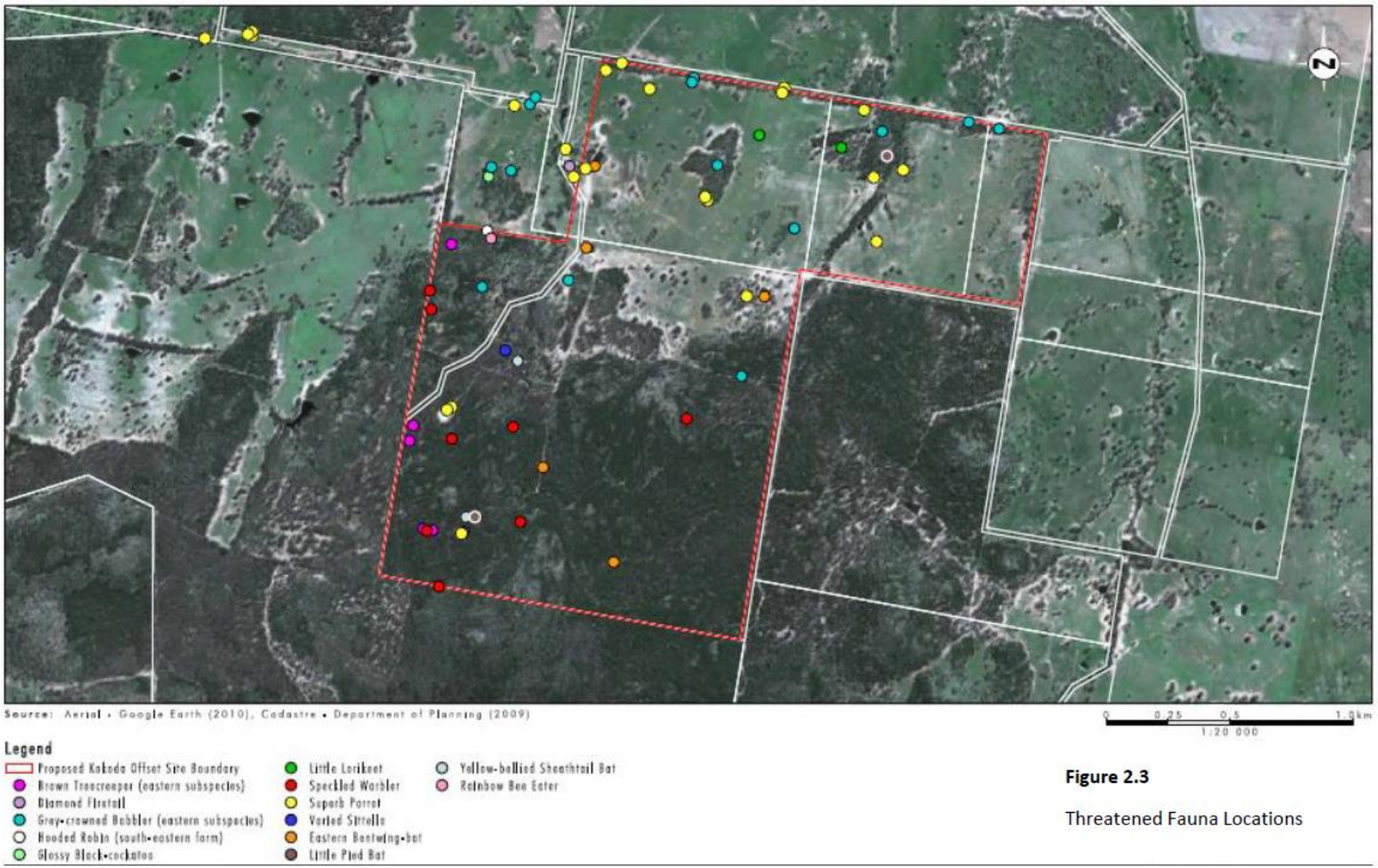

Figure 4: Threatened fauna locations

6.4 Management Zone Stratification

The Kokoda Offset Site has been stratified into seven management zones based primarily on the condition of the vegetation communities and their recovery potential. Table 5 below provides a summary of the management zones identified within the Kokoda Offset Site.

Table 5: Management Zones at the Kokoda Offset Site

Management Zone	Vegetation Type	Objective	Total Area
1	Grey Box Grassy Woodland – DNG – Active Revegetation	Restore to woodland	36.3
2	Grey Box Grassy Woodland – DNG – Potential Regeneration	Restore to woodland	21.3
3	Grey Box Grassy Woodland – DNG – Natural Regeneration	Restore to woodland	38.4
4	Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine DNG Active Regeneration	Restore to woodland	1
5	Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine DNG Natural Regeneration	Restore to woodland	13.8
6	Disturbed – Potential Regeneration	Restore to woodland	1.3
7	All Remnant Woodland and Forest	Conserve and maintain	238
		Total	**350**

Management zones 1 to 5 are all DNG communities that occur on the lower slopes in the northern section of the property. These areas will each receive varying levels of management, however the long term goal for each of these zones, plus zone 6, is to return them to their former woodland community structure.

7. BIODIVERSITY MANAGEMENT TARGETS

Biodiversity management targets form the basis of the BOMP. The proposed management and improvement strategies (Section 9) will enable the biodiversity management targets and conditions of the approval to be met. Specific performance indicators and completion criteria (Section 9) will be used to track the success of the BOMP in reaching these targets.

The short term (3 year) biodiversity management targets for the management of the Kokoda Offset Site are to:

- establish signage throughout the Kokoda Offset Site;
- remove stock-grazing activities from the Kokoda Offset Site by maintenance of fencing as required;
- establish a monitoring program to assess the success of ongoing management and improvement strategies, in particular focusing on the regeneration potential of Grey Box Grassy Woodland DNG areas; and
- commence establishment of Grey Box Grassy Woodland in areas of DNG through assisted natural regeneration principles;
- include a range of flora species from each vegetation strata represented in the target community (such as trees, shrubs, and ground cover forbs and grasses), even if only as seedlings/juvenile plants initially, as determined through monitoring of selected reference sites in the target community within the Kokoda Offset Site;
- contain a flora species assemblage trending towards the target communities (i.e. Grey Box Grassy Woodland EEC or Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest) as determined through monitoring of selected reference sites in the target community within the Kokoda Offset Site;
- support no more than 20 per cent foliage cover of perennial weed species (as a total of all strata, based on monitoring plot data); and

- support no more than 20 per cent bare ground as part of the ground layer.
- effectively manage weed and pest species;
- implement weed monitoring at to assess if weed species are out competing native species once grazing pressure has been removed. Adaptive management practices will be adopted to control weed species as necessary;
- from year two onwards, initiate active revegetation methods to establish Grey Box Grassy Woodland in areas of low recovery potential DNG as required through the results of monitoring in years 1 and 2;
- manage the remnant woodland areas to maintain similar or increasing flora and fauna species diversity;
- establish an appropriate long-term conservation mechanism; and
- demonstrate that accurate records are being maintained substantiating all activities and monitoring associated with the BOMP.

The preliminary medium term (6, 10 and 15 years) biodiversity management targets for the Kokoda Offset Site are to:

- effectively monitor, control and reduce weed and pest species populations;
- monitor and document collective trend towards an increase in native flora and fauna species diversity;
- monitor and document DNG areas trending toward woodland communities, containing natives species commensurate with those of the target woodland communities

The preliminary long term (i.e. 20 years) biodiversity management targets for the Kokoda Offset Site are to:

- effectively control and reduce weed and pest species populations;
- improve the overall native flora and fauna species diversity compared to conditions during baseline assessments;
- improve the habitat value of the remnant woodland communities in the Kokoda Offset Site compared to conditions during baseline assessments;
- successfully establish an additional 96 hectares of Grey Box Grassy Woodland EEC in areas of existing DNG and demonstrate that the regenerated communities are representative of local reference sites in remnant Grey Box Grassy Woodland EEC.
- regenerate/revegetate management areas contain a minimum of 50 per cent of the native flora species diversity recorded from reference sites in the target community within the Kokoda Offset Site;
- regenerate/revegetate management areas support a vegetation structure that is similar to that recorded for reference sites in the target community within the Kokoda Offset Site;
- demonstrate that second generation trees are present within regeneration/revegetation areas;
- identify that more than 75 per cent of trees are healthy and growing as indicated by long term monitoring;
- ensure that weed species do not dominate any vegetation stratum (i.e. weed species comprise less than 10 per cent of any vegetation stratum);
- ongoing monitoring of soil stability, including implementation of erosion and sediment controls to management significant erosions concerns, as required; and
- regenerate/revegetate areas linked to existing woodland remnants to establish vegetation corridors within the broader landscape and manage excessive edge effects.

8. OFFSET MONITORING PROGRAM

The Kokoda Offset Site will be subject to an ongoing monitoring program to measure the success of management and restoration strategies in meeting the approval conditions (Section 8) and performance indicators as set out in Section 9 in a timely manner. The monitoring program will incorporate annual systematic monitoring as well as biannual (twice yearly) inspections.

8.1 Monitoring Objectives

The objectives of the Kokoda Offset Site monitoring program will be to:

- identify any potential loss of biodiversity values over the entire Kokoda Offset Site;
- document the ecological characteristics of remnant woodland vegetation to establish a baseline for developing accurate closure criteria for the regeneration of DNG;
- assess the recovery of DNG areas;
- assess and map the presence of threats such as significant populations of pest fauna species or weed infestations; and
- identify the need for additional or corrective management measures to achieve the performance indicators and completion criteria.

8.2 Monitoring Timing and Schedules

Ecological monitoring will be annual for the first five years (however DNG monitoring will also be undertaken at six months – see Section 8), then every three years for the following 15 years. The first ecological monitoring survey will be completed within six months of the implementation of the BOMP, and subsequent monitoring events should occur in the same season. It is recommended that the ecological monitoring surveys be undertaken in spring or autumn as there tends to be a lower diversity of species detectable in the more extreme weather conditions of winter and summer seasons (except where specific seasons are required for targeted bird surveys).

8.3 Ecological Monitoring Techniques

The monitoring program incorporates techniques that:

a) are relatively simple to measure, can be replicated with limited subjectivity, and are reproducible;

b) adopt the SMART principles (specific, measurable, achievable, realistic and timely);

c) are targeted towards recording information that provides a good indication of the status of the biodiversity values of the Kokoda Offset Site;

d) allow for floristic composition and structure to be monitored over time using basic statistical analysis;

e) allow for comparison to reference (control) sites; and

f) are cost effective.

8.3.1 Vegetation monitoring

The ecological monitoring program for the Kokoda Offset Site will include a combination of condition assessments, floristic sampling, sapling survivorship counts and stratified quadrat sampling. Revegetation areas will be monitored by sapling survivorship counts of planted tubestock and condition assessments of surviving tubestock. Regeneration areas (DNG areas where grazing pressure from domestic stock has been removed) will be monitored via stratified and permanent quadrats. Floristic assessments will be undertaken using representative plots and standard botanical survey approaches (e.g. cover-abundance measures) to assess the floristic recovery of the DNG in comparison to the floristic composition of reference sites.

Stratified quadrats will be established in appropriate target communities within the Kokoda Offset Site. The aim of this is to provide reference sites to measure regeneration/ revegetation success against. In the event that regeneration/revegetation sites are unsuccessful in trending towards the ecological values of the reference sites, adaptive management will be undertaken, as required. This may include modifying management actions, or supplementing management actions with new or additional techniques to promote the recovery of regeneration/revegetation sites towards the values of reference sites.

Sections 9.6 (weed management) and 9.7 (regeneration of derived native grasslands) detail the individual vegetation monitoring requirements of the Kokoda Offset Site.

8.3.2 Landscape function analysis monitoring

Monitoring will include Landscape Function Analysis (LFA) techniques to assess the soil structure, stability and nutrient cycling within the DNG recovery areas. LFA is a standardised monitoring procedure that uses rapidly acquired field-assessed indicators to assess the biogeochemical functioning of landscapes (Tongway and Hindley 2004). LFA is based mainly on processes involved in surface hydrology: rainfall, infiltration, runoff, erosion, plant growth and nutrient cycling. The standard LFA methods as described by Tongway and Hindley (2004) will be followed for the survey.

A minimum of eleven LFA sites will be sampled within DNG recovery areas, five within Grey Box – Grassy Woodland EEC, three in Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest, one in Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest low quality, one in White Box Grassy Woodland CEEC and one in Grey-Box – Ironbark woodland non EEC. Suitable reference sites in remnant woodland of the target community within the Kokoda Offset Site will also be sampled. Reference sites will include a minimum of three in Grey Box – Grassy Woodland EEC and three in Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest.

8.3.3 Threatened bird monitoring

Threatened bird monitoring will be undertaken at the Kokoda Offset Site, focussing on key threatened species. The monitoring program will comprise of bird surveys of existing woodland and recovering DNG areas focusing on the presence of the threatened the grey-crowned babbler, superb parrot, swift parrot and regent honeyeater. Threatened bird monitoring will cover both the existing remnant vegetation areas as well as the recovering DNG areas, once there has been reasonable growth of canopy species (new sites will therefore be added as regeneration/revegetation areas progress). Bird monitoring will be undertaken during winter for the regent honeyeater and swift parrot (during periods when eucalypt trees are flowering) and during early spring for the superb parrot when it is most likely to be utilising the Kokoda Offset Site during local seasonal movements.

Section 9.8 details individual threatened bird monitoring requirements for the Kokoda Offset Site.

8.4 Biannual Inspections

Inspections will be undertaken biannually (twice yearly) by Northparkes environment team. During these inspections, a broad assessment of the site condition will be made and management strategies will be adapted accordingly if required.

During these inspections no systematic sampling will be undertaken, rather a broad assessment of the site condition will be made from a drive-over of the site. The inspections will aim to identify any visually obvious management concerns that require immediate attention such as new infestations of invasive weeds/pest fauna or track and fence condition. The general progress of regeneration and revegetation efforts will also be assessed during these inspections.
Key Components of Biannual Inspections:

- observe and document any weed and pest fauna infestations requiring management;
- assess the success of completed weed and pest management actions;
- assess the condition of fences, gates and access tracks, identifying areas requiring maintenance;
- document any areas of erosion, sedimentation or salinity requiring management;
- assess the progress of natural regeneration within the DNG areas; and
- inspect the condition of other infrastructure in the Kokoda Offset Site such as sheds, homesteads etc.

9. MANAGEMENT STRATEGIES, MONITORING ACTIONS, PERFORMANCE AND COMPLETION CRITERIA

The ability to report on the success of management actions relies on frequent and systematic monitoring of the Kokoda Offset Site. The monitoring program will incorporate annual comprehensive and systematic monitoring as well as biannual (twice yearly) inspections.
Ecological monitoring will be annual for the first 5 years, then every 3 years for the following 15 years. The first ecological monitoring survey will be completed within 6 months of the implementation of the BOMP, and subsequent monitoring events should occur in the same season. It is recommended that the ecological monitoring surveys be undertaken in spring or autumn as there tends to be a lower diversity of species detectable in the more extreme weather conditions of winter and summer seasons (except where specific seasons are required for targeted bird surveys).

Inspections will be undertaken biannually (twice yearly) by Northparkes environment team. During these inspections, a broad assessment of the site condition will be made, and management strategies will be adapted accordingly if required. During these inspections no systematic sampling will be undertaken; rather a broad assessment of the site condition will be made from a drive-over of the site. The inspections will aim to identify any visually obvious management concerns that require immediate attention such as new infestations of invasive weeds/pest fauna or track and fence condition.

The following management and improvement strategies have been developed for the Kokoda Offset Site to ensure that the BOMP objectives and targets are met. The strategies integrate findings and recommendations from the Northparkes Mines Step Change Project Environmental Assessment, the Preliminary Documentation report (Umwelt 2013a and 2013b) and the Northparkes Step Change Project Response to Submissions Addendum Report (Umwelt 2013c).

9.1 Access Management and Exclusion of Stock

9.1.1 Management actions

All domestic stock were removed from the Kokoda Offset Site in early 2015, within a month of the property being purchased by Northparkes.

9.1.2 Performance and completion criteria

Performance criteria and completion criteria for the access management and stock exclusion are provided in Table 6.

Table 6: Access management and exclusion of stock performance criteria and completion criteria

Action	Performance criteria	Completion criteria
Exclude stock	All stock excluded by 30 June 2015, or earlier.	Completed.

9.2 Fencing and Signage

Fencing will be used to demarcate the boundaries of the Kokoda Offset Site to exclude stock, as well as to protect from unauthorised access and disturbance. Fences will be suitably signposted to identify the purpose of the Kokoda Offset Site. Fences will be maintained to prevent stock access to the offset area.

9.2.1 Management actions

Boundary Fencing

Any new fencing (other than the boundary fences with adjoining neighbours) used within, or on the boundary of, the Kokoda Offset Site will use plain (i.e. non-barbed) wire on the upper strands, and as little barbed wire generally as possible to minimise the impact on native fauna species. As part of the ongoing monitoring program, if a restricted level of barbed wire on fencing is shown to fail to exclude stock, additional measures that pose minimal impact to native fauna will be investigated and implemented.

Removal of Redundant Fences

Where possible, redundant internal fences will be removed to allow free movement of fauna throughout the Kokoda Offset Site. Any such works would be appropriately assessed to ensure there is no adverse effect on existing vegetation and habitats.

Signage

Signs on access gates and strategic locations on boundary fencing have been erected. The signs will explain that the land is managed for conservation values and that there is restricted access to people, livestock and activities within the area.

9.2.2 Monitoring requirements

Maintenance of Fences

Boundary fence inspections will be undertaken as part of the biannual inspections by the Northparkes environment team to ensure that neighbouring stock are not able to enter the Kokoda Offset Site.

9.2.1 Performance and completion criteria

Performance and completion criteria for the fencing and signage are provided in Table 7. Trigger points for adaptive management of the fencing and signage are provided in Table 8.

Table 7: Fencing and signage performance and completion criteria

Action	Performance criteria	Completion criteria
Twice yearly boundary fence inspections by Northparkes environmental advisors	Completed twice per year	Ongoing and results included in annual reporting.
Signage inspection by Northparkes environment team	Completed twice per year	Ongoing and results included in annual reporting.

Table 8: Fencing and signage trigger points for adaptive management

Action	Trigger Point for Adaptive Management	Adaptive Management
Boundary fence inspections	Failure of fence allows humans or grazers to enter the site	Repairs undertaken as reqired
Signage inspection	Signage removed or damaged	Repair or replace signs

All adaptive management actions undertaken are to be documented.

9.3 Offset site in-perpetuity conservation

9.3.1 Management actions

The Kokoda Offset Site will be secured for in-perpetuity conservation. Northparkes has purchased the Kokoda Offset Site is currently undertaking the process of securing a Voluntary Conservation Agreement (VCA) across the Kokoda Offset Site.

9.3.2 Performance and completion criteria

Performance and completion criteria for the offset site in perpetuity are provided in Table 9.

Table 9: Offset site in-perpetuity conservation performance and completion criteria

Action	Performance criteria	Completion criteria
Purchase Kokoda Offset Site	Completed. Purchased in 2015	Completed
Establish an in perpetuity conservation mechanism across the Kokoda Offset Site	Completed on 12 June 2018	Completed

9.4 Track Maintenance

9.4.1 Management actions

Routine maintenance of tracks within the Kokoda Offset Site will be undertaken as required to make navigation through the property easier when implementing on-ground management and monitoring activities. The tracks also need to be well maintained for firefighting access if required.

9.4.2 Monitoring requirements

The condition of tracks will be assessed during biannual (twice yearly) inspections, with maintenance works undertaken as necessary.

9.4.3 Performance and completion criteria

Performance and completion criteria for the maintenance of tracks throughout the Kokoda Offset Site are provided in Table 10. Trigger points for adaptive management of the track inspections are provided in Table 11.

Table 10: Track maintenance performance and completion criteria

Action	Performance criteria	Completion criteria
Inspections of all tracks by Northparkes environment team	To be completed twice per year	Ongoing

Table 11: Track maintenance trigger points for adaptive management

Action	Trigger Point for Adaptive Management	Adaptive Management
Inspections of all tracks twice per year by Northparkes environmental advisors	Tracks blocked by fallen trees, excessively eroding or overgrown, preventing safe driving access	Repairs undertaken as required

9.5 Pest and Kangaroo Management

9.5.1 Management actions

Known feral fauna recorded within the Kokoda Offset Site are fox (*Vulpes vulpes*), rabbit (*Oryctolagus cuniculus*) and brown hare (*Lepus capensis*). These species may impact on the native fauna species through predation and competition for resources such as food, shelter, and breeding sites. Feral animals can also have a detrimental effect on regenerating areas as well as soil stability.

Pest management will comprise baiting control programs for foxes and rabbits, on an as needed basis as determined through monitoring. Where other pest species, such as cats pigs, goats, deer etc., are identified, their numbers will be monitored and control measures appropriate for the species will be included in the pest control program as needed. If monitoring identifies that pest species require control, pest management actions will be implemented in consultation with close neighbours, where possible.

9.5.2 Monitoring requirements

Feral animals (or their sign) will be opportunistically recorded during qualitative bi-annual inspections of the Kokoda Offset Site. If these records indicate the presence of a significant population of feral animals, appropriate adaptive management will be implemented. Bi-annual inspections commenced in April 2015. Data collected from this survey event will be used as the baseline data for ongoing feral animal monitoring.

Kangaroo monitoring will also be undertaken bi-annually within the regenerating woodland area. Monitoring is intended to give an indication of relative presence of kangaroo populations within the regenerating area over time. If a significant increase in the kangaroo population is recorded over two consecutive monitoring periods adaptive management will be investigated. Kangaroo monitoring will commence in 2017, at which point a suitable, repeatable survey methodology will be developed and documented in the Annual Review. All adaptive management actions undertaken are to be documented in the Annual Review.

All adaptive management actions undertaken are to be documented in the Annual Review.

9.5.3 Performance and completion criteria

Performance and completion criteria for pest management are provided in Table 12. Trigger points for adaptive management of the pest controls are provided in Table 13.

Table 12: Pest management criteria and completion criteria

Action	Performance criteria	Completion criteria
Annual opportunistic monitoring of feral animal presence during annual ecological monitoring surveys	Completed annually for the first 5 years then 3 yearly	Ongoing
Six monthly opportunistic monitoring of feral animal presence during site inspections by Northparkes environment officers	Completed every 6 months	Ongoing

Table 13: Pest control trigger points for adaptive management

Action	Trigger Point for Adaptive Management	Adaptive Management
Annual or 6 monthly surveys of the Kokoda Offset Site	Feral fauna species or signs of their presence are identified during 2 or more surveys. Or any feral species is identified during a single survey at a level (species specific) that may be impacting on biodiversity values of the Kokoda Offset Site.	Species specific management program will be developed and implemented. In the event that a species management program may increase the numbers of another pest species (e.g. fox control leading to an increase in cat numbers), both species will be targeted in the management program.

9.6 Weed Management

9.6.1 Management action

Introduced species recorded in the Kokoda Offset Site that are considered environmental weeds include Capeweed (*Arctotheca calendula*), Paterson's curse (*Echium plantagineum*), black-berry nightshade (*Solanum nigrum*), tree-of-heaven (*Ailanthus altissima*) and blackberry (*Rubus fruticosus* sp. agg.). Blackberry (*Rubus fruticosus* sp. agg.) is the only noxious weed species recorded on the Kokoda Offset Site listed in the Cabonne Local Government Area control area.

9.6.2 Monitoring requirements

Weeds will be opportunistically recorded during qualitative bi-annual inspections of the Kokoda Offset Site. If the opportunistic records indicate the presence of a significant population of weed species, appropriate adaptive management will be implemented. Bi-annual inspections commenced in April 2015. Data collected during this survey event will form the baseline data for ongoing weed monitoring. The weed control program aims to eradicate Blackberry and Tree of Heaven from thepreviously mapped locations on the property.

9.6.3 Performance and completion criteria

Performance and completion criteria for weed management are provided in Table 14. Trigger points for adaptive management of the weed controls are provided in Table 15.

Table 14: Weed management performance and completion criteria

Action	Performance criteria year 1	Performance criteria years 2 onwards	Completion criteria
Baseline weed inspection	Competed	NA	Completed
Initial weed control program	Completed	NA	Completed
Six monthly ecological monitoring of mapped weeds by Northparkes environment team	Completed twice per year	Completed twice per year	Ongoing
Weed management as required by monitoring	Undertaken as identified by monitoring	Undertaken as identified by monitoring	Ongoing

Table 15: Weed control trigger points for adaptive management

Action	Trigger Point for Adaptive Management	Adaptive Management
Annual ecological monitoring or 6 monthly surveys	Continued presence of weed plants at next survey period after treatment (e.g. 6 months after spraying).	The species specific management controls will be reviewed. The frequency of the controls may be increased or alternative control measures may be implemented
	Weed plants are identified in areas where they have not been previously identified	The weed management program will be extended to include these areas
	Patches of perennial/annual grass weeds occurring in DNG regeneration or revegetation areas (see Section 9.7)	Spot spray or dig out small clumps. Investigate potential suitability of strategic conservation grazing periodically for weed suppression. Monitor and maintain weed control.

9.7 Regeneration of Derived Native Grasslands

Areas of DNG across the Kokoda Offset Site will be managed back to areas of Grey Box Grassy Woodland EEC or Dwyer's Red Gum – Grey Box – Mugga Ironbark – black Cypress Pine Forest, consistent with the surrounding remnant vegetation.

Grey Box grassy woodlands and derived native grasslands of south-eastern Australia occurs in two forms (SEWPaC, 2012). The most common form is as a grassy woodland comprising a tree layer and an understory that must have native grasses but has a varying proportion of shrubs and herbs (SEWPaC, 2012). The derived native grassland form can occur in patches where the tree canopy and mid layer have been almost entirely removed but the native ground later remains largely intact with high flora diversity (SEWPaC, 2012). Key features of grey box grassy woodland communities include the following:

- Woodland with >50% grey box in the overstorey;
- A shrub layer that is moderately dense to absent and includes species such as Dodonaea viscosa ssp. Spatulata
- A ground layer that includes grasses, flowering plants, chenopods, leaf litter and/ or soil crusts. Common species in this layer include Rhodanthe diffusa, Goodenia pinnatifida, Einadia nutans and Crytogram soil crusts.

An initial assessment of the recovery potential for the DNG areas of the Kokoda Offset Site identified six vegetation management areas which are shown on and summarised in Table 16.

Table 16: Perliminary vegetation management areas

Vegetation Management Area	Area (ha[1])
Grey Box Grassy Woodland - DNG: Active Revegetation Areas	36
Grey Box Grassy Woodland - DNG: Natural Regeneration Areas	38
Grey Box Grassy Woodland - DNG: Potential Recovery Areas	21
Dwyer's Red Gum - Grey Box - Mugga Ironbark - Black Cypress Pine Forest DNG: Natural Regeneration Areas	14
Dwyer's Red Gum - Grey Box - Mugga Ironbark - Black Cypress Pine Forest DNG: Active Revegetation Areas	1.00
Farm Track - Disturbed Land: Potential Recovery Areas	1.32
Total	111

1 = Rounding of totals applied (numbers less than 1 – 2 decimal places, numbers between 1 and 10 – 1 decimal place, and greater than 10 - no decimal places)
DNG = Derived Native Grassland

Three types of vegetation management areas were identified:

- Natural regeneration areas which contained existing signs of regeneration and are expected to regenerate naturally once stock is removed and weeds are controlled.
- Potential regeneration areas which contained limited existing signs of regeneration or occur close to a potential seed source and may regenerate naturally once stock have been removed and weeds are controlled. After 24 months of management the level of regeneration occurring in potential regeneration areas will be assessed and such areas will either be managed for continued natural regeneration or active revegetation will be undertaken.
- Active revegetation areas contained no signs of natural regeneration and had little potential to regenerate naturally. After 24 months of management the level of regeneration occurring in active regeneration areas will be assessed and those identified with poor or no regeneration potential will be identified for active revegetation measures. Planting of tree and shrub species will be undertaken in active revegetation areas with poor or no regeneration potential.

9.7.1 Monitoring of regeneration areas

Management actions

Following the removal of domestic stock, natural regeneration management areas will be allowed to regenerate naturally for a period of 24 months. Weed monitoring will be undertaken to ensure that weed species do not out-compete native species once the grazing pressure has been removed.

At 24 months detailed monitoring of the recovery of the natural regeneration management areas will be undertaken to precisely map the recovery potential of the DNG areas to inform further detailed management actions. Those areas with high recovery potential will be allowed to continue regenerating naturally and management of high recovery potential areas will be limited to weed and pest control measures.

The key actions proposed to facilitate natural regeneration of DNG areas are:

- Stock removal: the removal of all stock grazing activities from the Kokoda Offset Site is likely to be the most important step in encouraging native species to re-establish in areas of DNG.
- Weed monitoring: in years one to three monitoring will be important in identifying key areas for weed control to ensure that native species are given the best chance of regenerating naturally. Weed monitoring will be undertaken through biannual (twice yearly) inspections and annual ecological monitoring to ensure that weed species do not out compete native species once the grazing pressure has been removed.
- Weed control: The removal of stock is likely to initially cause an influx of introduced species to establish and this will need to be managed appropriately to allow native tree and shrub species to naturally regenerate. It may be necessary to initially liberate naturally regenerating native trees and shrubs from introduced or invasive plants that are smothering their growth until they are large enough to out-compete and shade-out the invasive species.
- Pest fauna management: introduced and native fauna species have potential to threaten natural regeneration through overgrazing of new plant growth and soil disturbance. More intensive pest management may be required in assisted natural regeneration areas until a stable and resilient ecosystem is established. If it becomes a major threat to the success of natural regeneration, consideration may need to be given to other controls such as erecting temporary fencing around selected regeneration areas
- Other techniques to be implemented to trial for the regeneration of DNG areas include the use of crash grazing, slashing or controlled burning.

Monitoring requirements

As described above, for the first two years, all areas of DNG will be managed through assisted natural regeneration. After two years, detailed monitoring of the recovery of the DNG areas will be undertaken to precisely map the recovery potential of the DNG areas to inform further detailed management actions (using the vegetation management areas delineated in and Figure 3 as a guide). Those areas with high recovery potential will continue regenerating naturally and management will be limited to weed and pest control measures. Areas with low to moderate recovery potential will be managed using active revegetation techniques. Preliminary estimates of recovery potential indicate 37 hectares are likely to require active revegetation management.

DNG areas with moderate recovery potential will be targeted for low intensity revegetation works. This may include supplementary planting of canopy species (using tubestock) to supplement naturally occurring eucalypt saplings and/or other species as per recommendations of a consultant botanist and consistent with key species of Grey Box Grassy Woodland EEC or the Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest.

DNG areas with low recovery potential will be targeted for moderate to high intensity revegetation works. This may include ripping of soil and planting of tubestock species as per recommendations of a consultant botanist and consistent with the key species of the Grey Box Grassy Woodland EEC or the Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest. Tubestock will be planted at an approximate density of 400 individuals per hectare.

The selection of plant species used in the revegetation strategy is vital to the process of creating a vegetation community that is consistent both structurally and floristically with the target community, particularly in areas where the Grey Box Grassy Woodland EEC is the target. Selection of plant species used in revegetation activities should draw on the floristic results of monitoring in good condition reference sites, in consultation with a qualified and experienced botanist.
The ecological monitoring program for the Kokoda Offset Site DNG regeneration/ revegetation areas will include a combination of condition assessments, floristic sampling, sapling survivorship counts and stratified quadrat sampling. Revegetation areas will be monitored by sapling survivorship counts of planted tubestock and condition assessments of surviving tubestock. Regeneration areas (DNG areas where grazing pressure from domestic stock has been removed) will be monitored via stratified and permanent quadrats. Floristic assessments will be undertaken using representative plots and standard botanical survey approaches (e.g. cover-abundance measures) to assess the floristic recovery of the DNG in comparison to the floristic composition of reference sites.

Stratified quadrats will be established in appropriate target communities within the Kokoda Offset Site to provide reference sites to which the success of regeneration/ revegetation works can be compared. In the event that regeneration/ revegetation sites fail to trend towards the ecological values of the reference sites, adaptive management will be undertaken and management actions will be modified or supplemented with new or additional techniques to promote the recovery of regeneration/ revegetation sites towards the values of reference sites.

Monitoring will include LFA techniques to assess the soil structure, stability and nutrient cycling within the DNG recovery areas. Landscape function analysis (LFA) is a standardised monitoring procedure that uses rapidly acquired field-assessed indicators to assess the biogeochemical functioning of landscapes (Tongway and Hindley 2004). LFA is based mainly on processes involved in surface hydrology, rainfall, infiltration, runoff, erosion, plant growth and nutrient cycling. The standard LFA methods as described by Tongway and Hindley (2004) will be followed for the survey.

The proposed annual monitoring surveys comprise:

- six permanent flora plots will be established in existing remnant target woodland communities (reference sites), comprising:
    - three in Grey Box Grassy Woodland EEC; and
    - three in Dwyer's Red Gum – Grey Box – Mugga Ironbark – black Cypress Pine Forest.

Data on floristics and structure, habitat features and ecological condition will be recorded;

- eleven plots in DNG regeneration/revegetation areas, comprising:
    - five in Grey Box Grassy woodland DNG (EEC) probable active rehabilitation areas;
    - three in Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine DNG probable active rehabilitation areas;
    - one in Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest low quality;
    - one in White Box Grassy Woodland CEEC; and
    - one in Grey Box – Ironbark woodland non EEC.

Data on floristics and structure, habitat features and ecological condition will be recorded;

- sapling survivorship counts of planted tubestock and condition assessments of surviving tubestock in regeneration and revegetation areas (to start in 2015);

- permanent photo point monitoring at each monitoring site;
- a replicable stem count assessment in suitable reference (remnant woodland in target communities) and regeneration (DNG) sites for use in developing completion criteria and tracking future progress (to start in 2015); and
- LFA monitoring surveys in DNG recovery areas and reference sites in remnant woodland in target communities. A minimum of 11 LFA sites will be undertaken.

Performance and completion criteria

Performance and completion criteria for active and natural regeneration management areas are provided in Table 17. Trigger points for adaptive management of the active and natural regeneration management area methods are provided Table 18.

For performance and completion criteria for stock exclusion, weed management and pest management that apply to the regeneration and revegetation of derived native grassland areas see Section 9.1.1 (exclusion of stock), Section 9.5 (pest management) and 9.6 (weed management).

Table 17: Regeneration of derived native grasslands performance and completion criteria

Action	Baseline Surveys year 1	Performance criteria year 2 onwards	Completion criteria
Annual ecological monitoring, including LFA	Baseline ecological monitoring was completed in 2014	Completed annually for the first 5 years then 3 yearly	Ongoing

Table 18: Natural regeneration trigger points for adaptive management

Action	Trigger Point for Adaptive Management	Adaptive Management
Monitoring of DNG recovery potential at 2 years	DNG areas identified with high recovery potential	Those areas with high recovery potential will be allowed to continue regenerating naturally and management will be limited to weed and pest control measures.
	DNG areas identified with moderate recovery potential	DNG areas with moderate recovery potential will be targeted for low intensity revegetation works. This may include supplementary planting of canopy species tubestock to supplement naturally occurring eucalypt saplings and/or other species as per recommendations of a consultant botanist and consistent with the key species of the final target community.
	DNG areas identified with low recovery potential	DNG areas with low recovery potential will be targeted for moderate to high intensity revegetation works. This may include ripping of soil and planting of tubestock species as per recommendations of a consultant botanist and consistent with the key species of final target community.
Annual LFA monitoring	LFA results show a decrease of greater than 25% in soil stability, infiltration or nutrient cycling in successive years	Review current soil management practices and initiate specific control measures.
	Soil stability, infiltration and/or nutrient cycling scores of 1 or more DNG treatment types are not trending towards the values of the relevant reference sites.	Review current soil management practices and initiate specific control measures.
Ecological monitoring of DNG areas	Less than 50% success of plantings in any management area after 1 year	Investigate potential climatic or environmental reasons that may have contributed to the low success rate. Where possible develop strategies to address the climatic or environmental drivers for poor survival rates. Review current planting management practices and initiate specific management measures.

Action	Trigger Point for Adaptive Management	Adaptive Management
		Following the above investigations and development of management strategies to maximise future survival rates, replace the lost plants.
	Vertebrate pest species identified as limiting regeneration potential through grazing	Identify species specific pest management controls and implement specific control measures. Refer to Section 9.5 above (pest management).
	Native vertebrate species limit regeneration through grazing	Identify species specific management controls and implement species specific control measures. Consider exclusion fencing and other plant protection measures if other controls are not identified.
	Low species diversity or species diversity not consistent with target community.	Investigate presence of weed species and undertake targeted weed control where necessary (see Section 9.6) Undertake active revegetation techniques including direct seeding or tubestock planting, following appropriate ground preparation such as weed control, ripping and/or auguring.
	Low or no tree cover appearing	Plant or direct seed trees at an appropriate density using minimal disturbance.
	Tree dieback (from insect pressure, herbicide drift, water stress)	Revegetate with dense shrubs to increase diversity and attract insectivorous birds. Avoid using defoliants near woodlands when windy.
	Dense stands of colonising tree or shrub species dominate regeneration or revegetation areas	• Assess whether thinning is necessary thin manually if appropriate. • Leave if patches are small and plants are native.

9.7.2 Habitat augmentation

Habitat augmentation may be required if the regeneration areas do not meet the habitat structure benchmarks of the reference woodlands at the appropriate maturity stage. If required, nest boxes can be added to trees once that have reached a sufficient size, to accommodate a suite of fauna species that occur in the reference woodlands.
No habitat features salvaged from the impact area will be moved to the offset site as there is a risk that unknown diseases or pathogens could be transferred the approximate 50 kilometres between the sites during that process. Any fallen timber located during the track maintenance works within the offset site will be moved into the DNG regeneration areas, where practical.

Monitoring requirements

If applicable, any habitat augmentation will be monitored for its effectiveness during the annual ecological monitoring program. In the event that nest boxes are installed, an annual monitoring program will be developed which will include monitoring of occupancy rate and box condition.

Performance and completion criteria

Performance and completion criteria and trigger points for adaptive management of any habitat augmentation will be developed if required.

9.8 Threatened Bird Species Monitoring

9.8.1 Monitoring requirements

Threatened bird monitoring will be undertaken at the Kokoda Offset Site, focussing on key threatened bird species. Two threatened fauna species were recorded in the project disturbance area, the grey-crowned babbler (*Pomatostomus temporalis temporalis*) and the superb parrot (*Polytelis swainsonii*). Specific assessments of the potential for the Kokoda Offset Site to offset potential impacts on the swift parrot and regent honeyeater were a focus of the Preliminary Documentation report for the Referral to the Commonwealth Department of the Environment. Annual monitoring surveys of the Kokoda Offset Site will also include surveys for the swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*).

Threatened bird monitoring will comprise bird surveys of existing woodland and recovering DNG areas focusing on the presence of threatened. Threatened bird monitoring will cover both the existing remnant vegetation areas as well as the recovering DNG areas, once there has been reasonable growth of canopy species (new sites will therefore be added as regeneration/ revegetation areas progress). Monitoring should be undertaken during winter for the regent honeyeater and swift parrot (during periods when eucalypt trees are flowering) and during early spring for the superb parrot when it is most likely to be utilising the Kokoda Offset Site during local seasonal movements. Monitoring will be undertaken for the grey-crowned babbler during both winter and spring survey periods.

The proposed monitoring surveys will comprise:

- Plot-based diurnal spring woodland bird surveys. As a minimum, two x 20 minute bird surveys will be undertaken at six reference sites (in target woodland community remnants) and five DNG regeneration sites (consistent with flora monitoring sites where possible). Each survey will cover an approximate two hectare area around the flora monitoring plots. Spring woodland bird surveys will be undertaken in DNG regeneration sites during all growth stages as grey-crowned babblers may occur in both DNG and woodland areas, and superb parrots may forage in DNG areas.
- Plot-based diurnal winter bird surveys for the regent honeyeater and swift parrot. Winter bird surveys should be undertaken in areas of flowering eucalypts across the Kokoda Offset Site. Each year a minimum of six eucalypt flowering sites should be surveyed. If no flowering eucalypts are identified during the winter survey period, the winter bird surveys will be undertaken at the six flora reference sites (in target woodland community remnants). Two 20 minute bird surveys will be undertaken at each site and cover approximately a two hectare area around the flora monitoring plots. Once DNG regeneration areas provide a four metre high canopy, winter bird surveys will also be undertaken across each of the five DNG regeneration areas.;

Opportunistic observations of the four targeted threatened bird species will be recorded during all other monitoring survey activities.

9.8.2 Performance and completion criteria

Performance and completion criteria for threatened bird surveys are provided in Table 19. Trigger points for adaptive management of the threatened bird surveys are provided in Table 20.

Table 19: Threatened bird survey performance and completion criteria

Action	Baseline Surveys year 1	Performance criteria Year 2 onwards	Completion criteria
Annual winter and spring bird surveys	Completed	To be completed annually for the first 5 years then 3 yearly	Ongoing

Table 20: Threatened bird survey trigger points for adaptive management

Action	Trigger Point for Adaptive Management	Adaptive Management
Annual winter bird surveys	No flowering eucalypts are identified during winter months.	Consider undertaking additional winter bird surveys during May or October if a large proportion of the eucalypt trees present at the Kokoda Offset Site flower during May or October.

9.9 Seed Collection

The existing woodland vegetation of the Kokoda Offset Site provides a valuable source of native seed. If active revegetation activities are required, this seed resource will be utilised where practical. The use of local provenance seed can improve the success of revegetation, while also preserving the genetic integrity of the local vegetation.

Sustainable seed collection from the Kokoda Offset Site will also be considered for use in the rehabilitation of Northparkes Areas where suitable.

9.10 Appropriate Management of Adjacent Agricultural Land

There will be ongoing consultation with adjacent land owners and/or managers to ensure they are aware of the biodiversity conservation objectives of the Kokoda Offset Site.

9.11 Erosion and Sedimentation

Owing to a high vegetation cover across most of the Kokoda Offset Site, erosion is not currently a significant management issue. Inspections of any areas of erosion concerns should be included in routine biannual inspections, targeting riparian areas and sites with limited vegetation cover.

If an area of significant erosion concern is identified, appropriate short term erosion and sediment controls will be implemented and longer term stabilisation actions such as vegetation establishment will be investigated.

9.12 Salinity

Salinity has not been identified as an issue of concern within the Kokoda Offset Site to date. Given that the site has a high vegetation cover it is not likely to become a management issue. However, any evidence suggesting the land is affected by salinity should be documented and the appropriate management and remediation strategies implemented.

9.13 Bushfire Management

A Bush Fire Management Plan for the Kokoda Offset Site (BFMP) has been prepared (refer Appendix 4). The vegetation of the Kokoda Offset Site requires appropriate bushfire management to protect life and property while providing the necessary protection to the significant ecological features of the area.

The BFMP plans for the exclusion of fire from regeneration and revegetation areas, where possible. This allows young vegetation communities to mature to a stage where they are able to withstand bushfire and regenerate naturally following a fire event. This is nominally at least 15 years, but is dependent on the success of plant establishment and the vegetation community present. The Bushfire Management Plan also considers the locations of known records of threatened species and TECs. Fire should be excluded from these areas, where possible, so that planned burn frequency and intensity does not threaten the persistence of threatened species and TECs.

The use of low intensity controlled burns to facilitate natural regeneration from the soil seed bank may need to be considered later in the project if natural recruitment levels are not sufficient. If required, an appropriate strategy will be developed in close consultation with the Rural Fire Service.

9.14 Management of Cultural Heritage Values

The Kokoda Offset Site is not subject to an Aboriginal Cultural Heritage Management Plan, however there is potential that it may contain sites of Cultural Heritage Value. As such, appropriate consideration to Cultural Heritage values will be made in regards to activities undertaken within the Kokoda Offset Site.

10. ADAPTIVE MANAGEMENT

10.1 Adaptive Management Process

Adaptive management of the BOMP will be responsive to any new and relevant data that may arise through the monitoring described in Section 8, legislative change or any other studies completed at the site. This will enable a flexible approach to management commitments, allowing ongoing feedback and refinement of the BOMP. Adaptive management will be a key mechanism to address the risks to the successful implementation of the BOMP. Adaptive management steps include regular review of the BOMP, including adaptation of targets and performance indicators, recognising potential risks to the successful implementation of the BOMP and having a frame work in place for corrective actions.

10.2 Review of BOMP

The BOMP is to undergo an internal review and revision every three years to refine and make improvements to the management strategies and to assess their performance against preliminary performance indicators and completion criteria. The three year review will look for opportunities to improve the management strategies and further develop and forecast the longer term performance indicators and completion criteria.

Amendments to the BOMP in response to adaptive management and continual improvement requirements that are consistent with the conditions of approval do not need to be submitted to relevant authorities for approval.

10.3 Assess targets and performance indicators

The performance indicators and completion criteria outlined in Section 9 are preliminary and apply to the first three years of the BOMP implementation. Due to a delayed registration of the Voluntary Conservation Agreement, commencement of management actions began in June of 2018.

A three yearly reassessment of the BOMP will be undertaken in 2021, unless a process changes earlier than this date that requires consideration. This three yearly review will reassess the targets and performance indicators and will be:

- adapted and changed as targets are met and new challenges arise;
- will be assessed and redeveloped as appropriate in response to monitoring outcomes; and
- Will be assessed for the success of the management and improvement strategies.

Modifications to the targets and performance indicators will be recorded in a revised BOMP for the Kokoda Offset Site.

10.4 Potential risks and corrective actions

There are a number of potential risks, or situations where preliminary performance indicators and completion criteria might not be achieved. The key risk of the Kokoda BOMP not succeeding relates to the return of DNG communities to woodland communities, and to the management of threats such as weeds and pests. The use of reference sites will assist in identifying whether observations from monitoring are able to be addressed by modifying management actions, or if they are due to broader conditions that can't be controlled such as climatic and seasonal factors (e.g. drought).

A list of potential situations where biodiversity conservation objectives of this BOMP may not be met is provided in Table 21 along with potential corrective actions. This list is adapted from Rawlings *et al.* (2010).

Table 21: Risks and recommended corrective action measures[1]

Potential Risks	Recommended Corrective Actions
General Management Risks	
Unauthorised stock access	• identify access points and repair fences appropriately; and • communicate with adjacent landholders to emphasise that no stock are to have access to the Kokoda Offset Site.
Infestations of noxious and environmental weeds are increasing or new species detected.	• adapt weed management program and modify strategies accordingly.
Infestations of pest animals are increasing or new species detected.	• adapt pest management program and modify strategies accordingly.
Risk to Success of Regeneration/Revegetation of DNG Areas	
No regeneration of plants, or indicator species missing	• assess fencing and ensure there is no un-authorised stock access; • control exotic weeds and pest animals to reduce competition; and • if deemed necessary, instigate active regeneration techniques including direct seeding or tubestock planting, following appropriate ground preparation.
Low species diversity or species diversity not consistent with target community.	• targeted weed control; and • instigate active revegetation techniques including direct seeding or tubestock planting, following appropriate ground preparation such as weed control, ripping and auguring.
Low or no tree cover	• plant/ direct seed trees at appropriate rate using minimal disturbance.
Tree dieback (from insect pressure, herbicide drift, water stress)	• revegetate with dense shrubs to increase diversity and attract insectivorous birds; • avoid using defoliants near woodlands when windy; and • increase patch size through revegetation.
Patches of perennial/annual grass weeds occurring	• spot spray or dig out small clumps; • investigate suitability of strategic conservation grazing periodically for weed suppression and to stimulate native pasture; and • monitor and maintain control.
Dense stands of colonising tree or shrub species dominate regeneration or revegetation areas	• assess whether thinning is necessary; • leave if patches are small and plants are native; and • thin manually if appropriate.
Scarcity of key habitat features present in relation to reference sites	• add habitat features such as logs or branches; • control feral predators; • increase the number of vegetation layers in the patch; and • establish nest boxes for target species.

1 = Adapted from Rawlings *et al.* (2010)

11. REPORTING AND DOCUMENTATION REQUIREMENTS

11.1 Record Keeping

Northparkes will maintain accurate records substantiating all activities associated with measures taken to implement the BOMP. These records may be subject to audit by the Department or an independent auditor.

11.2 Annual Reporting

Condition 12 of the Commonwealth Project Approval states that:

> 'Within three months of every 12 month anniversary of the commencement of the action, the person taking the action must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of any plans as specified in the conditions. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the Department at the same time as the compliance report is published. The person taking the action must also notify any non-compliance with this approval to the Department in writing within two business days of becoming aware of the non-compliance'.

Further to this, Condition 8 of the NSW Development Consent states that:

> 'the Proponent shall provide regular reporting on the environmental performance of the project on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval'.

In accordance with these conditions, within 3 months of every 12 month anniversary of the commencement of the Project, Northparkes will prepare an Annual Review which will be published on their website. In relation to the BOMP, the Annual Review will contain the following information:

1. compliance with each of the conditions of approval;
2. description of implementation of the BOMP as specified in the conditions of approval;
3. rehabilitation and management activities undertaken within the reporting period, including estimated costs;
4. results of monitoring events for the reporting period; and
5. required amendments to the management or monitoring processes as identified by the adaptive management mechanism.

Utilising the adaptive management mechanism outlined in Section 10, the results of monitoring will be utilised to inform updates to the management actions to be undertaken in the Kokoda Offset Site.

11.3 Ecological Monitoring Reporting

An ecological monitoring report will be prepared on completion of each monitoring survey. The report will include:

- a detailed description of the monitoring methods employed;
- a discussion of the results;
- an assessment as to whether the preliminary performance indicators have been met, and how the project is tracking towards the completion criteria;
- a revision of the management and improvement strategies as appropriate; and
- a revision of the preliminary performance indicators and completion criteria (if required).

12. CONSERVATION BOND AND IMPLEMENTATION COSTS

A Conservation Bond for the Kokoda Offset Site is required by DPE in accordance with Condition 28. The purpose of this bond is to cover the cost of the management of land required to be set aside as an offset area, should the mine consent holder be unable or unwilling to continue management of the land. The Conservation Bond value is based on all the activities identified in the approved BOMP and is the full cost of implementing the biodiversity offset strategy. The Conservation Bond estimate has been prepared in accordance with relevant guidelines and accepted practice to inform this process.

13. BOMP CHECKLIST AND IMPLEMENTATION SCHEDULE

A checklist summarising the Kokoda Offset Site BOMP actions required, and their schedule for implementation for the first three years is provided in Table 22. This is a snapshot of the key actions required in the first three years of implementation of the BOMP. Reference to the relevant sections of this BOMP should be made for more detail of the actions required.

Table 22: Checklist and implementation schedule for the Kokoda offset site BOMP

Actions/Targets	Timeframe
Management and Improvement Actions	
Install necessary boundary fencing and signage for the Kokoda Offset Site.	Complete.
Remove stock grazing activities from the Kokoda Offset Site.	Complete Authorised strategic conservation grazing may be adopted for ecological restoration purposes
Establish an appropriate long-term conservation mechanism for the Kokoda Offset Site.	To be agreed upon before 12 June 2018.
Lodge a conservation bond.	Complete
Routine inspection and maintenance of tracks and fences by Northparkes environmental officers.	Biannual (twice yearly) inspections. Maintenance is required throughout the life of the BOMP.
Establish an effective annual weed and pest control programs.	To be established in Year 1. Annually review and revise.
Undertake weed and pest control activities.	Commencing Year 1, concentrate efforts in DNG areas in Years 1 – 3 to assist natural regeneration.
Establish woodland vegetation in areas of derived native grassland (DNG) through assisted natural regeneration.	Implement assisted natural regeneration activities (weed and pest control, stock removal etc.) in Years 1-5. Assess progress towards performance indicators and completion criteria during the Year 3 review of the BOMP (incorporating results of inspections and monitoring). Commence active revegetation methods after Year 2 if natural regeneration is not progressing appropriately.
Active revegetation activities	Will only commence if necessary after a minimum of 2 years trial with assisted natural regeneration. The need for active revegetation will be assessed at each 3 year revision of the BOMP.
Monitoring Actions	
Establish a suitable monitoring program to assess the success of ongoing management and improvement strategies	Complete
Ecological Monitoring	Commence surveys in autumn or spring in Year 1 (baseline survey), and undertaken annually for first 5 years. Winter migratory bird monitoring to commence in winter of Year 1 (baseline survey).
General inspections across the Kokoda Offset Site by Northparkes environmental officers.	Biannually from Year 1.
Reporting and Documentation Actions	
Accurate records are being maintained substantiating all activities and monitoring relating to implementation of the BOMP.	Ongoing from Year 1.
Collate data on actions implemented and results of inspections and monitoring into the Annual Review.	Annually from Year 1.

Actions/Targets	Timeframe
Ecological Monitoring Report	Following completion of each monitoring period, within 3 months of each monitoring survey event, commencing Year 1 (baseline survey).
Update BOMP, including a revision of management actions, performance indicators and completion criteria.	Every 3 years from commencement (earlier if deemed necessary).

14. REGULATORY REQUIREMENTS

The Kokoda BOMP addresses the relevant components of schedule 3 conditions 25-29 and schedule 6 condition 3 of the NSW Development Consent (DC11_0060), and conditions 4 – 9 of the Commonwealth Approval (EPBC 2013/6788) for the Northparkes Mines Step Change Project. The details of the NSW and Commonwealth conditions and reference to where they are addressed in this BOMP are provided in Table 23 and Table 24.

Table 23: NSW Development Consent Conditions

Requirement
Schedule 3
25. The Proponent shall actively manage and maintain the populations of Pine Donkey Orchid located to the north of the project area (near Adavale Lane) and near the E48 subsidence zone. *Note: The locations of the Pine Donkey Orchid populations are shown on the figure in Appendix 6 of Consent.*

26. The Proponent shall implement the biodiversity offset strategies summarised in Table 7 below, shown conceptually in Figures 1, 2 and 3 of Appendix 7 and detailed in the table at Appendix 7, to the satisfaction of the Secretary.

Limestone National Forest Offset	***Minimum Size hectares (ha)***
Revegetate land	45.1
Sub-Total	**45.1**
Estcourt Tailings Storage Facility Offset	
Vegetation Community:	
Yellow Box Tall Grassy Woodland	3.3
Inland Grey Box – White Cypress Pine Tall Woodland	38.8
Derived Tussock Grasslands	23
Sub-Total	**65.1**
Kokoda Biodiversity Offset	
Vegetation Community:	
Grey Box Grassy Woodland EEC	13
Grey Box Grassy Woodland DNG EEC	96
White Box Grassy Woodland EEC	2.2
Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest	150
Rocky Rise Shrubby Woodland	26
Grey Box – Ironbark Woodland	25
Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine DNG	15
Dwyer's Red Gum Creekline Woodland	9.4

Requirement

Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Woodland Low Quality	8.6
Mugga Ironbark Woodland	1.9
Farm tracks and dams (disturbed lands)	2.5
Sub-Total	**350.0**

Notes:

- *The The Limestone National Forest Biodiversity Offset area is marked in blue and labelled "Addition To Limestone National Forest" in Figure 1 of Appendix 7 of the Consent.*
- *The Estcourt Tailings Storage Facility Biodiversity Offset area is marked with bold black line in Figure 2 of Appendix 7 of the Consent.*
- *The Kokoda Biodiversity Offset area is marked with red line in Figure 3 of Appendix 7 of the Consent.*

The Proponent shall ensure that the Kokoda Biodiversity Offset provides suitable habitat for all the threatened fauna species confirmed and identified as being present in the disturbance areas.

Note: The threatened fauna species confirmed and identified as being present in the disturbance areas are listed in Appendix 8 of the Consent.

27. By the 30 June 2015, unless the Secretary agrees otherwise, the Proponent shall make suitable arrangements to protect the Kokoda Biodiversity Offset in perpetuity in consultation with BCD and to the satisfaction of the Secretary.

28. By 30 June 2015, unless otherwise agreed by the Secretary, the Proponent shall lodge a Conservation Bond with the Department to ensure that the biodiversity offset strategies are implemented in accordance with the performance and completion criteria of the Biodiversity Management Plan (refer to Condition 29 below). The sum of the bond shall be determined by:

(a) calculating the full cost of implementing the biodiversity offset strategy (other than land acquisition costs); and

(b) employing a suitably qualified quantity surveyor to verify the calculated costs,

to the satisfaction of the Secretary.

If the biodiversity offset strategies are completed generally in accordance with the completion criteria in the Biodiversity Management Plan to the satisfaction of the Secretary, the Secretary will release the bond.

If the biodiversity offset strategies are not completed generally in accordance with the completion criteria in the Biodiversity Management Plan, the Secretary will call in all, or part of, the conservation bond, and arrange for the satisfactory completion of the relevant works.

-
- Notes:
  - *This condition does not apply to the Limestone National Forest Offset;*
  - *Existing bonds which have been paid for the Estcourt Tailings Storage Facility Biodiversity Offset remain current and are satisfactory to fulfil the requirements of this condition;*
  - *Alternative funding arrangements for long-term management of the Biodiversity Offsets, such as provision of capital and management funding as agreed by BCD as part of a Biobanking Agreement or transfer to conservation reserve estate can be used to reduce the liability of the conservation and biodiversity bond, and*
  - *The sum of the bond may be reviewed in conjunction with any revision to the Biodiversity Offsets.*

Requirement

29. The Proponent shall prepare and implement a Biodiversity Management Plan for the project to the satisfaction of the Secretary. This plan must:

(a) be prepared in consultation with BCD, and submitted to the Secretary for approval prior to the commencement of any development on site;

(b) describe the short, medium, and long term measures that would be implemented to:

- manage the remnant vegetation and fauna habitat on the biodiversity offset sites;
- restore the derived native grassland component of the Grey Box Grassy Woodland EEC community within the Kokoda Biodiversity Offset to woodland community;
- implement the biodiversity offset strategies; and
- integrate the implementation of the biodiversity offset strategies to the greatest extent practicable with the rehabilitation of the site (where relevant);

(c) include detailed performance and completion criteria for evaluating the performance of the biodiversity offset strategies, and triggering remedial action (if necessary);

(d) include a detailed description of the measures that would be implemented for:

- enhancing the quality of existing vegetation and fauna habitat in the biodiversity offset areas, including the derived native grassland component of the Grey Box Grassy Woodland EEC community within the Kokoda Biodiversity Offset;
- creating native vegetation and fauna habitat in the biodiversity offset areas and rehabilitation area through focusing on assisted natural regeneration, targeted vegetation establishment and the introduction of naturally scarce fauna habitat features (where necessary);
- managing and maintaining the populations of Pine Donkey Orchid located to the north of the project area (near Adavale Lane) and near the E48 subsidence zone (refer to Appendix 6);
- collecting and propagating seed;
- managing any potential conflicts between the proposed enhancement works in the biodiversity offset areas and any Aboriginal heritage values (both cultural and archaeological) in these areas;
- managing salinity;
- controlling weeds and feral pests;
- controlling erosion;
- managing grazing and agriculture on site;
- controlling access; and
- bushfire management;

(e) include a seasonally-based program to monitor and report on the effectiveness of these measures, and progress against the detailed performance and completion criteria;

(f) identify the potential risks to the successful implementation of the biodiversity offsets, and include a description of the contingency measures that would be implemented to mitigate against these risks; and

(g) include details of who would be responsible for monitoring, reviewing, and implementing the plan.

Schedule 6

Requirement
3. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include: (a) detailed baseline data; (b) a description of: • the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; • the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures; (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria; (d) a program to monitor and report on the: • impacts and environmental performance of the project; • effectiveness of any management measures (see c above); (e) a contingency plan to manage any unpredicted impacts and their consequences; (f) a program to investigate and implement ways to improve the environmental performance of the project over time; (g) a protocol for managing and reporting any: • incidents; • complaints; • non-compliances with statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria; and (h) a protocol for periodic review of the plan.

Table 24: Commonwealth EPBC Act Approval Conditions

Requirement
4. To compensate for the loss of 46 hectares of GBGW and the related and additional loss of habitat for other matters of national environmental significance (Polytelis swainsonii; Lathamus discolour; Anthochaera phrygia) the person taking the action must secure the offset lands identified as the 'Kokoda Offset Site' in Section 2.3 of the Preliminary Documentation. These offset lands must be protected by a legal instrument under relevant legislation on the title prior to commencement of the action
5. The instrument referred to in Condition 4 must: (a) provide for the legal protection of the land for the duration of the impact (b) prevent any conflicting future development activities, including mining and mineral extraction; (c) c) ensure the active management of the land (in accordance with Condition 9).
6. The person taking the action must provide evidence to the Department of their compliance with Condition 4, along with offset attributes, shapefiles and textual descriptions and maps to clearly define the location and boundaries of the offset sites, prior to the commencement of the action.
7. In the event that Conditions 4 and 5 cannot be met, then the person taking the action must secure alternative offset lands to the satisfaction of the Department prior to the commencement of the action.
8. The area of land contained within the offset lands that are secured must include appropriate areas of offset lands (consistent with the Department's EPBC Act offsets policy) for each of the matters of national environmental significance that are impacted by the action, as per Section 2.4.2 and Appendix 6 of the Preliminary Documentation.

Requirement
9. The offset lands ('Kokoda Offset Site') identified in Condition 4 must be managed to improve and maintain the condition of the offset lands to the satisfaction of the Department to achieve the conservation objectives of the offset lands, including: (a) development of a suitable management plan for the offset lands which specifies conservation objectives and how they are to be achieved. The conservation objectives must be clearly set out, measurable and consistent with the conservation management intent described in Section 2.3 of the preliminary documentation. (b) implementation of all management actions and conservation measures identified in the Preliminary Documentation, including in Section 2.3 and Appendix 7, such as, weed management, pest management, stock exclusion and ecological monitoring; (c) active management of derived native grassland areas (GBGW) to allow regeneration and full recovery of these areas of GBGW ecological community over time; (d) allocation of appropriate funding to achieve the conservation objectives; (e) regular monitoring against conservation objectives and adaptive management as appropriate to achieve the conservation objectives.

14.1 Authority Consultation

Consultation with the relevant authorities including the NSW Office of Environment and Heritage (OEH) and the NSW Department of Planning and Environment (DPE) will occur throughout the implementation of this BOMP and throughout the ongoing management of the Kokoda Offset Site, as required.

Consultation with the Commonwealth Department of the Environment (DoE) has been undertaken as part of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) project approval process and will continue through the implementation of this BOMP, as required.

This BOMP was initially submitted to the Department of Planning and Environment (DPE) in November 2014. In September 2015, Northparkes received comments from the Department of Planning and Environment requesting Northparkes to amend additional information in this BOMP. Northparkes amended the BOMP and these comments are detailed in **Error! Reference source not found.**. Northparkes also received recommendations on the BOMP in December 2015 from OEH. These recommendations have been addressed in the current version of the BOMP and are detailed further in **Error! Reference source not found.**.

14.2 Impact Mitigation Strateies

Northparkes sought to avoid and minimise potential impacts on the ecological values of the proposed disturbance area throughout the Project planning process. This has included avoidance and minimisation of disturbance of key vegetation communities, particularly the White Box – Yellow Box – Blakely's Red Gum Woodland EEC and Grey Box Grassy Woodland EEC.

Key impact mitigation strategies in the Project Area include weed and feral animal control, general operation controls such as dust, noise, fugitive light and surface water, tree hollow replacement with nest boxes, salvage of ground habitat features (logs, boulders, etc.) for the creation of habitat features in nearby areas, a comprehensive tree felling procedure to limit impacts on hollow-dependent threatened species and the establishment of an annual ecological monitoring program.

These key impact mitigation strategies will be detailed in revision to relevant management strategies and plans. These revised strategies and plans includes the Flora and Fauna Management Plan (FFMP) and will be expanded to include areas to be impacted by the Project.

15. REFERENCE MATERIALS

Table 24: Reference Materials

Document Title	ID No. | Year
North Mining Limited, 2006. Management Plan – Site Wide – Land use. North Mining Limited.	2006
North Mining Limited, 2008. Management Plan – Site Wide – Flora and Fauna. North Mining Limited.	2010
Rawlings, K., Freudenberger, D. and Carr, D. (2010) *A Guide to Managing Box Gum Grassy Woodlands*, Department of the Environment, Water, Heritage and the Arts, Canberra	2010
Deparment of Sustainability, Environment, Water, Populations and Communities (SEWPaC) (2012). Grey Box (Eucalyptus macrocarpa) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia: A guide to the identification, assessment and management of a nationally threatened ecological community. Commonwealth of Australia. Canberra.	2012
Tongway, D J and Hindley, N L 2004. *Landscape Function Analysis: Procedures for monitoring and assessing landscapes with special reference to mine sites and rangelands.* CSIRO Sustainable Ecosystems, Canberra.	2004
Umwelt (2013a) *Environmental Assessment Northparkes Step Change Project*. Prepared by Umwelt on behalf of Northparkes Mines.	2013
Umwelt (2013b) Northparkes Mines Step Change Project Preliminary Documentation EPBC Act Referral 2013/6788. Prepared by Umwelt on behalf of Northparkes Mines.	2013
Umwelt (2013c) Northparkes Mines Step Change Project Response to Submissions Addendum Report. Prepared by Umwelt on behalf of Northparkes Mines, November 2013.	2013

16. REGULATORY COMMENTS

Biodiversity Management Plan – Updates to BOMP based on Department of Planning and Environment comments received in September 2015.

DoP comment	Comments	Status
Still appears in draft from	Document reformatted to Northparkes style for consistency with of Management Plan. Draft removed.	Complete
Appendices 1 & 2 missing	Attached Limestone National Forest Offset Area Revegetation Plan (Appendix 1) and Vegetation Management Plan (for the Estcourt Offset area) (Appendix 2)	Complete
Figures 2.3 and 2.4 missing	Figures updated to reflect the table of contents	Complete
Section 6.3 requires updating	Section 6.3 has been updated. As we are currently only in the first year on the BOMPs implementation, no results can be reported at this stage.	Complete Section 6.3
Objectives to include mention of Donkey Orchid conservation and management.	All information relating to the management of the pine donkey orchid (PDO) has been moved to Appendix 3 – Species Management Plan for the Pine Donkey Orchid (SMP for the PDO). Northparkes was requested to draft a SMP for the PDO following the submission of the BOMP to provide additional information about this particular threatened species and its management. As such, having all the information regarding the PDO in the one place provides clarity and increases readability, so that the BOMP only applies to the Kokoda offset site and all information relating to the PDO is centralised in one location.	Complete Refer Species Management Plan (Appendix 3)
Table 1. To include consent conditions for Donkey Orchid	Consent conditions relating to PDO have been included with a cross reference to Appendix 3 (SMP for the PDO).	Complete

Biodiversity Offset Management Plan- Additionally changes made to BOMP based on recommendations from the Office of Environment & Heritage in December 2015.

OEH comment	Comments	Status
1.1 Update the preliminary long term biodiversity management targets (section 3) to state: (a) "Increase the overall native flora and fauna species diversity *compared to the baseline condition*" (or something similar) (b) "Improve the habitat values of the remnant woodland communities in the *Kokoda Offset Site compared to the baseline condition*" (or something similar).	Acknowledged, change made to BOMP in Section 7.0	Complete
2.1 Remove reference to the establishment of 300 metres of new fencing in section 3	Acknowledged, changes made to BOMP in Section 3 and Section 5.2 to reflect that establishment/maintenance of fencing will be conducted as required to exclude stock from the offset area. Section 5.2 states that no new fencing is required.	Complete
2.2 The in-perpetuity conservation mechanism has not yet been finalised. Amend the status to "ongoing" or another similar description within Table 5.4.	Acknowledged, change made to BOMP in Table 5.4.	Complete
2.3 Develop an ecological burn strategy for the Kokoda offset site.	A Bush Fire Management Plan has been developed for the Kokoda Offset Site and has been included in this document (refer Appendix 4). The ecological burn strategy is included in Section 5.	Complete

OEH comment	Comments	Status
2.4 Collect and document baseline information on feral fauna and kangaroo populations. 2.5 Implement targeted monitoring of feral fauna and kangaroo numbers.	Kangaroos and feral fauna species (including foxes, hares and rabbits) occur at Kokoda. However, the number of kangaroos and feral fauna are not considered to be at a level that is detrimental to the biodiversity conservation values at the offset site. Additionally, as Kokoda is located within a predominately agricultural landscape and the boundary fences at the offset site are not kangaroo or feral proof, movement of these species, in particular kangaroos, occurs freely across property boundaries and the broader landscape. Vegetation surveys, using a Landscape Function Analysis (LFA) methodology, were undertaken across the property in 2014 and 2015. Baseline surveys conducting in 2014 were undertaken prior to the purchase of the property, while low intensity sheep grazing was still being undertaken across the property. In 2015, LFA monitoring surveys were undertaken across the property, approximately 6 months after stock had been removed. As such, both of these assessments provide baseline information on the level of grazing impacts on ground cover across the property, both with low intensity livestock grazing and after livestock grazing was removed. As stock have been excluded from the property since early 2015, the majority of ongoing grazing at the property will be from kangaroos. As Kokoda contains several ground cover species of interest, including several (not listed) orchid species, low level grazing provides an important service in terms of regulating the density of the ground cover so small herbs and forbes are able to compete and persist. However, it is acknowledged that left unregulated, kangaroo numbers, in particular, could increase over time. As such, the baseline vegetation surveys undertaken in 2014 and 2015 will be used as surrogate indictor of grazing intensity at the property. If ongoing LFA surveys indicate that ground cover has declined to levels similar to the baseline vegetation surveys, adaptive management will be initiated and an investigation into kangaroo numbers will be commenced. Additionally, feral fauna will be monitored during biannual inspections. Where feral animals are recorded, pest management options will be discussed with the near neighbours and implemented as required. Northparkes is in regular communication with the near neighbours around Kokoda, and will continue to discuss and collaborate with these neighbours on issues including kangaroo and feral animal management for the offset site.	Complete

OEH comment	Comments	Status
2.6 Consider the potential for updating the weed management actions (Table 5.9) to have a goal to eradicate tree-of-heaven and blackberry.	Northparkes internal Weed Control Program for the Kokoda Offset Site includes provisions to spray and actively manage tree-of-heaven and blackberry at the Kokoda Offset Site. However, as Kokoda occurs within an agricultural landscape with different land management practices, even if these weed species are eradiated from the property, it will be extremely difficult to ensure that these species are not reintroduced.	Complete
2.7 Amend the current trigger points for weed control (Table 14 and 15) so that they are quantifiable.	Acknowledged, change made to BOMP in Table 9.6	Complete
2.8 Information regarding the benchmark woodland sites for the derived native grassland vegetation communities should be included.	Acknowledged, change made to BOMP. Refer to Figure 2.2 for benchmark woodland sites for the derived native grassland vegetation communities.	Complete
2.9 Overlay locations of the LFA monitoring sites and the ecological monitoring sites on the vegetation management zone diagram.	Acknowledged, change made to BOMP. Figure 2.2 updated with LFA monitoring sites.	Complete
2.10 Northparkes Mines should meet with OEH after the detailed monitoring of the derived native grasslands has been completed and before the next stage of revegetation commences.	Northparkes has open communication with the OEH. Northparkes has an annual meeting regarding environmental monitoring (Annual Review), which OEH is invited to attend. Additionally, OEH is welcome to contact Northparkes at any time to arrange a meeting.	Complete

Biodiversity Offset Management Plan- Additionally changes made to BOMP based on recommendations from the Office of Environment & Heritage in August 2016.

OEH comment	Comments	Status
Targeted baseline surveys and ongoing monitoring of feral pests and kangaroo populations	Northparkes and OEH staff met on 19th October 2016 to discuss outstanding comments on the BOMP. The changes included in version 3 of the BOMP were discussed and agreed upon during this meeting.	Complete
Trigger points for weed control and eradication goals for specific weed species	Northparkes and OEH staff met on 19th October 2016 to discuss outstanding comments on the BOMP. The changes included in version 3 of the BOMP were discussed and agreed upon during this meeting.	Complete

17. ATTACHMENTS

17.1 Appendix 1 Limestone National Forest Offset Area Revegetation Plan

17.2 Appendix 2 Vegetation Management Plan (for the Estcourt Offset area)

17.3 Appendix 3 Species Management Plan for the Pine Donkey Orchid

17.4 Appendix 4 Bush Fire Management Plan for the Kokoda Offset Site

Management Plan

Limestone National Forest Offset Area

Revegetation Plan

Doc ID No.	Version No.	Owner	Next Review Date
NA	No. 1	PSE Manager	NA

Revision Summary

First Issue	Issue Date	Implementation Requirements	Approved By
0	16 Jul 07	Document drafted by NPM	NPM

Version No.	Revision Date	Clause No.	Revision Details	Approved By
1	6 Oct 2015		Document reformatted into CMOC template by R. Feeney	Environment and Farms Superintendent

Approval Position	Automatic Notifications

Hard Copy Locations	Associated Documents to be reviewed

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1. BACKGROUND

This Revegetation Plan is an outline of the work to be undertaken by Northparkes Mines (NPM) to fulfil the commitments (as outlined in the Environmental Assessment (Corkery, 2006)), development consent conditions and other requirements discussed with representatives from the Department of Primary Industries – Forests in Dubbo.

Revegetation of the Limestone National Forest (LNF) offset area will be undertaken in conjunction with the NPM annual tree corridor establishment initiative. Works will be undertaken by the NPM appointed Farm Manager, using established preparation and planting methods.

The area to be affected by the subsidence zone, along with the 45.14 hectares (ha) of offset area has been duly registered and the legal transfer of ownership is in progress.

1.1 General site overview

NPM is a metalliferous mining operation located 27 km north of Parkes, New South Wales (NSW). The main features of the operation comprises of an underground section (E26), two open cut pits (E22 & E27), a surface mineral processing facility and two tailings storage facilities (Figure 1).

NPM currently extracts copper-gold bearing ore from an underground block cave referred to as E26. The operation processes approximately 5.5 million tonnes of ore per annum and produces around 130,000 tonnes per annum of copper concentrate. The mine has been operational for 12 years, with a further planned operating life to 2018 based on known reserves. The mine employs a full time workforce consisting of approximately 200 direct employees and an additional 250 contractors.

The project location and the area around Parkes are typical of the intensively developed agricultural land of the central slopes of NSW. The pre-European settlement landscape of open savannah woodlands has been extensively cleared, with trees generally confined to road verges, scattered along creek lines and areas too poor to cultivate such as rocky outcrops or clay gilgais.

1.2 Development description

In 1993 a significant copper-gold bearing orebody was discovered approximately 2km north of the existing E26 underground mine. This orebody is locally referred to as E48 (Figure 2) and is expected to produce 35 million tonnes. Development of the underground block cave is currently underway and mining of the E48 reserve is scheduled to begin in 2009 and continue for eight years.

Underground mining of the ore body will result in the removal of the geology under the clay and soil layers which will create a subsurface cavity. Over time the surface layers (soil profile and weathered rock) will collapse into the underlying cavity resulting in a surface subsidence of approximately 24.4 ha as indicated in Figure 2. The surface subsidence will be similar in outcome to the E26 subsidence area (Figure 1).

1.3 Offset area

An offset area of 45.14ha on the western side of the LNF has been swapped to compensate for the area to be disturbed as a result of the E48 surface subsidence (Figure 2). Agreements were exchanged on 12 October 2006, subsequently all statutory requirements for the transfer of the offset property have been concluded.

1.4 Statutory requirements

1.4.1 NPM commitments

Listed below are the commitments specific to the LNF offset area made by NPM in the Environmental Assessment (Corkery, 2006).

- Section 9.12: Prepare and implement a detailed revegetation plan for the Limestone National Forest offset area.
- Section 9.17: Swap an area of 45ha (as identified in Figure F1 of the Environmental Assessment in agreement with the Department of Primary Industries (DPI Forests)) for 24ha located within the E48 subsidence zone.
- Section 9.18: Prepare, seed, plant, monitor and maintain (including weed control) in order to revegetate the offset area"
- Section 9.19: Ensure revegetation of offset area involves the use of local native species, sourced locally.

1.4.2 Project Development Consent Conditions

Listed below is the consent condition relating specifically to the LNF offset area, and can be found in Schedule 3, Section 13 of the project approval (Department of Planning, 2006).

13. The Proponent shall:

a) revegetate the 45.14ha of land adjacent to the Limestone National Forest As marked in blue and labelled "Addition To Limestone National Forest" on Figure 2 in Appendix 2); and

b) monitor and maintain this vegetation for 3 years,

to the satisfaction of DPI (Forests).

This Plan has been prepared in consultation with the DPI - Forests (Appendix A).

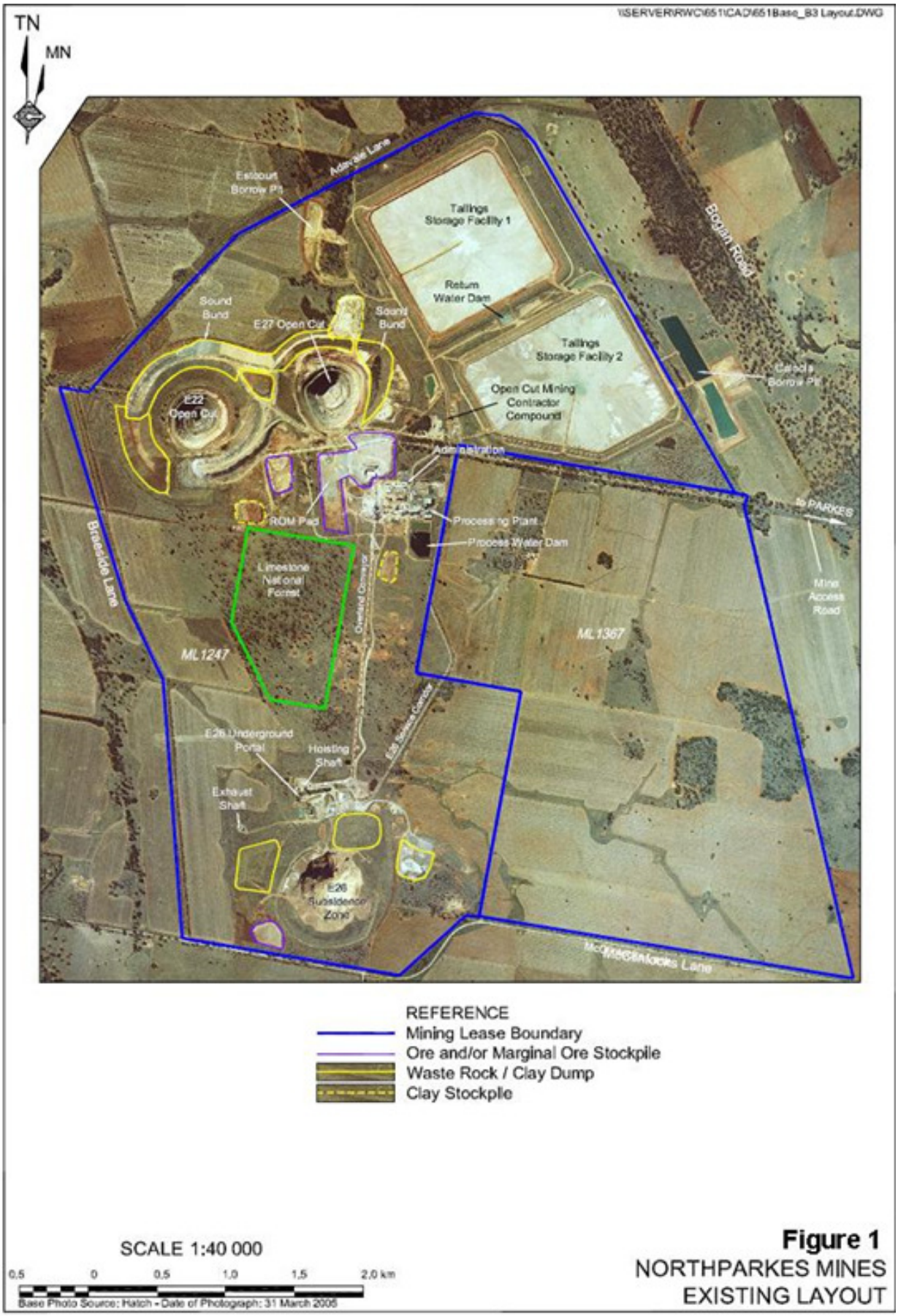


Figure 1 Northparkes Mines Existing Layout

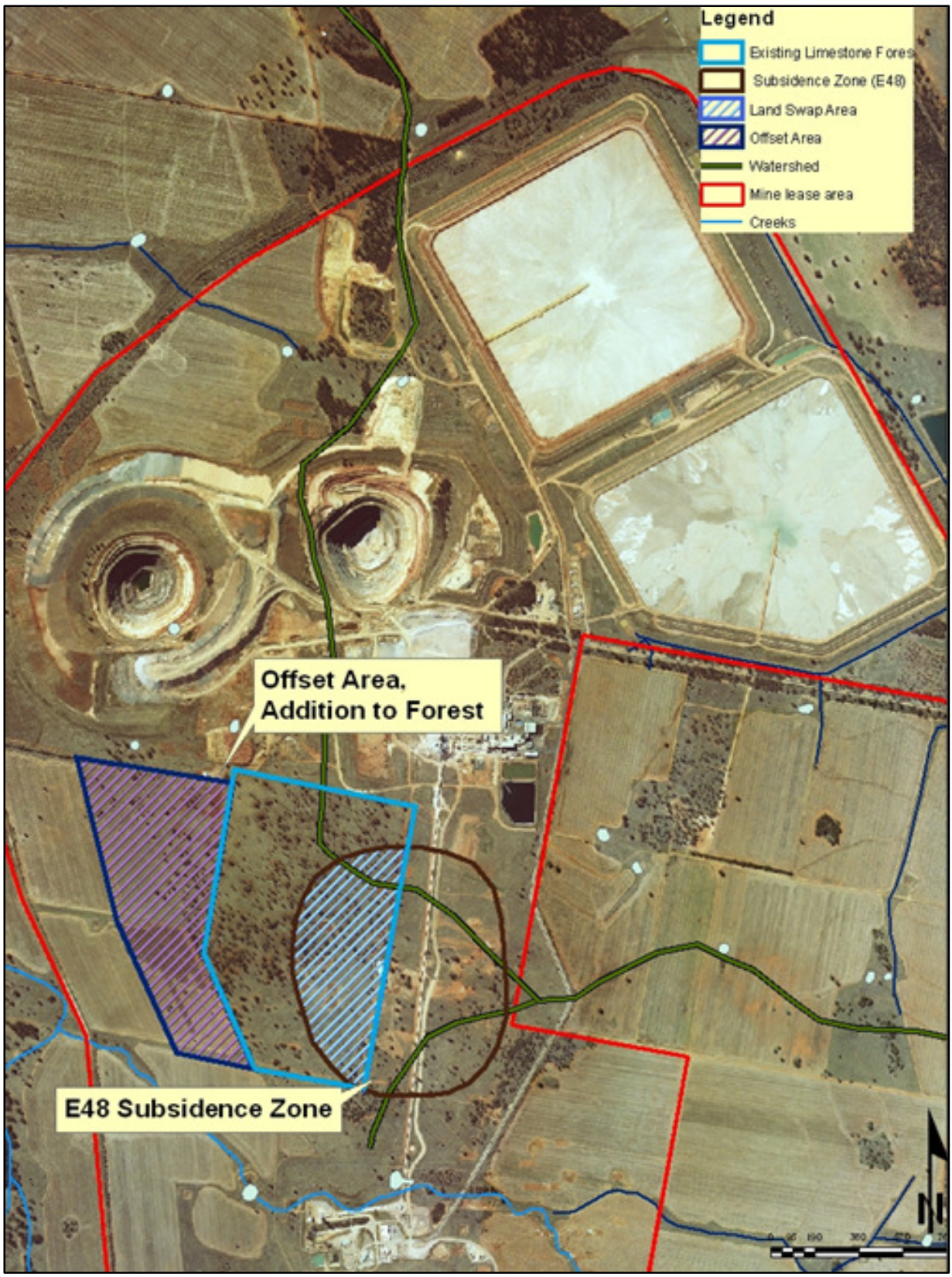


Figure 2 Limestone National Forest Offset Area

2. OFFSET AREA LANDSCAPE CHARACTERISTICS

2.1 Landform

Landform falls within the Mid Lachlan Region and can be described as flat to gentle sloping, with drainage in a westerly direction towards the Bogan River.

2.2 Soil profile types

A soil study was undertaken as part of the Environmental Assessment (Cunningham, 2006) identified two main soil types in the offset area (Figure 3).

Unit 1: Red Dermosol, Red Chromosol.

Unit 1 soil profile is described by Cunningham (2006) as follows:

Soil to 88cm deep; usually crest location sometimes midslopes; surface condition usually firm to hard setting, sometimes loos; some much angular [sometimes rounded] surface gravel 1-5cm present; at times angular stones to 20cm recorded

Topsoil – loam, sandy clay loam, clay loam, occasionally silty clay loam or loam; mainly roots present; no line present, no gypsum present; no manganese present; pH 5.0-7.0.

Subsoil – two subsoil horizons identified in sample pits; texture generally becomes more clayey with depth' sandy light clay, light clay, light to medium clay, medium to heavy clay usually many roots present no line present; no gypsum present; usually some manganese present; pH 5.5-7.5.

Unit 2: Red, Brown or Black Vertosol.

Unit 2 soil profile is described by Cunningham (2006) as follows:

Topsoil – is usually a light to medium clay, medium clay, medium to heavy clay, rarely loam; usually roots common to many; no lime present no gypsum present, no manganese present pH usually 5.0 – 6.5. No gravel or stones observed

Subsoil – comprised of up to five horizons; clay texture throughout with horizons sometimes becoming gritty near bedrock; usually high pedal but some massive horizons sometimes becoming gritty near bedrock".

2.3 Land use

Current land uses for the offset area are agricultural (cropping) and natural forest. These land uses approximately correlate with the mapped soil type profiles, where cropping takes place in the deeper soils of 'Unit 2' and the forest areas occur in the shallow soils of 'Unit 1' (Figure 3). The offset area will be integrated into the Limestone National Forest with final land use as forest.

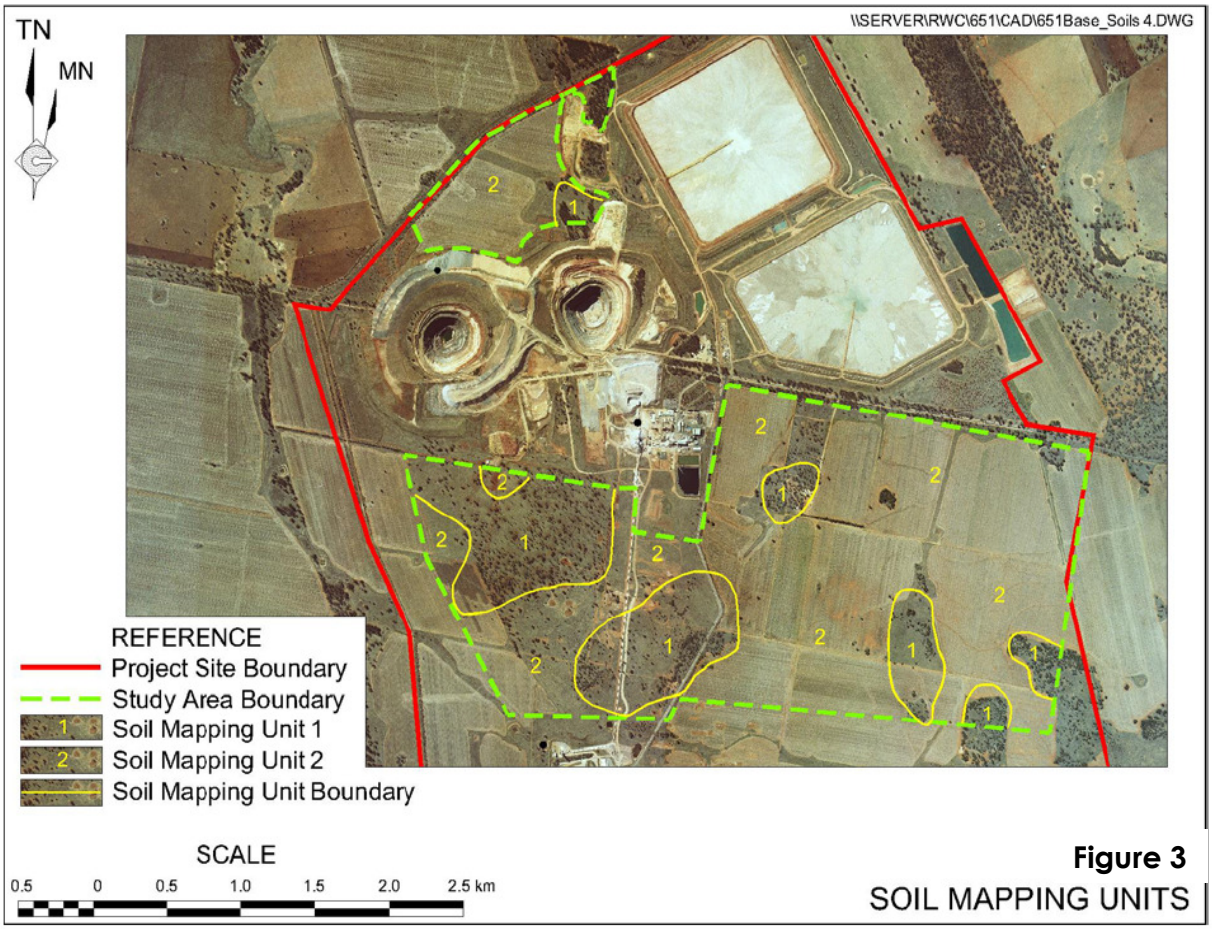


Figure 3 Soil Mapping Units

3. VEGETATION SECLECTION AND ESTABLISHMENT

3.1 Vegetation objectives

The key objectives will be to:

- Revegetate the offset area to open savannah woodland intermingled with white cypress pine, and
- Improve biodiversity, whilst maintaining the commercial potential of the forest.

3.2 Species selection

Native seedlings for the offset area will be sourced locally where possible. Establishment of the native vegetation will be based on the *Practical Guide to Revegetation in the Mid Lachlan Region (*Sydes et al., 2003) to achieve the desired open savannah woodland (e.g. Bimble Box, Yellow Box, Grey Box communities).

Detailed lists of selected plant species are given in Table 1 and Table 2. Species used will be determined by their availability at the time of planting. Planting density for native species will be aimed at 400 stems per hectare[1], 70% of plantings will be of those species listed in Table 1[2].

Commercial potential of the forest will be maintained by including White Cypress Pine *(Callitris glaucophylla)* in the planting program. Species such as White Box *(Eucalyptus albens)* and Fuzzy Box *(Eucalyptus conical)* will not be included, as they are not considered to be consistent with the objective of maintaining the commercial potential of the area.

Planting is to take place in the beginning of winter in the June – July period when soil moisture is optimal. Planting was postponed in 2007 due to continuing drought conditions. Planting is now scheduled for the 2008 winter period and will be dependent on favourable soil moisture content.

Table 1 Tree species to be used in revegetation

Common name	Botanical name	Maximum No/ha
Yarran	*Acacia homalophylla*	20
Bulloak	*Allocasuarina luehmannii*	30
White cypress pine	*Callitris glaucophylla*	175
Kurrajong	*Brachychiton populneus*	5
Yellow box	*Eucalyptus melliodora*	15
Western grey box	*Eucalyptus microcarpa*	40
Poplar box*	*Eucalyptus populnea*	5
Bimble box*	*Eucalyptus populnea subsp. bimbil*	5
Wilga	*Geijera parviflora*	30

*These species will be planted in complementary numbers due to their similarity.

Table 2 Shrubs and groundcover species to be used in revegetation

Common name	Botanical name	Maximum No/ha
Deane's wattle	*Acacia deanei*	20
Western golden wattle	*Acacia decora*	30
Hakea wattle	*Acacia hakeoides*	20
Punty Bush	*Cassia eremophila var. eremophila*	
Broad-leaf hopbush	*Dodonaea viscosa subsp. angustissima*	20
Wedge-leaf hopbush	*Dodonaea viscosa subsp. cuneata*	20
Butter bush	*Pittosporum angustifolium*	10

[1] As requested by DPI-Forests (Dubbo).
[2] As requested by DPI-Forests (Forbes).

3.3 Land Preparation

The offset area will be prepared for planting by NPM. This will include deep ripping (using a savannah plough) at approximately 5 metre spacing. Ripping and mounding will improve water and root penetration. The rip lines will avoid existing trees and rocky outcrops. If required and practicable, the rip lines will also be graded, mounded and rolled to remove excessive grass matter or weeds. Initial ripping was completed in April 2007 (Plate 1).

Appropriate fencing (Western electrical) will be erected around the areas to be revegetated to minimise access by herbivores.

Plate 1 Pre-ripping of offset area- completed in April 2007

Adequate weed control is an important factor in determining survival and early growth. Weed control will be undertaken to limit the spread and colonisation of noxious and environmental weeds.

Weed control methods will include:

- Ongoing surveillance and reporting (refer Section 4.1);
- Limiting vehicle access to the offset area;
- Chemical spraying with approved herbicides; and
- Physical removal by manual chipping.

4. MONITORING AND MAINTENANCE

4.1 Monitoring

NPM will undertake revegetation monitoring and maintenance of the offset area for a period of three years prior to hand over to DPI – Forests.

Revegetation monitoring will include observation of the following criteria on a quarterly basis:

- Presence/absence of erosion
- Presence/absence of grazing/browsing by herbivores
- Presence/absence of weed species
- Condition of fencing

Additionally the newly established vegetation will be monitored annually (typically in May) and the following criteria will be recorded:

- Survivability
- Growth rates
- Presence/absence of disease
- Species diversity

4.2 Maintenance

If poor vegetation establishment is observed (e.g. high seedling death rate due to disease, drought or other) the cause will be investigated and appropriate remediation will be undertaken. This may include follow up planting, disease control, erosion control or other.

In the event that weeds and/or feral animals are observed during the regular monitoring program, controls will be implemented in accordance with existing procedures for the mine lease and farm properties. Noxious weeds such as Bathurst burr (most common to the area) will be controlled by chipping, slashing and the use of herbicides.

Fencing will be maintained during the life of mine by NPM.

5. REPORTING

The results of the revegetation monitoring program will be maintained at NPM and reported in the Annual Environmental Management Report. A copy of this report will be provided to the relevant agencies, including DPI – Forests

6. OFFSET AREA RELINQUISHMENT

Upon completion of the offset area revegetation, NPM will monitor and maintain the area for a period of three years. The offset area will then be handed over to DPI – Forests for ongoing management as part of the LNF.

7. REFERENCES

Corkery R.W., (2006). "North Mining Limited Environmental Assessment".

Cunningham, G., (2006). "Soils Survey and Land Capability Assessment" Northparkes Mines – E48 Project Specialist Consultant Studies Compendium Part 2.

Department of Planning, (2006). "Notice of Project Approval".

Sydes M., Butterfield L. and Rutledge S. (2003). "A Practical Guide to Revegetation in the Mid Lachlan Region".

Appendix A Regulatory correspondence

FORESTS NSW
ABN 43 141 857 613
NSW Government Offices Camp St (P O Box 389) Forbes NSW 2871
www.forest.nsw.gov.au T 02 6850 2922 F 02 6852 3998

12/10/2007

Renee Morphett
Graduate Environmental Officer
Northparkes Mines

Dear Renee,

LNF Revegetation Plan

Forests NSW has reviewed the draft revegetation plan for the Limestone National Forest Offset Area and has the following recommendations for improvement.

1) **2.1 Landform**
The offset area lies east of the Bogan River and drains in a westerly direction, not easterly as described in the Plan.

2) **2.2 Soil Profile Types**
The landform and soil landscape descriptions, together with Figure 3, indicate that the offset area has a tendency towards heavier soils than the balance of Limestone National Forest. This is consistent with it being on the lower slopes and swales of the landscape. This would make it unlikely that the area previously supported plant species that prefer the better-drained or gravelly, ridge-type soils, yet there are several of these in the revegetation species mix. *Eucalyptus dwyeri, E polyanthemos, E sideroxylon,* and *E viridis* may survive if planted in the Offset Area but will probably be 'out of place' and should be deleted from the species mix. Similarly, *Acacia doratoxylon* is a species of hilltop, skeletal soils and not a natural inhabitant of this site.

3) **3.2 Species Selection**
Acacia dealbata is not a species that is widespread in this area but is a popular garden plant. Forests NSW does not want it planted on this site.

4) *E. populnea* and *E .populnea ssp. bimbil* will only need to be planted in complementary numbers (if you have them available separately) because of their similarity.

5) Of the shrub species listed in table 2, *Acacia linearis* and *A spectabilis* are both species of gravely ridgetops and probably will not do well on the heavier soils of the Offset Area.

6) A notable omission from the list of local shrub species is *Cassia eremophila* var. *eremophila* (Punty Bush). A small number could be added to the mix.

7) The Plan proposes a planting of 400 stems per hectare but does not specify what proportion will be overstorey trees and what proportion shrubs. Forests NSW requests that 70% of the plantings be of species in Table 1.

8) It is accepted that the exact proportions of species planted will vary according to what is available, but Forests NSW recommends the proportions set out in Tables 1 and 2 below.

TABLE 1: Tree species to be used in revegetation

Common name	*Botanical name*	*Maximum. No./ha*
Yarran	*Acacia homalophylla*	*20*
Bulloak	*Allocasuarina luehmannii*	*30*
White cypress pine	*Callitris glaucophylla*	*175*
Kurrajong	*Brachychiton populneus*	*5*
Yellow box	*Eucalyptus melliodora*	*15*
Western grey box	*Eucalyptus microcarpa*	*40*
Poplar box	*Eucalyptus populnea*	*5*
Bimble box	*Eucalyptus populnea subsp. bimbil*	*5*
Wilga	*Geijera parviflora*	*30*

Table 2: Shrubs and groundcover species to be used in revegetation

Common name	*Botanical name*	*Maximum. No./ha*
Deane's wattle	*Acacia deanei*	*20*
Western golden wattle	*Acacia decora*	*30*
Hakea wattle	*Acacia hakeoides*	*20*
Broad-leaf hopbush	*Dodonaea viscosa subsp. angustissima*	*20*
Wedge-leaf hopbush	*Dodonaea viscosa subsp. cuneata*	*20*
Butter bush	*Pittosporum angustifolium*	*10*

9) **3.3 Land Preparation**
The site preparation so far has been good, well up to current industry standards. However, adequate weed control is an important factor in determining survival and early growth. There is no detail in the plan to suggest how this will be achieved. While cultivation will provide effective pre-planting control, selective knockdown or pre-emergent sprays are usually required to control new weed germination after planting. Please provide details of your proposed weed control program.

Please accept my apologies for the delay in responding to your proposal. I trust that the above comments will help to ensure effective and durable revegetation of the offset area.

Yours sincerely,

S R Campbell
for P D Wells
Regional Manager


CMOC
NORTHPARKES

Management Plan

Vegetation

Risk Statement: Low

This document will be reviewed on a five yearly basis, unless a process change occurs earlier than this period.

Doc No.	Version No.	Next Review Date	Owner
PLN-0050	7	30/06/2025	Environment & Farms Superintendent

Revision Summary

First Issue	Issue Date	Implementation Requirements	Approved By
1	Apr 10	Developed by GHD to meet requirements under Condition 13A(a), Schedule 3 of Project Approval (06-0026 Mod 1).	K Edwards

Version No.	Revision Date	Summary of Revision Details	Approved By
2	Mar 10	DECCW and DOP review undertaken and no comments to address.	K Edwards
3	Apr 14	Indicative Program of Works; Inserted new photographs and made textual changes in line with 2013 Estcourt Offset Monitoring Report.	A Youssef
4	26 Jun 18	Review undertaken by Nathan Jones – minor amendments	C Dingle
5	18 Feb 20	Updated to new DCS	M Row
6	Jun 20	Annual review	Environment & Farms Superintendent

Consultation Required	Hard Copy Locations
Not Applicable	Northparkes Website

Associated Documents to be Reviewed
Not Applicable

Table of Contents

1. OVERVIEW

1.1 Background

CMOC Mining Services Pty Limited (CMOC) is the manager of the Northparkes Joint Venture, an unincorporated joint venture between CMOC Mining Limited (80%); Sumitomo Metal Mining Oceania Pty Ltd (13.3%) and SC Mineral Resources (6.7%). Northparkes is a copper-gold operation in Goonumbla, situated 27 kilometres north-west of the town of Parkes.

Construction of the ore processing plant and associated facilities began in 1993. Open cut mining commenced on the E22 and E27 ore bodies in late 1993. Development of the E26 lift 1 block cave underground mine began in 1994, with full scale production commencing in 1997.

1.2 Mining Context

Operations at Northparkes primarily comprises underground mining from multiple ore sources that feed a processing plant with a capacity of 6.5 million tonnes per annum (Mtpa). The underground mine is accessed via a decline ramp from the surface for people and materials with ore transported to the surface via inclined conveyors and a hoisting shaft, with a nominal capacity of 7.2 Mtpa. Northparkes utilises low cost block and sub-level cave mining and exploits industry leading technology, such as semi-autonomous loaders and various cave monitoring systems.

The ore processing operation consists of four stages: crushing, grinding, flotation and thickening / filtering. In addition to producing concentrate, the ore processing team also manages tailings disposal. The concentrator was constructed in two modules. Each module consists of its own grinding circuit with a single flotation circuit, concentrate thickener and filter. After extracting the copper and gold bearing minerals, the tailings are combined in a single tailings thickener before being deposited in the active tailings storage facility.

Northparkes' copper concentrate is transported to a rail siding at Goonumbla where it is then transported by rail to Port Kembla, for shipping to overseas customers.

1.3 Vegetation

The Vegetation Management Plan (VMP) outlines the restoration program for the Estcourt Tailings Storage Facility Offset (Estcourt offset) site, identified in the Biodiversity Offset Strategy (GHD 2009). The VMP includes details on plant species, planting techniques, revegetation methods and maintenance requirements for the two different zones found within the offset area.

This VMP has been developed in accordance with Condition 26, Schedule 3 of Development Consent (11_0060) and prepared in consultation with the NSW Office of Environment and Heritage (OEH).

2. SCOPE

This document applies to all activities undertaken by Northparkes including mining and exploration activities, processing of copper / gold ore resources, project development, maintenance activities, mine closure, logistics, associated service and support functions, bore fields, farming operations and products.

3. PURPOSE / OBJECTIVES

The objectives of the VMP are to:

- Conserve and improve biodiversity values of the offset site;
- Enhance connectivity with adjacent areas of vegetation;
- Manage the restoration process to ensure the retention of suitable habitat for those threatened and/or significant flora and fauna species present within the offset site and surrounds; and
- Identify opportunities for research and development projects in ecological restoration that assist in mine site rehabilitation.

4. RESPONSIBILITIES

General role responsibilities are outlined in the Health, Safety and Environment Responsibilities and Accountabilities Procedure (PRO-0080). Personnel carrying out work under this document must be familiar with and comply with it in full. The following persons have specific responsibility:

Table 1: Responsibilities

Role	Responsibility
All Personnel	– are responsible for identifying hazards with this document and initiating management of change to correct those deficiencies
Environment Team	– review this Management Plan (for effectiveness and its performance against its objective/s
Project Manager / Supervisor	– schedule works to ensure the restoration program and associated mitigation measures contained in this Plan are implemented – supervise all contractors undertaking works at the offset site on behalf of Northpakes – ensure all employees are provided with the appropriate training and awareness required to fulfil their obligations under this plan – maintain an accurate record of works undertaken (e.g. firebreak maintenance, site protection, weed control) in the offset site to fulfil reporting requirements and communicate this to the Environment and Community Superintendent – liaise with interested stakeholders in consultation with the Environment Superintendent where appropriate
Environment Superintendent	– ensure all works are conducted in compliance with this Plan and other regulatory requirements – provide technical advice and support to the Project Manager to ensure compliance with this Plan – compile information received from the Project Manager for the Annual Review
PSE Manager	– ensure appropriate resources are provided to implement the management and mitigation measures outlined in this document and associated procedures
Managing Director	– must provide sufficient resources to comply with this document

5. DEFINITIONS

Table 2: Definitions

Key Word	Definition
Bush regeneration	Refers to techniques used to assist and promote natural regeneration without utilising plant material propagated in nurseries
Establishment	Refers to the minimum 36-month maintenance program applied to revegetation work to ensure plant establishment
Final completion	Refers to the successful completion of the entire restoration program
Practical completion	Refers to the completion of installation of revegetation activities
Regeneration	Refers to natural regeneration of the vegetation community
Restoration	Refers to a combination of restoration activities and management techniques to restore native vegetation
Revegetation	Refers to the planting of tube stock or similar grown from local provenance seed to re-establish vegetation

6. MANAGING THE HAZARD

6.1 Site Location

The Management Plan applies to the Estcourt offset site identified in the Biodiversity Offset Strategy (GHD 2009). The offset site is comprised of 65.1 hectares of remnant vegetation and agricultural land in the northern portion of Lot 3, DP 830291 in the Parkes LGA. It is located approximately 2 km to the north east of the Northparkes site, situated within the Southwest Slopes Bioregion on the western slopes and plains of the Great Dividing Range. The property is owned by Northparkes and was previously managed under lease arrangements. Previous land uses include remnant vegetation and agriculture (cropping).

The offset site borders agricultural land with patchy remnant and planted native vegetation to the west and south, respectively, active mining lease to the southwest, and to the east is remnant native vegetation within the travelling stock route along Bogan Road.

The site location is shown in Figure 1 below.

Figure 1: Map showing the location of the woodland reference sites in relation to the escourt offset area

6.2 Climate

Meteorological data has been continuously recorded onsite at Northparkes since 2001. The region experiences a typical arid to semi-arid climate with hot, dry summers and cool winters.

Seasonal temperature fluctuations are typical for the region with the highest maximum daily temperatures recorded in the summer months (December, January and February) and the lowest maximum daily temperatures recorded in the winter months (June, July and August).

The average annual rainfall is 526mm, based on 114 years of data. The average monthly rainfall is relatively uniform throughout the year, varying between a low of 37.1mm in September and a high of 52.1mm in January (Bureau of Meteorology, 2014).

6.3 Topography

The topography of the Estcourt offset site is relatively flat with a slight rise in elevation occurring to the north-west corner of the site.

6.4 Geography and Soils

Northparkes operations are located within the Lachlan Fold Belt of Central Western NSW situated on Goonumbla Volcanics comprising volcanic and sedimentary Ordovician age deposits (Corkery and Co, 2006).

There is a correlation between the distribution of Inland Grey Box Woodland communities and soils of Tertiary and Quaternary alluvial origin, largely corresponding with the Red Brown Earths (OEH, previously DECCW, 2009).

6.5 Hydrology

An ephemeral flood zone occurs along the south portion of the offset site and Adavale lane. The flood zone is generally a chain of intermittent ponds and a broad undefined creek bed, which receives overland flow only following significant rainfall events. The majority of the offset site occurs above this flood zone. An abandoned gravel pit in the north-west corner of the site is known to contain standing water.

6.6 Vegetation

Currently five community types or 'zones' exist within the offset site. Each community type currently has an established monitoring site. Two of the current monitoring sites occurring within the derived grassland area which have been replanted to re-establish the original grassy woodland community. Three sites occurred in the existing woodland areas (zone two), whereby one site is situated in a grassy clearing (sub-zone 2b) and has received supplementary planting with the remaining two sites situated within open woodland areas where natural regeneration will be anticipated, and some supplementary hand planting has been undertaken (GHD 2010).

The location of the revegetation monitoring sites in the Estcourt Offset site is shown in Figure 2.

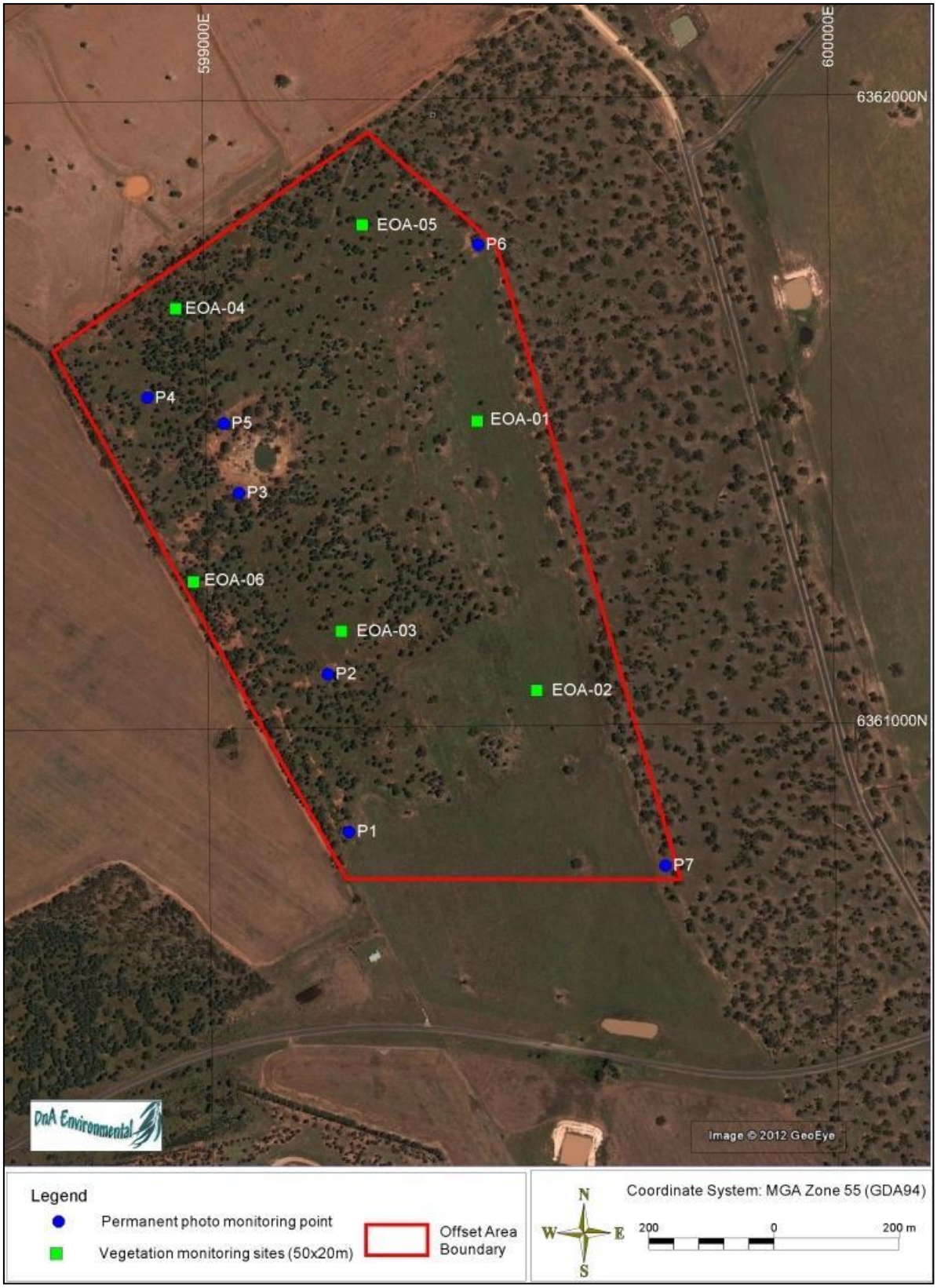


Figure 2: Map showing locations of the vegetation monitoring sites and permanent photo points with the escourt offset area

6.6.1 Native vegetation

The northwest portion of the site contains approximately 42.1 ha of native grassy woodland vegetation communities, made up of approximately 38.8 ha of Inland Grey Box – Poplar Box - White Cypress Pine Tall Woodland and 3.3 ha of Yellow Box Woodland. These communities are similar to those within the impact site for which the offset is required.

Inland Grey Box - Poplar Box - White Cypress Pine Tall Woodland occupies the majority of the offset site. Canopy species vary across the site, with areas dominated by Inland Grey Box (*Eucalyptus microcarpa*) and White Cypress Pine (*Callitris glaucophylla*) with scattered Bimble Box (*Eucalyptus populnea*). This community is in moderate to good condition across the site though shows signs of past clearing. The majority of canopy trees are mature regrowth (30-60cm DBH) with few pre-European age trees. The mid storey and shrub layers are virtually absent apart from occasional chenopod, *Acacia* species and White Cypress regrowth. The groundcover is patchy and comprises native tussock grasses (*Austrostipa* and *Austrodanthonia* spp.), native herbs including Kidney Weed (*Dichondra repens*) and various native daisies (*Vittadenia* spp. and *Calotis* spp.). Bare ground and leaf litter make up a large proportion of the ground cover.

Yellow Box Woodland features a canopy of Yellow Box (*Eucalyptus melliodora)* and occasional White Cypress Pine with a very sparse shrub layer and a grassy understorey. The canopy is dominated by mature regrowth trees (30cm – 80cm DBH) with a limited number of mature trees (>80cm DBH) and few saplings (<10cm DBH). There is a low, sparse layer of native shrubs including Ruby Saltbush (*Enchylaena tomentosa*). The ground cover is predominantly native, dominated by Speargrasses (*Austrostipa* spp.) along with the scrambler Amulla (*Eremophila debilis*) and herbs including Fuzzweed (*Vittadenia cuneata*).

This community occurs on the highest part of the site and surrounds an abandoned gravel pit. This area features good regeneration with Yellow Box seedlings and contains a dam/water hole within the old gravel pit area which contained a small number of native macrophytes.

Overall this northwest portion has experienced moderate disturbance by historical selective timber harvesting and ongoing grazing. The understorey is in relatively good condition, given grazing history, with good native plant species richness (20 - 28 native species per 20m by 20m vegetation survey quadrat). It is likely that a relatively diverse assemblage of native plants persists in the soil seed bank and, in the absence of grazing, the site exhibits a good capacity for regeneration. Both vegetation communities are consistent with the TSC Act listed EEC Inland Grey Box Woodland. The Yellow Box Woodland community on the site does not currently conform to the federally listed critically endangered community White Box – Yellow Box – Blakely's Red Gum grassy Woodland and Derived Grassland due to existing floristic composition and disturbance levels.

6.6.2 Cleared lands

The southeast portion of the site contains 23 ha of cropland with occasional paddock trees. This area would formerly have supported Inland Grey Box – Poplar Box - White Cypress Pine Tall Woodland but has been extensively cleared for agricultural purposes. The understorey has also been modified through ploughing and grazing. However, it does contains moderate native species richness (11 -12 native species per 20m by 20m vegetation survey quadrat), particularly in less heavily disturbed portions adjacent to remnant woodland. It is likely that a moderately diverse assemblage of native plants persists in the soil seed bank and that, in the absence of ploughing and grazing and through supplementary revegetation works, this area would exhibit some capacity for native regeneration.

6.6.3 Exotic Weed Species

The northwest portion of the site contains low to moderate numbers of exotic weeds. This is in contrast with the remaining southeast portion which features a high infestation of exotic weeds and sown crops, including Oats (*Avena* spp.), Bathurst Burr (*Xanthium spinosum*), Saffron Thistle (*Carthamus lanatus*), Paddy Melon (*Cucumis myriocarpus*), Barley Grass (*Hordeum sp*.) and Pattersons Curse (*Echium plantagineum*).

6.7 Habitat Value of the Site

The areas of native grassy woodland are in moderate to good condition. They contain healthy, mature Eucalypt and White Cypress trees forming a canopy with a woodland or tall woodland structure, similar to undisturbed examples of these vegetation communities in some areas. Hollow-bearing trees, stags and moderate recruitment of juveniles and seedlings are present within these areas. A small stand of water within the old gravel pit may provide seasonal habitat for some species of amphibians as well as suitable water supply to other fauna species including microbats, reptiles and birds utilising the site. The old gravel pit area also provides a small area of rocky outcrop which could potentially support a number of native reptiles. A large raptor nest, most likely a wedgetail eagle, was present.

Small logs and fallen woody debris are in low to moderate abundance in the northwest portion and completely absent through the cleared lands in the southeast. No large logs were noted on the site.

Based on these structural attributes, the woodland communities in the northwest of the site would be expected to support a moderate diversity of native birds, reptiles, microbats and ground and arboreal mammals. The size and shape of the woodland also affords a low perimeter to interior area ratio which would increase its long term viability as habitat for native biota. The remainder of the site comprising of cropland with isolated remnant trees could support open country bird species and a limited suite of native reptiles and mammals.

Two threatened bird species are known to utilise the site (GHD, 2009); the Grey-crowned Babbler (*Pomastomus temporalis temporalis)* and the Superb Parrot (*Polytelis swainsonii*) (GHD 2009b). Both are listed as Vulnerable under the *Biodiversity Conservation Act 2016* (BC Act) with the Superb Parrot also listed as vulnerable under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). All native grassy woodland vegetation in the subject site would provide habitat for local populations of these, and other threatened woodland birds species.

The site has strong connectivity with a travelling stock route (TSR) to the east. The TSR is a very large patch of Inland Grey Box Woodland, Inland Grey Box – Poplar box – White Cypress Pine and Mixed Box Woodland (> 200 ha) in excellent condition, with intact understorey, small tree layers and many hollow-bearing trees. The TSR is a regionally significant wildlife corridor. The site is contiguous with this wildlife corridor and once fenced and managed for biodiversity conservation would increase its overall size and viability.

Photographs of the existing vegetation in the offset site are provided in the attachment.

6.8 Adjacent Land Use

The offset site is surrounded to the north, west and south by extensively cleared agricultural lands and mining operations with small patches of remnant vegetation and revegetated corridors occurring throughout the landscape. In the context of the Parkes LGA, the 42 ha patch of woodland within the northwest portion of the offset site is a relatively large and significant remnant stand. It has the ability to support local populations of a range of native birds, mammals and reptiles including less mobile and patch-size dependant species

6.9 Information, Training and Instruction

Northparkes provides information, training and instruction on hazards through the following systems and processes:

Information:

- general and area specific inductions (including site access authorisation)
- HSE monthly meetings
- contractor pre-shut meetings
- contractor group communications (including performance reviews)
- monthly bulletin
- serious case reviews
- risk exposure groups
- OEM publications
- safety alerts and bulletins (both internal and external)
- zero harm / SHIFT program

Training:

- general and area specific inductions
- essentials program
- role specific training packages (e.g. electrical competency program)
- recruitment role criteria, i.e. qualifications (e.g. geotechnical engineering)
- statutory, i.e. high-risk work licence (sighted and copy retained)
- statutory, i.e. other qualification or licence (e.g. mine supervisor, Mining Engineering Manager, UHL / BEUL, driver's licence)

Instruction (and supervision):

- work instructions (including procedures), single point lessons, level 1 risk assessments and level 2 risk assessments
- permit to work (supervision – contractor)
- work orders
- supervisor checks (PTHA)

Records relating to the provision of information, training and instruction are retained via:

- Northparkes training matrix (SAP / LMS), including refresher training
- e-filing – training for individual training records, on the job assessments
- document control system
- secure (backed up) departmental drives
- VOC / e-filing
- site access authorisation (SAM form etc, online induction)

6.10 Monitoring and Reporting

In order to evaluate the success of the restoration program against agreed performance criteria, ongoing rehabilitation monitoring will be undertaken. The monitoring program will be carried out on an annual basis to assess:

- The physical stability of the landform of rehabilitated areas;
- The characteristics of the vegetation in rehabilitated areas;
- The establishment of self-sustaining ecosystems; and
- Success of fauna salvage and relocation efforts.

It is also important to keep an accurate photo-record of the progress of the restoration program by the use of an appropriate number of representative fixed photo-points across all restoration zones. Seven photo points have been set up on the site, as indicated in Figure 2. Photographs from annual monitoring events (2010-2013) are displayed in Appendix 1. Photos should be taken by digital camera and recorded by date and discrete photo-point number. Additional photo-point locations may be required prior to restoration works.

Monitoring the rehabilitated areas will ensure that any areas requiring remedial work are identified and maintenance procedures carried out where necessary.

It is anticipated that the frequency of monitoring will decrease as rehabilitation progresses and will cease when the VMP objectives and performance criteria have been achieved.

An initial report will be prepared at the Practical Completion stage to provide a baseline summary of offset vegetation condition for the remaining monitoring reports.

Northpakes will report results of the annual monitoring program outlined in this plan in the Annual Review.

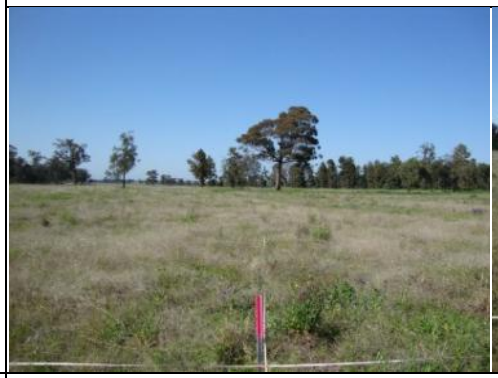
7. REFERENCE MATERIALS

Table 3: Reference Materials

Document Title	ID No. | Year
Rehabilitation Management Plan	PLN-0060
Auld, B.A. and Medd, R.W. (1987) Illustrated Botanical Guide to the Weeds of Australia, Department of Agriculture NSW, Inkata Press	1987
Beadle, N.C.W., Evans, O.D. and Carolin, R.C. (1991 ed), Flora of the Sydney Region, Reed Books, Terrey Hills, NSW	1991
Benson, D. and Howell, J. (1995) Taken for Granted: The bushland of Sydney and its suburbs, Kangaroo Press	1995
Benson, D., Benson J., McDougall, L. and Redpath, A. (1997) Cunninghamia: Ecology of Sydney plant species, Royal Botanic Gardens Sydney NSW	1997
Benson, J.S. (2008) New South Wales Vegetation Classification and Assessment: Part 2 Plant communities in the NSW South-western Slopes Bioregion and update of NSW Western Plains plant communities. Version 2 of the NSWVCA database. *Cunninghamia* 10(4): 599-673	2008
Buchannon, R. A. (1989) Bush Regeneration: Recovering Australian Landscapes. TAFE Learning Publications. NSW	1989
Costermans, L. (1992) Native Trees and Shrubs of South Eastern Australia. Weldon Publishing, NSW	1992
DEC (2006) *Reconstructed and Extant vegetation of Central West NSW*, DEC, Hurstville, NSW	2006
DECC (2007) Threatened species assessment guidelines: The assessment of significance, Department of Environment and Climate Change (NSW)	2007
Office of Environment and Heritage (OEH), *Principles for the use of biodiversity offsets in NSW*. <http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm>; Last updated 6th August 2013	2013
DECCW (2009) *Vegetation Types Database* http://www.environment.nsw.gov.au/resources/nature/BioMetric_Vegetation_Type_CMA.xls	2009
Department of Infrastructure, Planning and Natural Resources (DIPNR), Guideline for the Preparation of Environmental Management Plans, 2004	2004
GHD (2009), *Report for NPM Section 75W Modification: Ecological Impact Assessment*. Unpublished report by GHD for Northparkes Mine	2009
GHD (2009a) *Report for NPM Section 75W Biodiversity Offset Strategy*. Unpublished report by GHD for Northparkes Mine (Our reference: 21/17903/684)	2009
GHD (2009b) *Report Vegetation Mapping Project.* Unpublished report for Northparkes Mine	2009
Greening Australia NSW (Inc) (1999) *Management Principles to Guide the Restoration and Rehabilitation of Indigenous Vegetation*	1999
Greening Australia NSW (Inc), Management Principles to Guide the Restoration and Rehabilitation of Indigenous Vegetation, August 1999	1999
National Trust of Australia (NSW) (1999) Bush Regeneration Handbook. National Trust, Sydney, NSW	1999
New South Wales Government, Noxious Weeds Act 1993	1993
New South Wales Government, Threatened Species Conservation Act 1995	1995
Northparkes Mine (Our reference: 12857/72487)	N/A
Parkes Shire Council (1997) *Parkes Shire Council's Roadside Management Plan*, Parkes Shire Council, Parkes, NSW	1997
R.W. Corkery & Co (2006). *Environmental Assessment, North Mining Limited, Northparkes Mines – E48 Project*. Report No. 651/01. R.W. Corkery & Co. Pty. Limited report prepared for Northparkes Mine	2006

8. ATTACHMENTS

8.1 Photographs

Site	Photo 2010	Photo 2011	Photo 2012	Photo 2013
EOA-01	A derived grassland situated to the northeast of the Estcourt Offset Area. The site was an old cropping paddock that has not been recently grazed. In 2010 it contained a diverse understorey of native and introduced species including *Dichondra repens*, *Hordeum leporinum*, *Chloris truncata* and *Medicago polymorpha*. There was high in floristic diversity (57 species) and native species (34) were more abundant than exotic species (23). There was good ground cover and cryptogams were moderately abundant. There were scattered occurrences of *Echium plantagineum, Arctotheca calendula, Centaurea melitensis* and *Sonchus oleraceus*. In 2011, there were increased levels of ground over, decreased abundance of cryptogams and increased diversity of exotic species. One *Callitris glaucophylla* seedling was found. In 2012 the site was similar to but drier than last year and seven *C. glaucophylla* seedlings were found. In 2013, annual species continued to be dominant. Eleven *C. glaucophylla* seedlings were recorded.			
				
EOA-02	A derived grassland situated to the southeast of the Estcourt Offset Area. The site was an old cropping paddock that had not been recently grazed. In 2010 it contained a diverse understorey of native and introduced species including *Dichondra repens*, *Eragrostis parviflora* and *Medicago polymorpha*. There was a relatively high floristic diversity (48 species) and native species (26) were more abundant than exotic species (22). There was generally good ground cover and cryptogams were moderately abundant in the southern end of the transect. There were scattered occurrences of *Carthamus lanatus, Echium plantagineum* and *Arctotheca calendula.* In 2011, it was similar to EOA-01 with increased levels of ground over, decreased abundance of cryptogams but maintained a high diversity of native and exotic species and weeds were less abundant. In 2012 the site was similar to but drier than last year and 24 *C. glaucophylla* seedlings were found. In 2013, annual species continued to be dominant and only 15 *C. glaucophylla* seedlings were recorded.			

Site	Photo 2010	Photo 2011	Photo 2012	Photo 2013
EOA-03	An open grassy clearing situated in the centre of the southern woodland area on top of the hill. It was dominated by native grasses particularly *Austrostipa scabra subsp. falcata* and contained a very high diversity of native (43) and introduced species (18) including many Asteraceae and Poaceae species. There was good ground cover provided by perennial plants. There were sparse occurrences of *Carthamus lanatus, Echium plantagineum, Salvia verbenaca, Erodium cicutarium* and a variety of *Medicago* and *Trifolium species.* On the fringing woodland (photo point 2 GHD 2010), there was a diverse range of additional native species including *Arthropodium minus, Stackhousia monogyna, Pterostylis sp, , Bulbine bulbosa, Goodenia pinnatifida* and *Calotis cuneifolia* to name a few. In 2011 and 202 the site was very dry with macropod grazing maintaining low grass cover. There was a significant decline in floral diversity but the site retained good ground cover. In 2012 seven *C. glaucophylla* seedlings were found. In 2013 there continued be moderate abundance of native grasses and scattered *Xerochrysum bracteatum* and *Dichopogon stricta* but *Echium plantagineum* was also quite abundant. Twelve *C. glaucophylla* seedlings were recorded.			

Site	Photo 2010	Photo 2011	Photo 2012	Photo 2013
EOA-04	Estcourt Offset Area 04 (EOA-04) was situated on the edge of a woodland stand to the west of the site which contained a moderate canopy of *Callitris glaucophylla* trees of varying health, including numerous dead stags. The vegetation transect extended into an area of open grassland, which contained a higher diversity of native ground cover species than beneath the tree canopies. The understorey was relatively weedy with *Lolium* and *Trifolium* species being very common, but it retained high native species diversity (51 species) and native perennial grasses were particularly dominant. There were no shrubs and no tree hollows were observed. The site had very high species diversity (71 species). In 2011 and 2012 the drier seasonal conditions has resulted in a reduction in floristic diversity. In 2011 four regenerating *Dodonaea viscosa* subsp *cuneata* were recorded. In 2012, there were 7 *Dodonaea* and two *Callitris* seedlings. In 2013 there continued to be good cover of native grasses but there were patches of *Echium plantagineum*. Only one seedling each of *Dodonaea* and *Callitris* were found this year.			
				
EOA-05	Estcourt Offset Area 05 (EOA-05) was situated to the north east of the site within a sparse woodland stand of *Callitris glaucophylla* trees, including two dead stags. There was no *C. glaucophylla* recruitment but the trees were flowering or contained fruit. The understorey was relatively weedy (23 exotic species) especially beneath the trees where there were remnant stockcamps, with *Lolium* and *Trifolium* species being very common, but it retained high native species diversity (49 species) and native perennial grasses were particularly dominant. There were no shrubs and one tree hollow was observed in one of the dead stags. The site had very high species diversity (72 species). In 2011, later monitoring and drier seasonal conditions has resulted in a reduction in floristic diversity. In 2012 the site was very dry with macropod grazing maintaining low grass cover. There was a significant decline in floral diversity but the site retained good ground cover. In 2012 11 *C. glaucophylla* seedlings were found. In 2013 there continued to be good cover of native grasses but there were patches of *Echium plantagineum*. Fourteen *C. glaucophylla* seedlings were recorded. An echidna had destroyed a large any nest.			

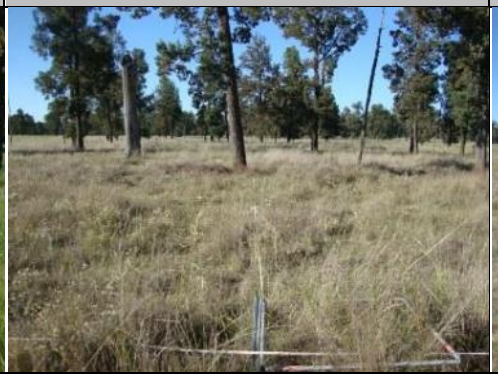
Site	Photo 2010	Photo 2011	Photo 2012	Photo 2013
EOA-06				
	In 2013 this site was established after a grass fire in November 2013 which was initiated by harvesting machinery in adjacent cropland and burnt approximately 1ha within the EOA. The LFA transect = vegetation transect. there were log patches and fallen trees which had caught fire and continued to burn at high temperatures leaving scorched tree canopies and charred blackened coals and bare scorched earth in these immediate areas. Much of the remaining burnt area however appears to have recovered with a very high diversity of scattered native grasses and wild flowers, however total ground cover was patchy. Exotic species tended to dominate areas beneath tree canopies.			
	NA	NA	NA	

Photo Point	2010	2011	2012	2013
P1 599223 6360834				
P2 599191 6361085				
P3 599052 6361375				

Photo Point	2010	2011	2012	2013
P4 598907 6361528				
P5 599028 6361486				
P6 599438 6361766				

Photo Point	2010	2011	2012	2013
P7 599728 6360775				

Management Plan

Pine Donkey Orchid

Risk Statement: High

This document will be reviewed on a one yearly basis, unless a process change occurs earlier than this period, due to monitoring requirements.

Doc No.	Version No.	Next Review Date	Owner
PLN-0064	4.03	4/06/2020	Community, Environment & Farms Superintendent

Revision Summary

First Issue	Issue Date	Implementation Requirements	Approved By
1.0	15 Feb 15	Prepared by R. Feeney for compliance with EA and OEH requirements	Environment and Farming Superintendent

Version No.	Revision Date	Summary of Revision Details	Approved By
2.0	22 Sep 15	Updated with Comments from OEH by R. Feeney	Environment and Farming Superintendent
3.0	26 Jun 18	Reviewed by Nathan jones	
4.0	26 Feb 20	Updated to new DCS	M Row
5.0	26 Apr 20	Updated to include changes in legislation	

Consultation Required	Hard Copy Locations
Not Applicable	Not Applicable

Associated Documents to be Reviewed
Not Applicable

Document Hierarchy

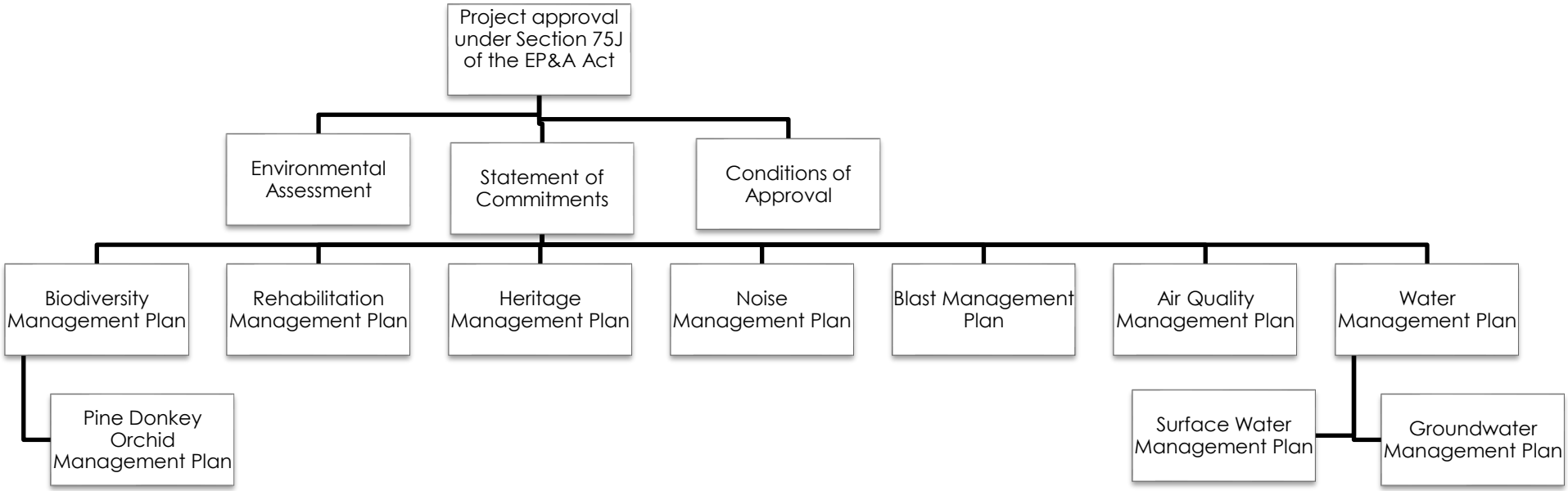


Table of Contents

1. OVERVIEW

1.1 Background

CMOC Mining Services Pty Limited (CMOC) is the manager of the Northparkes Joint Venture, an unincorporated joint venture between CMOC Mining Limited (80%); Sumitomo Metal Mining Oceania Pty Ltd (13.3%) and SC Mineral Resources (6.7%). Northparkes is a copper-gold operation in Goonumbla, situated 27 kilometres north-west of the town of Parkes.

Construction of the ore processing plant and associated facilities began in 1993. Open cut mining commenced on the E22 and E27 ore bodies in late 1993. Development of the E26 lift 1 block cave underground mine began in 1994, with full scale production commencing in 1997.

1.2 Mining Context

Operations at Northparkes primarily comprises underground mining from multiple ore sources that feed a processing plant with a capacity of 6.5 million tonnes per annum (Mtpa). The underground mine is accessed via a decline ramp from the surface for people and materials with ore transported to the surface via inclined conveyors and a hoisting shaft, with a nominal capacity of 7.2 Mtpa. Northparkes utilises low cost block and sub-level cave mining and exploits industry leading technology, such as semi-autonomous loaders and various cave monitoring systems.

The ore processing operation consists of four stages: crushing, grinding, flotation and thickening / filtering. In addition to producing concentrate, the ore processing team also manages tailings disposal. The concentrator was constructed in two modules. Each module consists of its own grinding circuit with a single flotation circuit, concentrate thickener and filter. After extracting the copper and gold bearing minerals, the tailings are combined in a single tailings thickener before being deposited in the active tailings storage facility.

Northparkes' copper concentrate is transported to a rail siding at Goonumbla where it is then transported by rail to Port Kembla, for shipping to overseas customers.

1.3 Pine Donkey Orchid Species Management

Umwelt Australia was commissioned by Northparkes to produce a Biodiversity Offset Management Plan (BOMP) for the Project. As well as outlining management, monitoring and compliance requirements for the Project and offset areas, the BOMP included management and monitoring requirements for two populations of the pine donkey orchid (*Diuris tricolor*) that occur within the Project Area. Following ongoing consultation with the former Office of Environment and Heritage (OEH), the BOMP for the Project was submitted in December 2014. Following review of the BOMP, OEH requested that Northparkes produce a Species Management Plan (SMP) for known populations of pine donkey orchid. The current document has been produced to comply with this request.

This SMP provides a framework for the management of the populations of pine donkey orchid within Northparkes. This SMP has been prepared to support the overarching Biodiversity Offset Management Plan, which was conditioned under schedule 3, section 29 of the Development Consent.
The pine donkey orchid is listed as vulnerable in New South Wales (NSW) under the *Biodiversity Conservation Act 2016* (BC Act). An endangered population of pine donkey orchid is also listed under the BC Act in the Muswellbrook local government area. As this population is located approximately 400 km north-east of Northparkes, it is not relevant to the current species management plan. The pink donkey orchid is not currently listed under the *Environment Protection and Biodiversity Protection Act 1999* (EPBC Act).

Ecological surveys for the Environmental Assessment (EA) identified pine donkey orchid within the Project area. Two populations of pine donkey orchid have been identified within the Project area; one population is located to the north of the Step Change Project Area (along Adavale Lane) and the other population is located near the E48 subsidence zone. A total of 1171 plants (234 and 937 respectively) were recorded within the two areas during ecological assessments for the Step Change Project. It is anticipated that a total of 14 individual plants and 0.05 hectares of known habitat will be removed by the Project.

2. SCOPE

This document applies to all activities undertaken by Northparkes including mining and exploration activities, processing of copper / gold ore resources, project development, maintenance activities, mine closure, logistics, associated service and support functions, bore fields, farming operations and products.

3. PURPOSE / OBJECTIVES

The objectives of this species management plan for the pine donkey orchid are to:

- Detail actions and procedures for pre-construction, construction and operation phases of the Project in order to mitigate adverse impacts on the pine donkey orchid.
- Manage, monitor and report on the two populations of pine donkey orchid over time in terms of changes in extent, changes in individual numbers and the response of the populations to management actions.
- Facilitate compliance with the development consent conditions as specified by a delegate of the Minister for Planning Industry and Environment under the EP&A Act.
- Facilitate compliance with commitments outlined in the EA

Expand existing knowledge of the life history and ecology of the pine donkey orchid through ongoing reporting to the OEH following monitoring events.

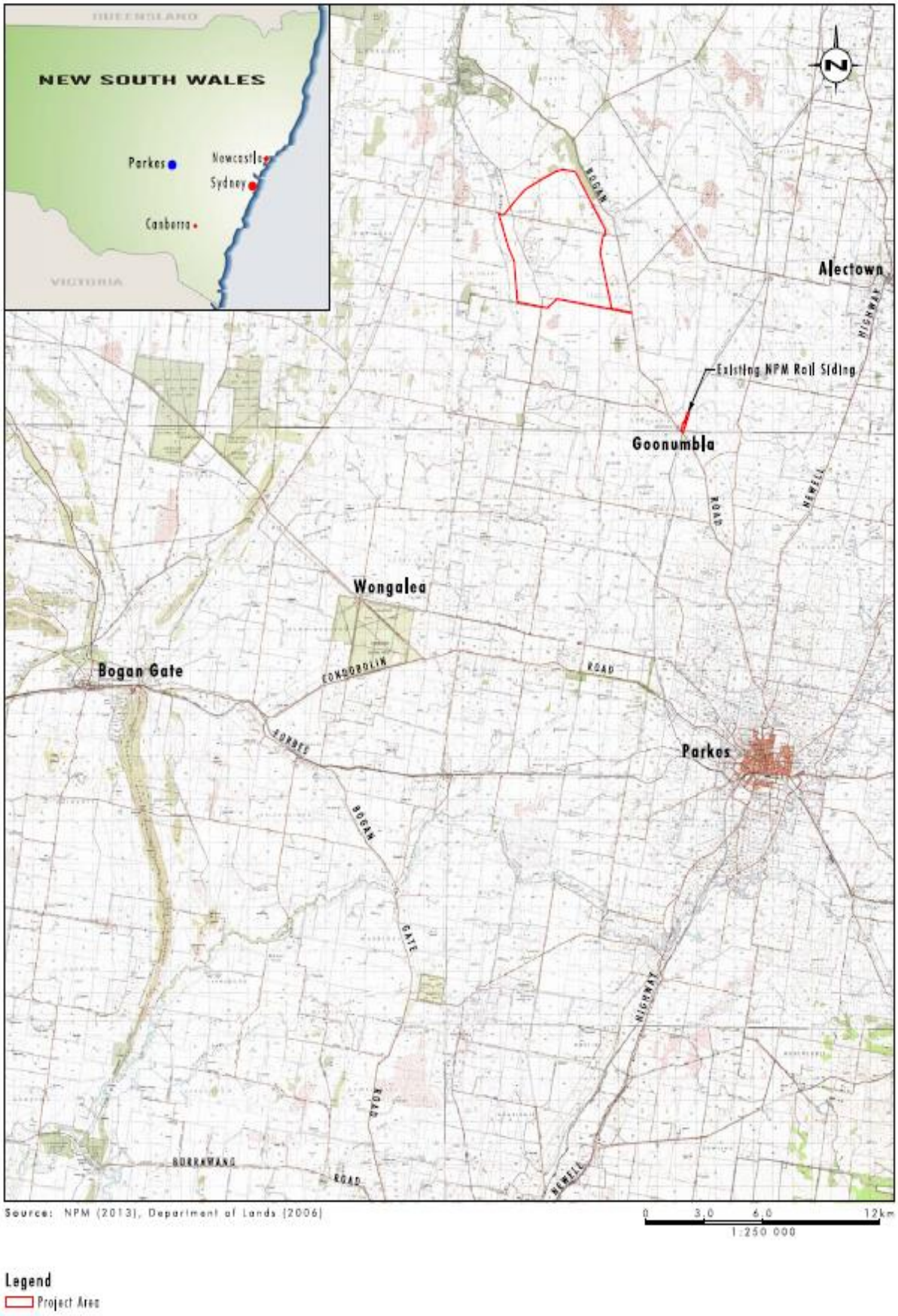


Figure 1: Location of Northparkes Mines in landscape context

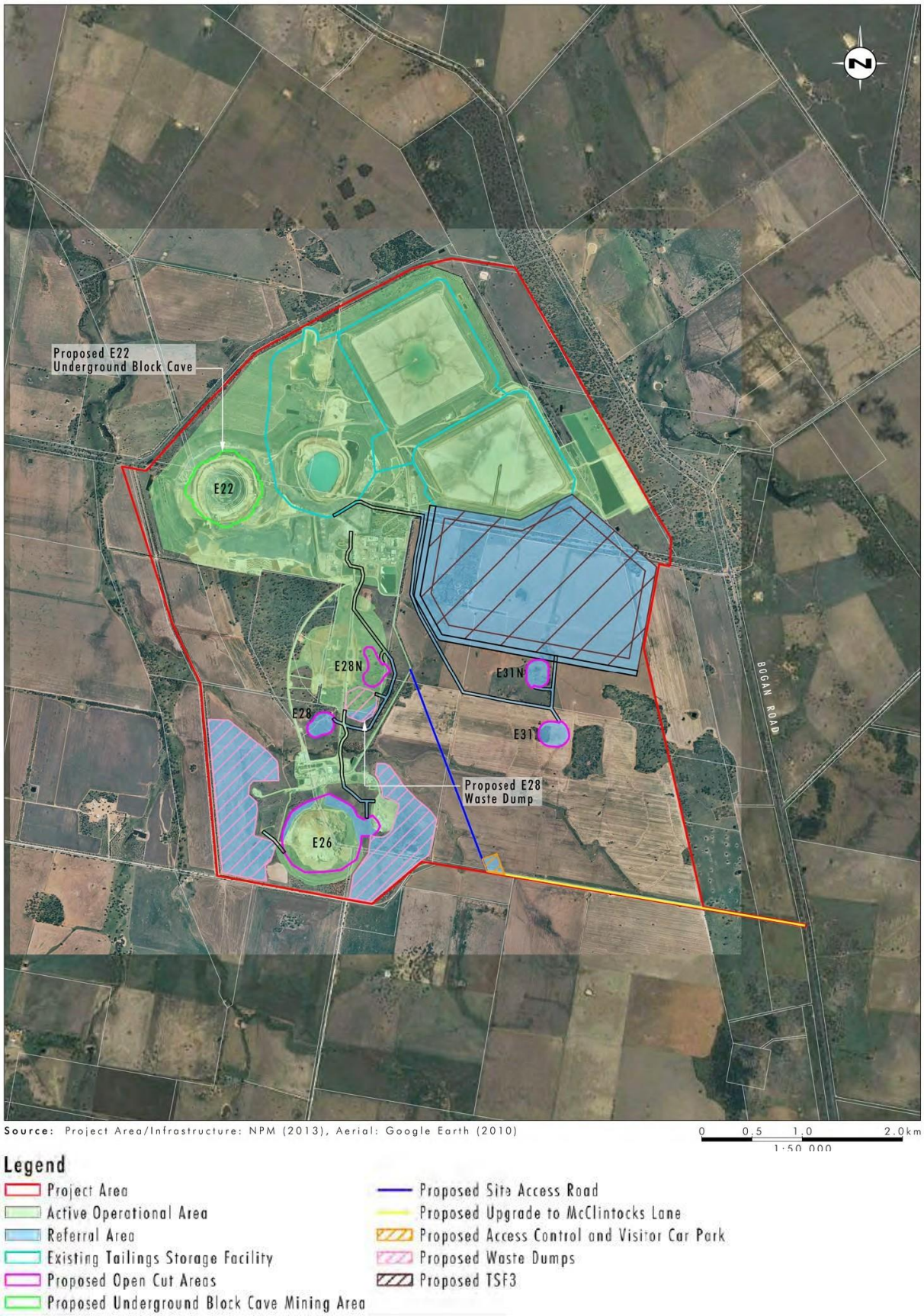


Figure 2: Nortparkes Mines existing and approved operations

4. RESPONSIBILITIES

General role responsibilities are outlined in the Health, Safety and Environment Responsibilities and Accountabilities Procedure (PRO-0080). Personnel carrying out work under this document must be familiar with and comply with it in full. The following persons have specific responsibility:

Table 1: Responsibilities

Role	Pre-construction	Construction	Operation
CMOC	– create and demonstrate a proactive culture towards HSE at Northparkes – support and endorse the Health, Safety and Environment (HSE) Policy. – ensure that adequate resources are available to comply with the HSE Policy.		
PSE Manager	– create and demonstrate a proactive culture towards HSE at Northparkes – ensure adequate resources are available to meet all compliance requirements and implement the actions outlined in this SMP – ensure that the requirements of this SMP are incorporated into the Project planning process – ensure all high-level legal requirements are fulfilled prior to construction	– create and demonstrate a proactive culture towards HSE at Northparkes – ensure adequate resources are available to meet all compliance requirements and implement the actions outlined in this SMP	– create and demonstrate a proactive culture towards HSE at Northparkes – ensure adequate resources are available to meet all compliance requirements and implement the actions outlined in this SMP
Environment & Farm Superintendent	– ensure adequate resources are available to achieve the requirements of this SMP – supervise regular audits against performance outcomes and Development Consent requirements – provide environmental advice and communicate the requirements of this SMP to all employees and contractors associated with the project	– ensure adequate resources are available to achieve the requirements of this SMP – provide environmental advice and communicate the requirements of this SMP to all employees and contractors associated with the project	– provide environmental advice and communicate the requirements of this SMP to all employees and contractors associated with the project – ensure adequate resources are available to achieve the requirements of this SMP

Role	Pre-construction	Construction	Operation
Environment Team	– conduct audits against performance outcomes and Development Consent requirements – provide environmental advice and communicate the requirements of this SMP to all employees and contractors associated with the project – produce species information profile to distribute to all employees to raise awareness of the pine donkey orchid around site	– assist all employees in achieving environmental compliance – conduct regular audits against performance outcomes and Development Consent requirements – provide environmental advice and communicate the requirements of this SMP to all employees and contractors associated with the project – produce species information profile to distribute to all employees to raise awareness of the pine donkey orchid around site – ensure that construction works are conducted in line with this SMP	– assist all employees in achieving environmental compliance – provide environmental advice and communicate the requirements of this SMP to all employees and contractors associated with the project – conduct regular audits against performance outcomes and Development Consent requirements – produce species information profile to distribute to all employees to raise awareness of the pine donkey orchid around site – ensure that construction works are conducted in line with this SMP
All personnel	– demonstrate a proactive culture towards HSE at Northparkes – work with the Environment team to achieve positive environmental outcomes	– demonstrate a proactive culture towards HSE at Northparkes – work with the Environment team to achieve positive environmental outcomes	– demonstrate a proactive culture towards HSE at Northparkes – work with the Environment team to achieve positive environmental outcomes

5. DEFINITIONS

Table 2: Definitions

Key Word	Definition
ALA	Atlas of Living Australia
BC Act	Biodiversity Conservation Act 2016 (New South Wales)
BGT	Botanic Gardens Trust
BOMP	Biodiversity Offset Management Plan
BOS	Biodiversity Offset Strategy
CMA	Catchment Management Area
CMOC	China Molybdenum Co. Ltd
DECC	Department of Environment and Climate Change
DoPIE	Department of Planning, Industry and Environment
DotE	Department of the Environment
EA	Environmental Assessment
EOI	Expression of Interest
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Reg	Environmental Planning and Assessment Regulation 2000
EPBC Act	Environment Protection and Biodiversity Act 1999 (Commonwealth)
NSW	New South Wales
OEH	Office of Environment and Heritage
SMP	Species Management Plan
TSF	Tailings Storage Facility
The Project	Northparkes Mine Extension Project
Umwelt	Umwelt Environmental Consultants

6. SPECIES INFORMATION

6.1 Habitat and Ecology

The pine donkey orchid is a slender to relatively robust terrestrial orchid, which grows annually from an underground tuber (Cunningham et al., 1992). This species has a single stem to approximately 40 cm high, where is has 2- 6 flowers. Flowers are bright yellow to orange, speckled with red to purple and white markings (OEH, 2014) (Figure 3). This species has one to three leaves, which are to 20 cm long and 4 mm wide. The sepals of the pine donkey orchid are very long and often crossed (OEH, 2014). This species fruits a capsule containing many minute seeds and flowers in spring (Cunningham et al., 1992).

The pine donkey orchid can be found in a range of habitats, where it is often associated with white cypress pine (*Callitris glucophylla)*, Poplar box (*Eucalyptus populnea)* and gum coolabah (*Eucalyptus intertexta)* as well as ironbark and acacia shrubland (OEH, 2014). This species often occupies grassy understories with herbaceous plants, such as bulbine species. Pine donkey orchid is also know to grow in sclerophyll forest among grass, often with Callitris species (OEH, 2014). When this species is detected, it is usually recorded as common to locally frequent in populations; however, this species has also been known to occur as single plants (OEH, 2014).

OEH has summarized vegetation associated with pine donkey orchid within for Central West region (as defined under the BioMetric Native Vegetation Assessment Tool). For a list of vegetation associated with the pine donkey orchid refer to Appendix A – Vegetation Formations, Classes and Types Associated with Pine Donkey Orchid in the Central West Region of NSW

Figure 3: Pine donkey orchid flower (left) and habit (right) (Plantnet, 2015)

The pine donkey orchid occurs along the east of Australia, where it predominately occurs in NSW, but has also been recorded in Queensland and northern Victoria (ALA, 2014). This species is sporadically distributed on the western slopes of NSW, extending from south of Narrandera to northern NSW.

6.2 Known Population and Relationship within the Region

Known populations of pine donkey orchid in the central west region of NSW occur along Condobolin-Nymagee road, in Wattamondara towards Cowra, Eugowra, Girilambone, Dubbo and Cooyal (OEH, 2014). OEH has summarized the known and predicted distribution of pine donkey orchid for the Central West region of NSW; for a list by catchment management area (CMA) sub-region, refer to Table 3

Table 3: Known or predicted occurrence of pine donkey orchid by CMA sub-region

CMA Sub-region	Know or Predicted Occurrence	Graphic restrictions
Bogan- Macquarie	Known	None
Canbelego Downs	Known	None
Lower Slopes	Known	None
Nymagee-Rankins Springs	Known	None
Pilliga	Known	None
Pilliga Outwash	Predicted	None
Talbragar Valley	Known	None
Upper Slopes	Known	None

Additionally, pine donkey orchid is known to occur within the Northparkes mining lease and surrounding area, with one population occurring north of Northparkes and a second population occurring near E48 subsidence area within the Project Area.

6.3 Local knowledge of the species

Several ecological surveys have been undertaken across Northparkes. Flora surveys undertaken for the EA and baseline monitoring surveys for the pine donkey orchid are outlined in the following sections.

6.3.1 *Flora field surveys for the EA*

The pine donkey orchid was first recorded within the Project area during surveys for the EA. Flora surveys for the EA are outlined below:

- 27 and 28 July 2011 – rapid vegetation surveys undertaken by two ecologists (Umwelt)
- 26 to 30 September 2011 - Rapid vegetation surveys, systematic plot-based surveys and targeted threatened flora searches undertaken by two ecologists (Umwelt)
- 30 January to 3 February 2012 - Rapid vegetation surveys, systematic plot-based surveys and targeted threatened flora searches undertaken by two ecologists (Umwelt)
- 15 to 19 May 2012 - Rapid vegetation surveys, systematic plot-based surveys and targeted threatened flora searches, undertaken by two ecologists (Umwelt)

Total flora survey effort undertaken for the EA is outlined in Table 4 below:

Table 4: Flora survey effort summary

Flora survey technique	Wider study area	Project area	Proposed disturbance area
Floristic quadrats	34	19	3
Semi quantitative rapid assessment points	60	18	1
Qualitative rapid assessment points	365	76	12
Meandering transects and field reconnaissance	151 km of walking and 526 km of driving		

Targeted threatened flora searches were completed across areas of suitable habitat throughout the Wider Study Area for the pine donkey orchid. Additionally, targeted seasonal surveys for the pine donkey orchid were conducted over only a small portion of the proposed disturbance area. Prior to conducting targeted surveys, the flowering status of this species was verified using a known population at Dubbo as a reference site. It was confirmed the week prior to the spring 2011 surveys that this species was in full flower.

The targeted threatened flora searches were variable in length and location, and were tailored to suit the environment in which they occurred to gain maximum coverage of likely habitat for potential threatened flora species. A meandering technique was selected over the plot-based method since the amount of replicate plots that could have been sampled within each vegetation unit was limited by a restricted survey time. The meandering technique within each search area increased the amount of data that could be collected within the available survey time, thereby maximising the quality and coverage of vegetation description and mapping. Targeted threatened flora searches are useful for detecting threatened flora species across large areas, as they enable the surveyor to cover large proportions of the area under investigation, unlike plot-based surveys.

6.3.2 *Results of the flora field surveys for the EA*

During field surveys for the EA, one population of pine donkey orchid was recorded within the wider study area. The population of pine donkey orchid was recorded within a patch of White Cypress Pine Woodland along the northern boundary of the Project Area (approximately 2.5 kilometres north of the proposed disturbance area). The population extended north, across the realigned section of Adavale Lane, into a larger patch of White Cypress Pine Woodland within the Wider Project Area. A total of 234 plants were recorded within the two areas, a majority of which occur outside of the Project Area.

No patches of White Cypress Pine Woodland occur within the Proposed Disturbance Area, however suitable habitat for the species remains present. Particularly in open areas of the Grey Box Woodland where white cypress pine is locally dominant. Habitat also occurs, albeit in small areas, within the Adavale Lane and McClintocks Lane road reserves. Additional areas include the woodland north of the E26 existing subsidence area.

6.3.3 *Results of the targeted pine donkey orchid surveys undertaken in 2013*

In response to comments from OEH, targeted surveys for the pine donkey orchid were undertaken in spring 2013. During these target survey, 947 individual pine donkey orchid plants were recorded in the Project Area and the approved E48 subsidence zone.

6.3.4 *Baseline monitoring surveys for the pine donkey orchid*

Following identification of the pine donkey orchid within the wider project area during surveys for the EA, baseline monitoring surveys were undertaken in spring 2014, to coincide with the flowering period. Survey of two populations of the pine donkey orchid associated with the Northparkes Mine project area were carried out on 11 and 14 November 2014. Populations were surveyed within the following two pine donkey orchid Management Zones:

- E48 Subsidence Zone.
- Adavale Lane.

The locations of these management zones are shown in Figure 4.

Survey comprised marking the locations of each individual plant encountered along walking transect, using a GPS-generated point. Transects were generally between 5 and 10 metres apart to achieve comprehensive spatial coverage of each population, with the aim of locating every individual orchid visible.

6.3.5 *Results of baseline monitoring surveys for the pine donkey orchid*

One hundred and ninety-nine individual pine donkey orchids were recorded in the two pine donkey orchid Management Zones surveyed in spring 2014. These included:

- 69 individual plants in E48 Subsidence Zone; and
- 130 in Adavale Lane.

Far fewer pine donkey orchids were recorded during baseline surveys in 2014 (199 individuals), compared to the target surveys undertaken in 2013 (947 individuals), and this result may have been due to a number of factors. Although surveys were carried out within the typical peak flowering period for pine donkey orchid, withering of the flowers on a number of the plants was observed, which may be attributable to the hot, dry conditions experienced in the Northparkes area in the week preceding survey. This may have reduced the total count of plants recorded during survey since the plant is more difficult to see when open flowers are absent. Additionally, as the pine donkey orchid has a narrow flowering period between September and late October/November, surveys undertaken during 2014 may have been at sub optimal time compared to surveys taken in 2013. As this species is only detectable during flowering, this may have contributed to the reduced population count. As there is limited academic literature on the ecology of this species, ecological and external factors, such as climatic conditions and flowering ecology of this species (such as if all plants flower annually) may have also contributed to the reduced number of the pine donkey orchid plants recorded in 2014 compared to 2013. However, it is likely that the majority of plants present during survey were recorded.

Figure 4: Pine donkey orchid management zones

6.4 Recognised threats

Many orchids are inherently rare or locally restricted (Swarts and Dixon, 2010). Because this rarity is often coupled with a mycorrhizal symbiosis between the root system of the orchid and the soils fungi and/ or animal pollination for survival, many species of orchid are susceptible to population decline (Merritt et. al., 2014).
The pine donkey orchid is threatened by the following processes in NSW:

- Habitat clearing, fragmentation and/ or modification - Construction of the Project will require clearing of areas of suitable habitat for the pine donkey orchid. Additionally, construction works may result in increased habitat fragmentation and/ or alternation. This species requires a grassy ground layer to provide some protection and moisture retaining litter (OEH, 2014).
- Low detectability –This species only flowers for a short period in spring, from September to November (Plantnet, 2015) and it is extremely difficult to identify outside of the flowering period. Low detectability may result in some plants going undetected if ecological surveys or pre-clearance assessments are undertaken outside of the flowering period (OEH, 2014).
- Feral animals - suitable habitat for the pine donkey orchid (consisting of open woodlands or grasslands with *Callitris* species) are susceptible to disturbance from introduced species including foxes, rabbits and hares (OEH, 2014).
- Weed competition - Increases habitat fragmentation and vehicle traffic may increase weed competition in areas of suitable habitat (OEH, 2014).
- Overgrazing – As the pine donkey orchid is a terrestrial species that occurs in open woodlands and grasslands, this species may be susceptible to grazing pressures from large numbers of introduced (cattle, sheep, rabbits, hares etc.) and native herbivores (macropods).
- Illegal collection – As orchids are desirable in gardens they are prone to illegal collection.

As well as the recognised threats for the pine donkey orchid listed above, orchid germination can also be suppressed through competition with other ground layer species, in particular dense growth of native grasses. Additionally, there is a large population of macropods that inhibit the Northparkes Miens lease area, which may inhibit the growth of this species through grazing.

7. PERFORMANCE INDICATORS

7.1 Objectives and indictors

The environmental objectives that have been developed for this SMP have been tailored to the environmental values of the populations of pine donkey orchid within and surrounding Northparkes and the potential impacts on this species. The performance objective for this SMP includes:

- That habitat values for the two populations of pine donkey orchid are maintained and enhanced where possible,
- The management of the two populations of pine donkey orchid within and surrounding Northparkes, as well as the management of areas offsite (including offset areas) will contribute to the recovery actions outlined in the Saving our Species Program including:
    - Conduct baseline surveys to locate new populations and extend the ranges of currently known populations.
    - Annually monitor populations that represent the spatial distribution of the species.
    - Erect stock-proof fences around populations that are highly threatened from trampling and grazing by stock.
    - Develop a fact sheet and distribute to employees and contractors to increase knowledge of the species

- Investigate culling kangaroo populations to reduce grazing pressure on pine donkey orchid.

The following indictors will be used to monitor the success of this SMP in achieving its objectives:

- An annual audit demonstrating implementation of the mitigation and management measures
- No net decline in the population of pine donkey orchid within the two management zones
- Evidence of natural germination of pine donkey orchid within the two management zones
- No net increase of weed species that reduced the habitat value for pine donkey orchid.

8. POTENTIAL IMPACTS

8.1 Overview

The following sections outline the potential impacts to the pine donkey orchid as a result of the project. The summary of impacts is based on impacts identified for the Project for the impact assessment in the EA that are of relevance to the pine donkey orchid.

8.2 Clearance of Vegetation/Loss of Habitat

The clearing of vegetation will comprise the main impact of the Project. This impact will come from the direct removal of vegetation (including constituent flora and potentially donkey pine orchid). The potential impacts of the clearance of vegetation/loss of habitat are to be mitigated for pine donkey orchid by conducting pre-clearance surveys prior to tree felling. The potential residual impacts will be mitigated via a biodiversity offset strategy (BOS) to secure, manage and improve appropriate habitat areas.

8.3 Fragmentation

The clearing of vegetation within the proposed disturbance area will increase the levels of fragmentation in the local area. Increased isolation and fragmentation results from a reduced gene flow throughout the landscape. Limited genetic flow into or out of a particular area can lead to reduced genetic variation and inbreeding depression within flora species. This can lead to isolated populations being placed at increased risk of local extinction due to a reduced ability to cope with stochastic events and environmental change.

8.4 Edge Impacts

Many native species are known to be sensitive to edge-effects. Such edge effects result in the deterioration of the quality of vegetation along the interface with cleared or disturbed environments. Such habitat deterioration can result from impacts such as increased weed invasion, rubbish dumping, increased predation, increased presence of introduced species or increased human presence. Edge effects from the Project could include minor weed issues, pest species movements, noise, light and dust.

There is a potential that edge effects as a result of the Project may have some marginal impacts on adjoining areas. The design of the Project includes measures to minimise the potential for air quality, fugitive light and noise impacts. However, edge effects are unlikely to significantly affect the ecology of the adjoining areas. The potential impacts from edge effects are managed via ongoing weed and feral animal control.

8.5 Introduced Species

Importation of materials to the proposed disturbance area, management activities, increased human presence and clearing of vegetation all have the potential to increase the incidence of introduced species within the proposed disturbance area. Weed species may be inadvertently brought into the proposed disturbance area with imported materials, or encouraged by removal of native vegetation. An increase in introduced species within the proposed disturbance area could have considerable impacts on existing native species. Introduced species are to be managed via weed and feral animal control programs.

9. MITIGATION AND MANAGEMENT ACTIONS

Management and mitigation measures will be implemented for the life of the Project. Management actions will seek to maintain and where possible, enhance the habitat for, and increase the populations of pine donkey orchid.

Key management actions that will be implemented to specifically mitigate impacts on the populations of pine donkey orchid during pre-construction, construction and operation of the Project include:

- fencing of the populations to remove potential impacts from human access (particularly vehicle access) prior to works commencing;
- annual seasonal monitoring during the flowering period (September to October) to assess the ongoing status of the population;
- annual monitoring of ground cover abundance and flora species composition;
- weed monitoring and control, as required. All weed control actions will be undertaken outside the flowering period of the species;
- educating staff through inductions and People, Safety and Environment meetings, with flora and fauna management included as a topic;
- the environment team will work to implement flora and fauna management throughout the planning, construction and operation phases of the project.

Other general management and mitigation measures that will be implemented to minimise potential impacts to the populations of pine donkey orchid during pre-construction, construction and operation are outlined in Table 5.

Table 5: Management and mitigation measures

Issue	Control	Responsibility	Project phase	Timeframe	Documentation
General	Establish ongoing monitoring program for the populations of pine donkey orchid	Environment & Farm Superintendent	Pre-construction	Complete	BOMP, SMP for pine donkey orchid, Annual monitoring reports
	Undertake annual monitoring of pine donkey orchid populations. Monitoring is to be undertaken during spring, when this species most detectable (flowering).	Environment & Farm Superintendent	Pre-construction, Construction, Operation (as required)	Ongoing. Once annually	BOMP, SMP for pine donkey orchid, Annual monitoring reports
	Provide information on the pine donkey orchid for inclusion in site training modules. Information will outline threatened status, general ecology and habitat preferences, flowering time and timeframe for detectability and a photo to aid identification if this species is seen during works.	Environment & Farm Superintendent	Pre-construction, Construction, Operation	Prior to site access	Basic environemtnal awreness training module
	Discuss ecological considerations, including the pine donkey orchid in shift change meetings, particularly during clearing works	Environment & Farm Superintendent , Project Manager	Pre-construction, Construction, Operation	Ongoing	SMP for the pine donkey orchid
	Be aware of requirements of this SMP for the pine donkey orchid during all works for the Project. If pine donkey orchid is identified during clearing work, suspend works and contact the Environment team.	All Northparkes staff and contractors	Pre-construction, Construction, Operation	Ongoing	BOMP, SMP for pine donkey orchid, Annual monitoring reports, Basic environemtnal awreness training module
	Establish fences around known populations of pine donkey orchid to restrict human disturbance.	Environment & Farm Superintendent	Pre-construction	Prior to construction	SMP for the pine donkey orchid.
Clearing of vegetation/ loss of habitat	Undertake pre-clearance surveys prior to vegetation clearing	Environment & Farm Superintendent	Pre-construction	Prior to construction	Development Consent for the Project, Pre-clearance report
	Have ecologist oversee tree-felling works for areas identified as Grey Box Grassy Woodland or potential habitat for the pine donkey orchid	Environment & Farm Superintendent	Construction	During construction	Development Consent for the Project, Pre-clearance report. Northparkes tree felling procedure
	Maintain a data set of the location of known pine donkey orchid populations, including GPS points of all known individual plants	Environment & Farm Superintendent	Pre-construction, Construction, Operation	Ongoing	Annual monitoring reports
	Undertaken rehabilitation and weed management in areas not directly impacted by the project to improve the quality of habitat in these areas	Environment & Farm Superintendent	Pre-construction, Construction, Operation	Ongoing	BOMP
	Clearly identify the extent of vegetation clearing on construction plans and in the field. Clearing extents will be communicated to all necessary construction supervisors	Project Manager	Construction	Prior to construction	Project maps and technical drawings
Fragmentation and edge effects	Minimise the extent of proposed new roads during Project planning	Project Manager	Preconstruction	Project planning phase	Project maps and technical drawings
Introduced species	All staff are to drive on designated roads to limited weed spread and damage to vegetation.	All staff	Pre-construction, Construction, Operation	Ongoing	Project maps and technical drawings

10. MONITORING

Annual monitoring of the known populations of the pine donkey orchid will be undertaken. The aims of this monitoring is to:

- assess the ongoing status of the population; and
- identify any threats to the population such as weed invasion.

The following monitoring activities will be undertaken:

- Both populations will be fenced to remove potential impacts from human access (particularly vehicle access) prior to works commencing. Along Adavale Lane the extent of the population that occurs within Northparkes landholdings will be fenced. Areas along the Adavale Lane road reserve where the species occurs will not be fenced (Figure 5). Near the E48 subsidence zone the population outside of the haul road buffer zone will be fenced (Figure 6). The fences will be inspected annually to ensure that disturbance by humans or grazers has been prevented.
- Prior to the construction of the road, all construction personnel will be briefed on the presence and location of pine donkey orchid and made aware of the importance of minimising disturbance in this area via inductions.
- Annual seasonal monitoring during the flowering period (September to October) to assess the ongoing status of the population will be undertaken. The location of all individuals are to be recorded using a hand held GPS and a total count is to be provided for each population.
- Annual monitoring of ground cover abundance and flora species composition using permanent five × five metre floristic plots will be undertaken. Three five × five metre plots floristic plots will be established at the Adavale Lane population and another three at the E48 population. The plots will be positioned to measure the species composition and cover abundance of ground covers in the population areas.
- Weed monitoring via walking meandering transects through both populations, and where required weed control. All weed control actions will be undertaken outside the flowering period of the species.

Following each monitoring event, a report will be produced outlining the outcomes. This report will be supplied to OEH.

Figure 5: Pine donkey orchid populations at Avadale Land

Figure 6: Pine donkey orchid population at the E48 subsidence zone

11. REVIEWS AND CONSULTATION

This SMP will be reviewed annually to:

- refine and make improvements to the management strategies; and
- assess the performance of the management strategies against preliminary performance indicators and completion criteria.

The review will look for opportunities to improve the management strategies as well as further develop and forecast the longer term performance indicators and completion criteria. Adaptive management amendments to this SMP that are made for continual improvement do not require submission to the relevant authorities for approval if they are consistent with the conditions of the Development Consent.

Northparkes will consult with the Department of Planning, Industry and Environment (DoPIE) regarding the implementation this SMP.

12. ADAPTIVE MANAGEMENT PROCESS

Adaptive management of this SMP will be responsive to any new and relevant data that may arise through the monitoring of the pine donkey orchid populations, legislative change or any other studies completed at the site. This will enable a flexible approach to management commitments, allowing ongoing feedback and refinement of this SMP. Adaptive management will be a key mechanism to address the risks to the successful implementation of this SMP. Adaptive management steps include regular review of this SMP, including adaptation of targets and performance indicators, recognising potential risks to the successful implementation of this SMP and having a frame work in place for corrective actions.

The adaptive management process is outlined in Figure 7.

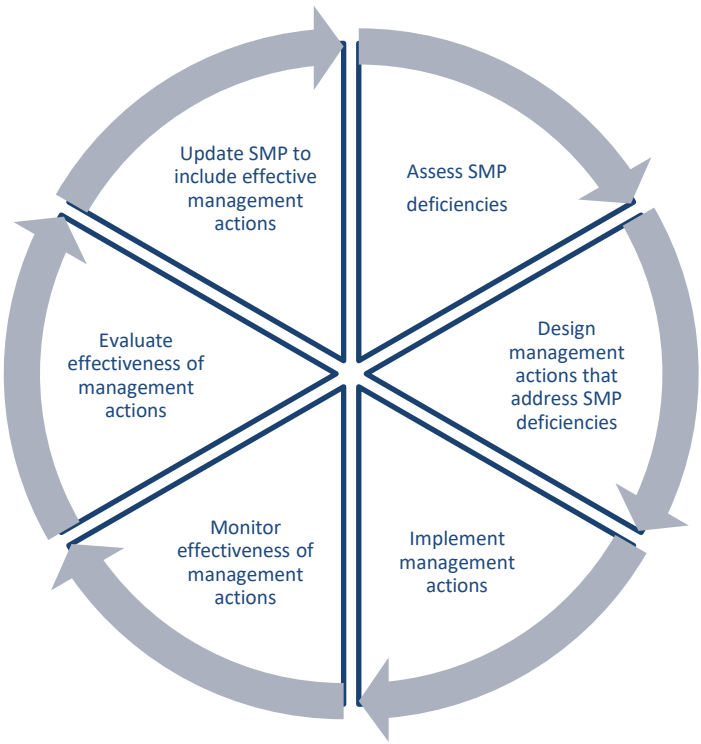


Figure 7: Adaptive management process

13. PERFORMANCE AND COMPLETION CRITERIA

Performance and completion criteria for the orchid populations are provided in Table 6.

Table 6: Avadale Lane and E48 subsidence zone pine donkey orchid populations performance and completion criteria

Action	2014 Baseline	Years 1 to 5 PC 2015 to 2019	Years 8, 11, 14, 17 & 20 PC	Completion criteria
Erect fence	Completed			Completed
Fence inspections		To be completed annually for the first 5 years	To be completed every 3 years after year 5	Ongoing
Annual orchid monitoring during flowering period	Completed	To be completed annually for the first 5 years	To be completed every 3 years after year 5	Ongoing
Ground cover monitoring		To be completed annually for the first 5 years	To be completed every 3 years after year 5	Ongoing
Weed monitoring	Completed	To be completed annually for the first 5 years	To be completed every 3 years after year 5	Onggoing

14. TRIGGERS FOR ADAPTIVE MANAGEMENT

Trigger points for adaptive management of the pine donkey orchid populations are provided in Table 7.

Table 7: Avadale Land and E48 subsidence zone pine donkey orchid populations' triggers for adaptive management

Action	Trigger Point for Adaptive Management	Adaptive Management
Orchid fence inspections	Failure of fence allows humans or grazers to enter the orchid populations	Repairs undertaken
Annual orchid monitoring	Population count declines by 50 per cent from annual average	Review climatic conditions, is the decline due to seasonal conditions. Review ground cover monitoring results. Have native species prevented emergence? Review weed monitoring results. Have weed species prevented emergence? Develop strategies to ensure declining population count is not related to ground cover management or potential disturbances
Ground cover monitoring	Total native ground cover abundance scores increase as the number of orchids declines over 2 years of monitoring.	Identify native ground cover species that have increased in cover abundance as the orchid population has declined. Remove the identified species by hand during the non-flowering season, or as a minimum reduce the identified species to pre orchid decline cover abundance values.
Weed monitoring	Weed species (individually or combined) cover 10 per cent or more of the extent of the population.	Weed species controlled during non-flowering periods by spraying or manual removal.

Results of the pine donkey orchid monitoring will be documented in a monitoring report, along with any management actions required such as weed management.

15. COMMUNICATION, TRAINING, REPORTING AND AUDITING

15.1 Communication

The requirements of this species management plan for the pine donkey orchid will be communicated to all Northparkes staff and contractors involved with the Project. The Project manager will work with the Northparkes environment team to communicate the general intent, scope and relevance of this document to all Northparkes staff and contractors working on the Project. Communication channels will include:

- Environmental training packages
- Construction project pre-start meetings
- Level 2 risk assessments (where relevant)
- Management meetings; and
- Environmental reports.

15.2 Site inductions

All personnel who undertake work at Northparkes must complete the basic environmental training module. Information about the pine donkey orchid will be included in the training module to raise awareness of the presence of this species. Information will include threatened status, general ecology and habitat preferences, flowering time and timeframe for detectability and a photo to aid identification if this species is seen during works. Inductees will be advised to contact the Northparkes Environment team if they suspect the presence of pine donkey orchid, and stop work until the species identification can be confirmed.

15.3 Project shift change meetings

At the commencement of each work shift, shift change meetings will be undertaken with contractors and staff to communicate relevant environmental considerations for the shift. Of particular importance, will be when works commence in a new location or new activities will be undertaken. Information relevant to works from the SMP will be communicated, including:

- Sensitive environmental areas in proximity to where works are being undertaken,
- Any mitigation and management measures that are relevant to works
- Recent environmental incidents and the corrective actions that are being undertaken.

15.4 Internal reporting

During construction and operation of the Project, the following environmental reporting, relevant to this species management plan for the pine donkey orchid, will be undertaken:

- Internal and external environmental audits
- Environmental incident reports
- Monitoring reports for the pine donkey orchid
- Monthly reports

15.5 External reporting

Consultation with DoPIE will occur, as required, throughout pre-construction, construction and operation of the Project in relation to management of the populations of pine donkey orchid. Additionally, DoPIE will be provided with a copy of monitoring reports produced following surveys of the pine donkey orchid populations. DoPIE will be contacted if any additional populations of pine donkey orchid are discovered at Northparkes or if any advice is sort regarding the known populations of pine donkey orchid at Northparkes.

The objectives for this management plan will be reported in the Annual Review which includes results of any monitoring undertaken, reporting against the performance objectives and findings from the inspections and audits.

16. REQUIREMENTS UNDER LEGISLATION

16.1 Environmental Planning and Assessment Act 1979

The EP&A Act governs land-use planning and development in NSW. The Act provides for the proper management, development and conservation of natural and artificial resources for the purpose of promoting the social and economic welfare of the community and the environment. The Act provides protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities and their habitats. The Act also allows for the assessment of project applications and provides for increased opportunity for public involvement and participation in environmental planning and assessment. The EP&A Act is administered by the Department of Planning, Industry and Environment in NSW.

16.2 Environmental Planning and Assessment Regulation 2000

The Environmental Planning and Assessment Regulation 2000 (EP&A Reg) is under the EP&A Act. The EP&A Reg aids the EP&A Act by providing further details of the development consents and requirements.

16.3 Biodiversity Conservation Act 2016

In New South Wales, threatened species are managed under the *Biodiversity Conservation Act 2016* (BC Act), which is administered by the DoPIE. The BC Act provides for the conservation of threatened species, populations and ecological communities of animals and plants (OEH 2014). The Act sets out a number of specific objects relating to the conservation of biological diversity and the promotion of ecologically sustainable development. Threatened species, ecological communities and key threatening processes are identified and classified by a scientific committee and are listed on the schedules of the BC Act.

16.4 New South Wales recovery plan

16.4.1 *Saving our Species program*

Saving our Species is a new conservation program that aims to maximise the number of threatened species that can be secured in the wild in NSW for 100 years. Under the NSW Saving our Species Program, the pine donkey orchid is assigned to the keep-watch species management stream (OEH, 2014). Species in this management stream are considered either naturally rare, have few known threats, or are more abundant than previously assumed (OEH, 2014). This allocation was made as this species is predicted to be secure in NSW for 100 years without targeted management at particular sites. Under the Saving our Species Program, a number of state-wide management actions have been identified for pine donkey orchid, including:

- Conduct baseline surveys to locate new populations and extend the ranges of currently known populations. Surveys should include all State Forests where suitable habitat occurs.
- Following surveys, assess the current conservation status and prepare & submit a nomination for de-listing if required.
- Annually monitor at least 5 populations that represent the spatial distribution of the species.
- Collect seed and soil for NSW Seedbank. Develop collection program (including mycorrhizal symbiont) in collaboration with BGT - multiple provenances.
- Conduct experimental trials into the effects of fire, grazing and weed disturbances.
- Erect rabbit, goat and stock-proof fences around populations that are highly threatened from trampling and grazing by feral animals and stock.
- Develop a fact sheet and distribute via community newsletters, regional shows and field days and by promoting the DEC threatened species website.
- Conduct surveys and assessments of less known sites to confirm presence of species and develop and implement conservation management agreements with landholders for high priority sites.

- Develop an Expression of Interest (EOI) for incentives targeted towards private landowners to locate new sites for conservation.
- Investigate seed viability, germination, dormancy and longevity (in natural environment and in storage) (+ symbionts and soil for orchids, gentians) (OEH, 2014)

16.5 Development Consent

In 2013, Northparkes proposed the Step Change Project, which encompassed the continuation of underground block cave, additional campaign open cut mining located in existing mining leases, augmentation to approved Tailings Storage Facilities (TSFs) and an extended mine life until 2032. Associated with the extension to mining operations is the development of supporting surface infrastructure related to amended access and tailings/ waste material storage.

16.5.1 *Commonwealth*

Following referral to the Commonwealth government, the Step Change Project was assessed as a controlled action under the Environment Protection and Biodiversity Act 1999 (EPBC Act), requiring assessment by Preliminary Documentation on 21 May 2013. The Preliminary Documentation for the Step Change Project included supplementary information on the superb parrot, avoidance and mitigation measures, proposed offsets and residual impacts. The final Preliminary Documentation for the Step Change Project was submitted to the Department of the Environment (DotE) in November 2013. The Step Change Project was approved with conditions by the DotE under the EPBC Act on 13 February 2014. Conditions attached to the approval addressed avoidance and mitigation impacts onsite, offsetting of residual impacts, reporting and auditing, revisions and publications of plans.

16.5.2 *New South Wales*

In New South Wales (NSW), the Step Change Project was assessed under Section 75J of the Environment Planning and Assessment Act 1979 (EP&A Act). Following submission of the Step Change Project's Environmental Assessment (EA), the Project was approved with conditions by a delegate of the minister under the EP&A Act on the 16 July 2014. Project conditions for biodiversity related predominately to the population of pine donkey orchid, the securing and management of biodiversity offsets, the securing of a conservation bond and requirements regarding the preparation and implementation of a Biodiversity Offset Management Plan (BOMP).

Following review of the Step Change Project, the scope was altered and project modifications were submitted to the relevant government agencies. The Northparkes Mines Extension Project (the Project) was approved with conditions on 16 July 2014.

17. REGULATORY REQUIREMENTS

As the pine donkey orchid is listed as vulnerable under the *Biodiversity Conservation Act 2016*, and is not listed under the EPBC Act, conditions relating to this species are added under the NSW Development Consent for the Northparkes Step Change Project. The Species Management Plan for the pine donkey orchid addresses DC11_0060, Schedule 3, Condition 25 and 29.

The details of the NSW conditions and reference to where they are addressed in the BOMP or SMP for the pine donkey orchid are provided in Table 8.

Table 8: Legal Requirements

Development Consent 11_0060	Northparkes Reference
Biodiversity	
24. The Proponent shall actively manage and maintain the populations of Pine Donkey Orchid located to the north of the project area (near Adavale Lane) and near the E48 subsidence zone.	Entire SMP for the Pine Donkey Orchid.
29. The Proponent shall prepare and implement a Biodiversity Management Plan for the project to the satisfaction of the Secretary. This plan must: (a) be prepared in consultation with BCD, and submitted to the Secretary for approval prior to the commencement of any development on site; (b) describe the short, medium, and long term measures that would be implemented to: • manage the remnant vegetation and fauna habitat on the biodiversity offset sites; • restore the derived native grassland component of the Grey Box Grassy Woodland EEC community within the Kokoda Biodiversity Offset to woodland community; • implement the biodiversity offset strategies; and • integrate the implementation of the biodiversity offset strategies to the greatest extent practicable with the rehabilitation of the site (where relevant); (c) include detailed performance and completion criteria for evaluating the performance of the biodiversity offset strategies, and triggering remedial action (if necessary); (d) include a detailed description of the measures that would be implemented for: • enhancing the quality of existing vegetation and fauna habitat in the biodiversity offset areas, including the derived native grassland component of the Grey Box Grassy Woodland EEC community within the Kokoda Biodiversity Offset; • creating native vegetation and fauna habitat in the biodiversity offset areas and rehabilitation area through focusing on assisted natural regeneration, targeted vegetation establishment and the introduction of naturally scarce fauna habitat features (where necessary); • managing and maintaining the populations of Pine Donkey Orchid located to the north of the project area (near Adavale Lane) and near the E48 subsidence zone (refer to Appendix 6); • collecting and propagating seed; • managing any potential conflicts between the proposed enhancement works in the biodiversity offset areas and any Aboriginal heritage values (both cultural and archaeological) in these areas; • managing salinity; • controlling weeds and feral pests; • controlling erosion; • managing grazing and agriculture on site; • controlling access; and • bushfire management; (e) include a seasonally-based program to monitor and report on the effectiveness of these measures, and progress against the detailed performance and completion criteria; (f) identify the potential risks to the successful implementation of the biodiversity offsets, and include a description of the contingency measures that would be implemented to mitigate against these risks; and (g) include details of who would be responsible for monitoring, reviewing, and implementing the plan.	Entire BOMP

18. REFERENCE MATERIALS

Table 1: Reference Materials

Document Title	ID No. | Year
Atlas of Living Australia (ALA) 2014, Diuris trocolor – Spotted-throat Cowslip. Accessed on 12/12/2014 from http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:apni.taxon:130949	
Cunningham, G.M., Mulham, W.E, Milthrope, P.Leigh, J.H. 1992, Plants of New South Wales. Inkata Press. Melbourne.	
Merritt, D.J. Hay, F.R., Swarts, N.D., Sommerville, K.D., Dixon, K.W. 2014, Ex Situ Conservation of Orchid Germplasm. International Journal of Plant Science. The University of Chicago Press.	
New South Wales Flora Online (Plantnet) 2015, Diuris tricolor. Accessed on 20/01/2015 from http://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Diuris~tricolor.	
Office of Environment and Heritage 2014, Pine donkey orchid – profile. Accessed on 15/01/2015 from http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10243	
Office of Environment and Heritage 2014, Saving our Species. Accessed on 20/01/2015 from http://www.environment.nsw.gov.au/savingourspecies/about.htm	
Swarts, N.D., Sinclair, E. A., Francis, A., Dixon, K.W., 2010, Ecological specialization in mycorrhizal symbiosis leads to rarity in an endangered orchid. Molecular Ecology. 19: 3226-3242.	

19. ATTACHMENTS

19.1 Appendix A – Vegetation Formations, Classes and Types Associated with Pine Donkey Orchid in the Central West Region of NSW

Formation	Class	Type
Dry sclerophyll forests (shrub/grass sub-formation)	Pilliga Outwash Dry Sclerophyll Forests	Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion
		White Cypress Pine - Bulloak - ironbark woodland of the Pilliga area of the Brigalow Belt South Bioregion
Dry sclerophyll forests (shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Black Cypress Pine - Narrow-leaved Ironbark - red gum +/- White Bloodwood shrubby open forest on hills of the southern Pilliga, Coonabarabran and Garawilla regions, Brigalow Belt South Bioregion
		Brown Bloodwood - cypress - ironbark heathy woodland in the Pilliga region of the Brigalow Belt South Bioregion
		Buloke - White Cypress Pine woodland in the NSW South Western Slopes Bioregion
		Inland Scribbly Gum - Black Cypress Pine - Red Ironbark open forest of the NSW central western slopes
		inland Scribbly Gum - Red Stringybark - Black Cypress Pine - Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion
		Inland Scribbly Gum - White Bloodwood - Red Stringybark - Black Cypress Pine shrubby sandstone woodland mainly of the Warrumbungle NP - Pilliga region in the Brigalow Belt South Bioregion
		Narrow-leaved Ironbark - Black Cypress Pine +/- Blakely's Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)
		Narrow-leaved Ironbark - White Cypress Pine - Buloke tall open forest on lower slopes and flats in the Pilliga Scrub and surrounding forests in the central north Brigalow Belt South Bioregion
		Red gum - Rough-barked Apple - Narrow-leaved Ironbark - cypress pine grassy open forest on flats and drainage lines in the Goonoo and surrounding forests, southern Brigalow Belt South Bioregion
		Red Stringybark woodland on hillslopes, northern NSW South Western Slopes Bioregion
		Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region
		White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions
		White Cypress Pine - Narrow-leaved Ironbark - Buloke grassy open forest of the Dubbo region, southern Brigalow Belt South Bioregion
		White Mallee - Dwyer's Red Gum mallee heath on sands in the Goonoo - Pilliga region, Brigalow Belt South Bioregion

	Yetman Dry Sclerophyll Forests	White Cypress Pine - Buloke - White Box shrubby open forest on hills in the Liverpool Plains - Dubbo region, Brigalow Belt South Bioregion
Semi-arid woodlands (shrubby sub-formation)	North-west Alluvial Sand Woodlands	Dirty Gum - White Cypress Pine tall woodland of alluvial sand (sand monkeys) in the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion
		Silver-leaved Ironbark - White Cypress Pine - Rough-barked Apple woodland on alluvial terraces in central-north NSW
	Western Peneplain Woodlands	Poplar Box - Gum Coolabah - White Cypress Pine shrubby woodland mainly in the Cobar Peneplain Bioregion

Management Plan

Kokoda Bushfire

Risk Statement: Moderate

This document will be reviewed on a five yearly basis, unless a process change occurs earlier than this period.

Doc No.	Version No.	Next Review Date	Owner
PLN-0066	3	25/06/2025	Environment & Farms Superintendent

Revision Summary

First Issue	Issue Date	Implementation Requirements	Approved By
1.0	14 Jul 16	Drafted by R. Feeney to be included as an appendix to the BOMP, as required by OEH.	E & F Superintendent

Version No.	Revision Date	Summary of Revision Details	Approved By
2.0	26 Feb 20	Updated to new DCS	M Row
3.0	24 Jun 20	Updated following submission of Annual Review	

Consultation Required	Hard Copy Locations
Not Applicable	Not Applicable

Associated Documents to be Reviewed
Not Applicable

Contents

1. OVERVIEW

1.1 Background

CMOC Mining Services Pty Limited (CMOC) is the manager of the Northparkes Joint Venture, an unincorporated joint venture between CMOC Mining Limited (80%); Sumitomo Metal Mining Oceania Pty Ltd (13.3%) and SC Mineral Resources (6.7%). Northparkes is a copper-gold operation in Goonumbla, situated 27 kilometres north-west of the town of Parkes.

Construction of the ore processing plant and associated facilities began in 1993. Open cut mining commenced on the E22 and E27 ore bodies in late 1993. Development of the E26 lift 1 block cave underground mine began in 1994, with full scale production commencing in 1997.

1.2 Mining Context

Operations at Northparkes primarily comprises underground mining from multiple ore sources that feed a processing plant with a capacity of 6.5 million tonnes per annum (Mtpa). The underground mine is accessed via a decline ramp from the surface for people and materials with ore transported to the surface via inclined conveyors and a hoisting shaft, with a nominal capacity of 7.2 Mtpa. Northparkes utilises low cost block and sub-level cave mining and exploits industry leading technology, such as semi-autonomous loaders and various cave monitoring systems.

The ore processing operation consists of four stages: crushing, grinding, flotation and thickening / filtering. In addition to producing concentrate, the ore processing team also manages tailings disposal. The concentrator was constructed in two modules. Each module consists of its own grinding circuit with a single flotation circuit, concentrate thickener and filter. After extracting the copper and gold bearing minerals, the tailings are combined in a single tailings thickener before being deposited in the active tailings storage facility.

Northparkes' copper concentrate is transported to a rail siding at Goonumbla where it is then transported by rail to Port Kembla, for shipping to overseas customers.

1.3 Kokoda Biodiversity Offset Bushfire Management

Northparkes manages Kokoda in accordance with the Northparkes Biodiversity Offset Management Plan (BOMP), which guides the short, medium and long term conservation and management actions at Kokoda. The BOMP was prepared to fulfil the NSW Development Consent (DC11_0060) and Commonwealth Project Approval (EPBC 2013/6788) requirements and provides a framework for the implementation of ecological management actions, regeneration strategies, controls and monitoring programs at Kokoda.

One of the requirements included in the BOMP is that Northparkes develop a Bush Fire Management Plan (BFMP) for the Kokoda. Additionally, included in the second round of comments on the BOMP from the Office of Environment and Heritage (OEH) was the requirement to develop an ecological burn strategy for the Kokoda. This requirement will be address in this Management Plan.

2. SCOPE

This document applies to all activities undertaken by Northparkes including mining and exploration activities, processing of copper / gold ore resources, project development, maintenance activities, mine closure, logistics, associated service and support functions, bore fields, farming operations and products.

3. PURPOSE / OBJECTIVES

The aim of this BFMP is to facilitate the long term management of Kokoda in relation to bush fire.

Specific objectives of the BFMP are to:

- Support the BOMP by providing information on bush fire management for Kokoda.
- Provide information on fire management in relation to particular threatened species and ecological communities known to occur within the Kokoda.
- Provide information on emergency response in the circumstance of a bush fire emergency at the Kokoda or an adjacent property.
- Provide details of the communication process with the neighbours around Kokoda, as well as the Mandagery Rural Fire Brigade

For information relating to other aspects of the management of Kokoda, refer to Northparkes mines Biodiversity Offset Management Plan.

4. RESPONSIBILITIES

General role responsibilities are outlined in the Health, Safety and Environment Responsibilities and Accountabilities Procedure (PRO-0080). Personnel carrying out work under this document must be familiar with and comply with it in full. The following persons have specific responsibility:

Table 1: Responsibilities

Role	Responsibility
All Personell	– ensure staff and contractors accessing the Kokoda Offset Site are informed and trained where relevant in relation to controls on activities within the Offset Sites; – receive training regarding controls on activities within the Kokoda Offset Site; – report any instances of uncontrolled or malicious burn; – observe boundaries of the Kokoda Offset Site when undertaking work on site; and – undertake activities in the Kokoda Offset Site in line with directions from the Operations Manager and People, Safety and Environment Manager.
PSE Manager	– co-ordinate the day to day implementation of the BOMP and BFMP, including the implementation of all management activities; – undertake biannual inspections of the Kokoda Offset Site; – assess the effectiveness of the management strategies and instigate the adaptive management process as required; – ensure that all relevant records are effectively maintained on site; – review this managmement plan on a five yearly basis – ensure that personnel involved in the carrying out and monitoring of the BOMP/BFMP activities and values are appropriately qualified, licensed and experienced to undertake the task; – manage/control access to the Kokoda Offset Site;
Managing Director	– ensure that sufficient time and resources are allocated to allow for the implementation of biodiversity management and monitoring strategies as outlined in the BOMP/BFMP; – authorise internal and external reporting requirements as well as subsequent revisions of this BFMP; and – oversee implementation of the BFMP to ensure compliance with approval requirements.

5. DEFINITIONS

Table 2: Definitions

Key Word	Definition
BC Act	Biodiversity Conservation Act 2016 (NSW)
BFMP	Bushfire Management Plan
BOMP	Biodiversity Offset Management Plan
CEEC	Critically Endangered Ecological Community
CMOC	CMOC Mining Services Pty Limited
DNG	Derived Native Grassland
DoPIE	Commonwealth Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
ha	Hectares
DP&E	NSW Department of Planning and Environment
TEC	Threatened Ecological Community

6. SITE CONTEXT

The following sections provide a summary of the characteristics and biodiversity values of Kokoda as relevant to this BFMP. Further description of the baseline condition and environment of Kokoda is provided in the Environmental Assessment and the Preliminary Documentation.

6.1 Location

Kokoda is strategically located along a north-south potential corridor of remnant woodland and forest vegetation that runs along ridges and hills from north of Eugowra in the south, to east of Narromine in the north. The north-south potential corridor includes Goobang National Park, the largest conserved remnant of woodland and forest vegetation in the Central West region of NSW.

Kokoda is located approximately 12 kilometres north-west of Nangar National Park, approximately 8 kilometres south of Goobang National Park, approximately 12 kilometres west of Mandagery State Forest, approximately 17 kilometres east of Cookamidgera State Forest, and approximately 20 kilometres east of Back Yamma State Forest (refer to Figure 1).

Kokoda comprises lower fertility soils in the northern sections, predominately cleared for grazing, and dense woodland covered slopes and ridge lines in the south of the property. Sheep and cattle grazing was undertaken across the property prior to purchase by CMOC and is likely to have been the predominant land use for many years. All stock were removed from the property in February 2015 following purchase of the property by CMOC.

To the north of Kokoda, the predominant land use is agriculture, primarily cropping but also grazing. This agricultural area is largely confined to the lower and flatter areas, occurring between Goobang National Park and the southern portion of Kokoda.

Figure 1: Location of Kokoda Biodiversity Offset

6.2 Climate

The climate in Mandagery district is relatively typical of the central west, with mean maximum temperatures of 33.5° C during summer, and mean minimum temperatures of 2.4°C during winter (Figure 2). Additionally, mean rainfall is highest in February with 66.1mm and lowest in April with 29.9mm. For more information on climate in Mandagery, refer to Figure 2.

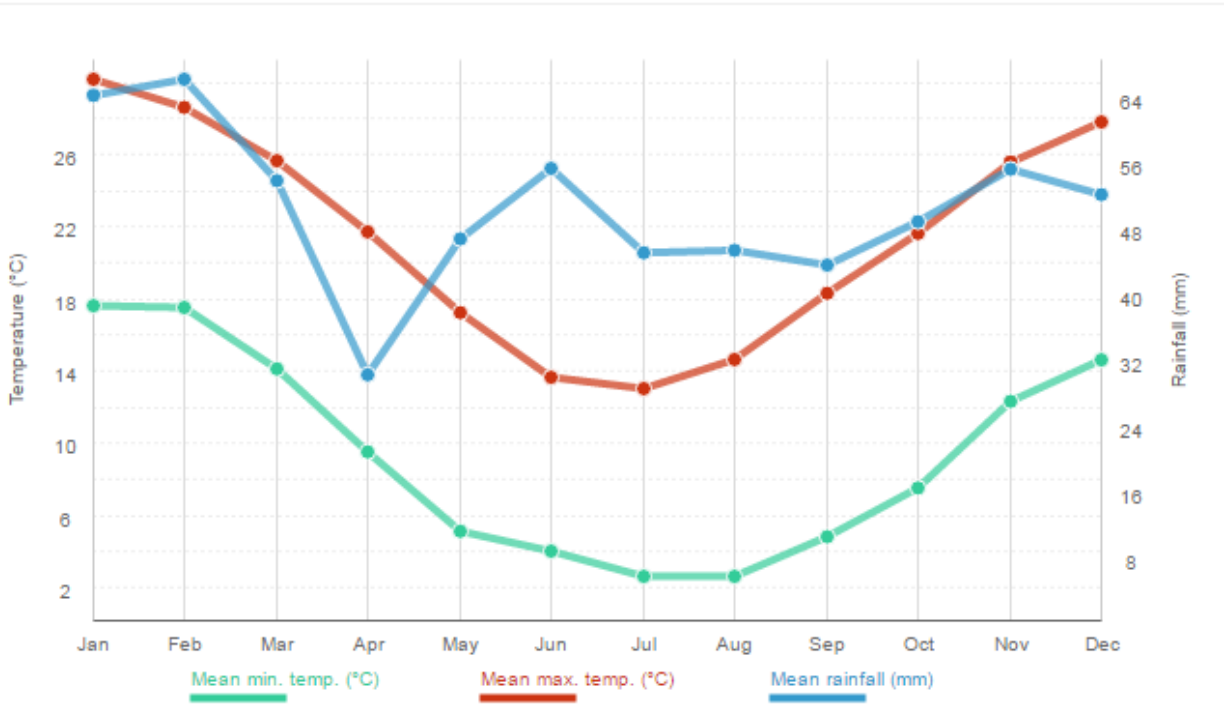


Figure 2: Mean Temperature and Rainfall Data for Mandagery (MLA, 2016)

6.3 Historical Land Use

Kokoda is located within a predominately agricultural area that is dominated by grazing activities. Prior being purchased by Northparkes, Kokoda was operated as sheep grazing operation.

6.4 Land Tenure and Conservation Mechanism

Kokoda will be secured in perpetuity conservation. Kokoda has been purchased by Northparkes and will be secured in perpetuity.

6.5 Key Ecological Values

Kokoda provides conservation of threatened ecological communities and known habitat for threatened fauna species. Threatened ecological communities, vegetation communities and threatened species known to occur at Kokoda will be discussed in Sections 6.5.1 and 6.5.2.

6.5.1 Threatened Ecological Communities and vegetation communities

A total of 11 vegetation communities have been recorded in Kokoda, 3 of which are listed Threatened Ecological Communities (TECs). Vegetation communities recorded on Kokoda are listed in below.

Table 3: Vegetation communities recorded at Kokoda

Vegetation Community	BC Act Status	EPBC Act Status	Vegetation within Kokoda (ha)
Grey Box Grassy Woodland	EEC	EEC	13
Grey Box Grassy DNG	EEC	EEC	96
White Box Grassy Woodland	EEC	CEEC	2.2
Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest	-	-	150

Vegetation Community	BC Act Status	EPBC Act Status	Vegetation within Kokoda (ha)
Rocky Rise Shrubby Woodland	-	-	26
Grey Box – Ironbark Woodland	-	-	25
Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine DNG	-	-	15
Dwyer's Red Gum Creekline Woodland	-	-	9.4
Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Woodland Low Quality	-	-	8.6
Mugga Ironbark Woodland	-	-	1.9
Farm Tracks and Dams – Disturbed Land	-	-	2.5
Total			350[1]

1 = Rounding of totals applied (numbers less than 1 – 2 decimal places, numbers between 1 and 10 – 1 decimal place, and greater than 10 - no decimal places)

CEEC = Critically Endangered Ecological Community

EEC = Endangered Ecological Community

EPBC Act = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

BC Act = Biodiversity Conservation *Act 2016*

DNG = Derived Native Grassland

ha = Hectares

The 13 hectares of Grey Box Grassy Woodland and 96 hectares of Grey Box Derived Native Grassland on Kokoda conforms to the BC Act listed *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions* EEC and the EPBC Act listed *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia* EEC.

The 2.2 hectares of White Box Grassy Woodland on Kokoda conforms to the BC Act listed White Box – Yellow Box – Blakely's Red Gum Woodland EEC and the EPBC Act listed White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC.
The 96 hectares of Grey Box Grassy Woodland DNG and 15 hectares of Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine DNG within Kokoda will be managed back to woodland form.

6.5.2 Threatened species

No threatened flora species have been recorded in Kokoda.

Twelve threatened fauna species have been recorded at Kokoda (Table 4).

Table 4: Threatened fauna species recorded within Kokoda

Common Name	Scientific Name	Status	
		BC Act	EPBC Act
Glossy black-cockatoo	*Calyptorhynchus lathami*	V	-
Superb parrot	*Polytelis swainsonii*	V	V
Little lorikeet	*Glossopsitta pusilla*	V	-
Brown treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	-
Speckled warbler	*Chthonicola saggitatus*	V	-
Hooded robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	-
Grey-crowned babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-
Varied sittella	*Daphoenositta chrysoptera*	V	-
Diamond firetail	*Stagonopleura guttata*	V	-
Eastern bentwing-bat	*Miniopterus schreibersii oceanensis*	V	-
Little pied bat	*Chalinolobus picatus*	V	-
Yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*	V	-

V = Vulnerable Species
BC Act = *Biodiversity Conservation Act 2016*
EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*

The grey-crowned babbler, brown treecreeper and the superb parrot have been the most commonly recorded threatened fauna species across Kokoda. The grey-crowned babbler and the brown treecreeper are both sedentary birds and will utilise the site across all seasons whereas the superb parrot is a seasonally nomadic species which will largely utilise Kokoda for foraging during spring and summer. Given the array of varied habitats within the site, there is a high potential that other threatened fauna species may occur within Kokoda.

7. FACTORS IMPACTING BUSH FIRE RISK

7.1 Components of Bushfire

Bush fires requires three components to burn; fuel, air and heat. These three factors together are known as the fire triangle (Figure 3). Removal or modification of any one of these three components will extinguish or reduce the fire and is the basis of all firefighting theory.

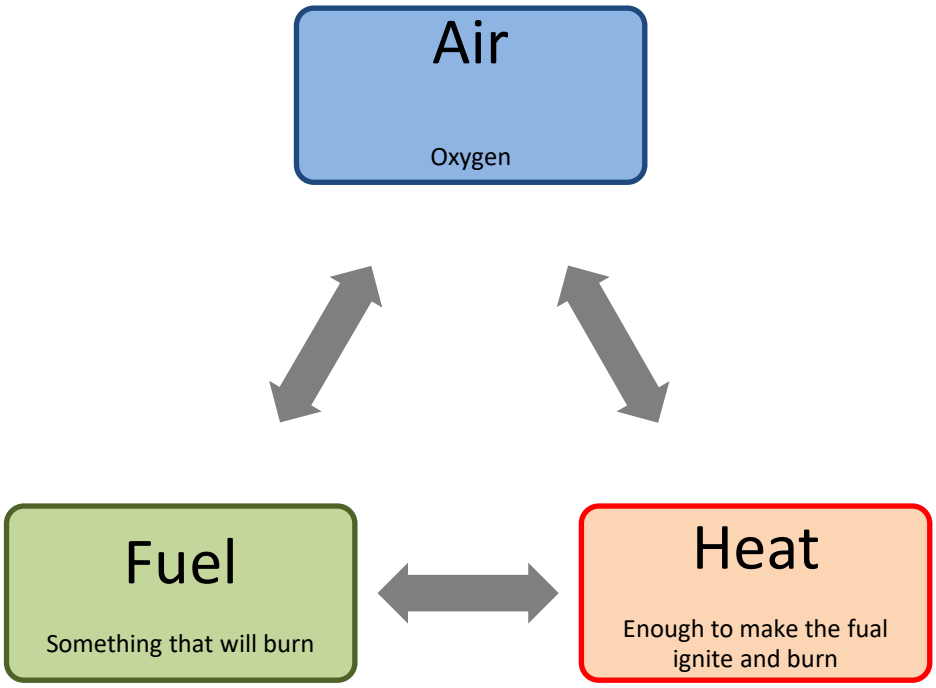


Figure 3: Fire Triangle

7.2 Conditions Associated with Bushfires

Conditions associated with bush fire intensity and the speed at which a bush fire will spread will depend on the following five elements; ambient temperature, fuel load, fuel moisture, wind speed and slope angle. These elements will be discussed in further depth in the following sections.

7.2.1 Fuel load

In general, the greater the fuel load, the hotter and more intense the fire. Other factors that impact how quickly fuel will burn is it if is concentrated with adequate spacing (which will burn faster) compared to fuel that is heavily compacted or scattered fuel sources. Smaller pieces of fuel such as twigs, litter and branches burn quickly, particularly when they are dry and loosely arranged. Some types of grasses burn very rapidly, while larger fuels, such as tree trunks, do not burn as easily.

Many of Australia's native plants burn easily. The high oil content in eucalyptus species makes them particularly combustible. The vast areas of dry grass common in mid-to-late summer also burn readily. In the southern part of Kokoda, there is a large fuel load on the ground in terms of fallen woody debris. Additionally, as time passes and Kokoda has more time to regenerate, the fuel load will increase. This will have to be adaptively managed as Kokoda undergoes various stages of restoration.

Landscape Function Analysis surveys are undertaken at Kokoda to track rehabilitation success. These surveys will be used to monitor the fuel load at Kokoda.

7.2.2 Fuel moisture

Dry fuel will burn quickly, but damp or wet fuel may not burn at all. As a consequence, the time since rainfall and the amount of rain received is an important consideration in assessing bush fire danger. Often a measure of the drought factor, or moisture deficit, will be used as an indicator of extreme bush fire weather conditions. Fuel moisture is at its lowest during the fire season, which for Kokoda is spring/ summer (refer to Figure 2). For more information on the climate at Kokoda, refer to Section 6.2.

7.2.3 Wind speed

Wind acts to drive a fire by blowing the flames into fresh fuel, bringing it to ignition point and providing a continuous supply of oxygen. Wind also promotes the rapid spread of fire by spotting, which is the ignition of new fires by burning embers lofted into the air by wind. Spotting can occur up to 30km downwind from the fire front. There is a threshold wind speed of around 12 to 15km/h which makes a significant difference in the behaviour of bushfires in the open. When wind speeds are below this threshold, fires with heavy fuel loads burn slowly. However, even a slight increase in wind speed above this threshold results in a significant increase in fire behaviour and advancement. Doubling the wind speed will quadruple the rate of spread of the fire. However above about 50 km/h this relationship begins to break down, and above 80 km/h the rate of spread in grasslands reduces. This occurs because the head fire breaks up into narrow tongues, many of which become self-extinguishing. The width of a fire front has an influence on the rate of spread and a wind shift can immediately widen the forward edge of a fire.

7.2.4 Ambient temperature

The higher the temperature the more likely it is that a fire will start or continue to burn. Fuel is closer to its ignition point at high temperatures and pre-heated fuel loads burn faster. Mandagery district has a mean maximum temperature of 33.5º C during summer, but can have temperatures above 40.0º C during summer. Refer to Section 6.2 for more information on the climate at Kokoda.

7.2.5 Relative humidity

Relative humidity is the most commonly used measure of atmospheric moisture and is defined as the ratio of the amount of water vapour actually measured to that which air could hold at saturation. Very low relative humidity of lower than 20 per cent, causes fuels to dry out and become more flammable.

Additionally, dry air promotes a greater intensity fire than moist air. Plants become more flammable at a low humidity because they release their moisture more easily. Relative humidity at Kokoda has the greatest potential for bush fire during the fire seasons, which occurs in spring/ summer at Kokoda (Refer to Figure 2).

Fires pre-heat their fuel source through radiation and convection. As a consequence of these heat transfer effects, fires accelerate when travelling uphill and decelerate travelling downhill. The steepness of the slope plays an important role in the rate of fire spread. The speed of a fire front advancing will double with every 10 degree increase in slope so that on a 20 degree slope, its speed of advance is four times greater than on flat ground.

Kokoda has areas of relatively flat ground in the northern section of the property, as well as hilly sections in the southern end of the property.

7.2.6 Origin

Bushfires can originate from both human activity and natural causes. Lightning is the predominant natural source of bush fire, accounting for about half of all ignitions in Australia. Fires of human origin currently account for the remainder and are classified as accidental or deliberate. Fires lit deliberately can be the result of arson or designed to achieve a beneficial outcome but experience sudden adverse weather conditions which results in their uncontrollable spread.

Unfortunately deliberate and accidentally lit fires are more prevalent near populated areas and have a disproportionately higher risk of infrastructure impact. Arsonists place people and property at serious and unnecessary risk, particularly when igniting fires on extreme fire weather days.

7.3 Bushfire Risk Potential

The centre of the bush fire risk triangle is bush fire risk. Bush fire risk can be understood as the likelihood of whether a bush fire will start, whether it will spread and whether it has consequences on, or impacts human life, property or the environment. As with the fire triangle, removal or modification of any one of the three components will reduce the risk (Fgure 4).

Many factors contribute to the components of risk. Some of them cannot be modified (e.g. weather and natural ignitions), however there are many that can either by reducing or entirely eliminating their contribution to the risk triangle. For example, reducing bush fire fuel loads is an important action that will reduce the likelihood of bushfires spreading in the wider landscape, as well as reducing consequences on properties. Additionally, the risk of bush fires can be reduced by implementing various strategies or through managing the factors that influence bush fire risk. Figure 4 outlines a number of strategies and factors that can influence bush fire risk.

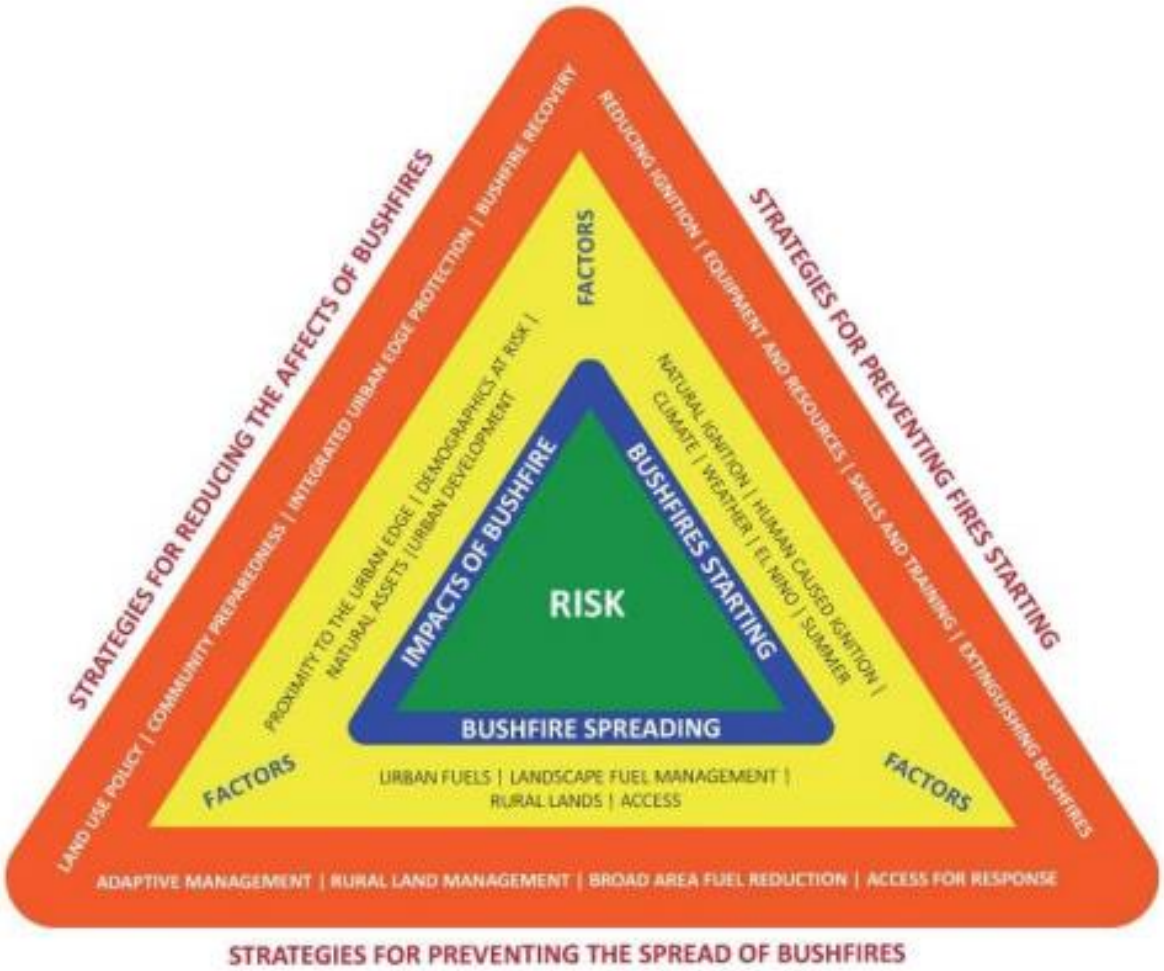


Figure 4: Bushfire risk triangle (which includes strategies to reduce bush fire risk)

The highest risk period for bush fire at Kokoda is during spring through to summer. The greatest danger occurs after the dry winter/spring period, before the onset of the rainy weather common in summer. Figure 5 illustrates the fire seasons across Australia.

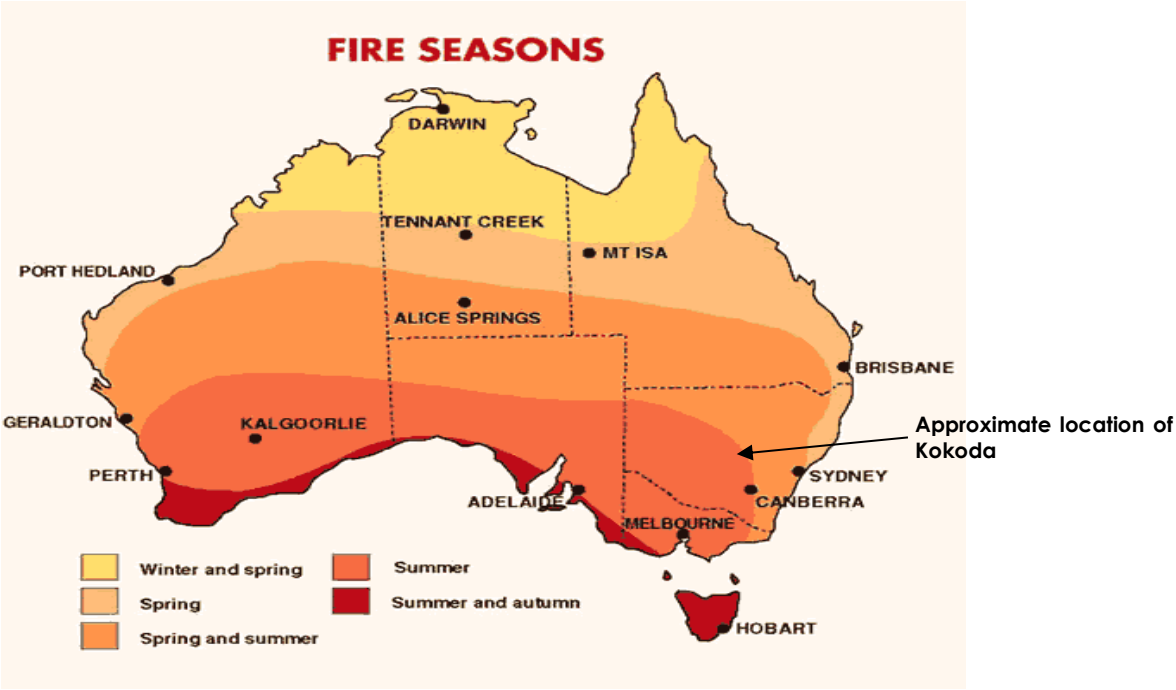


Figure 5: Fire seasons across Australia with approximate location of Kokoda

7.4 Assets at risk from fire

The following assets are at risk in the event of a fire at Kokoda;

- Neighbouring dwellings;
- Fences;
- Internal and external access roads; and
- Service infrastructure (powerlines and phone lines).

The risks to each of these assets will be described in further detail in the sections below.

7.4.1 Residential dwellings

A residential dwelling exists on the Kokoda property, but is located outside of the Offset Site boundary. The dwelling exists in the grassland area of the property, close to an ephemeral watercourse in the north-west of the property. It is not seen as a major fire risk due to the lack of woodland vegetation in the near vicinity.

There is one neighbour who has a residence that is approximately 2 km from the north eastern boundary of Kokoda. Open grassland mainly exists between Kokoda and this residence (towards the north east). There is a patch of remnant woodland to the south of the resident (north of Kokoda).

7.4.2 Fences

A windstorm has made significant damage to the fence on the south eastern and southern boundaries of Kokoda. This is currently being reinstated. While the fence lines are being reinstated, Northparkes will investigate the viability and value of clearing along the fence lines to create a defined fire break. This would provide much needed access in the event of a bushfire. This access may assist in the control of the bush fire and minimise impacts on the ecological values on the property as a result of fire.

7.4.3 Internal and External Access Roads

Roads will be maintained to assist in providing accessing for monitoring purposes, as well as access in the event of a bushfire.

7.4.4 Service Infrastructure

A powerline provides electricity to the dwelling on the Kokoda property. Power is switched off at the circuit breakers when the property is unoccupied, to minimise the potential of an electrical fire.

7.5 Fire History

Kokoda is located within Mandagery in the Cabonne local government area, which falls within the Canobolas Zone of the NSW Rural Fire Service. The Canobolas Zone produces an annual report, which summarises the number of incidents (including fire incidents) that have occurred in the zone over the 12 month period. Figure outlines the number of fire incidents that occurred in the Canobolas zone between 2010/2011and 2013/2014.

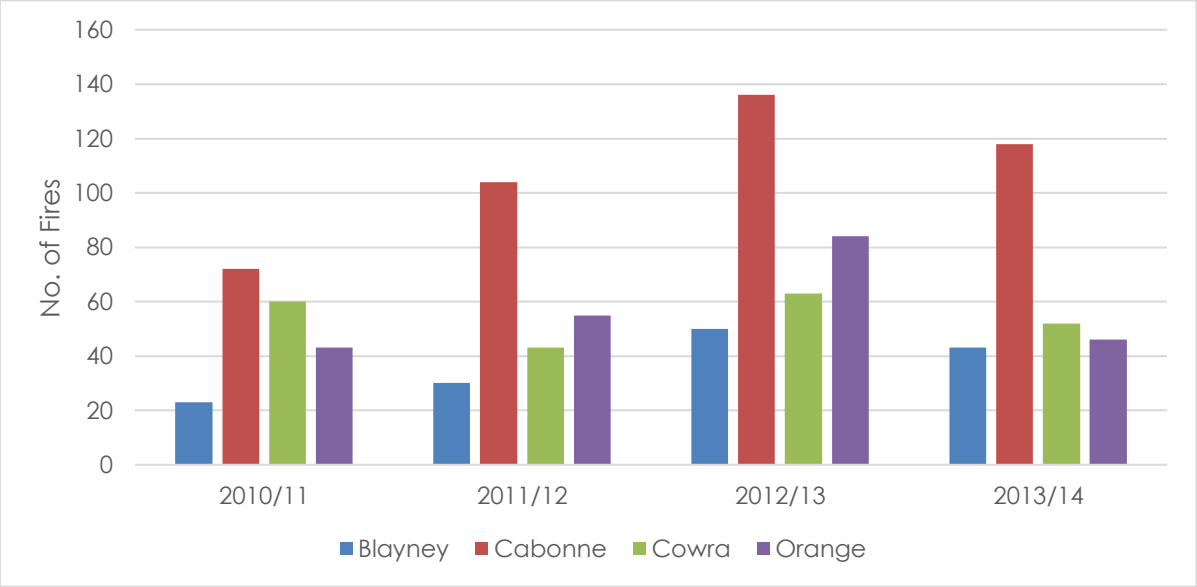


Figure 6: Number of fire incidents that occurred in the in the local government areas of Blayney, Cabonne, Cowra and Orange between 2010/2011 and 2013/2014 fire seasons (Kokoda is located in the Cabonne local government area)

The size of the fires was also reported in the Canobolas Zone Annual Report for 2013/2014 (Figure 7). During the 2013/2014 fire season, a total of 154 fire incidents were recorded during summer. Of these, the vast majority (89%) were restricted to less than 10 ha in size. Across the Canobolas Zone, a total of 1021 ha was lost due to fires throughout the 2013/2014 reporting period.

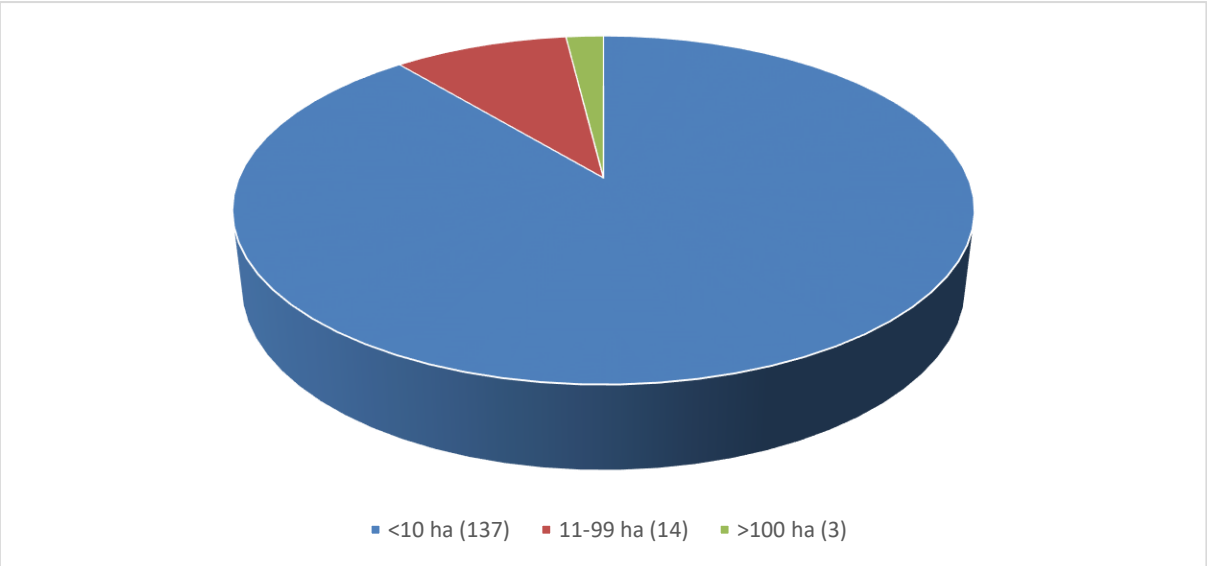


Figure 7: Canobolas Zone fire incidents by size for the 2013/ 2014 summer

7.6 Threatened Species Management

7.6.1 Threatened species hazard reduction list

The Threatened Species Hazard Reduction List is a component of the Bush Fire Environmental Assessment Code (2006) that provides conditions relating to undertaking hazard reduction works when threatened species, endangered populations or ecological communities are known to occur at a site. Table 5 outlines the threatened species or threatened ecological communities known to occur at Kokoda with the species specific conditions from the Threatened Species Hazard Reduction list.

Table 5: Threatened species known to occur at Kokoda with their species specific conditions from the Threatened Species Hazard Reduction List

Common Name	Scientific Name	Status		Conditions relating to use of fire	Conditions relating to mechanical forms of hazard reduction
		BC Act	EPBC Act		
Glossy black-cockatoo	*Calyptorhynchus lathami*	V		No burning of Allocasuarina thickets	Yes, but avoid Allocasuarina thickets
Superb parrot	*Polytelis swainsonii*	V	V	Only use low intensity fire, and only between May and end of July. Avoid burning of River Red Gum and Callitris, and protect hollow bearing trees	No slashing between September and end of December, and no trittering or tree removal
Little lorikeet	*Glossopsitta pusilla*	V		No species specific conditions specified	No species specific conditions specified
Brown treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V		No species specific conditions specified	No slashing, trittering or tree removal
Speckled warbler	*Chthonicola saggitatus*	V		No species specific conditions specified	No slashing, trittering or tree removal
Hooded robin (south-eastern form)	*Melanodryas cucullata cucullata*	V		No species specific conditions specified	No species specific conditions specified
Grey-crowned babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V		No species specific conditions specified	No slashing, trittering or tree removal
Varied sittella	*Daphoenositta chrysoptera*	V		No species specific conditions specified	No species specific conditions specified
Diamond firetail	*Stagonopleura guttata*	V		No species specific conditions specified	No slashing, trittering or tree removal
Eastern bentwing-bat	*Miniopterus schreibersii oceanensis*	V		No fire around known roost sites	No slashing around maternity caves
Little pied bat	*Chalinolobus picatus*	V		No species specific conditions specified	No species specific conditions specified
Yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*	V		No species specific conditions specified	No species specific conditions specified
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions		E	E	No fire more than once every 15 years	No slashing, trittering or tree removal
White Box Yellow Box Blakely's Red Gum Woodland		E	CE	No fire more than once every 5 year	Slashing, but no trittering or tree removal

7.7 Hazard Reduction

There are several different methods to undertaken hazard reduction including controlled burning, mechanical clearing like slashing undergrowth, or even reducing the ground fuel by hand.

The NSW Rural Fire Service's standards for low intensity bush fire hazard reduction burning (for private landholders) outlines the requirements for undertaking a safe and successful hazard reduction burn. The objective of a low intensity bush fire hazard reduction burn is to minimise the potential impacts of a bush fire on life, property and the environment. A low intensity fire is characterised by:

- Low flame heights- Flame heights should average about one meter, but may be higher in patches of heavy or elevated fuels
- Low scorch height – Scorch height should be less than five meters. Scorch height is the height to which tree leaves are killed from the heat of the fire
- Slow rate of spread- The fire should spread only at a slow walking pace

A successful low intensity hazard reduction burn will reduce the fuel load so that it creates a safe defensible space around an asset. It should also minimise the impact from the burn on the environment.

In carrying out a burn, the following factors need to be considered:

- The fuel load and structure
- The effects on the environment and community
- The specific zone objectives
- If there are adequate fire breaks and control lines
- The season and weather conditions
- The topography and fire behaviour
- What lighting patterns to use
- Condition a test burn
- What safety measures may be needed
- Mopping up afterwards; and
- If you need to report the results

For more information on any of these consideration for a hazard reduction burn, refer to Appendix A – NSW Rural Fire Service standards for low intensity burn hazard reduction burning (for private landholders).

8. ECOLOGICAL BURN STRATEGY

An Ecological Burn Strategy has been developed to assist with the management of the Kokoda. Refer to the following sections for more information on the burn strategy for Kokoda.

8.1 Ecological Burn Planning

The ecological burn plan for Kokoda will following the cycle outlined in Figure 8.

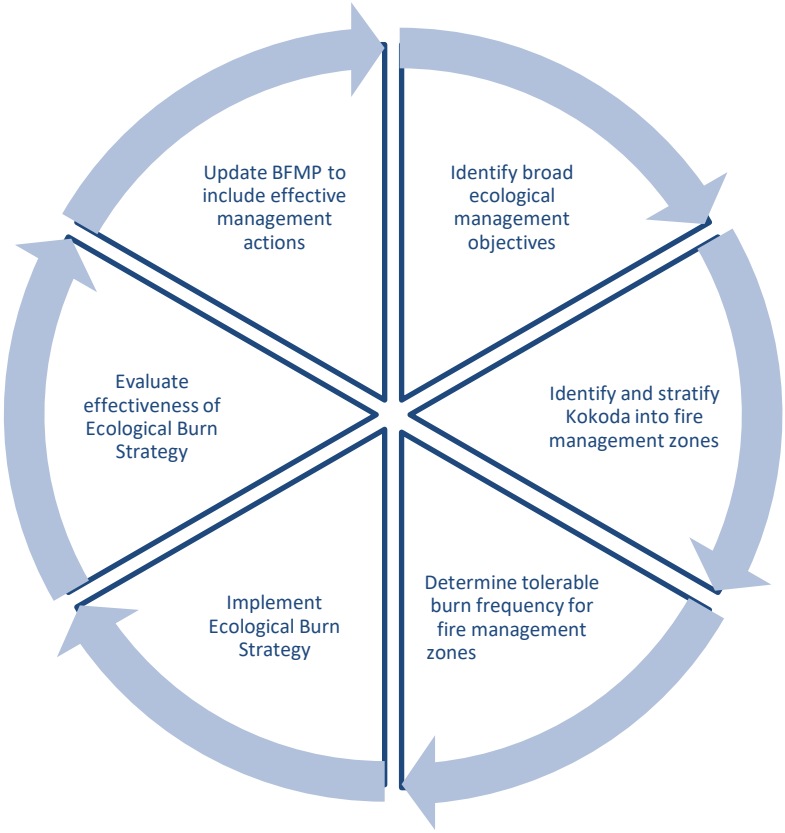


Figure 8: Ecological burn planning cycle

8.2 Ecological Management Objectives

The objective of this BFMP is to facilitate the long term conservation and enhancement of the ecological values at Kokoda through implementing appropriate fire management to the property. Specific ecological management objectives of the BFMP include:

- Support the BOMP by managing Kokoda in accordance with the short, medium and long term management objectives for the offset area
- Implement a fire management plan that enhances biodiversity at Kokoda, particularly for threatened species and threatened ecological communities at Kokoda.

For information relating to other aspects of the management of Kokoda, refer to Northparkes mines Biodiversity Offset Management Plan.

8.3 Kokoda broad fire management zones

The Kokoda Offset Site has been stratified into five broad fire management zone (refer Table 6), based primarily on vegetation communities. Table 6 below provides a summary of the fire management zones identified within the Kokoda Offset Site.

Table 6: Fire Management Zones at the Kokoda Offset Site

Broad fire management zone	Vegetation types	Area (ha)
Forest	• Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest	149.9
Woodland	• Grey Box Grassy Woodland (EEC/ EEC) • White Box Grassy Woodland (EEC/ CEEC) • Rocky Rise Shrubby Woodland • Grey Box – Ironbark Woodland • Dwyer's Red Gum Creekline Woodland • Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Woodland Low Quality • Mugga Ironbark Woodland	86.0
Grassland and areas regenerating to woodland	• Grey Box Grassy Woodland - DNG (EEC/ EEC) • Dwyer's Red Gum – Grey Box – Mugga Ironbark – Black Cypress Pine Forest DNG	111.2
Waterbody	• Farm Tracks and Dams – Disturbed Land	1.0
Modified landscape / assets	• Farm Tracks and Dams – Disturbed Land	1.6
	Total	350 ha

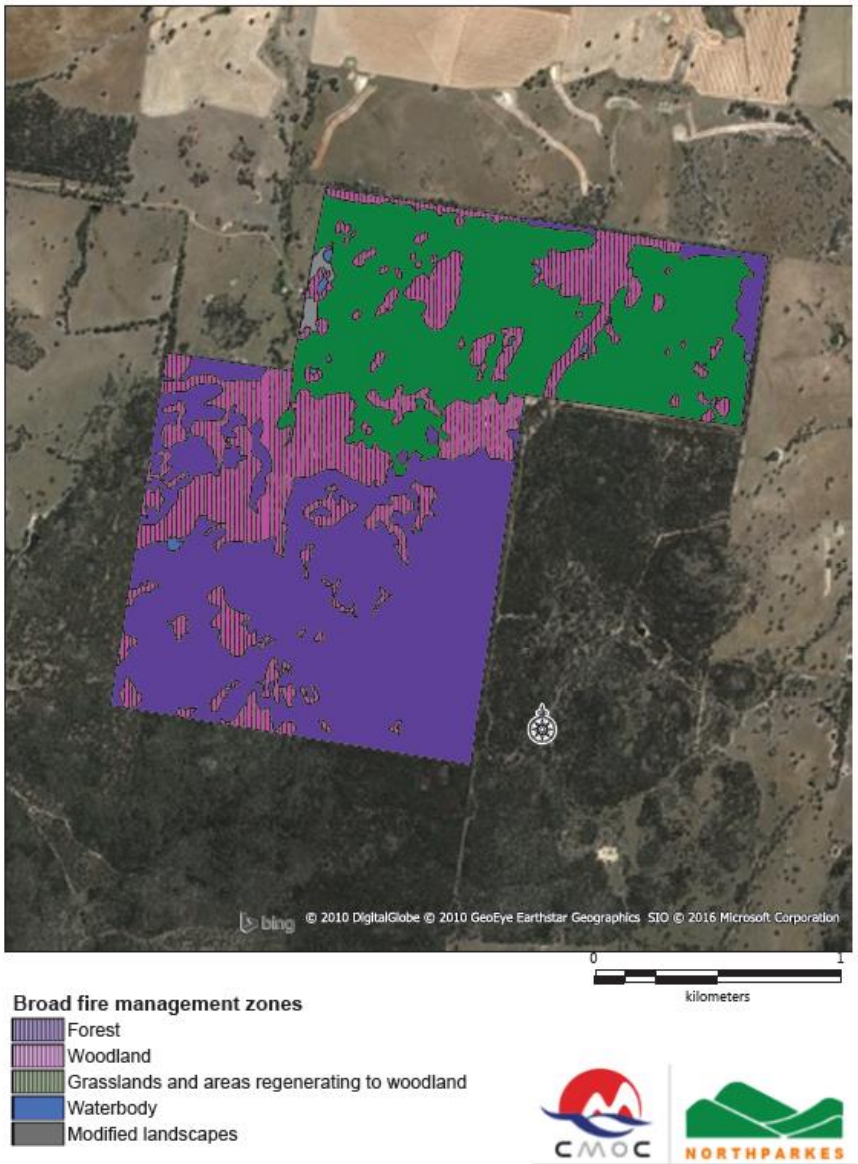


Figure 9: Broad fire management zone at Kokoda

8.4 Bushfire Considerations of Landscape Management Zones

The following factors should be considered when there is fire (planned or unplanned) at Kokoda:

Table 7: Bushfire considerations of landscape management zones

Fire management zone	Category	Considerations
Forest	Fuel Load	Forest areas contain eucalyptus species that, due to their high oil content, are particularly combustible The large volume of woody debris on the ground at Kokoda provides increased material to burn High potential for canopy fire (the most high risk type of bush fire) due to dense forested vegetation
	Fuel moisture	Towards the end of the fire season in March and April, the average rainfall deceases, potentially resulting in drier fuel load which may increase fire potential
	Ambient temperature	The ambient temperature in the Mandagery district has a higher mean temperature over summer, resulting in increased fire potential
	Slope angle	The forest area of Kokoda is generally sloped, which would increase the fire potential if the fire front was travelling in a southern direction
Woodland	Fuel Load	Forest areas contain eucalyptus species that, due to their high oil content, are particularly combustible Lower volume of woody debris on the ground than forest areas may make these areas less susceptible to intense fires As woodland areas are less densely vegetated, the chance of a canopy fire (is decreased companied to in the forested areas
	Fuel moisture	Woodland areas contain high level of green ground cover, which is less combustible due to the high moisture content
	Ambient temperature	The ambient temperature in the Mandagery district has a higher mean temperature over summer, resulting in increased fire potential
Grasslands and areas regenerating to woodland	Fuel Load	Decreased fuel load compared to forest and woodland areas However, with increase revegetation, the ground layer will become denser and have an increase fire potential
	Fuel moisture	Grassland areas are dominated by green groundcover, which has a relatively low fire potential However, during the summer months, very dry ground cover will be susceptible to bushfire.
	Ambient temperature	The ambient temperature in the Mandagery district has a higher mean temperature over summer, resulting in increased fire potential
Waterbody	NA	Waterbody's provide protection from bush fire due to availability of water source to refill firefighting trucks
Modified landscapes	NA	Low burn potential due to low level of vegetation.

8.5 Timeframe for Implementation of Hazard Reduction and Ecological Burn Strategies

The following hazard reduction timeframes will be implemented (as a minimum) for the fire management zones at Kokoda (Table 8).

Table 8: Hazard reduction timeframes for the fire management zones at Kokoda

Fire management zone	Mechanical hazard reduction timeframe	Ecological burn timeframe	Justification
Forest	No mechanical hazard reduction planned If mechanical hazard reduction is necessary due to safety, the method and timing must consider the conditions for glossy black cockatoo, superb parrot, brown treecreeper (eastern sub sp.), speckled warbler, grey-crowned babbler (eastern sub sp.), diamond firetail, Grey Box Woodland EEC and White Box Woodland CEEC.	No ecological burning to be undertaken more than once every 15 years When ecological burning is undertaken, it must consider the conditions for superb parrot, glossy black cockatoo and eastern bent-wing bat	The Threatened Species Hazard Reduction List for the Bush Fire Environmental Assessment Code outlines specific conditions relating to fire and mechanical forms for hazard reduce in relation to threatened species. Mechanical Hazard Reduction No slashing, trittering or tree removal is allowed for the following species/ TECs that have been recorded at Kokoda -Brown treecreeper (eastern sub.sp) -Speckled warbler -Grey-crowned babbler (eastern sub.sp) -Diamond firetail -Grey box woodland EEC No slashing between September and the end of December, and no trittering or tree removal is allowed for Superb Parrot No mechanical forms of hazard reduction allowed in *Allocasuarina* thickets for glossy black cockatoo No slashing, trittering or tree removal for Grey Box Woodland EEC Ecological Burn Superb parrot- only use low intensity fire and only between May and the end of July. Avoid burning of River Red Gum and Callitirs, and protect hollow bearing trees
Woodland	No mechanical hazard reduction planned If mechanical hazard reduction is necessary due to safety, the method and timing must consider the conditions for glossy black cockatoo, superb parrot, brown treecreeper (eastern sub sp.), speckled warbler, grey-crowned babbler (eastern sub sp.), diamond firetail, Grey Box Woodland EEC and White Box Woodland CEEC.	No ecological burning to be undertaken more than once every 15 years When ecological burning is undertaken, it must consider the conditions for superb parrot, glossy black cockatoo and eastern bent-wing bat	The majority of the woodland communities at Kokoda provide offsets for TECs or threatened species habitat potentially impacted by the Northparkes Mines Step Change Project Therefore any hazard reduction undertaken at Kokoda should comply with the conditions outlined in the Threatened Species Hazard Reduction List. The Threatened Species Hazard Reduction List for the Bush Fire Environmental Assessment Code outlines specific conditions relating to fire and mechanical forms for hazard reduce in relation to threatened species. Mechanical Hazard Reduction No slashing, trittering or tree removal is allowed for the following species/ TECs that have been recorded at Kokoda -Brown treecreeper (eastern sub.sp) -Speckled warbler -Grey-crowned babbler (eastern sub.sp)

Fire management zone	Mechanical hazard reduction timeframe	Ecological burn timeframe	Justification
			-Diamond firetail -Grey box woodland EEC No slashing between September and the end of December, and no trittering or tree removal is allowed for Superb Parrot No mechanical forms of hazard reduction allowed in *Allocasuarina* thickets for glossy black cockatoo No slashing, trittering or tree removal for Grey Box Woodland EEC No trittering or tree removal for White Box Woodland CEEC Ecological Burn Superb parrot- only use low intensity fire and only between May and the end of July. Avoid burning of River Red Gum and Callitirs, and protect hollow bearing trees Grey Box Woodland EEC is conditioned to have no fire more than once every 15 years White box woodland is no fire more than once every 5 years
Grassland and areas regenerating to woodland	Evaluate introducing crash grazing/ slashing to manage ground cover after 5 years	No ecological burning to be undertaken until minimum of 15 years	As these are areas assigned for regeneration and revegetation burning will be excluded (as much as practical), to allow young vegetation communities to mature to a stage where they are able to withstand bush fireand regenerate naturally following a fire event. This is nominally at least 15 years, but is dependent on the success of land establishment and the vegetation community present. Areas containing TECs (including Grey Box Grassy Woodland - DNG (EEC/ EEC)) should be excluded from fire. Planned burns in these areas should be at a frequency and intensity that does not threatened the persistence of the TEC.
Waterbody	Conduct yearly checks of waterbody access	No ecological burns will be required at the waterbodies	Yearly checks of waterbody access are to be undertaken to assess if a fire truck could access them in the instance of a bush fire at Kokoda or an adjacent property.
Modified landscape / assets	Conduct yearly assessment of mechanical hazard reduction around assets	No ecological burns will be required at modified landscapes/ assets	Modified landscapes around assets (in particular the house) will be assessed yearly to see if hazard reduction is required. Modified landscapes around the house will be mowed (mechanical hazard reduction) if the fuel load is assessed to be a hazard.

9. EMERGENCY MANAGEMENT

The following procedure should be activated in the case of a bush fire at Kokoda or an adjacent property.

9.1 Emergency response

In the event of a bush fire at Kokoda or on an adjacent property, the emergency procedure will follow the emergency information outlined by the NSW Rural Fire Service. Northparkes Mines does have an emergency response team, however, due to the location of Kokoda compared to the mine site, Northparkes will follow the RFS's emergency response procedure in relation to bush fires at Kokoda. To report a fire at Kokoda or an adjacent property:

- Call triple zero (000)

It is essential that the person reporting the emergency stays on the phone and provides all relevant information to the operator. Do not hang up the phone until the operator tells you to do so.

9.2 Fire trails and access

Access to the Kokoda Biodiversity Offset Site is via Chatmans Lane, off Reedy Creek Road. Otherwise, the property is surrounded by a boundary fence. There are no designated tracks across the grassland section of the property. Access to the forested area in the southern section of the property is limited, with three tracks providing access to this area. These tracks are regularly maintained. For more information on property access and tracks, refer to Figure 8.

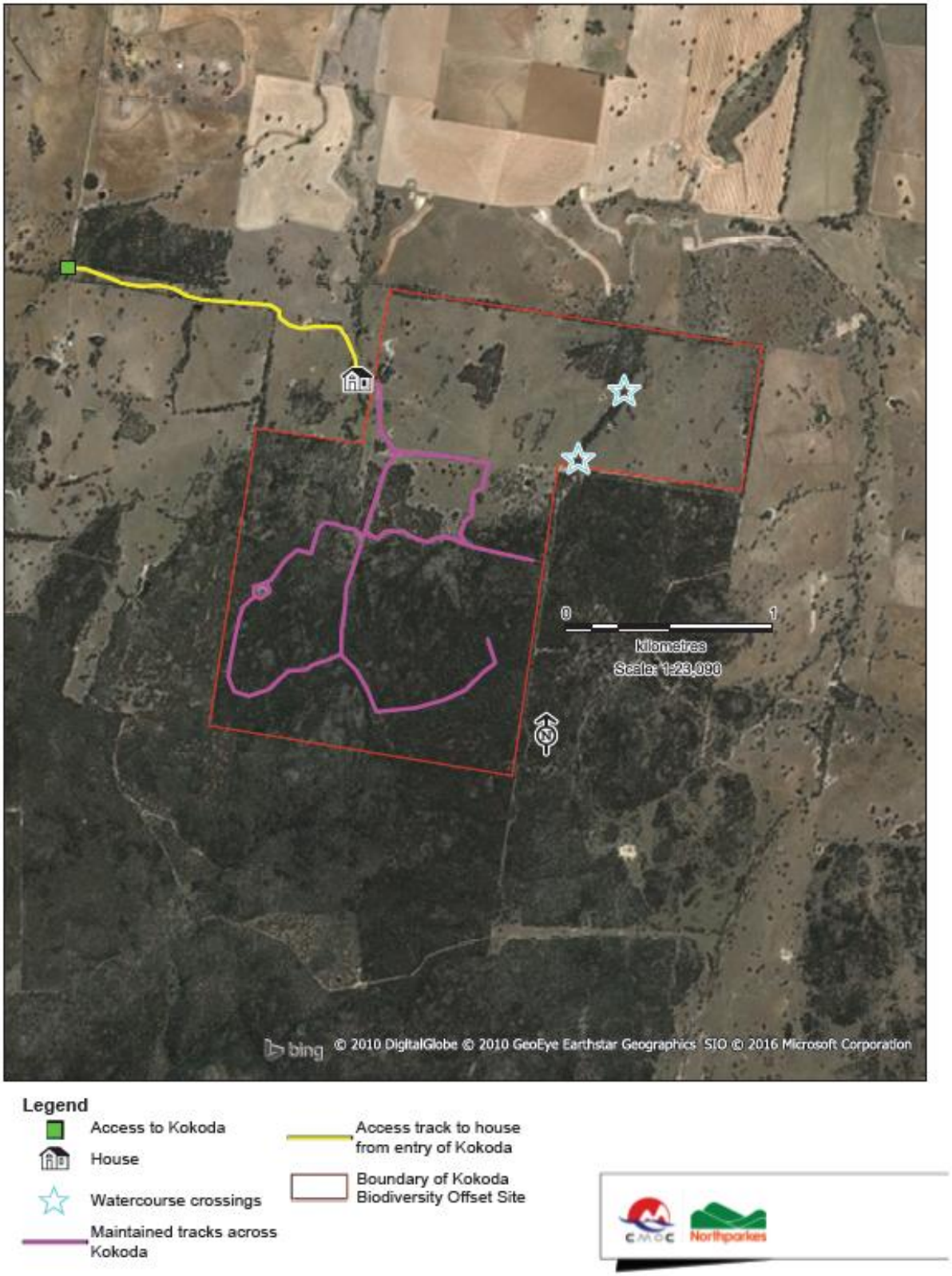


Figure 1: Access and tracks at Kokoda

9.3 Utilities and Facilities

There are several farm dams (including one located within the forested area) and two ephemeral creek lines across the Kokoda offset property that can be used to draw water for firefighting. Additionally, the farm house has access to electricity and running water.

9.4 Contacts

Kokoda is located within the Canobolas Zone of the RFS. This Zone is located in the Central West of NSW and combines the Rural Fire Districts of Blayney, Cowra, Cabonne and Orange. Within this zone, Kokoda is within the Mandagery brigade. The following contacts are relevant to a bush fire emergency at Kokoda:

Table 9: Emergency contacts for the Kokoda Biodiversity Offset Site

Name/ Position	Contact	Why they should be contacted
Emergency Services (Police/ Fire/ Ambulance)	000	Bushfire
Canobolas Zone NSW RFS	02 6363 6666	For any information relating to bush fire in Canobolas Zone
Bush fire information line	1800 NSW RFS (1800 679 737)	Current major incident activity Current total fire bans Advice on protecting your property and other fire related safety information Building development
Northparkes Mines Environment Phone	0418 206 471	Environmental enquiries relating to Kokoda
Northparkes Mines general enquires	02 6861 3000	General enquires for Northparkes Mines

10. MONITORING

Monitoring will be undertaken at Kokoda in accordance with the Northparkes BOMP. Included in this is biannual inspection of Kokoda. If any maintenance relating to bush management are required at Kokoda, these will recorded during the biannual inspections. The results of the biannual inspection are included in an annual report. In addition, Northparkes environmental staff undertake several ad hoc visits to Kokoda throughout the year.

11. COMMUNICATION AND TRAINING

As a limited number of Northparkes staff visit Kokoda as art of their role, training and communication relating to Kokoda will be limited to the Environment and Farms team. If staff members outside of this area are to visit Kokoda, they will be accompanied by an Environment and Farms staff member, who will give a short site induction to any visiting guests to the site. However, where required, the following communication channels will be used regarding activities at Kokoda:

- Monthly HSE meetings
- Level 2 Risk Assessments (where relevant)
- Management meetings; and
- Environmental reports.

As Kokoda is located over 50 kilometres from Northparkes Mines, information regarding a bush fire at Kokoda will not be included in the general site inductions.

To increase the bush firefighting knowledge at Northparkes, three members of the Environment and Farming team have joined the Mandagery brigade of the RFS. These employees will be available to assist with bush fire call outs at Kokoda or the adjacent properties (where applicable). In addition, these employees provide an interface with the community that Kokoda is located within through involvement in the RFS. This involvement will also provide a pathway for two way communication regarding fire hazards and learnings relating to Kokoda. Membership to the Mandagery RFS will be maintained by a minimum of one Northparkes representative.

12. REVIEWS AND CONSULTATION

This BFMP will be reviewed every three years to:

- refine and make improvements to the management strategies; and
- review and update the emergency procedures, access and track details and contact information included in this management plan.

The review will look for opportunities to improve the management strategies as well as further develop and forecast the longer term performance indicators and completion criteria. Adaptive management amendments to this BFMP that are made for continual improvement do not require submission to the relevant authorities for approval if they are consistent with the overall objectives of this management plan.

Northparkes will consult with OEH and RFS (as required) regarding the implementation this BFMP.

13. ADAPTIVE MANAGEMENT PROCESS

Adaptive management of this BFMP will be responsive to any new and relevant data that may arise through the biannual inspections, legislative change or any through consultation with the RFS. This will enable a flexible approach to management, allowing ongoing feedback and refinement of this BFMP. Adaptive management will be a key mechanism to address the risks to the successful implementation of this BFMP. Adaptive management steps include regular review of this BFMP, including adaptation of management actions, recognising potential risks to the successful implementation of this BFMP and having a frame work in place for corrective actions.

The adaptive management process is outlined in Figure 9.

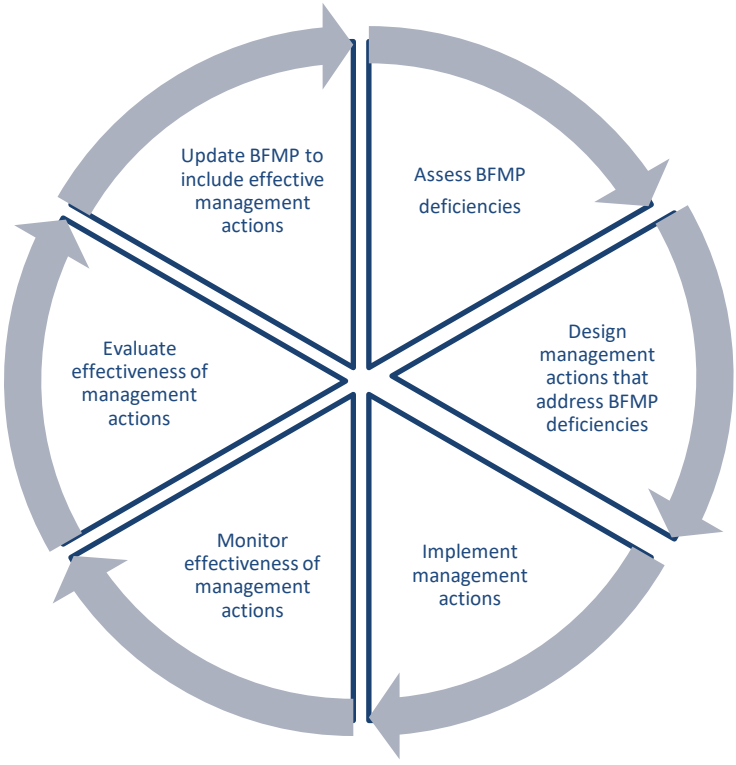


Figure 2: Adaptive management process for this BFMP

14. REQUIREMENTS UNDER LEGISLATION

14.1 National

14.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation. The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as matters of national environmental significance. In addition, the EPBC Act confers jurisdiction over actions that have a significant impact on the environment where the actions affect, or are taken on, Commonwealth land, or are carried out by a Commonwealth agency (even if that significant impact is not on one of the nine matters of 'national environmental significance').

The Northparkes Mines Step Change Project was approved with conditions under the EPBC Act in 2014 (Project Approval EPBC 2013/6788) and this Development Consent contains conditions relating to the Kokoda Biodiversity Offset Area, including the production of a BOMP for Kokoda.

14.2 New South Wales

14.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) governs land-use planning and development in NSW. The EP&A Act provides for the proper management, development and conservation of natural and artificial resources for the purpose of promoting the social and economic welfare of the community and the environment. The Act provides protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities and their habitats. The Act also allows for the assessment of project applications and provides for increased opportunity for public involvement and participation in environmental planning and assessment. The EP&A Act also includes provisions for bush fire management, particularly where a Bush Fire Risk Management Plan applies or where land is mapped as a bush fire prone area.

The Northparkes Mines Step Change Project was approved with conditions under the EP&A Act in 2014 (DC11_0060), which, under condition 37, includes the requirement to include a detailed description of the measures that will be put in place for bush fire management for Kokoda. The EP&A Act is administered by the Department of Planning and Environment in NSW.

14.2.2 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NP&W Act) provides for the care, control and management of all national parks, historic sites, nature reserves, reserves, Aboriginal areas and state game reserves. In addition, the NP&W Act provides for the bush fire management in a schedule 2 amendment through providing potential exemptions from the offences of harming or picking, or damaging the habitat of, threatened species, endangered populations or endangered ecological communities when carrying out vegetation clearing work under proposed section 100R of the *Rural Fires Act 1997* (with any such exemption subject to compliance with the 10/50 Vegetation Clearing Code of Practice). The National Parks and Wildlife Act 1974 (NP&W Act) is administered by the National Parks and Wildlife Service in NSW.

14.2.3 Biodiversity Conservation Act 2016

In New South Wales, threatened species are managed under the *Biodiversity Conservation Act 2016* (BC Act), which is administered by the Department of Planning, Industry and Environment (DoPIE). The purpose of this Act is to 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. The BC Act sets out a number of specific objects relating to the conservation of biological diversity and the promotion of ecologically sustainable development. Threatened species, ecological communities and key threatening processes are identified and classified by a scientific committee and are listed on the schedules of the BC Act.

14.2.4 Native Vegetation Act 2003

The *Native Vegetation Act 2003* regulates the clearing of native vegetation on land in NSW (except where exempt under Schedule 1 of the Act). The *Native Vegetation Act 2003* is administered by OEH and the Local Land Services (LLS).

14.2.5 Rural Fires Act 1997

The *Rural Fires Act 1997* (RF Act) provides for the management of the NSW rural fire service, the preparation of draft bush fire management plans, classifies bush fire prone land and outlines requirements for bush fire hazard reduction. The RF Act also outlines the requirements of bush fire environmental assessment codes and defines vegetation clearing works that can occur under the RF Act.

In relation to threatened species, the RF Act outlines under section 66 (7) a notice requiring the establishment of a fire break cannot require an occupier or owner to kill or remove any trees that are reasonably necessary for the protection of threatened species, populations, ecological communities or critical habitats within the meaning of the BC Act. Additionally, under subdivision 3 section 100c (4) bush fire hazard reduction work may be carried out on land despite any requirement for an approval, consent or other authorisation for the work make under the *Native Vegetation Act 2003*, the BC Act, the NP&W Act or any other Act or instrument made under the Act if:

a) the work is carried out in accordance with a bush fire risk management plan that applies to the land; and
b) there is a bush fire hazard reduction certificate in force in respect of the work and the work is carried out in accordance with any conditions specified in the certificate, and;
c) the work is carried out in accordance with the provisions of any bush fire code applying to the land specified in the certificate.

The RF Act is administered by the NSW Rural Fire Service.

14.2.6 Rural Fires and Environmental Assessment Legislation Amendment Act 2002

the *Rural Fires and Environmental Assessment Legislation Amendment Act 2002* amended the RF Act and EP&A Act to provide significant improvements in bush fire safety. In particular, this amendment includes requirements for bush fire prone lands (including the preparation of a bush fire prone land map identifying vegetation within local government areas that has the potential to support a bush fire), bush fire hazards and bush fire emergencies, among others.

14.2.7 Rural Fires Amendment (Vegetation Clearing) Act 2014

The Rural Fires Amendment (Vegetation Clearing) 2014 amends the RF Act to provide provisions for:

- The clearing of trees and vegetation within 10 meters of specified bush fire prone buildings; and
- The clearing of undergrowth within 50 meters of specified bush fire prone buildings.

Additionally, areas that are comply with these requirements will be known as '10/50' vegetation clearing entitlement areas and will be determined by the Rural Fire Service (RFS).

This amendment to the legislation was made to make preparing for bush fire safety easier while making sure that the environment, personal safety and landowners' rights are still protected.

14.2.8 Water Management Act 2000

The *Water Management Act 2000* is based on the concept of ecologically sustainable development – development today that will not threaten the ability of future generations to meet their needs. The Act recognises:

- the fundamental health of our rivers and groundwater systems and associated wetlands, floodplains, estuaries has to be protected
- the management of water must be integrated with other natural resources such as vegetation, soils and land

- to be properly effective, water management must be a shared responsibility between the government and the community
- water management decisions must involve consideration of environmental, social, economic, cultural and heritage aspects
- social and economic benefits to the state will result from the sustainable and efficient use of water.

The *Water Management Act 2000* is relevant to the current BFMP for potential bush fire management works that may impact on water quality in waterways such as earthworks for firebreaks etc.

14.2.9 Bushfire Environmental Assessment Code for New South Wales (2006)

The Bushfire Environmental Assessment Code (2006) (the Code) was established to provide a streamlined environmental assessment process for use by issuing authorities and certifying authorities in determining bush fire hazard reduction certificates.
It is a requirement of section 100J of the RF Act that the Commissioner, in preparing this Code, has regard to:

a) the principles of ecological sustainable development, and
b) considerations under section 111 of the EP&A Act.

The Code outlines standards for the protection of biodiversity, through the Threatened Species Hazard Reduction Map and Threatened Species Hazard Reduction List. The management actions identified within these lists must be imposed as a condition of any bush fire hazard reduction certificates issued for a piece of land.

15. REFERENCE MATERIALS

Table 10: Reference Materials

Document Title	ID No. | Year
Meat and Livestock Australia (MLA) (2016) Climate History for Mandagery. Accessed on 01/07/2016 from http://weather.mla.com.au/climate-history/nsw/mandagery	2016
Emergency Services Agency (ESA) (2014) The ACT Strategic Bushfire Management Plan 2014- 2019. Accessed on 24/06/2016 from http://esa.act.gov.au/wp-content/uploads/The-ACT-Strategic-Bushfire-Management-Plan.pdf	2014
Bureau of Meteorology (BoM) (2009) Bushfire Weather. Accessed on 1/07/2016 from http://www.bom.gov.au/weather-services/bushfire/about-bushfire-weather.shtml	2009

16. ATTACHMENTS

16.1 Appendix A - NSW Rural Fire Service standards for low intensity burn hazard reduction burning (for private landholders)

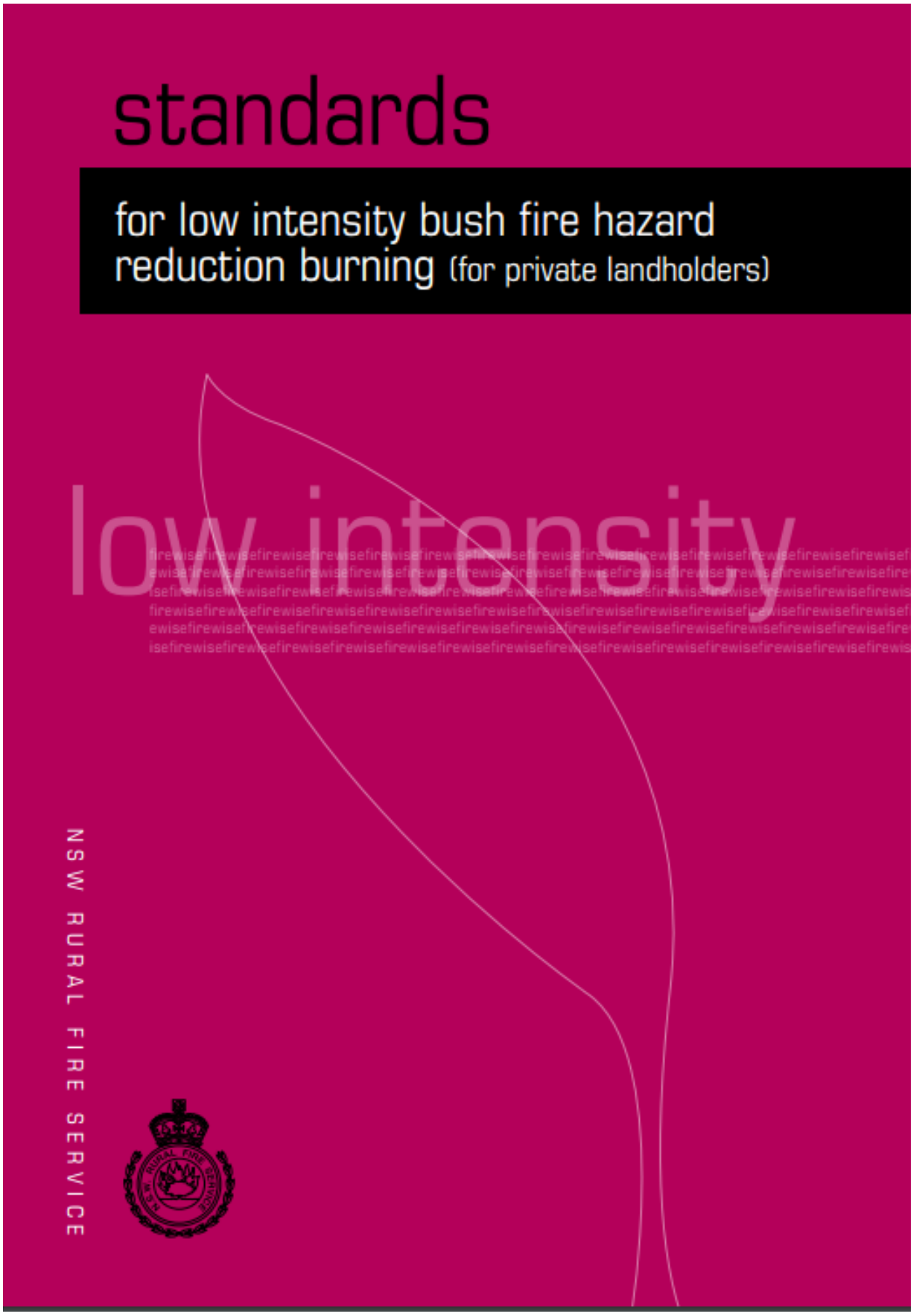

standards
for low intensity bush fire hazard reduction burning (for private landholders)
low intensity
NSW RURAL FIRE SERVICE

Table of Contents

INTRODUCTION

This document explains the best way to carry out low intensity bush fire hazard reduction burning. While most of the information outlined here relates to dry open Eucalypt forest, it can also be applied to any bush fire hazard reduction burning once you have assessed the fuel load and weather conditions.

Before you start any hazard reduction burning, you need to ensure that you have the required environmental approvals. In many cases your local NSW Rural Fire Service (RFS) Fire Control Centre will be able to issue you with a Bush Fire Hazard Reduction Certificate (which provides most of the necessary approvals) or advise you on how to obtain other approvals.

You may also be required to obtain a Fire Permit before you conduct any burning. For details of the restrictions on lighting of fires, see the RFS document *Before You Light That Fire*.

Burning of vegetation can potentially be hazardous. **Ultimately you are responsible for any fire you light and if it escapes you may be liable for the damage it causes.** Before you start you should be confident that you can carry out the burn. In some cases it may be safer and more practical for you to rake up the material and conduct a pile burn. For information on pile burns see the RFS document *Standards for Pile Burning*.

BUSH FIRE HAZARD REDUCTION BURNING

The objective of a low intensity bush fire hazard reduction burn is to minimise the potential impacts of a bush fire on life, property and the environment. Following the conditions on your Hazard Reduction Certificate and the requirements in these Standards will provide the necessary consideration of environmental and cultural heritage values.

The characteristics of a low intensity burn include:

- **Low flame heights** - Flame heights should average about one metre, but may be higher in patches of heavy or elevated fuels.
- **Low scorch height** - Scorch height should be less than five metres. Scorch height is the height to which tree leaves are killed from the heat of the fire.
- **Slow rate of spread** - The fire should spread only at a slow walking pace.

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OBJECTIVES FOR BUSH FIRE HAZARD REDUCTION BURNING

A successful low intensity hazard reduction burn will reduce the fuel load so that it creates a safe 'defensible space' around an asset. It should also minimise the impact from the burn on the environment.

In carrying out a burn, you need to consider:

1. the fuel load and structure
2. the effects on the environment and community
3. the specific zone objectives
4. if there are adequate fire breaks and control lines
5. the season and weather conditions
6. the topography and fire behaviour
7. what lighting patterns to use
8. conducting a test burn
9. what safety measures may be needed
10. mopping up afterwards
11. if you need to report the results.

In some cases (for example, if a bush fire hazard reduction burn is intended to cover many hectares) a detailed, written burn plan may be required. If in doubt, you should contact your local RFS Fire Control Centre to see if a burn plan is needed.

STEP 1. CONSIDER BUSH FIRE FUEL LOAD AND STRUCTURE

Bush fire fuel is vegetation that will burn. The most hazardous fuels are fine fuels that will burn during the intense initial passage of the fire front. Fine fuels include the dead or dry leaf litter, grass, twigs (less than 6 mm in diameter) and bark that gathers on the ground or is suspended in the shrub layer of a bushland area.

The rate of spread and behaviour of a fire is affected by both:

- **Fuel load** - the quantity (usually expressed in tonnes per hectare of fine fuel. More fuel will give a hotter fire.
- **Fuel structure** – the arrangement of shrubs and litter fuels. Fire will spread more easily through a continuous fuel layer. Shrubs, loose bark and vines provide a ladder for fire to climb into trees.

The objective of hazard reduction is to reduce, but not totally remove, the amount of fine fuel and to modify the fuel structure. With low fine fuel loads, a fire is difficult to light or sustain (like lighting a log fire without small kindling). With less suspended fine fuel, a fire is less likely to spread into the tree canopy.

Before conducting a hazard reduction burn, consider how the fuel load will affect the fire behaviour, and whether you are capable of controlling it. In areas of high fine fuel loads, a fire will be easy to light and you will need to be sure that you have the necessary people and equipment to control the fire and maintain a low intensity. As a rule of thumb, on flat ground, doubling the fuel load will double the forward rate of spread of the fire.

For more information about fuel assessment techniques, contact your local RFS Fire Control Centre.

STEP 2. CONSIDER THE EFFECTS ON THE ENVIRONMENT AND COMMUNITY

In some cases the area that you want to burn may have particular environmental values. To minimise possible environmental damage you need to comply with any conditions listed on your Hazard Reduction Certificate.

These conditions will take into account environmental factors such as:

- the presence of threatened species or endangered ecological communities;
- the risk of soil erosion or mass movement;
- fire history and minimum fire frequency intervals for specific vegetation types;
- the location of waterbodies and waterside vegetation; and
- the effect of smoke on the local community.

The conditions on your Certificate may include measures to protect biodiversity by limiting the frequency of burns, or excluding fire from specific areas. Failure to comply with the conditions will result in fines if damage is done to the environment.

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Riverside or creek (riparian) vegetation is sensitive to fire and is important for maintaining water quality and aquatic habitat. Every effort should be made to keep fire out of these areas.

Ensuring that fires are of low intensity will protect tree canopies and any tree-dwelling animals such as koalas. Low intensity fires are often also patchy, which reduces the potential for soil erosion if significant rain falls after the burn.

The smoke produced from hazard reduction burning has the potential to impact upon other people. Weather conditions may limit smoke dispersal, causing it to linger in the area, so it is important to consider if smoke-sensitive areas such as schools, hospitals, neighbours with health concerns or nursing homes are nearby. Make sure you discuss your plans with any neighbours and occupiers of properties that may be affected by the burn.

A No Burn Notice, which may prevent hazard reduction burning, is issued on days of predicted high air pollution. Your local RFS will advise you of pollution concerns or lighting bans when you notify them 24 hours before your burn. Notification is a requirement of your approval, and ensures that people who may be affected by smoke or embers are aware of the activity and don't mistakenly report the activity as a wild fire.

To minimise the impact of smoke, burning should be restricted to daylight hours whenever possible.

Large fires near roads may produce smoke that could be a traffic hazard. There are some cases where smoke from fires has caused serious accidents. The local traffic authority (generally RTA or Council) should be contacted at least two weeks prior to a planned burn. They will determine the best way to manage the effects of smoke on traffic. Road safety measures such as signage or traffic flow controls may be required.

STEP 3. DETERMINE SPECIFIC ZONE OBJECTIVES

Local Bush Fire Risk Management Plans (prepared by local fire authorities and land management agencies) divide the landscape into four zones: Land Management Zones, Strategic Fire Advantage Zones, Asset Protection Zones and Fire Exclusion Zones. The specific objectives of your burn will depend on the zone in which the work is being conducted. The zone in which your burn is planned will be identified on your Bush Fire Hazard Reduction Certificate.

The following are examples of objectives for each zone:

ZONE	OBJECTIVES
Asset Protection Zone (APZ)	• reduce fine fuel load and structure to a level that provides a safe 'defensible space' around an asset; • reduce fine fuels within the zone to prevent a ground fire reaching the asset; and • reduce vertical structure of the fine fuels by reducing shrub fuels.
Strategic Fire Advantage Zone (SFAZ)	• reduce fine fuel load and structure to a level that provides firefighters with an area in which they have a high probability of success in containing bushfires burning within, or into, the area • reduce fine fuels by approximately 50-80% within area; and • reduce vertical structure of the fine fuels by reducing shrub fuels.
Land Management Zone (LMZ)	• provide a mosaic of areas with varying fuel load structures; • maintain or enhance biodiversity; and • provide fuel reduced areas in which firefighting suppression efforts are safer and have greater chance of success.
Fire Exclusion Zone (FEZ)	• protect fire sensitive areas such as rainforest, cultural sites, plantations and commercial crops.

STEP 4. ENSURE THAT THERE ARE ADEQUATE FIRE BREAKS AND CONTROL LINES

When planning your hazard reduction burn, it is important to think about the need for well-placed control lines and fire breaks. A control line is a planned, defined perimeter used to stop the fire escaping from the designated burn area. Control lines may be a combination of roads, earth breaks (hand or machine constructed), streams, areas that are already bare of fuels (rock shelves, green crop areas or recently burnt) or cleared land.

You should create a basic map of your plan, even if it is a sketch. This should include the location of assets, existing and proposed control lines and the proposed burn area. This will help you show your intentions to others who are helping with the burn (for guidance with burn plans, contact your local RFS Fire Control Centre).

You must establish if further work is required to make existing control lines suitable (i.e. they may require cutting back or grading). Alternately you may be required to create a control line. If doing so, be sure to take into consideration any environmental impacts that may result, particularly soil erosion.

Constructing a Control Line

To construct a control line, determine the best place for the line and clear all leaf litter and other fuel (down to mineral earth) to at least one metre wide. Control lines work best when as straight as possible, but need to be directed around trees. Try to place the control line where vegetation has already been disturbed.

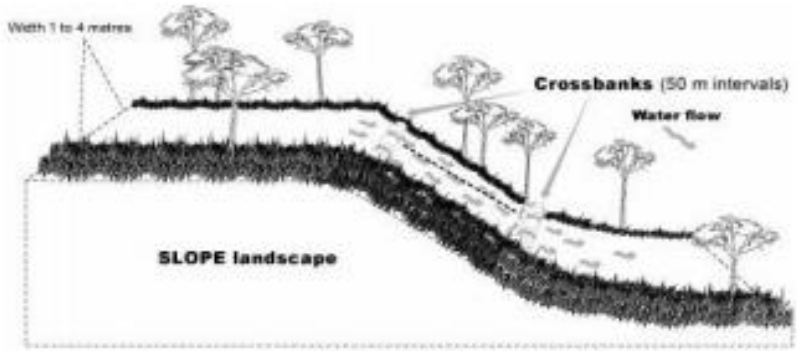
Rake the accumulated litter into the area on the side of the trail that will be burned, and spread the litter out over a wide area. Clear around the base of trees for approximately one metre and also around any large logs lying on the ground close to the control line. This will prevent the fire travelling up the trees (particularly trees with a rough bark surface or with hollows at the base). It is preferable to leave large logs unburned as they provide critical habitat for many native animals.

The width of a control line should be the minimum distance necessary to safely conduct the burn, however the width must not exceed four metres.

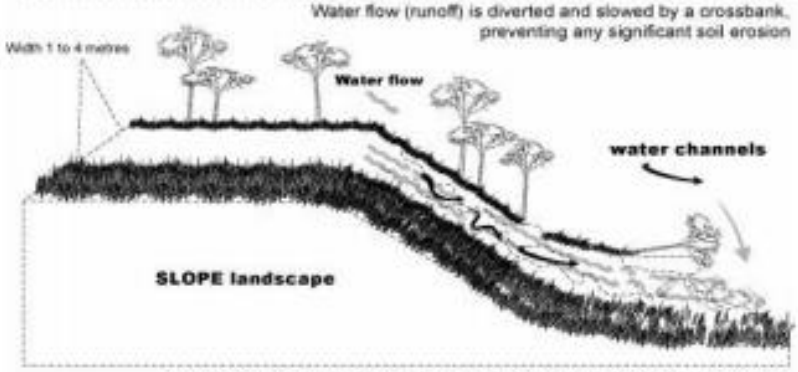
Control lines constructed down slopes (perpendicular to contours) with a width greater than one metre, require drainage structures to minimise water flow and subsequent soil erosion. There are many types of drainage structures, but the most simple to construct and possibly the most effective are crossbanks.

Crossbanks are mounds of earth that act like speed humps to slow down and divert the flow of water. Crossbanks should divert water away from the control line and onto a stable surface such as a vegetated or non-erosive surface. It is important that water flow is not diverted directly into a water course.

When drainage structures are required they should be placed at intervals of at least one every 50 metres.



Water flow (runoff) is diverted and slowed by a crossbank, preventing any significant soil erosion



Unmanaged water flow down a control line may cause significant soil erosion

Any control lines constructed for the purpose of a bush fire hazard reduction burn must be allowed to regenerate with natural vegetation following the burn.

The person responsible for bush fire hazard reduction work is responsible for its control. The law has severe penalties if a fire escapes its control lines onto your neighbour's property or into any environmentally sensitive location.

STEP 5. DETERMINE THE SEASON AND WEATHER CONDITIONS FOR A LOW INTENSITY BUSH FIRE HAZARD REDUCTION BURN

(a) Selecting the season

Selection of the right year and season to carry out hazard reduction burning is crucial to meet your fuel reduction and environmental goals, and minimise the potential for escape or re-ignition at a later date.

In southern NSW (generally from the Illawarra south) bush fire hazard reduction burning is typically conducted in autumn. Burning in late spring (after fuels have dried out sufficiently following winter rainfall) is usually avoided because there is potential for re-ignition in summer when rainfall is lowest and conditions are hot and dry. Spring burning in the south should only be carried out by, or with the assistance of, very experienced burning crews and should be avoided in years of below average rainfall.

In northern NSW (generally Sydney north, and more particularly north of the Hunter district) bush fire hazard reduction burning is generally conducted in early spring, when fuels have dried out during the usual dry winter. If fuels are sufficiently dry, a burn may also be conducted during autumn and winter. In most years, the onset of typical summer rainfall patterns reduces the potential for re-ignition during summer. Spring burning in years of below average rainfall should only be carried out by, or with the assistance of, very experienced burning crews.

(b) Selecting the appropriate day and time of the day

Fire behaviour is controlled by fuel and weather conditions. To minimise the risk of escape and to ensure calm fire behaviour, burning should be carried out when the weather conditions are suitable.

The four important weather elements for low intensity burning are:

(i) Temperature
Temperature affects the fire behaviour and moisture levels in the fuel. Ideally temperatures should be less than 25°C for low intensity burning. Temperatures are normally at a minimum early in the morning (3-4 am) and at a maximum early to mid-afternoon (2-3 pm).

(ii) Relative humidity
Relative humidity affects fire behaviour by altering fuel moisture levels. Relative humidity is usually highest overnight and lowest in the early afternoon. As a general rule, burning should only occur when the relative humidity is 50% and rising. Relative humidity forecasts and observations can be obtained from the Bureau of Meteorology website.

(iii) Wind speed and direction
Wind speed directly influences the rate of spread of the fire, thus increasing or decreasing the intensity of the burn. Wind speed usually strengthens mid-morning and reduces late evening. Low intensity burns are best carried out in wind conditions less than 15 km/h as measured in the open. The direction of the wind affects the direction in which the fire develops as well as how fast it progresses.

(iv) Atmospheric stability
To minimise the risk of escape, low intensity burning requires stable atmospheric conditions. Stable conditions are usually associated with a high-pressure system dominating the local weather pattern, with clear skies and light winds. Unfortunately a very stable atmosphere usually means that smoke will linger in the air. Rapid changes in atmospheric conditions such as unstable weather and high winds associated with the passage of a frontal system can affect the fire's behaviour.

In forest areas with deeply shaded fuels it may not be possible to burn successfully under the above weather conditions.

As an alternative, you may contact the local RFS Fire Control Centre to be given the Forest Fire Danger Index (FFDI) score and ways to measure your fuel load, to determine if the conditions are suitable to burn. An FFDI score is calculated based on all the weather elements and gives the best indication of potential fire behaviour. These scores are used for the fire danger signs. Low intensity burning should be performed when the FFDI is less than indicated in the table below.

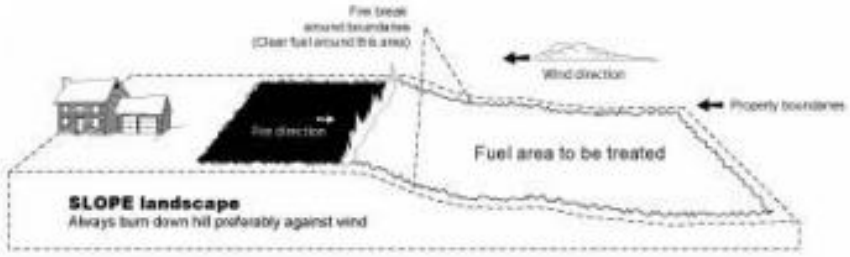
Table 1 Forest Fire Danger Index limits for low intensity bush fire hazard reduction burning.

Fuel Load (t/ha)	Forest Fire Danger Index (FFDI)						
	2	4	6	8	10	15	>15
5	burn	burn	burn	burn	burn	burn	don't
10	burn	burn	burn	burn	burn	don't	don't
15	burn	burn	burn	burn	don't	don't	don't
20	burn	burn	don't	don't	don't	don't	don't
>25	burn	don't	don't	don't	don't	don't	don't

STEP 6. CONSIDER TOPOGRAPHY AND FIRE BEHAVIOUR

- Fires burning on level ground will have a different intensity and rate of spread from a similar fire (under the same weather conditions) travelling up a slope or down a slope.
- On an uphill slope an increase of 10 degrees will cause a fire to double the rate of spread and therefore the speed of the fire. If the angle is increased to 20 degrees then the spread of the fire will be increased fourfold.
- On a downhill slope, the figures will be reversed which means the fire will travel slower. Generally fires lit for reducing a hazard should be lit at the top of a slope to burn downwards.

- The aspect or direction the fuel faces is of importance, as the fuel may be more moist on some aspects or drier on others. Generally, fuels facing west, northwest or north are exposed to longer periods of sun during the day and will be drier than those on other aspects. The dry fuels will burn more readily, increasing the potential for erratic fire behaviour.



STEP 7. LIGHTING PATTERNS

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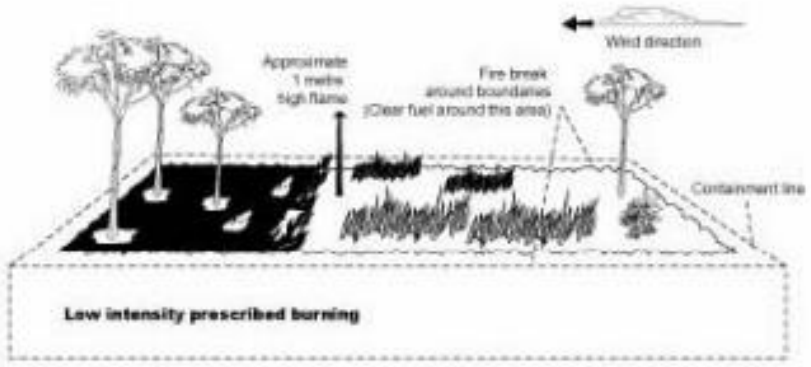
Lighting patterns strongly influence the area that will burn and the flame height generated. Different lighting patterns can be used to achieve different burn coverage, intensity and environmental controls.

The pattern of lighting a fire can also help to keep fire out of environmentally sensitive areas such as riparian vegetation (vegetation found along rivers, streams, lakes and wetlands).

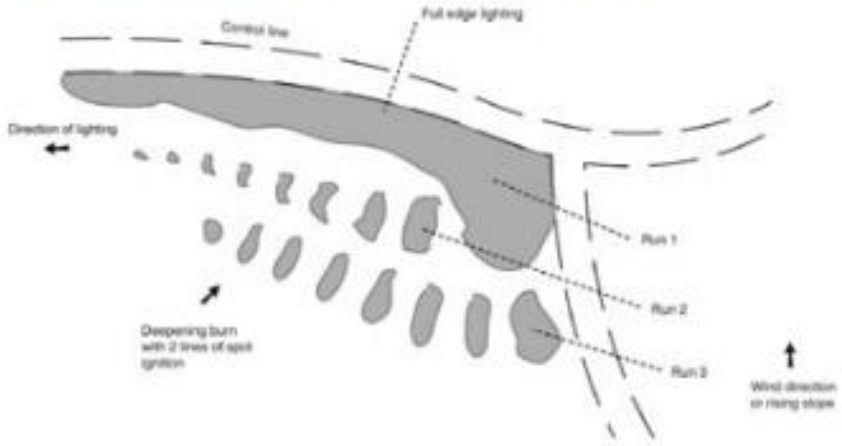
Lighting patterns to minimise environmental impacts:

- Burn when the higher parts of the topography (ridges) are drier, and the lower parts (valleys and gullies) are moist. To assess the likelihood of gully fuels burning, prior to the burning day collect gully fuel litter in the afternoon and, in a cleared area (such as the centre of a track), attempt to burn it. If fuels burn easily then burning should be delayed until rain has fallen.



- Use spot fires as they burn slower and with less intensity than a line of fire. The figure below clearly illustrates the spot lighting method.
- To minimise fire burning through stream areas, use a widely spaced spot lighting pattern (10 to 20 metres between spots) in areas adjacent to the streams, and do not light directly within any riparian vegetation or within 20 metres of the stream.

Implementing a spot ignition burning pattern for a low intensity burn:



- Make certain that your lighting pattern ensures that no fires are lit downslope of other personnel working in the burn area.
- Ensure that all personnel are familiar with the burn plan and lighting pattern.

STEP 8. CONDUCT A TEST BURN

It is important to test that conditions are suitable before lighting your low intensity burn. There are two steps to conducting a test burn:

(a) Use the burning leaf method to determine the fuel moisture.

A sample leaf (dead) should be taken from above and below the surface of the litter layer. Sheltered from any wind, light the end of each leaf. The aim is to discover the angle at which a small flame either goes out or flares up. The diagram below provides a guide.

There should be a difference between the two leaves. If the subsurface leaves are not moister than the surface leaves, the burn should not proceed.

Leaf burns if held straight down or does not burn at all
All fuels too wet if this leaf is in the area to be burnt.
OK if only in wet area not to be burnt.

Leaf burns if angled downwards
Fine fuels from this leaf's position will only burn if on a slope or in the wind.
OK if the leaf was from the bottom of the litter in the burn area, or from a wet area not to be burnt.

Leaf burns if level
Fine fuels from this leaf's position will burn, but very slowly unless helped by wind, slope and fuel continuity.

Leaf can be angled upwards and still burns
Fine fuels from this leaf position are dry enough to burn.
OK if this leaf is from the top of the litter, risky if from the bottom.

Leaf burns if held straight up
All fine fuels are very dry and flammable. Fire will spot if windy.
DON'T BURN

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(b) Light a small test fire.

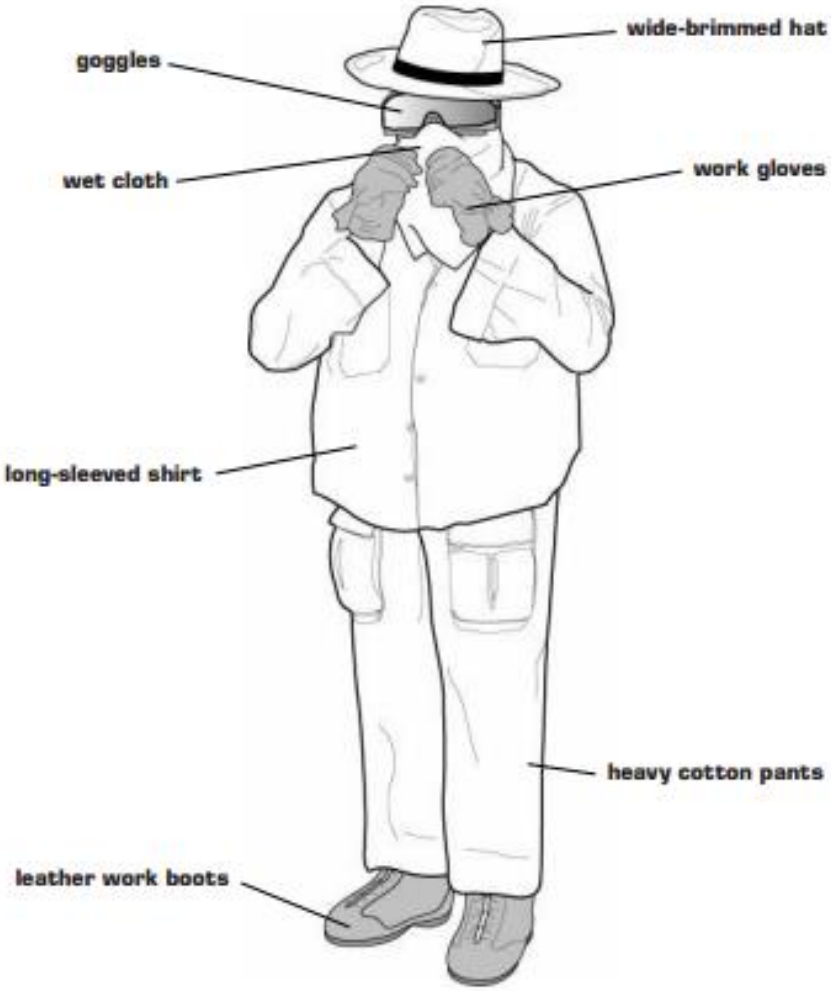
Having assessed that weather conditions are within a desirable range (Step 5), and with suppression equipment close at hand, light a test fire in a prepared area approximately five metres square on flat ground. Observe the test fire flame heights and rate of spread. If the height of flames burning in surface fuels consistently exceeds one metre, then the test fire should be immediately extinguished and your hazard reduction burn should be postponed.

STEP 9. ENSURE PERSONAL SAFETY CONSIDERATIONS ARE IMPLEMENTED

Your safety, and the safety of others assisting you during any hazard reduction burning is of utmost importance. You should discuss personal safety issues with your local RFS.

Before lighting the burn, everyone involved should consider:

- Wear natural fabrics (e.g. cotton, denim or wool). Synthetic fabrics can melt or burn.
- A long-sleeved shirt made from thick cotton or wool is ideal to prevent burns to the upper body and arms (e.g. flannelette or cotton drill work shirt).
- Sturdy leather work boots along with a pair of woollen socks prevent burns to the feet.
- A pair of heavy cotton pants will shield your legs from the radiant heat emitted from the fire (e.g. denim jeans or oil-free overalls).
- By wearing a wide-brimmed hat you can stop embers from dropping onto your head or down the back of your shirt.
- Work gloves will protect your hands.
- A good pair of goggles will safeguard your eyes against any embers and debris that may be in the air.
- Cover your nose and mouth with a wet handkerchief or piece of cloth to prevent inhalation of smoke and embers.



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Prior to burning:

- Drink plenty of water throughout the day to avoid dehydration.
- Ensure the area to be treated is clear of personnel before burning begins.
- Ensure that adequate resources are available to conduct the burn in the prevailing and expected conditions, and contain the burn to the planned area.
- Use the attached checklist to ensure you are adequately prepared to conduct the burn.

During the burn:

- Ensure the burn is monitored at appropriate times until the risk of the fire escaping the planned area, and/or trees falling across roads and trails has passed.
- Working arrangements should ensure that personnel are not working alone or out of sight of others.
- Ensure that any safety hazards are immediately reported to the person supervising the fire.

The highest risk of fire trapping people conducting a burn is when they are working within the burn area perimeter. Additional safety precautions need to be planned and implemented in such circumstances and all personnel briefed about the precautions.

STEP 10. MOP UP AND PATROL

When you have completed the burn make sure that any logs or trees that are still burning are properly extinguished. In large bush fire hazard reductions the perimeter should be extinguished to a depth of at least 10 metres from all fire edges.

You should be regularly patrolling the perimeter to ensure that there is no ignition from burning embers of unburnt areas outside the perimeter of the area being treated. Under drier conditions, the area may need patrolling for several days following the bush fire hazard reduction work.

STEP 11. REPORTING

Ensure that you report on the completion of works by returning the completion form from the Bush Fire Hazard Reduction Certificate to the address indicated on the Certificate.

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CHECKLIST FOR LOW INTENSITY HAZARD REDUCTION BURNING

PRIOR TO BURNING:
MAKE SURE YOU HAVE:

- ☐ **Obtained a Bush Fire Hazard Reduction Certificate**
- ☐ **Obtained a Fire Permit (See "Before You Light That Fire")**
- ☐ **Either :**
  - ○ Selected the appropriate season and weather conditions having considered:
    - Temperature
    - Relative humidity
    - Wind speed and direction
    - Atmospheric stability

    OR
  - ○ Contacted the RFS for a Forest Fire Danger Index (FFDI), determined your fuel load, then cross checked with Table 1 to determine whether the chosen day is suitable.

- ☐ **Made a map of burn site taking into consideration:**
  - ○ Location of assets and control lines
  - ○ Direction of fire travel
  - ○ Areas of dry and moist fuel loads
  - ○ Most appropriate lighting patterns
  - ○ Placement of personnel during burn
    - Safe escape routes
    - Safety zones

- ☐ **Established control lines around the burn area including:**
  - ○ Drainage structures if necessary
  - ○ Cleared areas under trees and around logs

- ☐ **Conducted a test burn**

- ☐ **Notified all necessary parties:**
  - ○ RFS (24 hours prior to burning) or NSWFB
  - ○ Neighbours
  - ○ RTA (if traffic control is necessary)

- ☐ **Ensured that all personnel are familiar with details of the burn plan and adequately prepared:**
  - ○ Appropriate experience
  - ○ Protective clothing
  - ○ Food and water
  - ○ Awareness of safe burning procedures and first aid

- ☐ **Considered emergency procedures:**
  - ○ Efficient communication system
  - ○ First Aid Kit

AT COMPLETION OF BURN:
HAVE YOU:

- ☐ **Extinguished all necessary burning material**
- ☐ **Returned the completion form from the Bush Fire Hazard Reduction Certificate**

HOW CAN I FIND OUT MORE?

The following documents are available from your local Fire Control Centre and from the NSW RFS website at **www.rfs.nsw.gov.au.**

- Before You Light That Fire
- Standards for Asset Protection Zones
- Standards for Pile Burning
- Application Instructions for a Bush Fire Hazard Reduction Certificate

If you require any further information please contact:

- your local NSW Rural Fire Service Fire Control Centre. Location details are available on the RFS website or
- call the NSW RFS Enquiry Line 1800 679 737 (Monday to Friday, 9am to 5pm), or
- the NSW RFS website at **www.rfs.nsw.gov.au.**

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