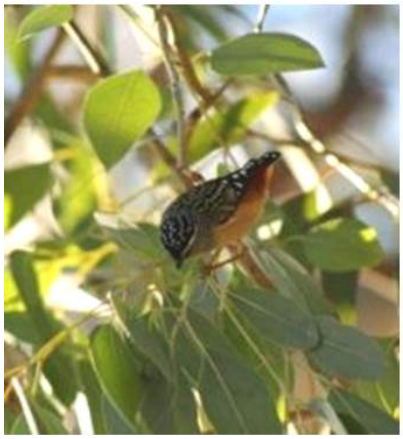
BIODIVERSITY and OFFSET MANAGEMENT PLAN



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Cover photos	Clockwise from top left: Grassy White Box Woodland Class 4; *Melanodrya scucullata* (Hooded Robin); *Pardalotus punctatus* (Spotted Pardalote); Regeneration in Grassy White Box Woodland Class 3				

EXECUTIVE SUMMARY and QUICK KEY

This Biodiversity Offset Management Plan (BOMP) has been prepared by Eco Logical Australia Pty Ltd (ELA) and Werris Creek Coal staff on behalf of Werris Creek Coal Pty Ltd (WCC). The BOMP identifies requirements and responsibilities of WCC relating to biodiversity and in implementing conditions of the Project Approvals (PAs) and Statements of Commitment (SoC). The BOMP describes the base line environmental condition, impacts of the mine and how biodiversity issues are to be managed via actions and the Biodiversity Offset Strategy (BOS).

WCC was granted Project Approval (PA 10_0059) on 25th October 2011 from the Department of Planning and Infrastructure (DoP) and 21st December 2011 (EPBC 2010/5571) from the Commonwealth Department of Sustainability, Environment, Water and Communities (DSEWPAC) for the Life of Mine (LOM) project. The Project involves a northerly extension of the current mine footprint, increasing the projected mine life by approximately 15 to 20 years. On 31st August 2012, PA 10_0059 (MOD1) was approved to increase Void Water Dam 1 (VWD1) storage capacity to 250ML and modify the Biodiversity Offset Strategy to include "Greenslopes/Banool" property compensating for the increased disturbance for VWD1 and alternate LOM Explosive Magazine location. To satisfy Condition 28, Schedule 3 of PA 10_0059, WCC are required to prepare and implement a BOMP for the project. The plan has also been prepared to meet the management plan requirements specified in Condition 2, Schedule 5 of the PA 10_0059 and in line with DSEWPAC requirements (EPBC 2010/5571).

The BOMP relates to management of biodiversity within the LOM footprint and 1316.88ha of land identified for management under the BOS, including the former Eurunderee, Hillview, Marengo and Railway View properties, the Mine Site and Additional Offset Area (Greenslopes). These lands have been stratified into broad Domains, Sub-domains and vegetation types and condition classes. Much of the Biodiversity Offset Area (BOA) comprises remnant White Box-Grassy Woodland of the Nandewar and Brigalow Belt South Bioregions (listed as the White Box Yellow Box Blakely's Red Gum woodland endangered ecological community (EEC) on Schedule 1 of the TSC Act and White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands under the EPBC Act), Plains Grass grassland on basaltic black earth soils mainly on the Liverpool Plain in the Brigalow Belt South Bioregion (listed as Native Vegetation of Cracking Clay Soils on the Liverpool Plains EEC on Schedule 1 of the TSC Act), Yellow Box – Blakely's Red Gum Grassy Woodland of the Nandewar Bioregion (a component of the listed White Box Yellow Box Blakely's Red Gum woodland EEC) and White Cypress Pine – Silver-leaved Ironbark – Tumbledown Red Gum shrubby open forest of the Nandewar Bioregion. The vegetation has been mapped in 4 condition classes (including cleared land).

There are several threatening processes that are affecting the site, including clearing for the LOM footprint, previous grazing by domestic stock and infestations of exotic plants/agricultural weeds. Cattle and sheep/goat grazing have been progressively removed from the BOA to allow the natural regeneration process to commence.

The management of these threatening processes and others has been addressed in **Sections 8** of this management plan, which provides information on the range of management actions that need to be implemented to manage the LOM and BOA in accordance with the Project Approval PA 10-0059 condition numbers 24, 25,26, 27, 28, 41 and 43(**Section 3**) and the Commonwealth Department of Sustainability, Environment Water, Population and Communities (DSEWPaC) conditions of approval issued on 21st December 2011 (**Section 3**). Associated with this, the monitoring, inspections, reporting and regeneration techniques described in **Appendix E** will assist WCC with the management of the site.

For ready reference to the required Section of the BOMP, use the following quick key:

Responsibilities	Section 2
Approval Conditions	Section 3
Baseline Condition	Section 4
Predicted environmental impacts	Section 5
Risk Assessment	Section 6
Objectives and targets	Section 7
Management Strategies, Measures & Controls including the BOS	Section 8
Monitoring	Section 9
Inspections	Section 10
Training requirements	Section 11
Biodiversity reporting	Section 12
BOMP Review processes	Section 13
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Monitoring data	Appendix C
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ACRONYMS USED THROUGHOUT THIS DOCUMENT

ABBREVIATION	DESCRIPTION
AEMR	Annual Environmental Management Report
BMP	Bushfire Management Plan
BOA	Biodiversity Offset Area
BOS	Biodiversity Offset Strategy
BOMP	Biodiversity and Offset Management Plan
DBH	Diameter at Breast Height
Director-General	The Director-General of the NSW Department of Planning& Infrastructure
DoP	NSW Department of Planning and Infrastructure
DNG	Derived Native Grassland
DRE	NSW Division of Resources and Energy
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water and Communities
EEC	Endangered Ecological Community
EA Report	Environmental Assessment Report
ELA	Eco Logical Australia Pty Ltd
EMS	Environmental Management System
EP&A Act	NSW *Environmental Planning and Assessment Act1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
HMP	Heritage Management Plan
IEA	Independent Environmental Audit
LFA	Landscape Function Analysis
LHPA	Livestock Health and Pest Authority
LMP	Landscape Management Plan
MOP	Mine Operations Plan
NPWS	NSW National Parks and Wildlife Service (part of OEH)
OEH	NSW Office of Environment & Heritage
PA	Project Approval
PCO	Pest Control Order
RFS	Rural Fire Service
RMP	Rehabilitation Management Plan
SoC	Statement of Commitments

SSA	Soil Sample Assessment
TSC Act	NSW *Threatened Species Conservation Act 1995*
WCC	Werris Creek Coal Pty Ltd

1 INTRODUCTION

This Biodiversity Offset Management Plan (BOMP) has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of Werris Creek Coal Pty Ltd (WCC). The existing Werris Creek Coal No.2 Coal Mine is operated by WCC and is located within the North West Slopes and Plains of New South Wales approximately 45km south west of Tamworth, 4km south of Werris Creek and 11km north-northwest of Quirindi **(Figures 1 & 2).**

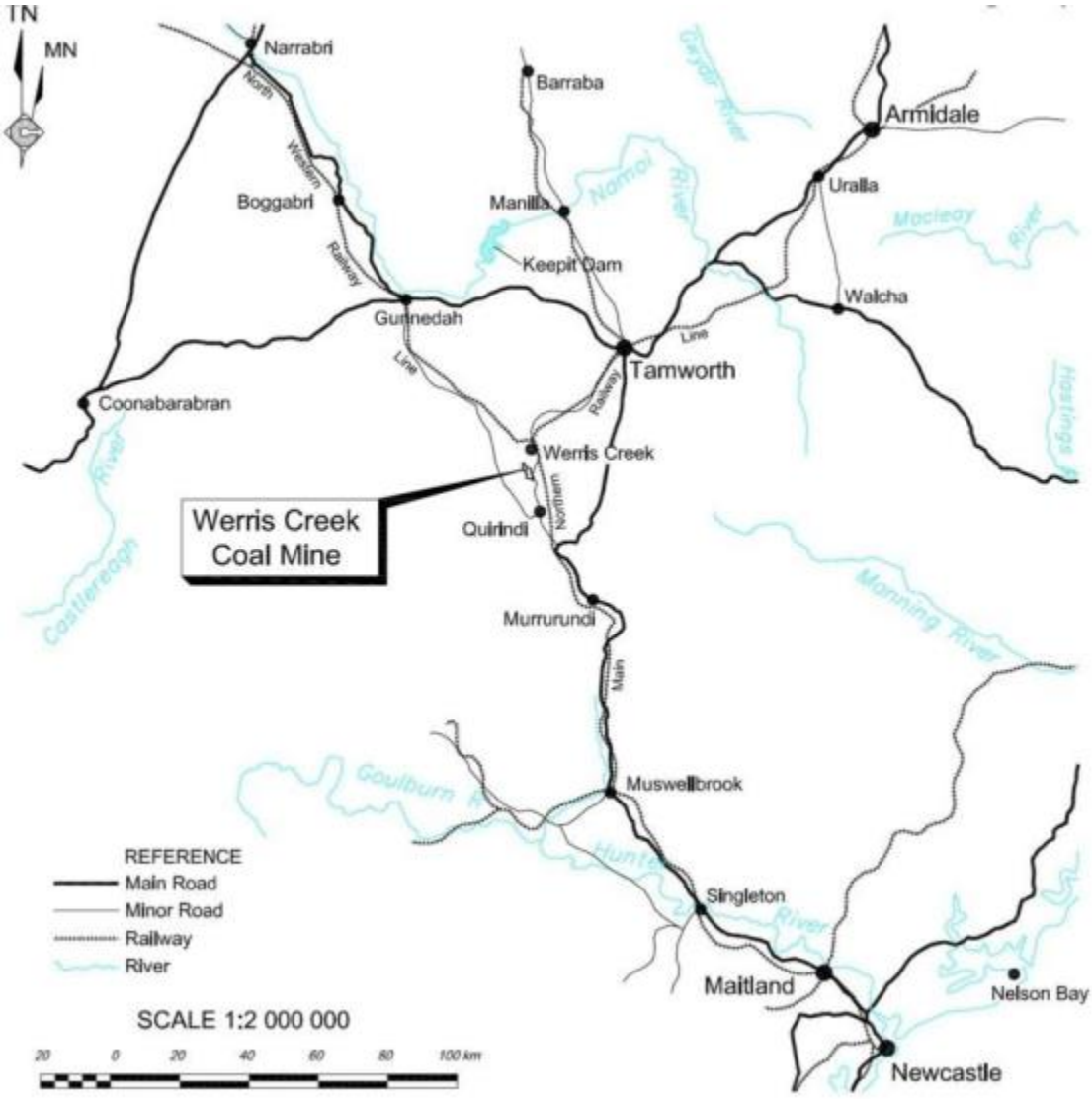

Figure 1: Regional context of Werris Creek Coal Mine (modified from Figure 1.1 R.W. Corkery & Co, 2010).

1.1 History of Operations

Underground mining at the former Werris Creek Colliery commenced commercially in 1925, closing in 1963 due to the cancellation of railway contracts for coal. The operation, owned by Preston Coal Company was small, employing a total of 13 people in 1928 (Pratt, 1996). The former Colliery was predominantly a board and pillar underground operation in which very few of the

pillars have been removed (Pratt, 1996). The operation mined the lower 2.5m of what was referred to as the "Tunnel Seam" which corresponds to the E Seam in the current operations.

In 2002, Exploration License (EL) 5993 was granted to Creek Resources Pty Ltd and Betalpha Pty Ltd to undertake further exploration of the coal basin. Development Consent DA 172-7-2004 was approved on the 18 February 2005 and the Mining Lease (ML) 1563 was granted on 23 March 2005. Construction for open cut operations commenced in April 2005. Whitehaven Coal Mining Pty Ltd purchased Creek Resources Pty Ltd in 2005 which owned 40% of WCC. Whitehaven Coal purchased the remaining 60% interest in WCC in late 2007 taking management control for the operation. The operating company is Werris Creek Coal Pty. Ltd, which is a wholly owned subsidiary of Whitehaven Coal Mining Pty Ltd.

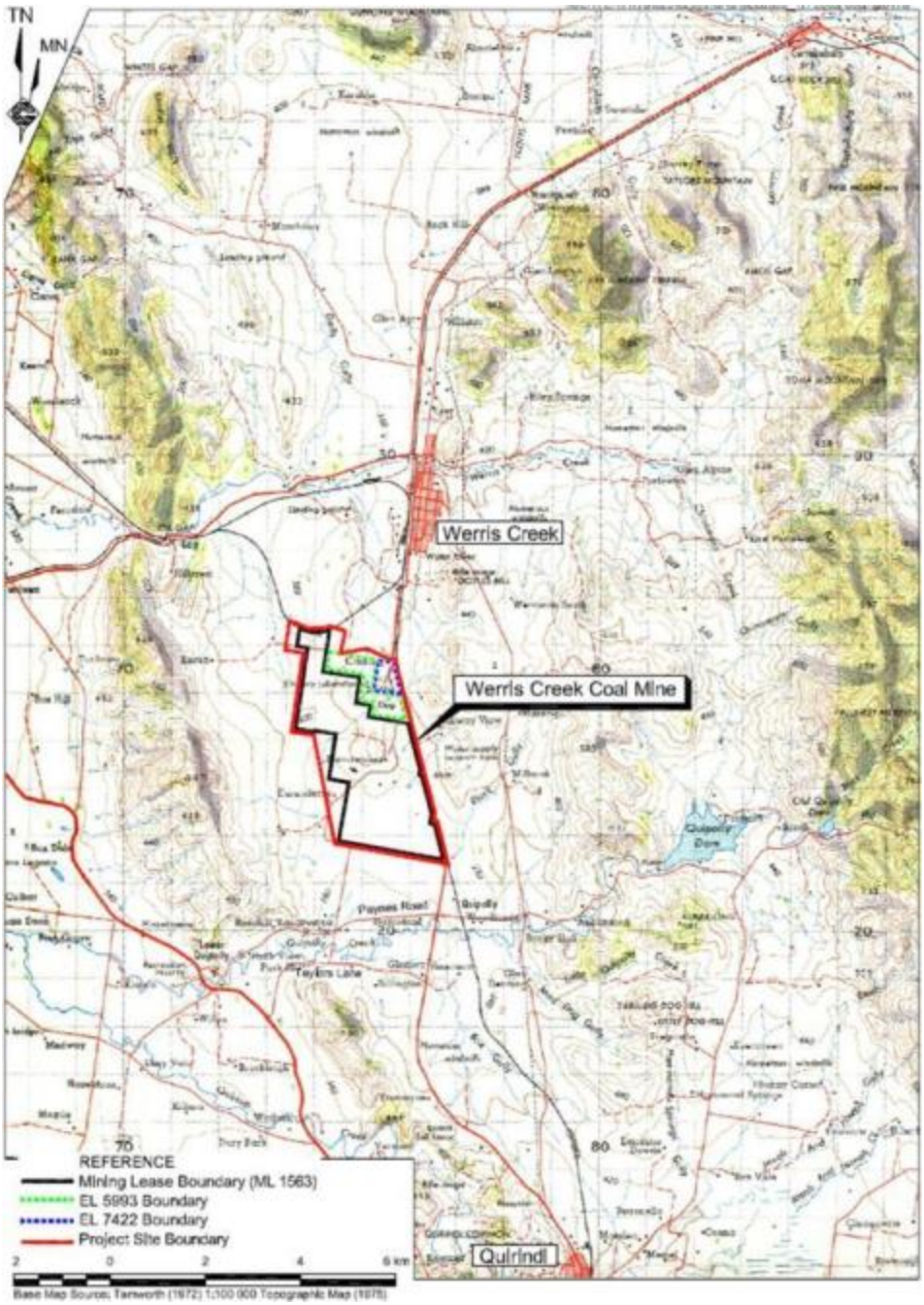

Figure 2: WCC Local Area (modified from Figure 1.1 R.W. Corkery & Co, 2011)

1.2 Life of Mine Project

The WCC Life of Mine (LOM) Project covers an area of 910ha including ML1563, ML1672 (covering EL5993 and EL7422) and ML1671 for mining related purposes which covers the remaining areas within the project boundary not covered by a mining title **(Figure 2)**. The LOM Project involves the following component activities and operations **(Figure 3)**:

- Increase Void Water Dam 1 (VWD1) storage capacity to 250ML and modify the Biodiversity Offset Strategy to include "Greenslopes/Banool" property compensating for the increased disturbance for VWD1 and alternate LOM Explosive Magazine location in accordance with PA 10_0059(MOD1);
- Northerly continuation of the existing open cut mine to extract the entire Werris Creek outlier of the Greta Coal Measures;
- Extension of the out-of-pit overburden emplacement area to the west over the current footprint of the Coal Processing Area and Site Administration and Facilities Area (out-of-pit emplacement) and construct a "Acoustic and Visual Amenity Bund" that extends around the eastern and north eastern perimeter of the open cut, and extend northwards over the completed sections of the open cut (in-pit emplacement);
- Relocation of coal processing infrastructure (Coal Processing Area) and increase ROM coal stockpile (ROM Coal Pad) capacity to 200000t;
- Maintaining road transportation of coal to domestic markets at 50000tpa to meet the needs of local customers for low ash coal (R.W. Corkery & Co2011). Road transport must not go through local government areas of Muswellbrook, Singleton, Mid-Western Regional, Cessnock and Newcastle;
- Production of up to 2.5Mtpa of thermal and Pulverised Coal Injection (PCI) coal for the domestic and international markets;
- Increased storage capacity of the Product Coal Storage Area at the Rail Load-out Facility and extend the pad to the east to increase the capacity of the stockpile area to approximately 250000t;
- Increase in the approved hours of operation to 24 hours, 7 day per week for all activities excluding Blast and road transport of coal from the WCC;
- Relocation of the administration and workshop areas (Site Administration and Facilities Area);
- Construction of a new entrance to WCC off Escott Road for direct access to the relocated coal processing infrastructure, offices and facilities. The use of Escott Road as the primary access point to the WCC would require the existing Escott Road and the intersection of Escott Road with Werris Creek Road to be upgraded;
- Construction of a second feed point to the Rail Load-out Facility to allow for product separation and reduced inter-product contamination;
- Construction of a 'turn-around' rail loop which would take off from the Werris Creek Rail Siding to the immediate west of the Rail Load-out Facility;
- Continued dewatering the underground workings of the former Werris Creek Colliery (approved under DA 172-7-2004) to enable open cut mining through all of these workings
- Construction of a Northern Void Water Dam for the storage of water which accumulates in the open cut;
- Depending on economics, allows for the construction of a conveyor to transport coal from the Coal Processing Area to the Product Coal Storage Area potentially replacing internal coal haulage; and
- Rehabilitation and new Biodiversity Offset Strategy (BOS) focusing on restoring Grassy White Box Woodland and habitat for Regent Honeyeater and Swift Parrot.

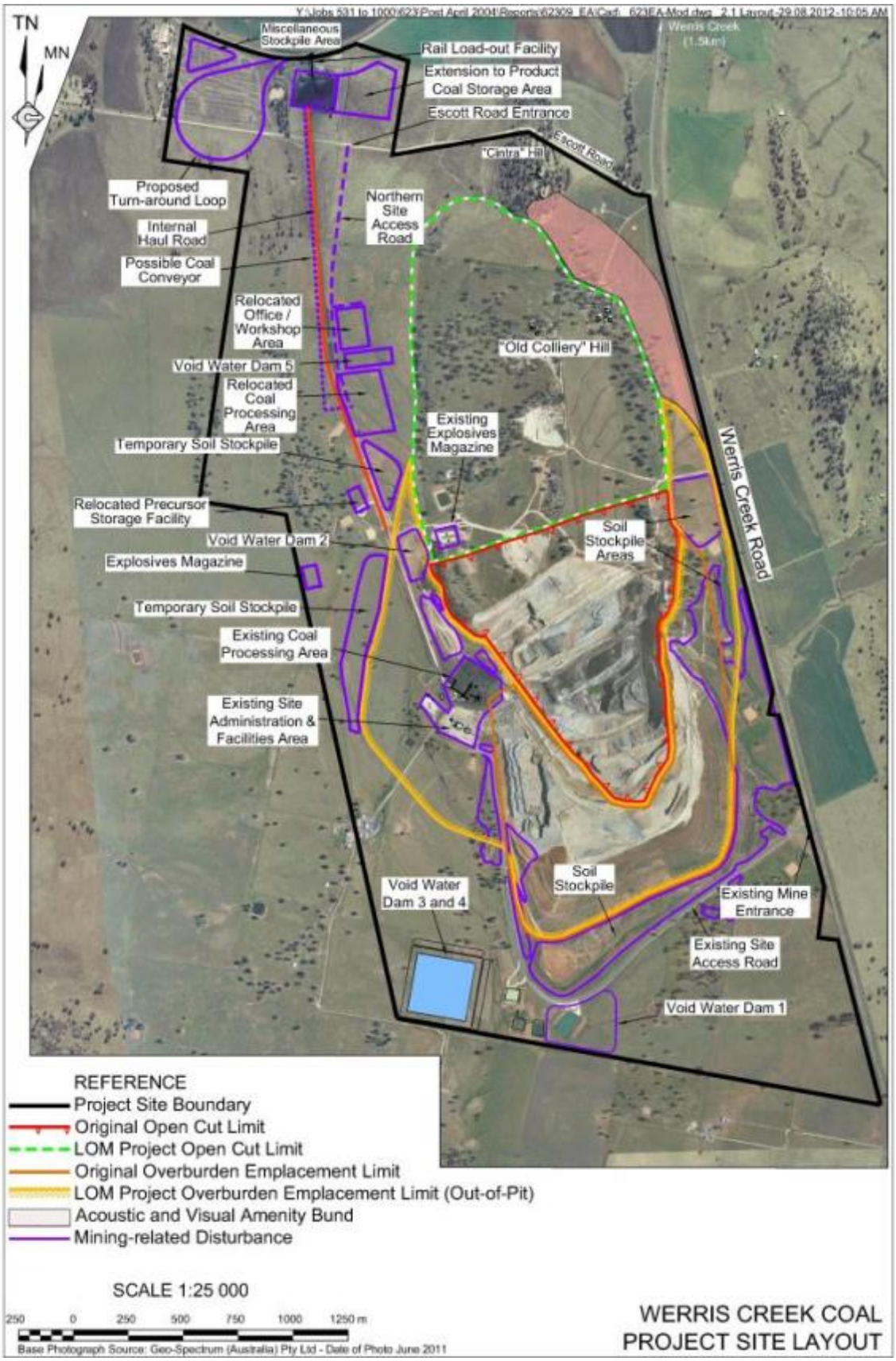

Figure 3: LOM WCC Layout (from Appendix 2 PA 10_0059 MOD1).

1.3 Purpose

The BOMP objectives are based around the three specific categories of Integrated Landscapes, achieving Sustainable Growth and Development, and establishing the Final Land Use.

Integrated Landscapes

- To guide and manage biodiversity impacts associated with the LOM project;
- To restore ecological community corridors across WCC land holdings and Quipolly Creek Catchment linking with sub-regional habitat corridors;
- To reduce the visibility of mine-related activities from adjacent properties, Werris Creek and the local road network;
- To blend the created landforms with the surrounding topography; and
- To provide a low maintenance, geotechnically stable and safe landform with minimal erosion.

Sustainable Growth and Development

- To achieve a soil profile capable of sustaining the specified final land use; and
- To establish native vegetation with the species diversity commensurate to each relevant ecological community.

Final Land Use

- To re-instate woodland ecological communities commensurate with the remnant woodland vegetation within Biodiversity Offset Areas and adjacent to the WCC mine site; and
- Undertake habitat augmentation to improve and promote corridors for fauna movement linking adjacent remnant woodland vegetation with the rehabilitation of WCC mine site.

The BOMP will provide WCC direction to:

- identify the land that will be required to be managed in accordance with this BOMP;
- provide a clear, concise, staged and instructional working document outlining the actions for managing biodiversity within the WCC mine site, rehabilitation and BOA;
- provide a management framework that will lead to an improvement in the condition of vegetation across the rehabilitation and BOA utilising expert knowledge of resilience in natural landscapes and through implementing specific restoration techniques to minimise the impacts of key threats to biodiversity at WCC; and
- outline the monitoring, performance evaluation and reporting procedures that are practical and able to be implemented and understood by the Environmental Officer.

2 RESPONSIBILITIES

Specific responsibilities in relation to biodiversity management for key management roles are outlined in **Table 1**.

Table 1: Roles and Responsibilities

ROLE	RESPONSIBILITIES
Group Environment Manager	• To provide the final sign off/authorised distribution of this management plan and all environmental reports • Ensure the management controls are implemented in accordance with this plan • Ensure sufficient resources are allocated for the implementation of this plan • Ensure all site personal have received the appropriate training for their responsibilities • Monitor the effectiveness of management strategies and provide ongoing guidance as needed • Ensure all internal and external reporting requirements are met, including incident reporting in accordance with relevant internal protocols
Operations Manager	• Ensure that operations are undertaken in accordance with relevant regulations, licenses and approvals • Monitor the effectiveness of management strategies and provide ongoing guidance as needed • Maintain overall responsibility for activities undertaken on the WCC site
Environment Officer – Werris Creek Coal	• Implementing the procedures contained in this management plan • Post induction education and contact with all employees and contractors on issues • Analysis of monitoring results and inclusion in the Annual Environmental Management Report (AEMR) • Timely reporting of environmental monitoring data on the Whitehaven Coal website • Regularly revise the performance of management strategies. • Regularly report environmental performance to Group Environmental Manager • Develop strategies to prevent or reduce environmental impacts • Attend Community Consultation Committee meetings • Receive and respond to community complaints

ROLE	RESPONSIBILITIES
Site Managers	• Ensure that all operations on site are undertaken in compliance with this management plan • Ensure all site personal have received the appropriate training for their responsibilities • Conduct regular inspections of the work area to monitor compliance with this plan • Implement controls • Report any incidences or complaints immediately to the Environmental Officer • Provide feedback on the adequacy and effectiveness of this plan
Consultant Ecologists	• Undertake pre-clearing surveys and post clearing inspections to minimise the potential impact on biodiversity of clearing activities • Undertake biodiversity surveys of BOA and rehabilitation in accordance with the annual monitoring requirements
Employees and Other Contractors	• Ensure the implementation of this plan with respect to their specific work practices • Act in accordance with the management procedures or protocols outlined in this plan • Ensure any potential or actual issues, including environmental incidents, are reported to the immediate supervisor

3 REQUIREMENTS

The BOMP for the WCC LOM Project has been prepared in accordance with the requirements established under various legislative and best practice instruments. The requirements established under these instruments are outlined in the following sections.

3.1 Project Approval10_0059 (MOD1)

Specific conditions relating to the implementation of the WCC LOM Project are outlined in PA 10_0059 (MOD1) granted by the NSW Minister for Planning and Infrastructure. PA 10_0059 was approved on 25th October 2011 and MOD1 approved on 30th August 2012. **Table 2** summarises the requirements relating to biodiversity management from the Project Approval, and identifies where these requirements are addressed within this management plan.

Table 2: Conditions established in Project Approval 10_0059 (MOD1)
Note: Figures and tables cited in the below table are within the Project Approval

<table>
<tr><th>SCHEDULE (CONDITION)</th><th>REQUIREMENT</th><th>RESPONSE DETAILED IN SECTION</th></tr>
<tr><td></td><td>BIODIVERSITY OFFSET STRATEGY</td><td></td></tr>
<tr><td>S3 C24</td><td>The Proponent shall implement the biodiversity offset strategy for the project described in the EA, summarised in Table 12 of the PA, and shown conceptually on the figure in Appendix 4 of the PA to the satisfaction of the Director-General.
Table 12: Summary of the Biodiversity Offset Strategy
<table>
<tr><th>Offset Areas</th><th>Minimum Sizes (hectares)</th></tr>
<tr><td>Eurunderee</td><td>363.93</td></tr>
<tr><td>Hillview</td><td>57.32</td></tr>
<tr><td>Marengo</td><td>284.12</td></tr>
<tr><td>Railway View</td><td>243.69</td></tr>
<tr><td>Mine Site</td><td>215.86</td></tr>
<tr><td>Greenslopes/Banool</td><td>123</td></tr>
<tr><td>Total</td><td>1,287.92</td></tr>
</table>
Notes:
• To identify the areas referred to in Table 12, see the applicable figure in Appendix 4(refers to PA10_0059, not this BOMP);
• The strategy includes the enhancement of existing fauna habitat within these areas, and where necessary the targeted establishment of naturally scarce fauna habitat; and
• Greenslopes/Banool must have at least 74 hectares of Box Gum Woodland EEC.</td><td>8.2</td></tr>
<tr><td>S3 C25</td><td>By the end of June 2012, unless the Director-General agrees otherwise, the Proponent shall update the biodiversity offset strategy for the project, in consultation with OEH, and to the satisfaction of the Director- General. The updated strategy must include the specific details of the Additional Offset Area (see Table 12 of the PA above).</td><td>8.2</td></tr>
<tr><td rowspan="2">S3 C26</td><td>The Proponent shall ensure that the biodiversity offset strategy and/or rehabilitation strategy is focused on the re-establishment and/or enhancement of:
(a) the following endangered ecological communities:
• White Box-Yellow Box-Blakely’s Red Gum Woodland EEC
• White Box-Yellow Box-Blakely’s Red Gum Grassy Woodland and Derived Native Grassland CEEC</td><td>8.2, 8.3 & 8.5</td></tr>
<tr><td>(b) habitat for threatened fauna species, including the:</td><td>8.6</td></tr>
</table>

SCHEDULE (CONDITION)	REQUIREMENT	RESPONSE DETAILED IN SECTION
	• Regent Honey Eater, Swift Parrot, Brown Treecreeper, Hooded Robin, Little Lorikeet, and Barking Owl • Eastern Bent-wing Bat, Eastern False Pipistrelle, Yellow-bellied Bent-wing Bat and Greater Broad-nosed Bat	
	Long Term Security of Offsets	
S3 C27	The Proponent shall make suitable arrangements to provide appropriate long-term security for the offset areas (excluding the rehabilitation areas) by December 2012, or other date agreed by the Director- General, to the satisfaction of the Director-General.	8.2
	Biodiversity Offset Management Plan	
S3 C28	The Proponent shall prepare and implement a Biodiversity Management Plan for the project to the satisfaction of the Director-General. This plan must: (a) be prepared in consultation with OEH, and submitted to the Director-General for approval by the end of December 2012	Appendix A
	(b) describe how the implementation of the biodiversity offset strategy would be integrated with the overall rehabilitation of the site	8.3
	(c) describe the short, medium, and long term measures that would be implemented to:	8.0
	• manage the remnant vegetation and habitat on the site and in the offset area/s (if and when applicable)	8.5
	• implement the biodiversity offset strategy (if and when applicable), including detailed performance and completion criteria	7.1
	(d) include detailed performance and completion criteria for evaluating the performance of the biodiversity offset strategy, and triggering remedial action (if necessary)	7.1
	(e) include a detailed description of the measures that would be implemented over the next 3 years, including the procedures to be implemented for:	8.0
	• enhancing the quality of existing vegetation and fauna habitat	8.8 & 8.12
	• restoring native vegetation and fauna habitat on the biodiversity areas and rehabilitation area through focusing on assisted natural regeneration, targeted vegetation establishment and the introduction of naturally scarce fauna habitat features (where necessary)	8.5 & 8.8
	• landscaping the land on site that faces public roads to minimise the visual and lighting impacts of the project	8.3
	• maximising the salvage of resources within the approved disturbance area – including vegetative, soil and cultural heritage resources – for beneficial reuse in the enhancement of the biodiversity areas or rehabilitation area	8.1
	• collecting and propagating seed	8.4
	• minimising the impacts on fauna on site, including undertaking pre-clearance surveys	8.1

SCHEDULE (CONDITION)	REQUIREMENT	RESPONSE DETAILED IN SECTION
	• managing any potential conflicts between the proposed restoration works in the biodiversity areas and any Aboriginal heritage values (both cultural and archaeological)	8.10
	• managing salinity	8.14
	• controlling weeds and feral pests	8.7 & 8.8
	• controlling erosion	8.11
	• managing grazing and agriculture on site	8.12
	• controlling access	8.9
	• bushfire management	8.13
	(f) include a seasonally-based program to monitor and report on the effectiveness of these measures, and progress against the detailed performance and completion criteria	9.0
	(g) identify the potential risks to the successful implementation of the biodiversity offset strategy, and include a description of the contingency measures that would be implemented to mitigate against these risks	6.0
	(h) include details of who would be responsible for monitoring, reviewing, and implementing the plan	2.0

3.2 Statement of Commitments

Table 3: Relevant Statement of Commitments, actions and Sections that respond to commitments.

Note: Figures and tables cited in the below table are within the Project Approval

	3. BIODIVERSITY		
DESIRED OUTCOME	ACTION	TIMING	RESPONSE DETAILED IN SECTION
Avoid and minimise impacts on native vegetation (including the two identified EECs) where possible.	3.1 Ensure disturbance associated with the relocation of site infrastructure occurs in the locations specified on Figure 2.1, i.e. on cleared and cultivated land (Condition Class 1), or derived native grassland without native tree overstorey (Condition Class 3)	Prior to and during relocation of infrastructure	8.1
	3.2 Limit vegetation clearing each year to an area required for the following 12 months mine development	Annual	8.1
	3.3 Clearly mark / peg areas required for surface infrastructure establishment and mining	Ongoing	8.1
	3.4 Retain felled trees on the Project Site for subsequent use during rehabilitation activities	Site establishment and rehabilitation phases	8.1
Mitigate unavoidable disturbance to native vegetation and fauna habitat.	3.5 Identify, as part of the Pre-start Clearing Inspection, biological resources within the disturbance area including habitat resources such as hollows, stag trees and coarse woody debris, and the availability of endemic seed	During annual clearing campaigns	8.1

	3. BIODIVERSITY		
DESIRED OUTCOME	**ACTION**	**TIMING**	**RESPONSE DETAILED IN SECTION**
	3.6 Implement a seed collection strategy and program to harvest endemic seed from local vegetation to either directly sow or propagate for tube stock planting in either biodiversity offset or rehabilitation areas	Ongoing	8.4
	3.7 Complete monitoring and inspection programs to review the progress of rehabilitation against criteria based on vegetation community benchmark data	Annual	9 and 10
Rehabilitate disturbed areas to create a final land form that maintains or improves biodiversity values of the Project Site.	3.8 Create a final landform generally similar to that of the pre-mining landform, i.e. approximating the conceptual final landform provided by Figure 2.18	Ongoing	8.3
	3.9 Revegetate the final landform as nominated by Figure 2.18 (or subsequent Rehabilitation Management Plan), i.e. predominantly native woodland vegetation which will supplement the LOM Project BOS and improve the linkage between remnant areas of native woodland vegetation to the east and west	Ongoing	8.3
	3.10 Designate approximately 3.7ha of the final landform as Brigalow woodland	During rehabilitation operations	8.3
	3.11 Augment habitat through the placement of previously cleared timber (on the ground as well as upright 'stags') to provide important habitat value for arboreal and ground hollow dependant fauna and perching sites	During rehabilitation operations	8.3
Manage the impacts of noxious weeds.	3.12 Monitor noxious weeds on a regular basis, and if required, conduct weed management campaigns to manage weed outbreaks	Ongoing	8.7, 9 and 10
Minimise or avoid impacts on native fauna (including threatened species).	3.13 Undertake vegetation clearing during a single campaign each year (except when there are extenuating circumstances), preferably during seasons that minimise the risk of impacting on hibernating microbats or breeding woodland birds, i.e. Autumn	Vegetation clearing and ongoing	8.1
	3.14 Commission a Pre-start Clearing Inspection of the proposed disturbance area by an ecologist to identify the presence of native fauna (including threatened species such as the Koala and microbats)	Vegetation clearing and ongoing	8.1
	3.15 Suspend all clearing activities, in the event a koala (or other threatened fauna species) is present in the trees to be cleared, until it moves away from the subject area or is relocated by a suitably qualified person	Prior to clearing operations within areas of remnant vegetation	8.1
Offset residual impact	3.16 Develop and implement, in consultation with the	Within 18	8.2

	3. BIODIVERSITY		
DESIRED OUTCOME	**ACTION**	**TIMING**	**RESPONSE DETAILED IN SECTION**
of the LOM Project.	DECCW, DoP and DSEWPaC, a Biodiversity Offset Strategy for the LOM Project	months of Project Approval	
	3.17 Prepare a Biodiversity Offset Management Plan which includes a detailed description of the procedures to be applied within the offset area including: o erosion and sediment control; o soil and water management, bushfire management o exclusion of domestic stock o weed management o retention of regrowth and native vegetation o retention of dead timber and fallen logs; o in-fill planting with locally indigenous species where required o feral animal control o limitation of human access, and o an annual review and reporting requirement	Within 18 months of Project Approval	Provided in this document
Offset residual impact of the LOM Project. (cont'd)	3.18 Provide for the completion of an independent review of the BOMP at least every 5 years to report on the success of BOMP procedures (see Commitment 3.17)	Every 5 years following the establishment of the BOMP	12

3.3 DSEWPAC Approval conditions

The following provides the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) conditions of approval for the Werris Creek Coal mine (EPBC 2010/5571).

Table 4: DSEWPAC approval conditions and relevant section in BOMP

CONDITION NO.	CONDITION	RESPONSE DETAILED IN SECTION
1.	To offset the impact to the White Box-Yellow Box-Blakely's Red Gum Grassy Wood land and Derived Native Grassland Ecological Community and foraging habitat of the Regent Honeyeater and Swift Parrot the person taking the action must register a legally binding conservation mechanism over the Werris Creek Life of Mine (LOM) Extension Project Biodiversity Offset Strategy (BOS) sites identified in the map at Appendix 1 and an additional area of at least 74 hectares of White Box-Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community (together, the Offset Areas). The mechanism/s must provide enduring protection for the offset area and be registered within 2 years of the date of this approval	8.2

2.	To offset the impacts to the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community, Regent Honeyeater and Swift Parrot, the person taking the action must submit to the Minister for approval an Offset Management Plan for all of the Offset Areas within 12 months of the date of this approval. The Offset Management Plan must be implemented. The Offset Management Plan must include, at a minimum, the following information: a) A textual description and map to clearly define the location and boundaries of all of the Offset Areas). This must be accompanied with the offset attributes and a shapefile. b) details of management actions to protect and enhance the extent and condition of habitat values of the offset areas including but not limited to rehabilitation, weed control, fire management, erosion and sediment control, management of livestock and restrictions on access of no less than: i. 310.2 hectares of habitat for the Regent Honeyeater and Swift Parrot; and ii. 731 hectares of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community; c) the timing, responsibilities and performance criteria for management actions; d) a monitoring plan including the undertaking of ecological surveys by a qualified ecologist to assess the success of the management actions against identified milestones and objectives; e) a process to report, to the department, the management actions undertaken in the offset areas and the outcome of those actions, including identifying any need for improved management; f) a description of the potential risks to successful management and rehabilitation in the offset areas, and a description of the contingency measures that would be implemented to mitigate these risks; and g) details of parties responsible for management, monitoring and implementing the plan, including their position or status as a separate contractor. Note: For clarity. the offset areas specified in condition 2 can accommodate offset requirements for more than one species habitat within the one area, if suitable habitat is verified as present and includes specific habitat requirements for the relevant species.	8.2; 8.4 to 8.14; 9; 10; 6
3.	Within 14 days from the commencement of construction the person taking the action must advise the department in writing of the actual date of commencement of construction.	Correspondence dated December 2011
4.	Within three months of every 12 month anniversary of the commencement of construction, 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 management 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.	12
5.	Upon the direction of the Minister, the person taking the action must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the Minister. The independent auditor	13; 12

	must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agreed to by the Minister and the audit report must address the criteria to the satisfaction of the Minister.	
6.	If the person taking the action wishes to carry out any activity otherwise than in accordance with the management plan, as specified in the conditions , the person taking the action must submit to the department for the Minister's written approval a revised version of that management plan. The varied activity shall not commence until the Minister has approved the varied plan in writing. The Minister will not approve a varied management plan unless the revised plan would result in an equivalent or improved environmental outcome. If the Minister approves the revised plan, that management plan must be implemented in place of the management plan originally approved.	N/A
7.	If the Minister believes that it is necessary or convenient for the better protection of listed threatened species and communities to do so, the Minister may request that the person taking the action make specified revisions to the plan referred to in condition 2 and submit the revised plan. The person taking the action must comply with any such request. The revised plan must be implemented. Unless the Minister has approved the revised plan then the person taking the action must continue to implement the original plan.	N/A
8.	If at any time after 5 years from the date of this approval, the person taking the action has not substantially commenced the action, then the person taking the action must not substantially commence the action without the written agreement of the Minister.	N/A
9.	The person taking the action must maintain accurate records substantiating all activities and outcomes associated with or relevant to the above conditions of approval, including measures taken to implement the management plans required by this approval, and make them available upon request to the department.	12
10.	Such records may be subject to audit by the department or an independent auditor in accordance with section 456 of the EPBC Act, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the department's web site. The results of audits may also be publicised through the general media.	12; 13
11.	Unless otherwise agreed to in writing by the Minister, the person taking the action must publish all management plans referred to in these conditions of approval, on their website. Each management plan must be published on the website within 1 month of being approved.	12

4 BASELINE CONDITION

4.1 Climatic Information

The closest long term meteorological station is Quirindi (11km south east). The Quirindi area is influenced by a temperate weather system and experiences warm summer and mild winter temperatures. Summer maximum temperatures are experienced in January with an average maximum of 32.2^{O}C (daily) and minimum of 16.3^{O}C (nightly). Winter minimums are experienced in July with an average maximum of 15.9^{O}C (daily) and minimum of 1.6^{O}C (nightly). The average rainfall is 682.7 mm per year with the greatest falls received in January (80.9 mm) and the lowest falls in April (42.2 mm).

4.2 Vegetation

The native vegetation of the general area has been mapped during various previous vegetation mapping exercises, including as part of the Brigalow Belt South Vegetation Survey and Mapping Project Stage 1 (RACAC 2000; GCNRC 2004), Biodiversity Impact Assessment (ELA 2010b) and the Namoi CMA Regional Vegetation Communities Profiles Project (ELA 2010a) (**Table 5**).

GCNRC (2004) identified six vegetation communities and large areas of cleared land used for grazing and/or cultivation in ML1563; however, this did not cover the entirety of the proposed BOA. The mapping by GCNRC was reviewed and ground surveyed by ELA ecologists Antony von Chrismar and Daniel McKenzie in October 2011 as part of the preparation of this BOMP (**Figure 5**).

4.3 Vegetation Condition

The condition of each vegetation community was assigned to one of four broad condition classes based on the presence/absence of a canopy layer and whether the ground cover was greater than or less than 50% native ground cover. The four condition classes were:

1. <50% native ground cover with no native canopy present (Cleared Land);

2. <50% native ground cover with a native canopy present (Scattered Trees/Paddock Trees in Poor Condition);

3. >50% native ground cover with no native canopy present (Derived Native Grasslands in Moderate-Good Condition). Sub condition classes have been assigned to Class 3 for the purposes of assigning EEC's under the TSC Act and EPBC Act;

   - Class 3a (high diversity): no native canopy cover, >11 native perennial understorey species (not including grasses) and at least 1 important species. Where Box-Gum Woodland canopy species are likely to have occurred in this class, this condition class equates to the EPBC Act and TSC Act definition of Box-Gum Woodland DNG
   - Class 3b (low diversity): no native canopy cover, native grassy understorey with low diversity of herbs or other perennial understorey species. Where Box-Gum Woodland canopy species are likely to have occurred in this class, this condition class equates only to the TSC Act definition of Box-Gum Woodland DNG; and

4. >50% native ground cover with a native canopy present (Native Vegetation in Moderate –Good Condition).

4.4 Vegetation Resilience Categories

The resilience of the site was assessed using the following categories:

- Very High resilience – sufficient native vegetation remaining in-situ to enable the natural regeneration of native vegetation. Low levels of management is required to facilitate restoration;
- High resilience – native vegetation is present, but there are large areas with no overstorey present. Low levels of management is required to facilitate restoration; and
- Low resilience – no or very little native vegetation is present and the overstorey has been removed or remains only as scattered paddock trees. Significant levels of active management is required to facilitate restoration.

Table 5: Relationship between mapped Biometric vegetation types and previous mapping.

BIOMETRIC VEG TYPE	EEC	CUNNINGHAM COMMUNITY NAME (GCNRC 2004)	NAMOI CMA RVC NAME (ELA 2010A)
Cleared land	N/A	Community 1 Cleared - Cultivated / Pasture Lands	N/A
Plains Grass grassland on basaltic black earth soils mainly on the Liverpool Plain in the Brigalow Belt South Bioregion	Native vegetation on Cracking Clay Soils of the Liverpool Plains	Community 2 Cleared Land - Uncultivated	Plains Grass – Blue Grass grasslands, Brigalow Belt South and Nandewar
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	White Box- Yellow Box- Blakely's Red Gum Grassy Woodland	Community 4 *Eucalyptus albens* (White Box) *Eucalyptus melliodora* (Yellow Box) *Eucalyptus blakelyi* (Blakely's Red Gum) Community	White Box grassy woodland, Brigalow Belt South and Nandewar
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	White Box- Yellow Box- Blakely's Red Gum Grassy Woodland	Community 5 *Eucalyptus albens* (White Box) - *Angophora floribunda* (Rough-barked Apple) Community	White Box grassy woodland, Brigalow Belt South and Nandewar
Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion	White Box- Yellow Box- Blakely's Red Gum Grassy Woodland	Community 4 *Eucalyptus albens* (White Box) *Eucalyptus melliodora* (Yellow Box) *Eucalyptus blakelyi* (Blakely's Red Gum) Community	Box- Gum Woodlands, Brigalow Belt South and Nandewar
White Cypress Pine - Silver-leaved Ironbark -Tumbledown Gum - shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	N/A	Community 6 *Eucalyptus dealbata* (Tumbledown Gum) Community	White Box - Pine - Silver-leaved Ironbark Shrubby open forest, Brigalow Belt South and Nandewar
White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	N/A	N/A	White Box – pine – Silver-leaved Ironbark shrubby open forests, Nandewar

Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion	N/A	N/A	Rough-barked Apple – Blakely's Red Gum riparian grassy woodlands, Brigalow Belt South and Nandewar
Rusty Fig - Wild Quince - Native Olive dry rainforest of rocky areas of the Nandewar Bioregion	N/A	N/A	Rusty Fig – Wild Quince – Native Olive dry rainforest of rocky areas, Nandewar and New England Tablelands

Eight vegetation types have been mapped within the LOM and BOA and are described in accordance with the biometric vegetation types used as a state wide standard by the OEH. Vegetation types were mapped across the entire property, and trimmed to the boundary of the BOA after the mapping was completed. The area and proportion of each vegetation type within the BOA is shown in **Table 6**.

Table 6: Area of Biometric vegetation types in WCC LOM site and BOA.

Biometric Vegetation Communities	Condition	BOA Total (Offset)	LOM Total (Impact)
Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion	Class 4	8.50	
Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion	Class 4		0.35
White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions	Class 4	326.28	58.50
	Class 3a	250.25	74.60
	Class 3b	408.52	60.70
	Class 2	26.35	
Plains Grass grassland on basaltic black earth soils mainly on the Liverpool Plain in the Brigalow Belt South Bioregion	Class 3	25.33	
Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion	Class 4	1.28	
	Class 3	3.05	
Rusty Fig - Wild Quince - Native Olive dry rainforest of rocky areas of the Nandewar Bioregion	Class 4	1.00	
White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions	Class 4	156.40	
	Class 3	20.74	
White Cypress Pine - Silver-leaved Ironbark - Tumbledown Gum shrubby open forest	Class 4	45.23	
Total Extant Vegetation		**1272.92**	
Cleared Land to be restored		18.87	
Mine Site Rehabilitation		482.20	
Other Cleared Land (incl. roads, dams, rubbish dump)		25.08	31.49
GRAND TOTAL		**1799.08**	**225.64**

It is noted that GCNRC (2004) identified large areas of clear/cultivated land and Native Vegetation on Cracking Clay Soils of the Liverpool Plains as part of the assessment of the original development application. Whilst mapping the vegetation for the proposed BOA, ELA noted that the majority of the grassland areas were more closely aligned to the White Box – Yellow Box – Blakely's Red Gum community (White Box Grassy Woodland of the Nandewar and Brigalow belt south bioregions) than the Native vegetation on Cracking Clay Soils due to the frequent occurrence of previously ring barked White Box trees and White Box regeneration. It was also noted that areas where there was no tree canopy or regenerating canopy species, that the understory was greater than 50% native ground cover species and therefore considered as native vegetation rather than cleared or cultivated land.

4.5 Vegetation Community Descriptions

4.5.1 White Box grassy woodland of the Nandewar and Brigalow Belt South Bioregions and Yellow Box- Blakely's Red Gum grassy woodland of the Nandewar Bioregion

This community ranges in condition from condition class 1 – 4. It generally has a sparse canopy dominated by *Eucalyptus albens* (White Box) with *E. melliodora* (Yellow Box) occasionally present. In some areas there is prolific regeneration of one or both of these overstorey species. The midstorey is absent with no shrubs observed at all. The understorey consists of a mix of native and introduced flora. The native understorey species include *Calotis lappulacea* (Yellow Burr-Daisy), *Einadia hastata* (Berry Saltbush), *Eremophila debilis* (Amulla) and *Wahlenbergia communis* (Tufted Bluebell), with native grasses dominating large areas including *Aristida ramosa* (Purple Wiregrass), *Austrostipa verticillata* (Slender Bamboo Grass), *Bothriochloa macra* (Red Grass), *Chloris truncata* (Windmill Grass), *Dichanthium sericeum* (Queensland Bluegrass), *Sporobolus elongatus* (Slender Rat's Tail Grass).

This community is representative of the endangered ecological community "White Box Yellow Box Blakely's Red Gum Woodland (as described in the final determination of the NSW Scientific Committee)" listed as an endangered ecological community on Schedule 1 Part 3 of the TSC Act and also meets the definition of the Commonwealth listed White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands endangered community listed on the EPBC Act.

Introduced flora recorded in this community includes *Carthamus lanatus* (Saffron Thistle), *Centaurea solstitialis* (St Barnaby's Thistle), *Echium plantagineum* (Paterson's Curse), *Hypericum perforatum* (St John's Wort), *Hypochaeris radicata* (Cats Ear), *Marrubium vulgare* (Horehound) and *Opuntia* spp. (Prickly Pear). White Box grassy woodland has been further stratified into two DNG variants, 3a and 3b and are described as follows:

- Condition Class 3a (high diversity): no native canopy cover, >11 native perennial understorey species (not including grasses) and at least 1 important species. This condition class equates to the EPBC Act and TSC Act definition of Box-Gum Woodland DNG.

- Condition Class 3b (low diversity): no native canopy cover, native grassy understorey with low diversity of herbs or other perennial understorey species. This condition class equates only to the TSC Act definition of Box-Gum Woodland DNG.

Hereafter these vegetation units are referred to White Box Grassy woodland Class 3a or Class 3b (or collectively as Class 3).

Plate 1: White Box-Grassy Woodland of the Nandewar and Brigalow belt south bioregions

4.5.2 Yellow Box – Blakely's Red Gum grassy woodland of the Nandewar Bioregion

This community ranges in condition from condition Class 4 (**Figure 4**). It generally has a sparse canopy dominated by *Eucalyptus melliodora* and *E. blakelyi* (Blakely's Red Gum). The midstorey is absent with no shrubs observed at all. The understorey consists of a mix of native and introduced flora. The native understorey species include *Calotis lappulacea* (Yellow Burr-Daisy), *Einadia hastata* (Berry Saltbush), *Eremophila debilis* (Amulla) and *Wahlenbergia communis* (Tufted Bluebell), with native grasses dominating large areas including *Aristida ramosa* (Purple Wiregrass), *Austrostipa verticillata* (Slender Bamboo Grass), *Bothriochloa macra* (Red Grass), *Chloris truncata* (Windmill Grass), *Dichanthium sericeum* (Queensland Bluegrass), *Sporobolus elongatus* (Slender Rat's Tail Grass).

This community is representative of the endangered ecological community "White Box Yellow Box Blakely's Red Gum Woodland (as described in the final determination of the NSW Scientific Committee)" listed as an endangered ecological community on Schedule 1 Part 3 of the TSC Act and also meets the definition of the Commonwealth listed White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands endangered community listed on the EPBC Act.

Introduced flora recorded in this community includes *Carthamus lanatus* (Saffron Thistle), *Centaurea solstitialis* (St Barnaby's Thistle), *Echium plantagineum* (Paterson's Curse), *Hypericum perforatum* (St John's Wort), *Hypochaeris radicata* (Cats Ear), *Marrubium vulgare* (Horehound) and *Opuntia* spp. (Prickly Pear).

4.5.3 Plains Grass grassland on basaltic black earth soils mainly on the Liverpool Plain in the Brigalow Belt South Bioregion

This community was represented by one condition class, Class 3, although it is a natural grassland community rather than a derived grassland. The canopy was very sparse and contained the occasional *Angophora floribunda* (Rough-barked Apple) and very occasionally on the edges of the community *E. albens*. Native understorey species included *C. lappulacea, E. hastata*, and *Oxalis perennans* (Wood Sorrel), while native grasses were dominated by *A. ramosa, Austrodanthonia tenuior* (Wallaby Grass), *A. aristiglumis* (Plains Grass), *A. verticillata C. truncata* and *D. sericeum.*

This community is representative of the endangered ecological community "Native Vegetation on Cracking Clay Soils of the Liverpool Plains (as described in the final determination of the NSW Scientific Committee)" listed as an endangered ecological community on Schedule 1 Part 3 of the TSC Act.
Introduced flora recorded in this vegetation community included *C. lanatus*, *E. plantagineum*, *H. perforatum*, *Lepidium bonariense* (Peppercress) and *Lycium ferocissimum* (African Boxthorn).

Plate 2: Plains Grass grassland on basaltic black earth soils mainly on the Liverpool Plains in the Brigalow Belt South Bioregion

4.5.4 White Cypress Pine – Silver-leaved Ironbark – Tumbledown Gum shrubby open forest of the Nandewar and Brigalow belt south bioregions

This community is represented in condition class 4and only occurs in the BOA (**Figure 4**). It consisted of a sparse canopy comprised of *Eucalyptus dealbata* (Tumbledown Red Gum) with the occasional *E. albens*. As the site has been subject to historical grazing by livestock, there are limited midstorey and understorey species present. The only midstorey species observed was *Brachychiton populneus* (Kurrajong), while understorey species included, *Wahlenbergia*. *communis* and native grasses similar to the White Box Grassy Woodland community, including *Aristida ramosa*, *Bothriochloa*. *macra*, *Chloris truncata* and *Sporobolus elongatus*.

Introduced flora recorded in this vegetation community includes *Carthamus lanatus*, *Centaurea solstitialis* and *Echium plantagineum*.

Plate 3: White Cypress Pine – Silver-leaved Ironbark – Tumbledown Gum shrubby open forest of the Nandewar and Brigalow belt south bioregions

4.5.5 White Box - White Cypress Pine shrubby open forest of the Nandewar and Brigalow Belt South Bioregions

The most common and widespread vegetation community on Marengo Domain is a shrubby open forest/woodland occurring in steeper areas less suitable for agriculture and occurring in two condition classes, Class 4 and Class 3. The most abundant tree species is *Eucalyptus albens* (White Box) while other common trees include *Eucalyptus dealbata* (Tumbledown Red Gum), *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Callitris glaucophylla* (White Cypress Pine). In the shallowest soils on the ridgetops Tumbledown Red Gum and Narrow-leaved Ironbark often dominate while White Box is always more common on the hillslopes. The shrub layer ranges from sparse to quite dense with the most common species being *Notelaea microcarpa*(Native Olive), *Bursaria spinosa* (Blackthorn), *Olearia elliptica s.l.*(Sticky Daisy Bush) and *Pimelea neo-anglica* (Poison Pimelea). The ground layer is particularly diverse with numerous native grasses and herbs such as *Bothriochloa macra* and *B. decipiens*(Red-leg Grass), *Dichanthium sericeum* (Queensland Bluegrass), *Aristida sp.* (Wire Grass), *Cymbopogon refractus* (Barb-wire Grass), *Sporobolus creber* (Slender Rat's-tail Grass), *Digitaria brownii* (Cotton Finger Grass), *Calotis lappulacea* (Burr Daisy) and *Desmodium brachypodum* (Large Tick Tre-foil). Note that some areas of cleared land adjacent to the timbered areas are mapped as a condition class of this community (i.e. "no native canopy present") even though it could also be considered to be a separate derived grassland community.

Plate 4: White Box – White Cypress Pine shrubby open forest on the Marengo Domain

4.5.6 Rough-barked Apple riparian forb/grass open forest of the Nandewar Bioregion

Along the major drainage lines in the far south-western section of Marengo domain are some small remnant patches occurring in two condition classes, Class 4 and Class 3. This riparian woodland is dominated by *Angophora floribunda* (Rough-barked Apple). Shrubs are relatively uncommon except for the occasional Native Olive and scattered clumps of the introduced woody weed *Lycium ferocissimum* (African Boxthorn). The ground layer is a mixture of native grasses such as *Aristida leptopoda* and *Aristida* sp., *Bothriochloa macra* and *B. decipiens*, *Austrostipa verticillata* (Slender Bamboo Grass) and *Paspalum distichum* (Water Couch), and introduced grasses such as *Paspalum dilatatum* (Paspalum) and *Pennisetum clandestinum* (Kikuyu). The latter species often carpets the ground to the exclusion of all other species. Although this community is the weediest of all the vegetation types on the block the abundance of native groundcover species still slightly outweighs the introduced species and so the community is still in reasonable condition.

Plate 5: Rough-barked Apple riparian open forest on the Marengo property.

4.5.7 Rusty Fig - Wild Quince - Native Olive dry rainforest of rocky areas of the Nandewar Bioregion

In the centre of the property along a minor drainage line is a small patch of Dry Rainforest dominated by *Ficus rubiginosa* (Rusty Fig), *Canthium odoratum* (Iamboto), *Notelaea microcarpa*. Shrubs are common beneath the stunted tree canopy with the most common species being *Phyllanthus subcrenulatus* (Spurge) and *Olearia elliptica s.l.*. Grasses are relatively uncommon in this dry rainforest type and are replaced by ground ferns such as *Adiantum aethiopicum* (Common Maidenhair Fern) and *Pellaea falcata* (Sickle Fern). Vines are uncommon with the exception of *Pandorea pandorana* (Wonga Vine) which is abundant throughout.

Although Wild Quince trees were not present the distribution and species composition of this community is still a good match for the biometric community known as “Rusty Fig - Wild Quince - Native Olive dry rainforest of rocky areas of the Nandewar Bioregion”. The patch present on ‘Marengo’ also has affinities with “Semi-evergreen Vine Thicket”, an Endangered Ecological Community (EEC), but there are too few tree species for the patch to be considered part of this EEC. In addition, the small patch of dry rainforest is also growing on a soil derived from conglomerate rock whilst true “Semi-evergreen Vine Thicket” nearly always occurs on basalt.

Plate 6: Rusty Fig – Wild Quince – Native Olive dry rainforest on the Marengo property

4.5.8 Disturbed, Cropped/cultivated paddocks (Cleared Land)

To the north of Escott Road, an area of the mine site surrounding the product coal storage area and rail load-out facility has previously been cleared for cultivation and cropping and as such no longer represent a native vegetation community.

These areas have been modified from the natural state to the extent that native species are now uncommon and most of the cultivated areas were either cleared at the time of survey or dominated by planted introduced species such as *Medicago sativa* (Lucerne),

Although these paddocks are now either cleared or under cultivation, they would have previously been White Box Grassy Woodlands, as such have been mapped as 'Box-Gum Woodland DNG, Condition Class 1', i.e. <50% native groundcover with no native canopy.

4.5.9 Brigalow - Belah woodland on alluvial often gilgaied clay soil mainly in the Brigalow Belt South Bioregion

One small patch of 0.35ha is found on within the WCC mine site footprint to be cleared as part of the LOM Project. Excluding the Brigalow (*Acacia harpophylla*), the remainder of the vegetation species found are consistent with the White Box Grassy Woodland vegetation community. The original development of the WCC mine avoided directly disturbing the patch of Brigalow by mining adjacent to the stand however the overburden emplacement will expand over the stand and thus will need to be removed.

4.6 Threatened Ecological Communities, Flora and Fauna

Two of the vegetation communities found at WCC are listed as Endangered Ecological Communities (EECs) under the NSW TSC Act and Commonwealth EPBC Act, one also being a Critically Endangered Ecological Community (CEEC) under the EPBC Act:

- *Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains bioregions* EEC, listed under TSC Act and Brigalow (*Acacia harpophylla*) dominant and co-dominant under the EPBC Act; and
- *White box - yellow box - Blakely's red gum woodland* EEC, listed under TSC Act and the equivalent *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC under the EPBC Act.

During the 2012 biodiversity monitoring, a new threatened flora species (*Digitaria porrecta* Finger Panic Grass) was identified at monitoring Site 5 (**Figure 12**). The threatened grass species, Digitaria porrecta (Finger Panic Grass) is listed as endangered under both the Threatened Species Conservation Act (TSC Act) and the Environment Protection and Biodiversity Conservation Act (EPBC Act).

Table 7 compiles the threatened fauna species recorded within the WCC mine and BOA from the Environmental Impact Statement for the WCC mine (ELA 2011a; ELA 2011b). **Appendix C** provides all flora and fauna species recorded across the BOA from previous monitoring years.

Table 7: Threatened fauna recorded or considered potential occurrences within the WCC mine site and BOS and their habitat requirements.

SPECIES NAME	STATUS		HABITAT REQUIREMENTS	LIKELIHOOD
	TSC ACT	EPBC		
THREATENED BIRDS				
Lathamus discolor Swift Parrot	Endangered	Endangered and Migratory	Foraging: Feeds mostly on nectar from medium to large Eucalypts. Also forages on psyllid insects and lerps, seeds and fruit. Predominantly an arboreal forager, but sometimes feeds on the ground for seeds, fallen flowers, fruit and lerp. Semi nomadic; foraging predominately in dry woodlands between Victoria and NSW. High site fidelity; returning to sites on a cyclic basis (SEWPaC 2013). Breeding locations: Migratory. Breeds in Tasmania (spring) and migrates to mainland Australia in autumn during non-breeding season (winter). Nests in vertical or horizontal tree hollows (SEWPaC 2013). Vegetation type and structure: Dry sclerophyll eucalypt forests and woodlands, and occasional wet sclerophyll forests. Winter foraging grounds include box-ironbark forests and woodlands of Victoria, NSW and southern Queensland. Seeks medium to large Eucalypts to forage (SEWPaC 2013). Floristic composition: Box-ironbark forests with Yellow Gum (*Eucalytpus leucoxylon*), Red Ironbark (*E. tricarpa*) and Grey Box (*E. microcarpa*) in Victoria, and with Mugga Ironbark (*E. sideroxylon*) and Grey Box on the western slopes of NSW. Common grassy woodland vegetation types utilised for foraging include, White Box (*E. albens*) woodlands, Grey Box woodlands and Grey Box/Yellow Gum woodlands. Narrow-leaved Red Ironbark (*E.crebra*), Forest Red Gum (*E. tereticornis*) forests and Yellow Box (*E. melliodora*) forests are utilised for foraging in northern NSW and south-eastern QLD. On the western slopes, Mugga Ironbark and Grey Box woodlands are used (SEWPaC 2013). Patch Size: Usually in parties of 30 birds, or sometimes larger flocks of several hundred birds when food is abundant (SEWPaC 2013). Patch size information unavailable. Competition: The introduced Common Starling (*Sturnus vulgaris*) competes with the Swift Parrot for nest hollows. The Noisy Miner (*Manorina melanocephala*) is an aggressive native bird that excludes other nectarivorous birds from sources of nectar (SEWPaC 2013). Connectivity: Habitat is highly fragmented, although due to their high mobility their populations is not fragmented (SEWPaC 2013). Landscape position: Information not available.	Potential

SPECIES NAME	STATUS		HABITAT REQUIREMENTS	LIKELIHOOD
	TSC ACT	EPBC		
Anthochaera phrygia Regent Honeyeater	Endangered	Endangered and Migratory	Foraging: The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). They actively seek the largest trees to forage in. As such, it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (Environment Australia 2000). They are also known supplement nectar with invertebrates and occasionally fruit (SEWPaC 2013). Breeding locations: Breeding activity is generally from September to November and appears to correspond with regional flowering patterns in preferable eucalypt and mistletoe species, including Mugga Ironbark, White Box, Yellow Box and Needle-leaf Mistletoe (*Amyema cambagei*) (SEWPaC 2013). In NSW, the Regent Honeyeater is most common on the Great Diving Range. They prefer to nest in Eucalypts, in the canopy of forests or woodlands and in the crown of tall trees. Nests are often constructed in mistletoes on trees as well. In riparian areas nests are placed in rough barked trees (e.g. ironbarks), and where rough-barked trees are unavailable, nests are found in smooth-barked species. They have also been known to nest in exotic trees, native shrubs, among flood debris, in fence posts or tree stumps and in open sheds (SEWPaC 2013). Nests are usually constructed on large, often horizontal branches, closer to the tip of the branch. Nests are frequently supported by vertical twigs and are sometimes in vertical forks (SEWPaC 2013). Vegetation type and structure: Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts and riparian forests of River Oak (*Casuarina cunninghamiana*) (Garnett 1993). Areas containing Swamp Mahogany (*Eucalyptus robusta*) or Spotted Gum (*Corymbia maculata*) in coastal areas have been observed to be utilised. Needle-leaf Mistletoes are also an important species for feeding and breeding (NPWS 1997). Floristic composition: Important species include those that produce large amounts of nectar, including Mugga Ironbark, Yellow Box, White Box and Yellow Gum, but also in association with woodland species such as Grey, Red Box (*E. polyanthemos*), Blakely's Red Gum (*E. blakelyi*), River Red Gum (*E. camaldulensis*), Silver-leaved Ironbark (*E. melanophloia*), Narrow-leaved Ironbark, Caley's Ironbark (*E. caleyi*) and Rough-barked Apple (*Angophora floribunda*). May also utilise *Callitris* woodlands that are in association with Eucalypts (SEWPaC 2013). Patch Size: Little data is available on home ranges. Nests are generally located up to 1 km from preferred feed trees.	Potential

SPECIES NAME	STATUS		HABITAT REQUIREMENTS	LIKELIHOOD
	TSC ACT	EPBC		
			During the non-breeding season, foraging sites are up to 800 m from roosting sites (SEWPaC 2013). Competition: Nest predation is a predominant cause of nest failure; Pied Currawongs (*Strepera graculina*) are known to take young and Pallid Cuckoos (*Cacomantis pallidus*) are known to parasitise nests (SEWPaC 2013). Connectivity: Information not available. Landscape position: Dry Box-Ironbark eucalypts woodland and dry sclerophyll forest associations in areas of low to moderate relief, wherein they prefer moister, more fertile sites, e.g. along creek flats, or in broad river valleys and foothills (SEWPaC 2013).	
Climacteris picumnus Brown treecreeper	Vulnerable		Foraging: Ants, beetles & larvae taken from ground, fallen logs and tree trunks (OEH 2013). Breeding locations: Roosts in outer branches of mature trees. Nests in tree hollows 5-15 cm in size. Utilises a wide variety of tree species – not selective. It is sedentary and nests in permanent territories (NSW Scientific Committee 2001). Vegetation type and structure: The Brown Treecreeper occupies eucalypt woodlands, particularly open woodland lacking a dense understory (NSW Scientific Committee 2001). Floristic composition: Not critical Patch Size: Unable to maintain viable populations in remnants less than 200 ha. Abundance decreases as patch decreases in size (OEH 2013). Competition: Noisy Miners dominate fragmented woodlands and will exclude smaller species from territories. Habitat fragmentation has led to an increased competition with aggressive honeyeater species. Starlings compete for nesting hollows (OEH 2013). Connectivity: Will use paddock trees for dispersal but are unable to cross gaps greater than 230m. Dispersal of females critical to maintain viable populations; females are unable to disperse to isolated fragments (OEH 2013). Landscape position: Low to moderate relief, particularly fertile patches.	Recorded
Glossopsitta pusilla Little Lorikeet	Vulnerable		Foraging: They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including melaleucas and mistletoes (OEH 2013). They are also known to feed on fruits of mistletoes (NSW Scientific Committee 2007)	Recorded

SPECIES NAME	STATUS		HABITAT REQUIREMENTS	LIKELIHOOD
	TSC ACT	EPBC		
			Breeding locations: Nests in hollow of approximately 3 cm in diameter at heights between 2 m and 15 m predominantly in living, smooth-barked eucalypts. Preferred species include Manna Gum (*E. viminalis*), Blakely's Red Gum and Tumbledown Gum (*E. dealbata*) (NSW Scientific Committee 2007). Vegetation type and structure: Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes (OEH 2013). Floristic composition: White Box and Yellow Box are particularly important food sources, while preferred species to nest in include Manna Gum, Blakely's Red Gum and Tumbledown Gum (NSW Scientific Committee 2007). Patch Size:Not critical. Competition:Noisy Miners dominate fragmented woodlands and will exclude smaller species from territories. Habitat fragmentation has led to an increased competition with aggressive honeyeater species (OEH 2013) Connectivity: Not critical. Landscape position: Information unavailable.	
Hieraaetus morphnoides Little Eagle	Vulnerable		Foraging: Preys on birds, reptiles and mammals, and occasionally feeds on large insects or carrion (OEH 2013). It inhabits eucalypts forest, woodland or open woodland that is rich in prey(Scientific Committee 2010). Breeding locations: Generally utilises tall trees for nesting, with a large stick nest being built. Lays eggs in spring and young fledge in early summer (OEH 2013). Vegetation type and structure: Utilises open eucalypt, sheoak and acacia forest, woodland or open woodland (OEH 2013). Floristic composition: In the Armidale region, Little Eagles have been known to nest in all common Eucalypt species (Debus & Ley 2009). Patch Size: In the Armidale region, inter-nest distances and density was observed to be 2-5km between neighbouring nests with one-breeding pair utilising an area of 1500-1600 ha (Debus & Ley 2009). Competition: A reduction in breeding sites may increase interspecific competition with the dominant Wedge-tailed Eagle (*Aquila audax*) for breeding habitat and nest-sites (Scientific Committee 2010).	Recorded

SPECIES NAME	STATUS		HABITAT REQUIREMENTS	LIKELIHOOD
	TSC ACT	EPBC		
			Connectivity: Habitat loss and urban expansion is thought to impact on breeding success (Debus & Ley 2009). Landscape position: Little Eagles have been known to prefer large trees on slopes with a southerly component in the Armidale region (Debus & Ley 2009).	
Melanodryas cucullata Hooded Robin	Vulnerable		Foraging: Mostly feeds on invertebrates (mostly insects), some smaller vertebrates (skinks and frogs) and on occasion seeds off the ground, trunks, branches and in the air. Prey is usually taken from logs and coarse woody debris on the ground (NSW Scientific Committee 2008). Breeding locations: Builds a nest of plant fibres and cobweb, generally on low, live or dead forks or branches of trees or stumps. It may also occasionally utilise fallen trees or limbs (NSW Scientific Committee 2008). Vegetation type and structure: Associated with a wide range of Eucalypt woodlands, Acacia shrubland and open forests (Blakers et al. 1984). In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover (NSW Scientific Committee 2001). Prefers an open understorey and a complex ground layer. It is sometimes found in grassland habitat(NSW Scientific Committee 2008). Floristic composition: Not critical. Patch Size: The occurrence of the Hooded Robin is correlated with patch size, habitat complexity (tree canopy cover, shrub cover and ground cover). Logs, fallen branches and litter (NSW Scientific Committee 2008). Hooded Robin home ranges in the non-breeding season are relatively large; their winter home range is approximately 18 ha and is sometimes up to 30-50 ha. However, during the breeding season nesting territories are about 6 ha (NSW Scientific Committee 2008). Competition: High rates of nest predation, particularly by native birds (e.g. Pied Currawongs) and potentially cats and foxes. Noisy Miners are also known to exclude the robin from woodland patches, and is absent from patches dominated by Noisy Miners (NSW Scientific Committee 2008). Connectivity: Hooded Robin is reactive to a reduction in patch size and habitat complexity. Even large fragments seem unable to sustain robin populations in the long term (NSW Scientific Committee 2008). In Victoria, It has been recommended that several patches of high quality vegetation of at least 25 ha in size and less than 1 km a part be conserved for the Hooded Robin (Platt & Lowe 2002).	Recorded

SPECIES NAME	STATUS		HABITAT REQUIREMENTS	LIKELIHOOD
	TSC ACT	EPBC		
			Landscape position: Not critical.	
Stagonopleura guttata Diamond Firetail	Vulnerable		Foraging: Forages on the ground, mostly feeding on grass seeds and other plant material, but has also been known to forage on insects (Scientific Committee 2010). Breeding locations: Constructs bottle-shaped nests in trees and shrubs with dense foliage (Scientific Committee 2010). Vegetation type and structure: Typically found in grassy eucalypt woodlands, but also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities (OEH 2013). It is often found in riparian areas and sometimes in lightly wooded farmland (OEH 2013). Most occur on the inland slopes of the GDR (Scientific Committee 2010). Floristic composition: Not critical. Patch Size: Appears to be sedentary, though some populations move locally, especially those in the south (OEH 2013). Competition: Red-browed Finches (*Neochmia temporalis*) have expanded with the spread of exotic species, which may cause some disadvantages to the Diamond Firetail. The increase of Australian Ravens and Pied Currawongs may have increased nest predation of the Diamond Firetail (Scientific Committee 2010). Connectivity: Seemingly unable to survive in areas which lack remnant native vegetation greater than 200 ha (Scientific Committee 2010). In north-central Victoria they were only recorded in woodland remnants more than 20 ha in size, which had a dense shrub and groundcover of native plants, and that were located within 1 km of other woodlands remnants. In the Boorowa River catchment of NSW, firetails were only recorded in remnants that were >5 ha in size, with a moderately complex understorey and that were at most 2.7 km from another woodland remnant > 10 ha in size (Chambers 2008). Landscape position: Information unavailable.	Recorded
Oxyura australis Blue-billed Duck	Vulnerable		Foraging: Feed on aquatic insect larvae, as well as seeds and leaves of freshwater plants. During autumn and winter they migrate to permanent waters in flocks. They forage in permanent freshwater zones in clear water with minimal turbulence (NPWS 1999). Breeding locations: Breeding occurs in the Murray-Darling Basin. Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and over-wintering lakes, with some long-distance dispersal to breed	Recorded

SPECIES NAME	STATUS		HABITAT REQUIREMENTS	LIKELIHOOD
	TSC ACT	EPBC		
			during spring and early summer (OEH 2013). Known to nest in rushes, sedges, Lignum (*Muehlenbeckia cunninghamii*) and paperbark (*Melaleuca* spp.) (NPWS 1999).Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes (OEH 2013). Vegetation type and structure: The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation (OEH 2013). Can be found on temperate, fresh to saline, terrestrial wetlands, including sewerage ponds, rivers, salt lakes and saltpans. This species is completely aquatic, swimming low in the water along the edge of dense cover (OEH 2013b). Floristic composition: Known to nest in rushes, sedges, Lignum (*Muehlenbeckia cunninghamii*) and paperbark (*Melaleuca* spp.). Patch Size: Relatively low densities. Non-breeding flocks of approximately several hundred individuals congregate in wetlands (NPWS 1999). Competition: Information not available. Connectivity: Regionally and seasonally nomadic (NPWS 1999). They generally have short-distance movements between breeding swamps and non-breeding lakes, with some long distance dispersal for the breeding season (OEH 2013). Landscape position: Wetlands and other water bodies, as above (NPWS 1999).	
Threatened Mammals				
Phascolarctos cinereus Koala	Vulnerable	Vulnerable	Foraging: Diet is largely restricted to foliage of particular Eucalypt species, and may also include *Corymbia* spp., *Angophora* spp. and *Lophostemon* spp. Supplementary species includes *Leptospermum* spp. and *Melaleuca* spp. Species preference varies between regions and seasons (SEWPaC 2013). Breeding locations: The koala is not a territorial species, and thus its home range extensively overlaps Vegetation type and structure: Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70% (Reed et al. 1990), with acceptable Eucalypt food trees. Floristic composition: Some preferred Eucalyptus species are: White Box, Blakely's Red Gum, Ribbon Gum and Tumbledown Gum (OEH 2013).	Observed

SPECIES NAME	STATUS		HABITAT REQUIREMENTS	LIKELIHOOD
	TSC ACT	EPBC		
			Patch Size: The koala is not a territorial species, and thus its home range extensively overlaps. Home range is dependent on the availability of habitat; koalas in habitat of lower quality have a large home range and koalas in habitat of higher quality have smaller home ranges. Koalas move between trees a few times a day (SEWPaC 2013). Competition: Population crashes in areas of over-abundant koalas are common (SEWPaC 2013). Connectivity: Local koala extinction occurs in habitat patches that are too isolated or small to support viable populations (SEWPaC 2013). Landscape position: Not critical.	
Threatened Bats				
Falsistrellus tasmaniensis Eastern False Pipistrelle	Vulnerable		Foraging: They eat large beetles, moths and some bugs, ants and flies(Churchill 2008). Breeding locations: Roosts in tree hollows of Eucalypt trees, but has also been found roosting in buildings or under loose bark (OEH 2013). Vegetation type and structure: Prefers moist habitats with trees taller than 20m (OEH 2013). Floristic composition: Eucalypt trees for roosting (Churchill 2008). Patch Size: Radio-tracked individuals moved between roosts almost every night. Between nights roosts were generally less than 150 m apart. They have a home range of up to 136 ha (Churchill 2008). Competition: Information unavailable. Connectivity: Information unavailable. Landscape position: Information unavailable.	Recorded
Miniopterus schreibersii oceanensis Eastern Bentwing Bat	Vulnerable		Foraging: It forages above and below the tree canopy on small insects (Dwyer 1995, Dwyer 1981). Prey items include moths, flies cockroaches and beetles (Churchill 2008). Breeding locations: Generally cave dwellers but may also use man-made constructions, e.g. abandoned mines and road culverts (Churchill 2008). Vegetation type and structure: Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest,	Recorded

SPECIES NAME	STATUS		HABITAT REQUIREMENTS	LIKELIHOOD
	TSC ACT	EPBC		
			monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995). Floristic composition: Not critical. Patch Size: Movement between territories is unusual, although one bat is recorded to have moved 1300 km. Females have been known to travel up to 65 km in one night (Churchill 2008). Competition: Information unavailable. Connectivity: Information unavailable. Landscape position: Information unavailable.	
Saccolaimus flaviventris Yellow-bellied Sheathtail Bat	Vulnerable		Foraging: Predominantly feeds on beetles, but also grasshoppers, crickets, leafhoppers, shield bugs, wasps and a few flying ants (Churchill 2008). Breeding locations: Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock (Environment Australia 2000) and in abandoned sugar glider nests (Churchill 1998). Vegetation type and structure: Found in almost all habitats, from wet and dry sclerophyll forest, open woodland (Churchill 1998), open country, mallee, rainforests, heathland and waterbodies (SFNSW 1995). Floristic composition: Not critical. Patch Size: Information unavailable. Competition: Information unavailable. Connectivity: The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (Environment Australia 2000). Landscape position: Information unavailable.	Recorded
Scoteanax rueppellii Greater Broad-nosed Bat	Vulnerable		Foraging: Within denser vegetation types use is made of natural and man made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye& Richards 1998). Beetles are their dominant food source, as well as moths, ants, spiders and large flies. It is also likely that bats form a part of their diet also (Churchill 2008).	Recorded

SPECIES NAME	STATUS		HABITAT REQUIREMENTS	LIKELIHOOD
	TSC ACT	EPBC		
			Breeding locations: Roosts in tree hollows, cracks and fissures in trunks and dead branches, under bark, as well as in the roof of old buildings. Vegetation type and structure: Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998), tending to be more frequently located in more productive forests (Hoye& Richards 1998). Other habitats include cleared paddocks with remnant trees and tree-lined creeks in open areas (Churchill 2008). Floristic composition: Not critical. Patch Size: Information unavailable. Competition: Information unavailable. Connectivity: Information unavailable. Landscape position: Usually located in gullies draining east (Hoye and Richards 1995).	

4.7 Introduced Flora

Several weed species were observed during the site assessment and 2010 and 2011 spring monitoring events across the site and BOA. The most abundant weed species recorded across the site include, *Echium plantagineum* (Patterson's Curse), *Carthamus lanatus* (Saffron Thistle) and *Hypericum perforatum* (St. Johns Wort). Other weed species of note recorded include *Lycium ferocissimum* (African Boxthorn) and *Opuntia spp*. (Prickly Pear). Of the weed species observed, five species are listed as noxious weeds in the Liverpool Plains Shire Council under the NSW Noxious Weeds Act 1993, these species are listed in **Table 8.**

Table 8: List of Noxious Weeds observed on the site

SPECIES NAME	COMMON NAME	NOXIOUS WEED CATEGORY
Lycium ferocissimum	African Boxthorn	4
Echium plantagineum	Patterson's Curse	4
Opuntia spp.	Prickly Pear	4
Xanthium spp.	Noogoora Burr	4
Hypericum perforatum	St. Johns Wort	4

4.8 Complaints

Since the commencement of mining in 2005 at WCC has received two biodiversity related complaints. On 8 April 2010, the EPA passed an anonymous complaint alleging illegal clearing at WCC, however on investigation it was found that the vegetation clearing was approved by a modification to DA 172-7-2004 (September 2009) for a northern extension of mining operations that required clearing of woodland ahead of the mine that was visible from Werris Creek Road. On 28th November 2012, DoP forwarded on a complaint from WIRES regarding out of season clearing at WCC alleging fauna deaths. The clearing was required for the construction of the new Mine Infrastructure Area and critically important to the continuity of the business ensuring that the current office and workshop are relocated in 6 months time to allow sufficient overburden dump space for mining operations to continue. The investigation found that the Pre Clearing Inspection did not identify a number of hollows as active, that upon clearing contained bird hatchlings. No bird hatchlings died because of the clearing. In accordance with the BOMP, the hatchlings were collected by the ecologists present at the time of clearing and provided to WIRES to be cared for with the food paid by Whitehaven Coal.

5 ENVIRONMENTAL IMPACTS

5.1 Avoidance, Mitigation and Offsetting

The LOM Project has, in accordance with the project DGR's, avoided and minimised impacts wherever possible and, where this was not possible, compensatory offsetting measures were to be implemented (ELA 2010b). The LOM Project involves the extraction of a sub-surface coal seam through open cut extraction and as such the immediate impact of the open cut development is unavoidable. However, the LOM design has limited impacts where possible, with the majority of overburden to be placed within the completed section of the open cut and extending the LOM footprint from the existing Werris Creek operation to consolidate impacts and minimise habitat isolation, fragmentation and edge effects (ELA 2010b).

Outside of the impact footprint of the LOM Project open cut and overburden emplacement, the placement of the ancillary infrastructure for the LOM Project has been located preferentially in areas of lower conservation value, i.e. in order of preference within cleared land and exotic pastures or derived native grasslands (Class 3 vegetation).

Where possible, current infrastructure such as the rail load-out road, rail load-out facility and water storages have been retained to avoid potential further impacts to the vegetation at the WCC mine site. Areas currently utilised for, or approved for, the stockpiling of soil and cleared vegetation resources would continue to be used in preference to other undisturbed locations. Furthermore, once the overburden emplacement reaches its maximum height, the upper surface of the structure would be used for the stockpiling of soil and cleared vegetation (for future spreading over the created final landform).

In order to further mitigate impacts on biodiversity, WCC implement pre-clearing and clearing protocols, as described in **Section 8.1**. Further management measures are made to reduce the overall impact through habitat resource and seed collection (**Section 8.1** and **Section 8.4**), mine site rehabilitation (**Section 8.3**), habitat augmentation (**Section 8.6**), weed management (**Section 8.7**), fence and access management (**Section 8.9**) and erosion and sedimentation management (**Section 8.11**). A detailed monitoring and inspection program is also being implemented to evaluate the effectiveness of these measures (**Section 9** and **Section 10**).

As illustrated on (**Figure 4**), the majority of the disturbance footprint is proposed to be rehabilitated to a woodland structure using locally sourced seed of species common to the 'Box – Gum Grassy Woodland EEC', as well as the 'White Box – White Cypress Pine - Silver-leaved Ironbark Shrubby Open Forest'. Areas of water storage would be retained in the final landform, providing a fauna watering resource and habitat for water birds. Areas that are currently cleared within the footprint and on the surrounding offset properties would also be revegetated to meet the standard commenced in earlier revegetation works. With these proposed measures, along with the introduction of habitat features absent in the revegetation areas for between 20 and 100 years, including coarse woody debris, stags, hollows and rocky substrates, it is considered that the mine rehabilitation would form an important part of the offset package and the east to west sub-regional corridor.

In addition to these measures, a BOS has been developed (**Section 8.2**), with 1,272.92ha of extant vegetation being set aside for conservation management.

Figure 4: Conceptual final landform and rehabilitation plan.
Note: the Biodiversity Offset Area has now been revised as per Section 8.2.

5.2 Direct impacts

The LOM Project would result in the removal of approximately 194.15ha of native vegetation, comprising approximately 58.85ha of woodland vegetation (Class 4) and 135.3ha of derived native grasslands (Class 3a and 3b). Of the DNG vegetation, 74.6 ha is listed as threatened under both the NSW TSC Act 1995 and the Commonwealth EPBC Act and a further 60.7ha is listed under the TSC Act only (**Figure 5**). This clearing would result in:

- a direct reduction in the extent of these communities in the local area
- a loss of fauna habitat
- potential incidental mortality of threatened bats during clearing
- temporary fragmentation of remnant woodland and grassland vegetation and
- a temporary reduction in the ecological function of this vegetation type in the immediate area

5.3 Indirect impacts

5.3.1 Edge Effects

Potential edge effects that may be introduced by the LOM Project include weed invasion and fragmentation of existing woodland remnants. These impacts would be considered minimal due to current weed management practices undertaken by the Proponent and the highly cleared nature of the surrounding landscape (e.g. cropping and grazing lands).

5.3.2 Noise

The noise associated with the operation of the LOM Project is discussed in detail in the Environmental Assessment (RWC 2010). It is possible that the noise associated with mining operations will indirectly impact upon fauna species by limiting communication between individuals and the general ambience of the natural environment. This may cause the migration of some highly mobile species from the WCC mine site to alternative habitat in the local area during the period of mining operations.

5.3.3 Blasting

Noise, vibrations and dust from mine blasting presents an indirect impact to biodiversity. The Blast Management Plan provides the procedure to be implemented for blasts which to some degree mitigates this impact, particularly in relation to dust. Whilst some fauna may display tolerance to these short term interferences, blasting and other necessary mine activities have the potential to disrupt biodiversity.

5.3.4 Artificial Lighting

Lighting for the WCC mine will be limited as much as possible to the mine footprint and not be directed into adjacent areas. Lighting can affect fauna behaviour in various ways including deterring some fauna and attracting other fauna (e.g. Microchiropteran bats and other insectarivores).

5.3.5 Dust

Generation of dust from general mine activities is a likely indirect impact potentially affecting the nearby adjacent lands. However, mine operation measures are implemented to suppress dust wherever possible.

5.3.6 Exploration Drilling

Some drilling may be required within the LOM and have the potential to cause indirect localised impacts, such as vegetation disturbance. Disturbance is to be limited as much as possible.

5.3.7 Traffic movements

Traffic movements associated with the WCC mine may present a potential impact to fauna, in the form of noise and human presence and vehicular collision. Signage to slow vehicle movements through the mine access road is to be installed and fencing installation excluding fauna from high traffic areas may be considered.

5.3.8 Watertable Drawdown

There is a potential for a drawdown of the watertable due to the water extraction required for the LOM Project. A significant drawdown could potentially impact upon Groundwater Dependant Ecosystems in the vicinity of Werris Creek and Quipolly Creek. The drawdown expected from the mine operations has been modelled by RCA (2010), and is predicted through modelling to be minimal.

5.4 Cumulative Impacts

Previous mining approvals have allowed the clearance of 43 ha native woodland (CES 2009). The loss of a further 193.8 ha of native vegetation as a result of the LOM Project would add to the cumulative loss of vegetation from the local area. These losses are proposed to be offset through a comprehensive Biodiversity Offset Strategy (BOS) (**Section 8.2**) which would ultimately increase the areas of woodland above current levels and provide for increased connectivity including enhanced regional corridors.

6 RISK ASSESSMENT

The BOMP has thus far discussed the proposed LOM Project operations, the relevant approval conditions relating to biodiversity management; baseline condition, complaints and environmental impacts from the LOM Project. The next step is to determine the risks to biodiversity from WCC LOM Project operations. Three risk assessments were conducted for WCC which covered the identification of hazards to biodiversity, risk (consequence and likelihood) and management controls to mitigate risks. Completed risk assessments are located in **Appendix D** for:

- Environmental Risk Assessment from LOM Project (R.W. Corkery & Co., 2010);
- Whitehaven Coal Broad brush Environmental Risk Assessment for WCC (SMS, 2012); and
- WCC Biodiversity and Offset Management Plan Specific Risk Assessment (Ecological, 2012)

A summary of the risk assessments for biodiversity is outlined in **Table 9** with the hazards identified to biodiversity, risk ranking, the existing controls and proposed additional management actions to be implemented to further mitigate potential impacts.

Table 9: LOM Project Biodiversity Management Risk Assessment Summary

HAZARD	CAUSE	CURRENT MANAGEMENT CONTROL	RISK	ADDITIONAL MANAGEMENT ACTION
Native vegetation	1. Rehabilitation/regeneration success	▪ Existing land management plan and biodiversity management plan.	H	▪ Implementation of BOMP management strategies relevant to regeneration (i.e. weed management; seed collection; rehabilitation; revegetation) ▪ Monitoring and reporting ▪ Contingency plan
Endangered Ecological Communities	1. Vegetation clearing for mine footprint and ancillary works 2. Introduction of weeds from vehicle movements and operations	▪ Avoiding clearing where possible ▪ Existing BOS, rehabilitation and offset management to mitigate the loss of vegetation ▪ Pre-clearing and pre-start clearing inspections ▪ Annual flora and fauna monitoring ▪ Periodic inspections ▪ Weed control program	H	▪ LOM BOS increase in BOA managed and restored woodland
Koala	1. Habitat removal for mine footprint and ancillary works 2. Traffic collisions	▪ Existing BOS, rehabilitation and offset management to mitigate the loss of vegetation ▪ Pre-clearing and pre-start clearing	M	▪ Include targeted Koala monitoring techniques into the offset flora and fauna monitoring ▪ LOM BOS increase in BOA managed and

		inspections ▪ Staged clearing in Autumn (outside active breeding season)		restored woodland
Microchiropteran bats	1. Habitat removal for mine footprint and ancillary works 2. Disturbance of foraging patterns due to lighting	▪ Existing BOS, rehabilitation and offset management to mitigate the loss of vegetation ▪ Pre-clearing and pre-start clearing inspections ▪ Staged clearing in Autumn (outside of breeding and over-wintering periods) ▪ Annual flora and fauna monitoring	H	▪ Installation of Microchiropteran bat boxes within offset area and incorporate in to monitoring ▪ Stag tree habitat augmentation in rehabilitation areas ▪ LOM BOS increase in BOA managed and restored woodland
Woodland birds	1. Habitat removal for mine footprint and ancillary works 2. Disruption of home ranges and behavioural patterns due to noise and disturbance	▪ Existing BOS, rehabilitation and offset management to mitigate the loss of vegetation ▪ Pre-clearing and pre-start clearing inspections ▪ Staged clearing in Autumn (outside of migration periods for winter migrants) ▪ Annual flora and fauna monitoring	M	▪ Surveys for threatened winter migrant birds (Swift Parrot and Regent Honeyeater) ▪ Planting known food species into BOA and rehabilitation ▪ LOM BOS increase in BOA managed and restored woodland
Threatened Raptors	1. Habitat removal for mine footprint and ancillary works 2. Disruption of home ranges and behavioural patterns due to noise and disturbance	▪ Existing BOS, rehabilitation and offset management to mitigate the loss of vegetation ▪ Pre-clearing and pre-start clearing inspections ▪ Staged clearing in Autumn (outside of migration periods for winter migrants) ▪ Annual flora and fauna monitoring	M	▪ Stag tree habitat augmentation in rehabilitation areas ▪ LOM BOS increase in BOA managed and restored woodland

7 OBJECTIVES AND TARGETS

In this section, WCC will outline the relevant biodiversity completion criteria for the LOM Project BOA and rehabilitation areas and develop biodiversity related objectives and targets as part of the Environmental Management System (EMS) that will guide the ongoing management of the biodiversity risks identified in **Section 6**.

7.1 Biodiversity Offset and Rehabilitation Areas Completion Criteria

The strategic objectives of the BOMP (Integrated Landscapes, Sustainable Growth & Development and Final Land Use) are outlined in **Section 1.3**. **Table 10** outlines the specific criteria by which WCC will measure the progress of the BOA and rehabilitation restoration overtime. The management actions outlined in **Section 8** have been developed to mitigate biodiversity impacts and restore ecological communities across WCC BOA and rehabilitation areas. **Table 10** has been modified based on the WCC LOM Mining Operations Plan (MOP Table 5.3 – approved by Division of Resources and Energy and DoP as the Rehabilitation Management Plan, RMP) and LOM Project Environmental Assessment (Table 2.12) with only the criteria relevant to biodiversity presented below (full table provided in MOP/RMP). The WCC completion criteria (including the Biodiversity Related criteria) aim to achieve:

- The ongoing refinement of completion criteria and monitoring programs that will facilitate the relinquishment of the relevant approvals following mine closure;
- Alignment with Rehabilitation and Biodiversity Offset Area Objectives; and
- Facilitate continuous improvement in restoration management practices of the rehabilitation and biodiversity offset areas.

Table 10: **BOA and Rehabilitation (Biodiversity Related) Completion Criteria**

OBJECTIVE 1.0 INTEGRATED LANDSCAPES			
CRITERIA	**MEASURE**	**PERFORMANCE INDICATOR**	**REMEDIAL ACTION**
1.2 The area does not represent an erosion hazard	Quarterly Visual Inspection by Environmental Officer.	Erosion should not exceed 0.3m (gully) deep (natural drainage lines exempt).	Undertake maintenance rehabilitation by additional shaping of surface to repair gully erosion.
OBJECTIVE 2.0 SUSTAINABLE GROWTH AND DEVELOPMENT			
CRITERIA	**MEASURE**	**PERFORMANCE INDICATOR**	**REMEDIAL ACTION**
2.1 Appropriate native plant species richness is present for the restored Vegetation Community	Vegetation monitoring by ecologist will determine native plant species richness.	The following provides a performance measure of native plant species richness for the each of the vegetation classes and rehab areas. Note: Because of the varying effect of environmental conditions, floristic monitoring will enable comparison against these benchmarks over successive years to analyse how vegetation classes are performing against analogue sites to identify trends. Native plant species numbers (per 400m^2):	Undertake maintenance rehabilitation by re-sowing / replanting missing plant species to achieve desired species richness.

		• White Box Grassy Woodland*: 23 • White Cypress Pine – Silver-leaved Ironbark Tumbledown Gum open forest: 30 • Rough-barked Apple riparian forb/grass open forest: 25 • Brigalow Woodland: 20 • White Box – White Cypress Pine shrubby open forest: 26 • Rusty Fig – Wild Quince – Native Olive dry rainforest: 35 • Plains Grass Grassland: 17 Based on DECCW 2008 Biobanking Vegetation Benchmarks Database until data from analogue sites is available from successive years of monitoring.	
2.2 Appropriate density/structure of native Over Storey species is present	Vegetation monitoring by ecologist will determine over storey cover scores.	The following provides a performance measure of native over storey cover for the each of the vegetation classes and rehab areas. Note: Because of the varying effect of environmental conditions, floristic monitoring will enable comparison against these benchmarks over successive years to analyse how vegetation classes are performing against analogue sites to identify trends. Over Storey cover range between: • White Box Grassy Woodland*: 0-25% • White Cypress Pine – Silver-leaved Ironbark Tumbledown Gum open forest: 6-40% • Rough-barked Apple riparian forb/grass open forest: • Brigalow Woodland: 0-25% • White Box – White Cypress Pine shrubby open forest: • Rusty Fig – Wild Quince – Native Olive dry rainforest: • Plains Grass Grassland: 0-0% Measured at 10 points along a 50 metre transect. Based on DECCW 2008 Biobanking Vegetation	Undertake maintenance rehabilitation by re-sowing / replanting missing plant species to achieve desired species richness.

		Benchmarks Database until data from analogue sites is available from successive years of monitoring.	
2.3 Appropriate density/structure of native Mid Storey species is present	Vegetation monitoring by ecologist will determine midstorey cover scores	The following provides a performance measure of native mid storey cover for each of the vegetation classes and rehab areas. Note: Because of the varying effect of environmental conditions, floristic monitoring will enable comparison against these benchmarks over successive years to analyse how vegetation classes are performing against analogue sites to identify trends. Mid Storey cover range between: • White Box Grassy Woodland*: 0-5% • White Cypress Pine – Silver-leaved Ironbark Tumbledown Gum open forest: 6-25% • Rough-barked Apple riparian forb/grass open forest: • Brigalow Woodland: 0-5% • White Box – White Cypress Pine shrubby open forest: • Rusty Fig – Wild Quince – Native Olive dry rainforest: • Plains Grass Grassland: 0-0% Measured at 10 points along a 50 metre transect. Based on DECCW 2008 Biobanking Vegetation Benchmarks Database until data from analogue sites is available from successive years of monitoring.	Undertake maintenance rehabilitation by re-sowing / replanting missing plant species to achieve desired species richness.
2.4 Appropriate native ground cover is present	Vegetation monitoring by ecologist will determine understorey cover scores.	Native ground cover scores per vegetation type should be as follows. Note: Because of the varying effect of environmental conditions, floristic monitoring will enable comparison against these benchmarks over successive years to analyse how vegetation classes are performing against analogue sites to identify trends. • White Box Grassy Woodland*: 55% • White Cypress Pine – Silver-leaved Ironbark Tumbledown	Undertake maintenance rehabilitation either apply mulch and/or by re-sowing / replanting missing plant species to achieve desired coverage.

		Gum open forest: 55% • Rough-barked Apple riparian forb/grass open forest: • Brigalow Woodland: 65% • White Box – White Cypress Pine shrubby open forest: • Rusty Fig – Wild Quince – Native Olive dry rainforest: • Plains Grass Grassland: 50% Measured at 50 points along a 50 metre transect. Based on DECCW 2008 Biobanking Vegetation Benchmarks Database until data from analogue sites is available from successive years of monitoring.	
OBJECTIVE 3.0 LAND USE			
CRITERIA	**MEASURE**	**PERFORMANCE INDICATOR**	**REMEDIAL ACTION**
3.1 The land use is sustainable and consistent with intended land use	Annual Rehabilitation Plan to quantify areas BOMP will be audited every 3 years and assess woodland land use.	Establish areas of rehabilitation and restoration consistent with MOP/RMP and BOMP	Undertake required areas of rehabilitation/restoration to achieve final land use.
3.2 No hazards that are inconsistent with intended land use	Quarterly Visual Inspection by Environmental Officer.	The site is free of safety or environmental hazards within the area including: • Holes, tunnels or unstable areas; • Mining infrastructure or debris; or • Hazardous materials.	All safety or environmental hazards are to be removed/repaired as required.
3.3 Soil pH is representative of intended land use	Annual Soil Analysis by Environmental Officer will determine if pH is within the range of analogue sites.	pH levels are within the range generally acceptable for plant growth (5.0 to 8.5) until data from analogue sites is available.	Undertake maintenance by applying soil ameliorants/fertiliser as required (lime lower pH and sulphur to raise pH).

3.4 Exotic/weed vegetation out competing natives or impacting on intended land use	Quarterly Visual Inspection by Environmental Officer Routine Weed Mapping	Noxious and environmental weeds are under control within rehabilitation or biodiversity offset areas	Undertake weed management strategies in MOP/RMP/BOMP.
3.5 Feral pests are not impacting on intended land use	Quarterly Visual Inspection by Environmental Officer. Routine Pest Mapping	Feral pests are under control within rehabilitation or biodiversity offset areas	Undertake vertebrate pest management strategies in BOMP.
3.6 Overabundant native herbivores are not impacting on intended land use	Routine Pest Mapping	Overabundant native herbivores are under control within rehabilitation or biodiversity offset areas	Undertake vertebrate overabundant native herbivore management strategies in BOMP.
3.7 Fire not impacting on intended land use	Fuel Load Monitoring	Fire risk to assets (WCC and other private infrastructure) and biodiversity are under control within rehabilitation and biodiversity offset areas	Undertake fire management strategies in BOMP.

* Yellow Box-Blakely's Red Gum grassy woodland biometric vegetation community benchmarks are exactly the same as White Box grassy woodland.

7.2 Biodiversity Management Objectives and Targets

As part of the planning process in Environmental Management Strategy (EMS), objectives and targets are set to drive organisations towards continuous improvement in environmental performance. WCC will establish specific objectives and targets for biodiversity management which will be incorporated into the WCC EMS. The objectives and targets (**Table 11**) will be reviewed monthly by the WCC Environmental Officer and revised annually based on the overall year's performance. The objectives and targets proposed for future years are only indicative and will be subject to the results of the BOMP Performance Annual Review (**Section 13**).

Table 11: EMS Biodiversity Objectives and Targets

Objective		Performance Indicator	Actual		Target		
Activity	Environmental Hazard		2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	Reason
Biodiversity offset Area	Completion Criteria Non-Compliance	Number of monitoring sites meeting Completion Criteria	2 (Site 3 & 11)	3 (Site 13)	4	5	Increase of one monitoring site per year meeting Completion Criteria
Rehabilitation	Not achieve required rehabilitation	Annual Hectares of Rehabilitation	24.8	44.0 (25.7)	3.3 (21.6)	22.4	Rehabilitation Targets from MOP

Note: Actual Rehabilitation in 2012/2013 was 18.3ha greater than the MOP target and thus reduces 2013/2014 MOP Target to 3.3ha

8 MANAGEMENT STRATEGIES AND MEASURES

This section describes the range of management strategies and measures implemented by WCC to mitigate impacts from mining on biodiversity and the related risks to compliance.

In order to mitigate the risks associated with the biodiversity hazards identified in **Section 6**, **Table 12** summarises the biodiversity management strategies and measures to be implemented by WCC throughout the life of the LOM Project. Each management measure listed in **Table 12** is discussed in further detail in the relevant section below.

Table 12: Biodiversity Management Strategies and Measures

SECTION	MEASURE	RESPONSIBILITY	TERM		
			SHORT 1 YEAR	MED 1-5 YEARS	LONG >5 YEARS
8.1	Vegetation Clearing	Mine Planning Engineer, WCC Environmental Officer, Contractors & Ecologist	✓	✓	✓
8.2	Biodiversity Offset Strategy & Biodiversity Offset Area	WCC Environmental Officer	✓		
8.3	Rehabilitation	WCC Environmental Officer &Contractors	✓	✓	✓
8.4	Seed Collection and Propagation	WCC Environmental Officer &Contractors		✓	✓
8.5	Revegetation	WCC Environmental Officer &Contractors	✓	✓	✓
8.6	Habitat Augmentation	WCC Environmental Officer &Contractors		✓	✓
8.7	Weed Management	WCC Environmental Officer &Contractors	✓	✓	✓
8.8	Vertebrate Pest and Over Abundant Native Herbivores	WCC Environmental Officer &Contractors	✓	✓	✓
8.9	Fence, Signage and Access Management	WCC Environmental Officer &Contractors	✓	✓	✓
8.10	Narrawolga Axe Grinding Grooves and Aboriginal Heritage	WCC Environmental Officer			✓
8.11	Erosion Management	WCC Environmental Officer &Contractors		✓	✓
8.12	Exclusion of Agriculture & Grazing	WCC Environmental Officer	✓	✓	✓
8.13	Bushfire Management	WCC Environmental Officer &Contractors	✓	✓	✓
8.14	Salinity Management	WCC Environmental Officer			✓
8.15	Infrastructure Management and Rubbish Removal	WCC Environmental Officer	✓	✓	✓
8.16	Management of Threatened Flora Species Digitaria Porrecta	WCC Environmental Officer	✓	✓	✓

8.1 Vegetation Clearing

Vegetation clearing must be undertaken for mining to occur; however, WCC implements the following processes to mitigate potential impacts to biodiversity from clearing activities. The WCC Mine Planning Engineer determines the minimum area required for the next 12 months of mining with the area large enough not to limit mining efficiencies and production rates; however, only requiring the minimum annual area to be disturbed to reduce the amount of mature vegetation (and habitat) cleared. The clearing area will be compared to the approved disturbance limits outlined in the LOM Project Environmental Assessment (and MOP) and will be surveyed in the field with the boundary clearly pegged by the Surveyor. **Table 13** presents the indicative clearing schedule from the LOM MOP/RMP (Table 3.1) for the first seven years of the LOM Project.

Table 13: Indicative WCC MOP Clearing Schedule

PERIOD*	GRASSY WHITE BOX WOODLAND		OTHER (HA)	ANNUAL TOTAL (HA)	CUMULATIVE TOTAL (HA)
	CLASS 3 (HA)	CLASS 4 (HA)			
2011 - 2012	59.2	0.8	31.6	91.6	91.6
2012 - 2013	20.3	0.6	3.4	24.3	115.9
2013 - 2014	13.0	1.8	0.0	14.8	130.7
2014 - 2015	10.9	3.6	0.3	14.8	145.5
2015 - 2016	10.5	9.4	3.0	22.9	168.4
2016 - 2017	5.9	4.9	1.0	11.8	180.2
2017 - 2018	35.9	19.4	3.5	58.8	239.0

* Period aligns with WCC's annual statutory reporting dates 1st April to 31st March

Clearing activities will be scheduled outside of periods of fauna breeding or hibernation/torpor; typically late Summer and Autumn however this does not apply to all fauna which varies based individual species ecology, prevailing climate and resource availability. Clearing for ancillary activities will be undertaken as required (preferably late Summer and Autumn), however the same due diligence processes to mitigate the impacts to biodiversity will be applied as for mining areas.

The Environmental Officer will visually inspect each proposed clearing area. The inspection will determine if any faunal habitat is present or vegetation species/communities not previously assessed in the LOM Project Environmental Assessment. If the inspection identifies habitat or unknown species, Ecologists will be engaged to complete Pre-Clearing, Clearing and Post Clearing Assessments of the proposed clearing area. The following describes the Pre-clearing, Clearing and Post-clearing Assessment procedure. This process will be documented in the Clearing Checklist (**Appendix J**).

The Heritage Impact Assessment undertaken for the WCC LOM Project (Landskape, 2010) did not identify any items of cultural heritage within the LOM Project footprint and given the long history of agricultural land use, it is unlikely that any additional cultural heritage items would exist. The Heritage Management Plan (WCC, 2012) has outlined what actions would be required if any unexpected heritage (both aboriginal or historical) items were to be identified. This process will be documented in the Clearing Checklist (**Appendix J**).

8.1.1 Pre-clearing Assessment

As discussed in **Section 4**, the vegetation to be cleared WCC is listed as a threatened ecological community and a number of threatened birds have been recorded onsite or could potentially occur onsite will be targeted during the Pre-clearing Assessment. Despite numerous vegetation surveys

since 2004, no threatened vegetation species have been identified in the LOM footprint and are believed unlikely to occur due to the extended disturbance history of the site.

In the week/s prior to vegetation clearing within the required clearing area, an Ecologist will undertake the following assessment:

1. Hollow bearing trees, hollow logs and other habitat features such as rocks are to be located and recorded by GPS, marked in the field by marking paint or similar and documented on field sheets. Data to be recorded for logs and other habitat features can be general, including length, width and any comments. Data recorded for hollow bearing trees includes:
   - an allocated tree number;
   - the tree species;
   - the Diameter at Breast Height (DBH) of the tree;
   - the number of hollows in hollow size classes (e.g. <20mm; 20-30mm; 50-150mm; >150mm);
   - the aspect of the hollow; and
   - any observations of fauna activity.
2. Evening/nocturnal surveys will be undertaken to gauge fauna activity within the proposed clearing area. The surveys include stag or hollow watching of as many trees as possible, microchiropteran bat call detection, call playback for owls and Koala (*Phascolarctos cinereus*) and spotlight traverses to detect any other fauna present;
3. The proposed LOM footprint is relatively disturbed; however, in the unlikely event that a threatened plant species is identified during pre-clearing surveys, the location of the threatened plant species is to be marked with GPS and in the field (using flagging tape or similar). The location of the threatened plant species is to be retained in situ including a buffer of five metres until a strategy for retention or translocation has been developed in consultation with OEH and DSEWPaC.
4. The presence of seed for collection and salvageable habitat resources will be identified; and
5. The presence environmental and noxious weeds will also be identified.

As required, the Environmental Officer will coordinate any seed collection or weed control with sufficient time prior to clearing. WCC will review the results of other mines pre-clearing trapping and radio tracking programs; however it is unlikely that this practice would be implemented at WCC given that the disturbance history of the site has resulted in the only native mammals identified onsite being from the kangaroo family and the Common Brushtail Possum.

8.1.2 Clearing and Post-clearing Assessment

At the time of clearing, an Ecologist or wildlife handler will be present to supervise the following clearing procedures. The open woodland vegetation structure at WCC does not have a significant shrub layer and the disturbance history of the site has resulted in limited regeneration. Therefore vegetation clearing procedures relate only to overstorey vegetation.

1. Prior to felling, each tree will be visually inspected for the presence of fauna. Each tree will be nudged and shaken immediately prior to felling to encourage any fauna, such as birds, to vacate the tree;
2. The dozer or excavator undertaking the clearing will attempt “slow drop” techniques during the felling of each tree;
3. Once on the ground, each hollow will be inspected for the presence of fauna, with the aid of a burrow-scope if required. If any injured or juvenile fauna are identified, they will be captured and transported to either WIRES or a veterinary hospital. Other fauna captured but not requiring care will be released into the same habitat near the point of rescue. This

will be done at dusk for nocturnal fauna. Separate management strategies is not required as this process would be acceptable for any threatened species encountered which would be threatened birds or microbats based on monitoring since 2004; and

4. Hollow bearing trees will be left on the ground overnight to allow any unidentified fauna still residing in the tree to vacate;
5. Where practicable, the cleared timber and habitat features, particularly hollow bearing trees, logs and rocks, will be salvaged and placed in suitable locations out of the clearing area for reuse in the BOA or rehabilitation areas. The quantities of habitat material salvaged will be documented on the Clearing Checklist (**Appendix J**).
6. At the completion of clearing, the Ecologist will prepare a report based on the results of the Pre-clearing, Clearing and Post-clearing Assessment. The report is to be provided to WCC and OEH.

8.2 Biodiversity Offset Area

In accordance with PA 10_0059 (Schedule 3 Condition 24) and EPBC Act Approval 2010/5571 (Condition 1 & 2); WCC has developed the following Biodiversity Offset Strategy (BOS) to be implemented over the BOA for the life of the LOM Project. Both PA 10_0059 and EPBC Act Approval require WCC to make suitable arrangements to provide long term security of the BOA.

8.2.1 Long Term Security

WCC intends to secure the BOA initially using a 'conservation covenant' (s88E of the Conveyancing Act 1919) registered on the title of the land to provide security of the BOA in perpetuity. WCC has previously consulted with DoP and DSEWPaC in 2012 (correspondence in **Appendix A**) agreeing in concept with the use of this instrument to secure the BOA. In addition, DoP have requested that over time WCC commit to transferring the BOA security into conservation agreements under the National Parks and Wildlife Act 1974 Act. Such a transfer of BOA security is contingent on OEH agreeing to any conservation agreements for land considered suitable under the Act. Depending on OEH's position, it is anticipated that a mix of conservation agreements and s88E covenants over the BOA landholdings will be held; and pending the successful restoration of land, will be transferred to conservation agreements over time. **Appendix H** summaries the land titles that will be modified with the BOA caveat.

8.2.2 Biodiversity Offset Strategy

The LOM BOS has been designed to meet both Commonwealth and State offset principles. The package includes a range of direct (land protection and management) measures to offset the impacts of the LOM Project. The BOS package incorporates 'like for like' EEC vegetation including Box-Gum Grassy Woodland and Derived Native Grasslands and other woodland vegetation communities in good condition providing extensive habitat features not available in the derived native grassland areas and mine rehabilitation. The intent of the BOA is to avoid, minimise and ameliorate the impacts of the LOM Project to the maximum extent possible.

The key objectives of the BOS focus on the re-establishment and/or enhancement of:

a) endangered ecological communities:
   - White Box-Yellow Box-Blakely's Red Gum Woodland (GWBW) EEC; and
   - White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC; and

b) habitat for threatened fauna species, including the:

- Regent Honeyeater, Swift Parrot, Brown Treecreeper, Hooded Robin, Little Lorikeet, and Barking Owl; and
- Eastern Bent-wing Bat, Eastern False Pipistrelle, Yellow-bellied Bent-wing Bat and Greater Broad-nosed Bat.

The key outcomes of the BOS include:

- Linking the BOA to Liverpool Plains Shire regional and sub-regional corridors (north to south) and providing a cross catchment corridor (east to west);
- Overstorey (canopy – Class 4) vegetation retention is to be 5:1 offset:impact ratio;
- Grassy White Box Woodland Class 4 BOA offset to impact ratio of 5.5:1;
- White-Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland BOA meeting EPBC CEEC criteria offset to impact ratio of 4.3:1;
- Grassy White Box Woodland BOA meeting TSC EEC criteria offset to impact ratio of 5.1:1;
- Grassy White Box Woodland BOA Class 3 (a and b) criteria offset to impact ratio of 4.9:1;and
- Potential existing foraging habitat for the Regent Honeyeater and Swift Parrot within BOA offset to impact ratio of 8.25:1.

In order to achieve these outcomes, WCC has purchased six properties adjacent to the mine site to be incorporated into the BOA. Each BOA property is described as a management domain; being Mine Site (formerly Narrawolga), Eurunderee, Hillview, Marengo, Railway View and Greenslopes (the additional offset area). **Figure 5** presents the location and vegetation community and condition class of each domain of the BOA and **Table 14** outlines the area calculations of the BOS. Each domain has been further categorised into sub-domains based on discrete geographic areas(**Figure 6**).The following describes the current condition of each BOA domain and sub-domain.

8.2.3 Mine Site Domain BOA

This domain incorporates sub-domains O'Donnells and Narrawolga, the areas to the west and south of the mine (**Figure 6**). **Table 14** provides the detailed calculations for the Mine Site domain vegetation types and classes. This domain contains three vegetation types, with all four condition classes present (Class 1 to Class 4) (**Figure 5**). Class 4 vegetation types offers seasonal inflorescence for foliavores and nectarivores, include winter season nectar and pollen that may be used by Regent Honeyeater and/or Swift Parrot.

Hollows, bark exfoliations and fallen timber is also present within Class 4 vegetation and provides potential habitat respectively for hollow-obligate species (e.g. some microchiropteran bats, birds and arboreal mammals), reptiles, amphibians and terrestrial mammals. Grassland classes (i.e. Class 1 and 3) offer habitat for granivorous birds, generalist and some threatened (i.e. *Climacteris picumnus* (Brown Treecreeper)) woodland birds and reptiles, and *Macropus giganteus* (Eastern Grey Kangaroo). Aquatic habitat in the form of dams also provides habitat and resources for a range of fauna including for wetland birds, such as the *Tachybaptus novaehollandiae* (Australasian Grebe), *Aythya australis* (Australian Hard Head) and possibly intermittent use by *Oxyura australis* (Blue-billed Duck).

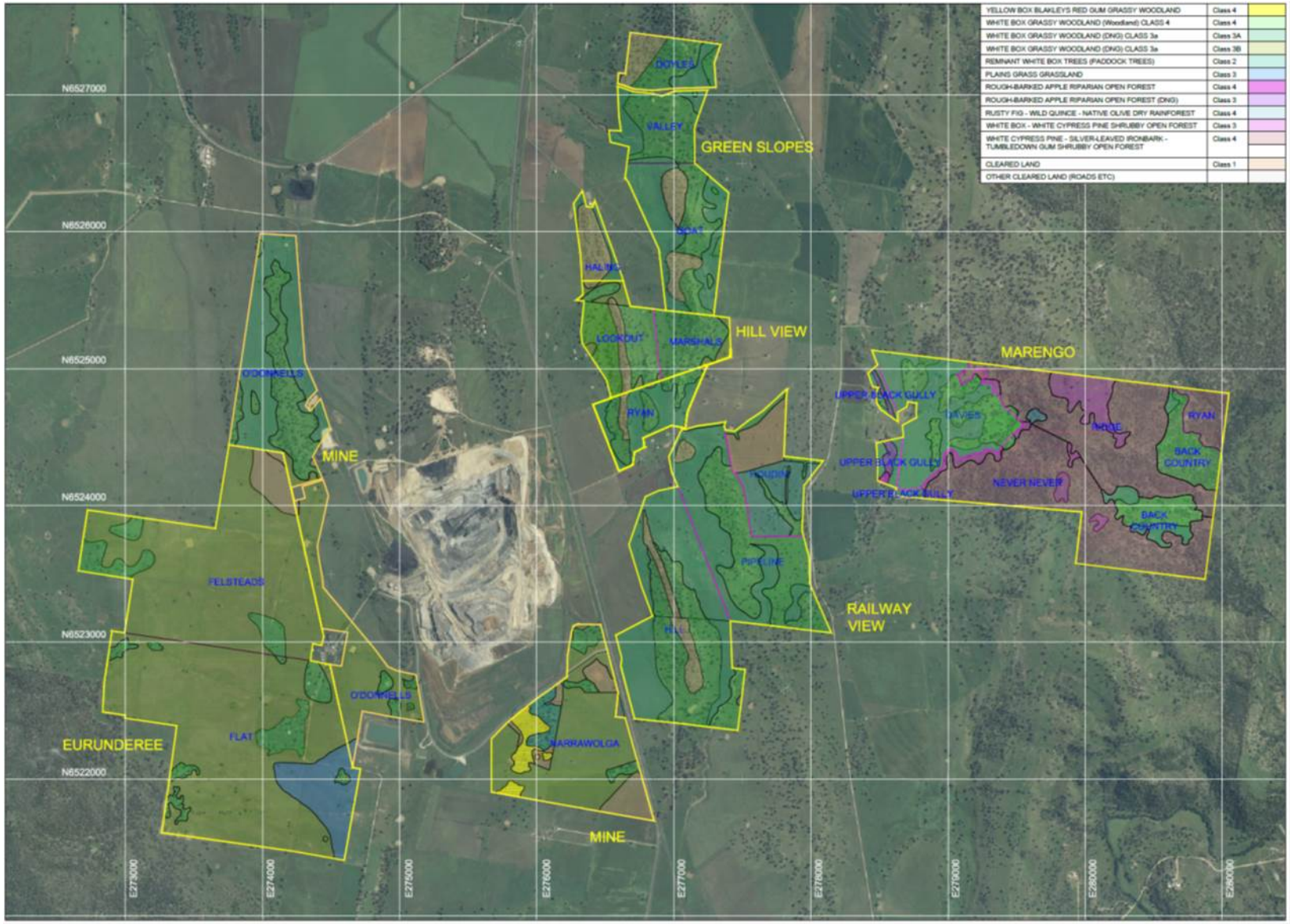

Figure 5: WCC BOA Management Domains Locations and Vegetation Community & Condition Class

Table 14: WCC BOS

BIOMETRIC VEGETATION COMMUNITIES	CONDITION	BIODIVERSITY OFFSET AREA						
		EURUNDEREE	HILL VIEW	GREEN SLOPES	MARENGO	MINE SITE	RAILWAY VIEW	TOTAL
Yellow Box - Blakely's Red Gum grassy woodland	Class 4					8.15		*8.15*
White Box grassy woodland (Woodland)	Class 4	34.78	46.40	44.60	53.56	38.72	105.50	*323.56*
White Box grassy woodland (DNG)	Class 3a		5.94	51.10	48.76	46.88	106.59	*259.27*
	Class 3b	304.76	0.56			103.35		*408.67*
Remnant White Box trees (Paddock Trees)	Class 2	0.12				6.10	19.64	*25.86*
Plains Grass grassland	Class 3	24.79				0.72		*25.51*
Rough-barked Apple riparian open forest	Class 4				0.45			*0.45*
Rough-barked Apple riparian open forest (DNG)	Class 3				2.78			*2.78*
Rusty Fig - Wild Quince - Native Olive dry rainforest	Class 4				1.00			*1.00*
White Box - White Cypress Pine shrubby open forest	Class 4				20.74			*20.74*
White Box - White Cypress Pine shrubby open forest (DNG)	Class 3				157.40			*157.40*
White Cypress Pine - Silver-leaved Ironbark - Tumbledown Gum shrubby open forest	Class 4		4.97	28.24			12.90	*46.11*
Total Extant BOA Vegetation		**364.45**	**57.87**	**123.94**	**284.69**	**203.92**	**244.63**	**1,279.50**
Cleared Land	Class 1	10.39				14.69	14.30	*39.38*
Other cleared land (internal roads, dams)						0.61		*0.61*
TOTAL BIODIVERSITY OFFSET AREA		**374.84**	**57.87**	**123.94**	**284.69**	**219.22**	**258.93**	**1,319.49**
PA10_0059 BOS		**363.93**	**57.32**	**123.00**	**284.12**	**215.86**	**243.69**	**1,287.92**

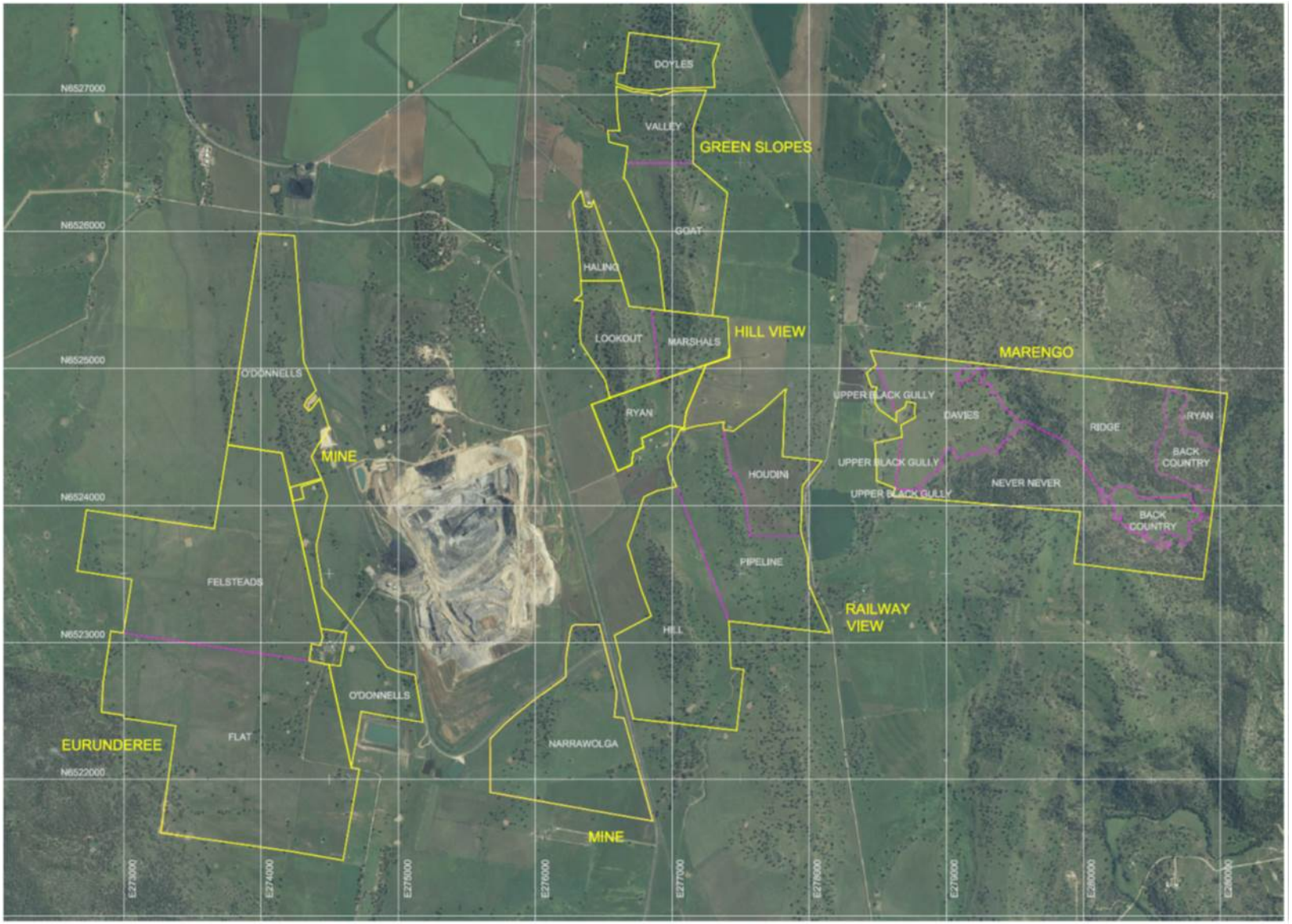

Figure 6: WCC BOA Sub-domains Locations

8.2.3.1 O'Donnell's Sub-domain

O'Donnell's sub-domain contains White Box grassy woodland in three classes, Class 4 Woodland, Class 3 DNG (3a and 3b) and Class 2; an area of Plains Grass Grassland DNG; and a small area of cleared land. This sub-domain directly borders the WCC mine operations (**Figure 5**). Existing infrastructure within this sub-domain includes the main powerline to WCC along the eastern boundary with the Coal Haul Road, a sub-powerline to the Escott property and the main communication/optic fibre line into WCC including a small structure at the connection with the external Telstra network. Dirty water management dams, the main site access road to WCC and to the Explosive Magazine also border this sub-domain. This sub-domain ceased being grazed in September 2012.

8.2.3.2 Narrawolga Sub-domain

Narrawolga sub-domain contains Yellow Box - Blakely's Red Gum grassy woodland Class 4 Woodland; White Box grassy woodland in three classes, Class 4 Woodland, Class 3 DNG (3b) and Class 2; and an area of cleared land. A small portion of this sub-domain was agisted until September 2012 for agricultural activities of cultivation for lucerne hay and cattle grazing.

8.2.4 Eurunderee Domain BOA

Eurunderee comprises two sub-domains, Flat and Felsteads (**Figure 6**). **Table 14** provides the detailed calculations for the domains and the vegetation types and classes. This domain contains two vegetation types (**Table 5**), with all four condition classes present (Class 1 to Class 4). Class 4 vegetation types offers seasonal inflorescence for foliavores and nectarivores, including winter season nectar and pollen that may be used by Regent Honeyeater and/or Swift Parrot. Hollows, bark exfoliations and fallen timber is also present within Class 4 vegetation and provides potential habitat respectively for hollow-obligate species (e.g. some microchiropteran bats, birds and arboreal mammals), reptiles, amphibians and terrestrial mammals. Grassland classes (i.e. Class 1 and 3) offer habitat for granivorous birds, generalist woodland birds and reptiles, and *Macropus giganteus* (Eastern Grey Kangaroo). The small dam in the Flat sub-domain offers habitat for avifauna such as Australasian Grebe, Australian Hard Head and on occasion *Elseyornis melanops* (Black-fronted Dotterel).

8.2.4.1 Flat Sub-domain

Sub-domain Flat contains four vegetation types and classes, White Box grassy woodland Class 4, Class 3 (3b)and Class 2, and Plains Grass DNG Class 3 (**Table 14** and **Figure 5**).The Flat sub-domain contains a gravel road (used for infrequent/emergency access for a neighbouring property), a couple of old hay and other agriculture related sheds and derelict agriculture related infrastructure and rubbish that will need to be removed. An old farm rubbish dump of mainly scrap metal and other non-putrescible waste was removed and rehabilitated in 2011. The south western boundary fence was relocated from the former "give and take" fence location onto the physical cadastral boundary in 2011. This sub-domain ceased being grazed in December 2010.

8.2.4.2 Felsteads Sub-domain

Sub-domain Felsteads contains three vegetation types and classes, White Box grassy woodland Class 4 and Class 3 (3b) and a cleared area (**Table 14** and **Figure 5**). The north western boundary fence will need to be relocated from the "give and take" location to the cadastral boundary. This sub-domain ceased being grazed in September 2012.

8.2.5 Railway View Domain (BOA)

Railway View domain contains four sub-domains, Hill, Pipeline, Houdini and Ryan (**Figure 6**).**Table 14** provides the detailed calculations of this domains and the vegetation types and classes. This domain contains two vegetation types (**Figure 5**), with all four condition classes present (Class 1 to Class 4). Class 4 White Box grassy woodland offers seasonal inflorescence for foliavores and nectarivores, including winter season nectar and pollen that may be used by Regent Honeyeater and/or Swift Parrot. Hollows, bark exfoliations and fallen timber is also present within Class 4 vegetation and provides potential habitat respectively for hollow-obligate species (e.g. some microchiropteran bats, birds and arboreal mammals), reptiles, amphibians and terrestrial mammals. Grassland classes (i.e. Class 1 and 3) offer habitat for granivorous birds, generalist woodland birds and reptiles, and *Macropus giganteus* (Eastern Grey Kangaroo). White Cypress Pine - Silver-leaved Ironbark - Tumbledown Gum shrubby open forest typically contains areas of exposed granite rock slabs with some rock exfoliations that provide habitat for geckos and other reptiles. The small dam in the Hill sub-domain offers habitat for avifauna such as Australasian Grebe, Australian Hard Head and on occasion *Elseyornis melanops*(Black-fronted Dotterel).

Black Gully drains through the south portion of the property and is currently deeply incised. Ongoing monitoring of the stability of the gully with regard to the erosion will be implemented to inform whether additional stabilisation and rehabilitation is necessary.

The pipeline (and powerline) that provides Werris Creek with its drinking water from Quipolly Dam crosses this property. Additional powerlines that supply power to Marengo and other properties on Black Gully Road also cross this property.

The selected area of vegetation provides a link between the current and other proposed conservation lands to the west on the southern portion of the WCC mine site (Mine Site south), through to a travelling stock route and reserve to the east which is situated between “Railway View” and “Marengo” properties.

8.2.5.1 Hill Sub-domain

Sub-domain Hill contains three vegetation types and classes, White Box grassy woodland Class 4 and Class 3 (3a) and White Cypress Pine – Silver-leaved Ironbark – Tumbledown Gum shrubby open forest Class 4 (**Table 14** and **Figure 5**). The majority of this sub-domain ceased being grazed in December 2010. The deeply incised section of Black Gully drains through this sub-domain.

8.2.5.2 Pipeline Sub-domain

Sub-domain Pipeline also contains three vegetation types and classes, White Box grassy woodland Class 4 and Class 3 (3a) and White Cypress Pine – Silver-leaved Ironbark – Tumbledown Gum shrubby open forest Class 4 (**Table 14** and **Figure 5**).This sub-domain was under agistment until September 2012 for native pastures for cattle grazing.

8.2.5.3 Houdini Sub-domain

Sub-domain Houdini contains three vegetation types and classes, White Box grassy woodland Class 4, Class 3 (3a) and Class 2 (**Table 14** and **Figure 5**).This sub-domain was under agistment until September 2012 for agricultural activities of cultivation for annual oats and forage sorgum.

8.2.5.4 Ryan Sub-domain

Sub-domain Ryan contains three vegetation types and classes, White Box grassy woodland Class 4, Class 3 (3a) and White Cypress Pine – Silver-leaved Ironbark – Tumbledown Gum shrubby open forest Class 4 (**Table 17** and **Figure 5**).This sub-domain was under agistment until September 2012 for agricultural activities of native pastures for cattle grazing.

8.2.6 Marengo Domain (BOA)

Marengo domain contains five sub-domains, Upper Black Gully, Davies, Never Never, Ridge and Back Country (**Figure 6**).**Table 14** provides the detailed calculations of this domain and the vegetation types and classes. This domain contains four vegetation types (**Figure 5**), with two condition classes present (Class 3 and 4). Class 4 White Box grassy woodland and White Box - White Cypress Pine shrubby open forest offers seasonal inflorescence for foliavores and nectarivores, including winter season nectar and pollen that may be used by Regent Honeyeater and/or Swift Parrot. Hollows, bark exfoliations in Eucalypts and Callitris and fallen timber is also present within Class 4 vegetation and provides potential habitat respectively for hollow-obligate species (e.g. some microchiropteran bats, birds and arboreal mammals), reptiles, amphibians and terrestrial mammals. Grassland classes (i.e. Class 1 and 3) offer habitat for granivorous birds, generalist woodland birds and reptiles, and *Macropus giganteus* (Eastern Grey Kangaroo). Areas of exposed granite rock slabs occur within the Ridge and Never Never Sub-domains with some rock exfoliations that provide habitat for geckos and other reptiles.

The inclusion of the Marengo domain in the BOA provides an increase in the size and continuity of the vegetated corridor between the two sub-regional corridors (ELA 2010b). The small rainforest remnant found on the “Marengo” property, ‘Rusty Fig – Wild Quince – Native Olive dry rainforest’ provides important habitat for fauna including the Endangered Population, Australian Brush-turkey population in the Nandewar and Brigalow Belt South bioregions, along with several other threatened species considered potential occurrences. Notably, two threatened woodland birds, the *Melanodrya scucullata* (Hooded Robin) and *Stagonople uraguttata* (Diamond Firetail), were observed on this property in July 2010 (ELA 2010b).

A powerline passes through the western part of the property supplying power to an adjoining neighbour. Grazing was removed from the property in January 2011 and no other land use has occurred since that time.

8.2.6.1 Upper Black Gully Sub-domain

Sub-domain Upper Black Gully contains four vegetation types and classes, White Box grassy woodland Class 4 and 3 (3a) and Rough-barked Apple riparian open forest Class 3 and Class 4 (**Table 14** and **Figure 5**). Small amounts of residual agricultural rubbish remain within this sub-domain that will need to be cleaned up. While Black Gully is deeply incised in this sub-domain, it is largely stable except for a couple of minor gully heads that will require further monitoring.

8.2.6.2 Davies Sub-domain

Sub-domain Davies contains three vegetation types and classes, White Box grassy woodland Class 4 and Class 3 (3a) and a small area of Class 4 White Box - White Cypress Pine shrubby open forest (**Table 14** and **Figure 5**).

8.2.6.3 Never Never Sub-domain

Sub-domain Never Never contains three vegetation types and classes, White Box - White Cypress Pine shrubby open forestClass 4 and Class 3and a small area of Class 4 White Box grassy woodland (**Table 14** and **Figure 5**).

8.2.6.4 Ridge Sub-domain

Sub-domain Ridge contains three vegetation types and classes, Class 4 White Box grassy woodland,White Box - White Cypress Pine shrubby open forest Class 4 and Class 3, and Rusty Fig – Wild Quince – Native Olive dry rainforest (**Table 14** and **Figure 5**).

8.2.6.5 Back Country Sub-domain

Sub-domain Back Country contains one vegetation type of two classes, White Box grassy woodland Class 4 and Class 3 (3a) (**Table 14** and **Figure 5**).

8.2.7 Hillview Domain (BOA)

Hillview domain contains two sub-domains, Look Out and Marshalls (**Figure 6**). **Table 14** provides the detailed calculations for domain and the vegetation types and classes. This domain contains two vegetation types (**Figure 5**), with two condition classes present (Class 3, and 4). Class 4 White Box grassy woodland offers seasonal inflorescence for foliavores and nectarivores, including winter season nectar and pollen that may be used by Regent Honeyeater and/or Swift Parrot. Hollows, bark exfoliations in Eucalypts and fallen timber is also present within Class 4 vegetation and provides potential habitat respectively for hollow-obligate species (e.g. some microchiropteran bats, birds and arboreal mammals), reptiles, amphibians and terrestrial mammals. Grassland classes offer habitat for granivorous birds, generalist woodland birds and reptiles, and *Macropusgiganteus* (Eastern Grey Kangaroo). Areas of exposed granite rock slabs occur within the White Cypress Pine - Silver-leaved Ironbark - Tumbledown Gum shrubby open forest, with some rock exfoliations that provide habitat for geckos and other reptiles.

The addition of Hillview to the BOS enhances north to south connectivity of the vegetation types found between Railway View and Greenslopes/Banool and strengthens the sub-regional east to west corridor identified in ELA (2010b).

The pipeline that provides Werris Creek with its drinking water from Quipolly Dam crosses this property.

This domain was under agistment until September 2012 for agricultural activities of native pastures for cattle grazing.

8.2.7.1 Look Out Sub-domain

Sub-domain Look Out contains three vegetation types and classes, White Box grassy woodland Class 4 and Class 3 (3a and 3b) and White Cypress Pine – Silver-leaved Ironbark – Tumbledown Gum shrubby open forest Class 4 (**Table 14** and **Figure 5**).

8.2.7.2 Marshalls sub-domain

Sub-domain Marshalls contains two vegetation types and classes, White Box grassy woodland Class 4 and Class 3 (3a) (**Table 14** and **Figure 5**).

8.2.8 Greenslopes Domain (BOA)

Greenslopes domain contains four sub-domains Haling, Doyles, Valley and Goat (**Figure 6**).**Table 14** provides the detailed calculations of this domain and the vegetation types and classes. This domain contains two vegetation types (**Figure 5**), with two condition classes present (Class 3, and 4). Class 4 White Box grassy woodland offers seasonal inflorescence for foliavores and nectarivores, including winter season nectar and pollen that may be used by Regent Honeyeater and/or Swift Parrot. Hollows, bark exfoliations in Eucalypts and fallen timber is also present within Class 4 vegetation and provides potential habitat respectively for hollow-obligate species (e.g. some microchiropteran bats, birds and arboreal mammals), reptiles, amphibians and terrestrial mammals. Grassland classes offer habitat for granivorous birds, generalist woodland birds and reptiles, and *Macropusgiganteus* (Eastern Grey Kangaroo). Areas of exposed granite rock slabs occur within the White Cypress Pine - Silver-leaved Ironbark - Tumbledown Gum shrubby open forest, with some rock exfoliations that provide habitat for geckos and other reptiles.

As mentioned above, the addition of both Hillview and Greenslopes to the BOS enhances north to south connectivity of the vegetation types found between Railway View and Greenslopes and strengthens the sub-regional east to west corridor identified in ELA 2010b.

The gully within sub-domain Valley will require monitoring for erosion issues and intervention may be required.

The pipeline that provides Werris Creek with its drinking water from Quipolly Dam crosses this property.

This domain was under agistment until September 2012 for agricultural activities of cultivation of oats and native pastures for cattle and goat grazing.

8.2.8.1 Haling Sub-domain

Sub-domain Haling contains two vegetation types and classes, White Box grassy woodland Class Class 3 (3a) and White Cypress Pine – Silver-leaved Ironbark – Tumbledown Gum shrubby open forest Class 4 (**Table 14** and **Figure 5**).

8.2.8.2 Doyles Sub-domain

Sub-domain Doyles on the footslopes of Doyles Hill contains three vegetation types and classes, White Box grassy woodland Class 4 and Class 3 (3a) and White Cypress Pine – Silver-leaved Ironbark – Tumbledown Gum shrubby open forest Class 4 (**Table 14** and **Figure 5**).

8.2.8.3 Valley Sub-domain

Sub-domain Valley contains two vegetation types and classes, White Box grassy woodland Class 4 and Class 3 (3a) (**Table 14** and **Figure 5**).

8.2.8.4 Goat Sub-domain

Sub-domain Goat contains three vegetation types and classes, White Box grassy woodland Class 4 and Class 3 (3a) and White Cypress Pine – Silver-leaved Ironbark – Tumbledown Gum shrubby open forest Class 4 (**Table 14** and **Figure 5**).

8.3 Rehabilitation Area

DRE approved the WCC LOM MOP on 29th November 2011 as meeting the Mining, Rehabilitation and Environmental Management Plan guidelines. Subsequently approval was also given for Section 4 and 5 of the LOM MOP relating to rehabilitation activities as the Rehabilitation Management Plan (RMP) on 2nd May 2012 in accordance with Condition 43 of PA 10_0059. The LOM MOP/RMP outline the objectives, domains, completion criteria, methodology, targets, processes and activities and conceptual decommissioning relating to rehabilitation management at WCC.

WCC's rehabilitation objectives are consistent with this BOMP and focus on the restoration of native woodland vegetation, specifically the endangered ecological community Grassy White Box Woodland. Rehabilitation works aim to restore this woodland community similar to that which was present pre-mining and will eventually enhance the east west corridor with the adjacent Mine Site BOA domain to the south of the rehabilitation area.

Rehabilitation will consist of two final land uses including:

- Class III land capability agricultural land; and
- Vegetation Community:
  - Grassy White Box Woodland (GWBW);
  - Shrubby White Box Woodland (SWBW); and
  - Brigalow Woodland.

The woodland restoration areas will include habitat augmentation and corridors for fauna movement linking with adjacent BOA. In accordance with the LOM MOP/RMP, **Table 15** summarises the program for both the progressive rehabilitation completed to date and proposed rehabilitation targets for WCC LOM Project.

Table 15: Completed and proposed rehabilitation program

Period*			Woodland Vegetation Community			Agriculture Class 3 (ha)	Temporary Rehab (ha)	ANNUAL TOTAL (ha)	CUMULATIVE TOTAL (ha)
			GWBW(ha)	SWBW(ha)	Brigalow (ha)				
Actual/Pre-MOP	2008-2009		14.31	0.0	0.0	0.0	-	14.31	14.31
	2009-2010		-5.12**	0.0	0.0	0.0	-	-5.12	9.19
	2010-2011		20.49	0.0	0.0	0.0	-	20.49	29.68
	2011-2012		16.51	0.0	0.0	0.0	-	16.51	46.19
	2012-2013		**40.74**	**0.0**	**0.0**	**0.0**	**6.72**	**47.46**	**93.65**
Target/LOM MOP	Year 1	**2012 - 2013**	**22.0**	**0.0**	**3.7**	**0.0**	**-**	**25.7**	**80.38**
	Year 2	2013 - 2014	21.6	0.0	0.0	0.0	-	21.6	101.98
	Year 3	2014 - 2015	22.4	0.0	0.0	0.0	-	22.4	124.38
	Year 4	2015 - 2016	23.5	0.0	0.0	0.0	-	23.5	147.88
	Year 5	2016 - 2017	15.1	0.0	0.0	0.0	-	15.1	162.98
	Year 6	2017 - 2018	24.0	0.0	0.0	0.0	-	24.0	186.98
	Year 7	2018 - 2019	14.3	0.0	0.0	0.0	-	14.3	201.28
TOTAL			189.3	0.0	3.7	0.0	-	-	201.28
REMAINING***			188.1	180.0	0.0	47.9	-	-	404.0

* Period aligns with WCC's annual statutory reporting dates 1st April to 31st March; ** Approval of DA 172-7-2004 MOD 5 for an extension to the eastern emplacement required 5ha of existing rehabilitation to be re-disturbed; *** Remaining rehabilitation to be completed by mine closure following ongoing mining until the resource is exhausted at WCC beyond this MOP period.

The LOM MOP/RMP discusses rehabilitation of the overburden emplacement along Werris Creek Road, in particular the proposed Acoustic and Visual Amenity Bund (MOP Section 3.4.3) which is to be constructed along the northern and eastern perimeter of the open cut and between the road. The Acoustic and Visual Amenity Bund will provide a physical barrier between Werris Creek Road and the mine to prevent offsite visual and lighting impacts of mining operations. As soon as practical after the bund is constructed, it will be topsoil and sown with a cover crop. The bund will be treated as woodland rehabilitation and will be revegetated in accordance with **Section 8.5**. To offset the short term visual impact of the construction of Acoustic and Visual Amenity Bund, WCC have planted a vegetation screen along the road and on the bund in the south, between the mine entrance and the former council quarry access road. A vegetation screen was planted in September 2010 between Werris Creek Road and Cintra Hill (see MOP) to shield the construction of the Acoustic and Visual Amenity Bund when viewed from the north. Given the proximity of a powerline to the north of the former council quarry access road, revegetation can only be undertaken once the rehabilitation of the bund is complete.

8.4 Seed Collection and Propagation

Where possible, seed identified either opportunistically or during Pre-Clearing Inspections will be collected onsite. Any tree or shrub seed collected will be given to local nurseries to propagate. Any native grass seed harvested would be broadcast sown over rehabilitation areas with a cover crop on the next available occasion. Subject to commercial availability and seasons, the majority seed and plants (either hikos or tubestock) to be planted within the BOA and Rehabilitation Areas will be sourced from local nurseries that supply endemic White Box Woodland species local to the area (Quirindi and Liverpool Plains provenance). Potential target species by vegetation type are presented in **Table 16**.

Native seed collected for the BOA should follow the principles developed by Ralph (2000) and Florabank (2008). These principles include:

- Obtaining the necessary permits and property permission (where required);
- Collecting a maximum of 15% of the seed from one plant;
- Collecting a maximum of 20% of the seed from a particular species from one seed collection site;
- Avoiding or minimise damage to sites and native vegetation;
- Collecting local provenance seed to maintain genetic diversity; and
- Labelling seeds and storing correctly.

In correspondence dated 3rd May 2013 from an OEH Scientific Licensing Officer, WCC does not require a Scientific Licence for activities approved by PA 10_0059 (including this BOMP). Therefore WCC restoration projects with EEC's and threatened species such as native seed harvesting do not require separate licensing from OEH.

Table 16: Target species for seed collection and notes on collection (also refer to Table 17 for species per vegetation type and strata).

SPECIES	COMMON NAME	COLLECTION/GERMINATION AND NOTES
Trees		
Eucalyptus albens	White Box	Collect January to May, suitable for direct seeding, 150 viable seeds/gram
Eucalyptus meliodora	Yellow Box	Collect January to June, 200-400 viable seeds/gram
Angophora floribunda	Rough-barked Apple	45 viable seeds /r gram. Collect during warmer months.
Eucalyptus blakelyi	Blakely's Red Gum	600-700 viable seeds / gram. Collect October to March.
Shrubs & Small Trees		
Callitris glaucophylla	White Cypress-pine	Collect late November – April, 10-20 viable seeds/gram, use seed within 12 months
Bursaria spinosa	Blackthorn	Collect January to May, 80 viable seeds/gram
Dodonaea viscosa		Collect mid October to early January, 100-200 viable seeds/gram
Brachychiton populneus	Kurrajong	Hand pick in December to January, suitable for direct seeding 37-69 viable seeds/gram
Hypericum gramineum	Small St Johns-wort	
Grasses and ground cover		
Austrostipa scabra ssp. scabra	Rough Speargrass	Collect December to February, highly suitable for hand seeding
Austrostipa verticillata	Slender Bamboo Grass	
Cymbopogon refractus	Barbed Wire Grass	Collect December to February, 1350 viable seed/gram
Bothriochloa macra	Red-leg Grass	Collect December to February, suitable for hand seeding, 300 viable seed/gram
Chloris truncata	Windmill Grass	Collect November to March, 835 viable seed/gram
Imperata cylindrica	Blady Grass	Collect December to February.
Microlaena stipoides	Weeping Grass	Collect November to December, 90 viable seed/gram
Calotis lappulacea	Yellow Burr-daisy	Collect January to February, suitable for hand seeding, 500 viable seed/gram

SPECIES	COMMON NAME	COLLECTION/GERMINATION AND NOTES
Chrysocephalum apiculatum	Common Everlasting	Collect December to January, moderately suitable for direct seeding, 11600 viable seeds/gram
Dichondra sp A.	Kidneyweed	Moderately suitable for direct seeding, hand pick capsules, usually grown by division
Dichopogon fimbriatus	Nodding Chocolate Lilly	Collect December to January, hard to source large quantities, store 2-3 months before sowing, 400 viable seeds/gram
Einadia nutans	Climbing Saltbush	Collect April to May, highly suitable for direct seeding, 1000 viable seeds/gram
Geranium solanderi	Native Geranium	Hand pick the well developed fruits and allow to dry in warm place, collect December to February.
Vittadinia cuneata	Fuzzweed	Collect November to January, 770 viable seed/gram
Vittadinia muelleri	Daisy	Collect November to January, highly suitable for hand seeding, 1408 viable seeds/gram
Wahlenbergia gracilis	Australian Bluebell	Collect December to February, hard to source seed in large quantities,
Glycine clandestina	Twining Glycine	Collect October to February.

8.5 Revegetation

WCC will encourage and assist natural regeneration of the vegetation community where ever possible as the preferred method of revegetation of the BOA. Areas of low resilience such as the Rehabilitation Area will utilised direct seeding and planting methods of revegetation; and maybe implemented in other areas of the BOA where natural regeneration is lagging.

8.5.1 Revegetation Species Composition

Species richness of each vegetation community at WCC is guided by the NSW biometric vegetation community benchmark for the Namoi Catchment Area, (http://www.environment.nsw.gov.au/biobanking/VegTypeDatabase.htm, DECCW, 2008). If direct seeding and/or planting is undertaken then actual species used in revegetation may be affected by availability of local seed resources or subject to commercial availability and season. Where ever possible, seed and tubestock is to be of local provenance. **Table 17** outlines the key species to be used during revegetation for each biometric vegetation type, though other species that occur locally in the respective communities may also be used.

Table 17: Suggested species suitable for revegetation per Vegetation Community

NATIVE BIOMETRIC VEGETATION TYPE	BENCHMARK SPECIES DIVERSITY	STRATA	PREFERRED SPECIES
White Box grassy woodland	23	Canopy	*Eucalyptus albens* (White Box); *Eucalyptus blakelyi* (Blakely's Red Gum); *Eucalyptus melliodora* (Yellow Box); *Angophora floribunda* (Rough Barked Apple)
		Mid-storey/ shrub	Generally sparse but could include *Brachychiton populneus* (Kurrajong)
		Ground layer	*Bothrichloa macra* (Queensland Red Grass); *Aristida ramose* (Wire Grass); *Chloris truncata* (Windmill Grass); *Sporobolus creber* (Slender Rats Tail Grass); *Austrodanthonia racemosa* (Wallaby Grass); *Cymbopogon refractus* (Barbed Wire Grass); *Stipa verticillata* (Slender Bamboo Grass); *Wahlenbergia communis* (Tufted Bluebell)
Yellow Box - Blakely's Red Gum grassy woodland	23	Canopy	*Eucalyptus blakelyi* (Blakely's Red Gum); *Eucalyptus melliodora* (Yellow Box); *Angophora floribunda* (Rough Barked Apple)
		Mid-storey/ shrub	Generally sparse but could include *Brachychiton populneus* (Kurrajong)

NATIVE BIOMETRIC VEGETATION TYPE	BENCHMARK SPECIES DIVERSITY	STRATA	PREFERRED SPECIES
		Ground layer	*Austrostipa aristiglumis* (Plains Grass); *Dichanthium sericeum* (Queensland Blue Grass); *Bothrichloa macra* (Queensland Red Grass); *Aristida ramosa* (Wire Grass); *Chloris truncata* (Windmill Grass); *Sporobolus creber* (Slender Rats Tail Grass); *Austrodanthonia racemosa* (Wallaby Grass); *Cymbopogon refractus* (Barbed Wire Grass); *Wahlenbergia communis* (Tufted Bluebell); *Cheilanthes sieberi*
Plains Grass grassland	17	Canopy	Mostly absent
		Mid-storey/ shrub	Absent
		Ground layer	*Austrostipa aristiglumis* (Plains Grass); *Dichanthium sericeum* (Queensland Blue Grass); *Bothrichloa macra* (Queensland Red Grass); *Aristida ramosa* (Wire Grass); *Chloris truncata* (Windmill Grass) *Austrodanthoniabipartita*.
White Cypress Pine - Silver-leaved Ironbark - Tumbledown Gum shrubby open forest	30	Canopy	*Eucalyptusdealbata* (Tumbledown Red Gum); *Callitris glaucophylla* (White Cypress Pine); *Eucalyptus albens* (White Box)
		Mid-storey/ shrub	*Notelaea microcarpa* (Native Olive), *Olearia elliptica* (Sticky Daisybush), *Pimelea neo-anglica* (Poison Pimelea); *Bursaria spinosa subsp. spinosa* (Blackthorn), *Leucopogon muticus*, *Cassinia quinquefaria*.
		Ground layer	*Bothrichloa macra* (Queensland Red Grass); *Aristida ramosa* (Wire Grass); *Chloris truncata* (Windmill Grass); *Sporobolus creber* (Slender Rats Tail Grass); *Austrodanthonia racemosa* (Wallaby Grass); *Cymbopogon refractus* (Barbed Wire Grass); *Stipa verticillata* (Slender Bamboo Grass); *Wahlenbergia communis* (Tufted Bluebell)
Rough-barked Apple riparian forb/grass open forest	25	Canopy	*Angophora floribunda* (Rough Barked Apple); *Eucalyptus blakelyi* (Blakely's Red Gum); *Eucalyptus melliodora* (Yellow Box)
		Mid-storey/ shrub	*Notelaea macrocarpa* (Native Olive)
		Ground layer	*Lomandra longifolia* (Mat Rush), Dichondra sp. A (Kidney Weed); *Microlaenastipoidesvar. stipoides*; *Geranium solanderi*; *Bothrichloa macra* (Queensland Red Grass); *Aristida ramosa* (Wire Grass) *Stipa verticillata* (Slender Bamboo Grass)
White Box - White Cypress Pine shrubby	26	Canopy	*Eucalyptus albens* (White Box); *Callitris glaucophylla* (White Cypress Pine); *Eucalyptus dealbata* (Tumbledown Red Gum)

NATIVE BIOMETRIC VEGETATION TYPE	BENCHMARK SPECIES DIVERSITY	STRATA	PREFERRED SPECIES
open forest		Mid-storey	*Callitris glaucophylla* (White Cypress Pine); *Brachychiton populneus* (Kurrajong); *Olearia elliptica* (Sticky Daisybush); *Notelaea microcarpa var. microcarpa* (Native Olive); *Cassinia quinquefaria*, *Dodonaea viscose*; *Bursaria spinosa subsp. spinosa* (Blackthorn).
		Ground layer	*Aristidaramosa*; *Desmodium brachypodum*, *Cymbopogon refractus* (Barbed Wire Grass); *Cheilanthes sieberi*; *Dichondra species A*.
Rusty Fig - Wild Quince - Native Olive dry rainforest	35	Canopy	*Ficus rubiginosa* (Rusty Fig); *Alectryon subdentatus* (Wild Quince); *Notelaea microcarpa var. microcarpa* (Native Olive)
		Shrub	*Alectryon forsythii* (Gorge Alectryon); *Olearia elliptica* (Sticky Daisybush), *Pandorea pandorana*
		Ground layer	*Oplismenus aemulus*; *Microlaena stipoides var. stipoides*; *Dichondra species A*; *Pellaea calidirupium*

Note: planting density is given as the indicative number required to achieve benchmark cover designs for each vegetation community but actual planting densities will vary because of local conditions (slope, rocks, soil, fallen timber) existing plants in planting area and heterogeneous plant spacing in the field.

Given the former agriculture land use of the BOA, there is potential that soils could contain high levels of nutrients that would be prohibitive to growth and restoration. Annual soil analysis (**Section 9.1**) will identify if such sites exist and methods to reduce soil nutrients (Phosphorus and Nitrogen) such as scalping will be considered.

8.5.2 Revegetation Stages

WCC revegetation methods to restore woodland vegetation communities across the BOA and Rehabilitation Areas comprise of three stages of cover crop, overstorey and under storey revegetation strategies. The removal of grazing pressure by cattle and goats from the BOA will aid overall revegetation of the BOA with the following methods complementing restoration of the woodland vegetation communities at WCC.

8.5.2.1 Cover Crop

Cover crop is applicable to the Rehabilitation Area and other disturbed areas only. After the soil has been respread, a seasonal cover crop is sown as soon as practicable to stabilise the soil and prevent erosion and out compete potential colonising weed species.

8.5.2.2 Overstorey Revegetation

To encourage natural overstorey regeneration across the BOA, WCC will implement weed (**Section 8.7**) and fire (**Section 8.13**) management to reduce competition from weeds and grasses and together with the removal of stock grazing should increase access to resources for germination and seedling growth for all vegetation communities and condition classes. The high resilience areas are more likely to have natural regrowth of revegetation are identified as zones surrounding and within Class 4 woodland areas (**Figure 5**). Focusing on overstorey revegetation is known as the “top down” restoration strategy.

If after sufficient time (~5 years) or for low resilience restoration sites; active revegetation methods will be required to complement natural regeneration. In particular, overstorey revegetation will be

undertaken for the Rehabilitation Area and BOA Class 1 and Class 2 areas. Overstorey revegetation of condition Class 1 and 2 sites will depend on the amount of the native understorey present. Given the open woodland nature of the vegetation communities being restored, planting of overstorey species will be the preferred method to control both stem density and species richness that cannot be achieved from direct seeding. Undertaking good site preparation of planting areas prior to revegetation is important.

Generally, site preparation of the planting areas will follow the methodology from Chapter 2 by David Carr in Lindenmayer, Crane & Michael (2010) to minimise mortality and increase both survival and growth. Sites to be planted are to be sprayed to control competing grasses by either spraying the entire site out or just 1m diameter for individual plants if understorey is to be retained. Soil is to be loosened mechanically such as by ripping (if practicable), augering or digging to create a depression that will increase soil moisture. Site preparation should be completed over a period of 6 to 12 months ahead of planting unless adequate soil moisture is already present or other factors that prevent delaying planting.

The actual revegetation methods used will be determined for each campaign, however indicatively overstorey tubestock/hiko species are planted into holes 0.15-0.3m deep by a mechanical auger, pottiputki or mattock and depending on the prevailing weather conditions, a native tree fertiliser pill and water saving crystals may be added. The hole is to be back filled to create a basin for increased surface water retention and each plant watered in at time of planting (depending on the conditions).

The overstorey species are indicatively planted at a 10mx10m aiming to replicate a 100 stem/ha typical woodland density. At this density for Grassy White Box woodland this allows for up to 70% mortality which would achieve the minimum 30 stems/ha overstorey (Lindenmayer et. al. 2005). For other vegetation communities, 100 stems/ha is close to the approximate benchmark densities particularly for shrubby and open forest communities. **Table 17** provides the species to be used during revegetation according to the different vegetation types, with the species listed in descending order of dominance.

8.5.2.3 Understorey revegetation

Understorey woodland revegetation mainly relates to the Rehabilitation Area and vegetation Class 1 and 2 within the BOA. Given the existing diversity of native grasses across the BOA, natural regeneration of the understorey can be encouraged through weed and fire management together with the removal of stock grazing. Native grasses are resilient to fire and regenerate quickly, therefore controlled burns can remove weeds (particularly exotic annual grasses) from grassland but also reduce plant densities to improve access to light and moisture as well as improve the health of the grassland by promoting nutrient recycling and removing biomass. Spraying can control exotic species reducing the competition with native species. Slashing is another method that can reduce biomass and shading in grassland. The timing of both slashing and burning must consider the season, observations of biomass and both native and exotic seeding. Slashing and targeted burning (i.e. with a weed burner) would ideally be implemented prior to weeds setting seed (e.g. in early to mid spring). Burning to control biomass should generally occur after mid to late autumn, once native grasses have set seed and as a cool low intensity ecological burn.

If after sufficient time (~5 years) or for low resilience restoration sites; active revegetation methods will be required to complement natural regeneration. Understorey revegetation of Rehabilitation Areas combines lightly tyning the soil surface to improve soil-seed contact in Autumn during the period that native grasses are flowering allowing the wind to disperse the seed from within the rehabilitation or from adjacent native grasslands. WCC also harvests native grass seed from the BOA to be sown on the Rehabilitation Areas. Native grasses harvested are lightly passed through a hammer mill to reduce the awns and improve broadcast spreading. The native grass seed (as harvested from the BOA) is

mixed with an Oats cover crop seed to bulk the seed mix to further improve its spread ability. No fertiliser is used in understorey revegetation because the natives have a competitive advantage to exotic weeds in low nutrient soils.

If natural regeneration and assisted/broadcast seeding does not achieve the require understorey revegetation, then more intensive understorey revegetation methods can be implemented. Where significant weed or cropping species are present (Class 1 or 2 sites), weed management and ground preparation including broad herbicide application, soil scraping, and fallow with weed spraying periods will be required prior to understorey revegetation (Gibson-Roy et al., 2010a). Following weed management and soil preparation, understorey revegetation techniques will include direct seeding of multiple species seed mixes (representative species of the community that is being restored) (Gibson-Roy et.al. 2010b). Timing of direct seeding will depend on local weather conditions and rainfall though it is generally thought that late summer or early spring achieves successful results (Gibson-Roy et.al. 2010b). The ultimate goal is for Class 1 and 2 vegetation is to increase native species richness and density to reach Class 3 vegetation condition.

Beyond the period of this BOMP, it is envisaged that assisted revegetation of the less common or more sensitive native grasses, herbs and forbs may be required for the understorey. This would only occur once the Class 3 condition vegetation reaches a level of a sustainable grassland or species have not naturally regenerated within Class 4 sites.

8.6 Habitat Augmentation

A number of specific management actions have been formulated to manage the impact of mining activities by replacing the diversity of habitats used by both common and threatened species occurring or considered likely to occur at WCC. These habitats are crucial for the provision of shelter, food, water and other habitat functions required for species to survive. Habitat augmentation involves the anthropogenic construction of items that replicates natural features in woodland ecological communities that provide habitat for native fauna. Habitat augmentation will principally occur within the Rehabilitation Area but will also be implemented across the BOA where required.

8.6.1 Terrestrial and arboreal habitat structures

Due to the time lag in establishing woodland habitat within restoration areas, WCC propose to install habitat structures to improve habitat diversity and facilitate fauna recolonisation of the Rehabilitation Area and to improve habitat connectivity across the BOA where required. Augmentation measures include stag trees, coarse woody debris, nest boxes and rocks.

Where practicable, trees and timber salvaged from the clearing area will be used as stag trees or coarse woody debris in the Rehabilitation and BOA. Pieces of salvaged woody debris are typically snigged (towed) by a dozer from the pre-strip side of the open cut mine, around the active mining area to the rehabilitation area at the southern end of WCC (**Plate 7a**). Timber/trees that are erected vertically to replicate naturally occurring dead trees in the woodland landscape are known as stag trees. The stag tree habitat augmentation process starts with pits excavated in the rehabilitation area to a depth equivalent to one third of the length of the timber to ensure that approximately half the weight of the timber is in the ground to balance the upper exposed portion of the tree (**Plate 7b**). An excavator lifts the woody debris into the hole with a dozer infilling and compacting the material (overburden/spoil and soil) around the base of the augmented stag tree (**Plate 8**).

Plate 7a: Dozer snigging timber on rehabilitation area and 7b: Excavator and dozer installing augmented stag tree in rehabilitation area.

Augmented stag trees are selected based on the size and strength of the timber. The shortest length of woody debris used should be 5m so that the actual height off the ground, as a minimum, represents the height of a small tree. The maximum weight for each piece of woody debris is also a limiting factor in that a dozer snigging and/or an excavator can only safely lift timber off the ground that it can adequately counter balance. For example, the maximum stag tree weight a 20t excavator could lift is 10t. While some augmented stag trees may have hollows present, it was preferred if the woody debris at installation is not decomposed that would affect the short term integrity of the timber. The selected timber for stag trees therefore would initially have minimal hollows ensuring that augmented stag tree will not immediately breakdown and can last sufficiently long; allowing hollow forming processes to commence in the future at a time when the rehabilitation can sustain faunal habitation. Based on the persistence of hollow bearing stag trees on the Eurunderee property from ring barking anecdotally in the 1930s, WCC is confident that stag trees will be able to provide habitat in excess of 100 years to compensate for the lag between the initial overstorey tree planting and the time that the revegetation reaches maturity and provides the full diversity of aboreal habitat fauna. In addition to hollows that augmented stag trees will provide in time, stag trees provide a range of other habitat niches that are immediately available after initial installation such as roosting, perching, hawking (vantage point) and nesting habitat for avian fauna that is currently subject to a Masters of Science research project "Arboreal Habitat Augmentation of Grassy White Box Woodland Restoration" (Wright, unpublished). To date, WCC have installed 28 stag trees and over 40 pieces of coarse woody debris across the rehabilitation area (**Figure 7**).

Coarse woody debris habitat differs from stag trees by being snigged into position and placed parallel to the rehabilitation surface. Coarse woody debris habitat is limited to a maximum size that can be safely snigged from the prestrip area by a dozer, typically 20t for a D10. Coarse woody debris provides habitat for ground dwelling fauna such as shelter for birds, mammals and reptiles, while also providing a microclimate for seed germination and a substrate for macro-invertebrates.

The salvage of timber from the clearing area is not always practicable due to:

- excessive distances between the clearing and rehabilitation area (>2km);
- the location of active mining or other infrastructure areas preventing snigging timber from the clearing area through or around to the rehabilitation;
- timber or trees of a size, dimension or weight in excess of what is safe to snig to the rehabilitation or to install as augmented stag trees; and
- timber or trees too small, decomposed or weak to be snigged safely or of useful habitat for stag trees or coarse woody debris.

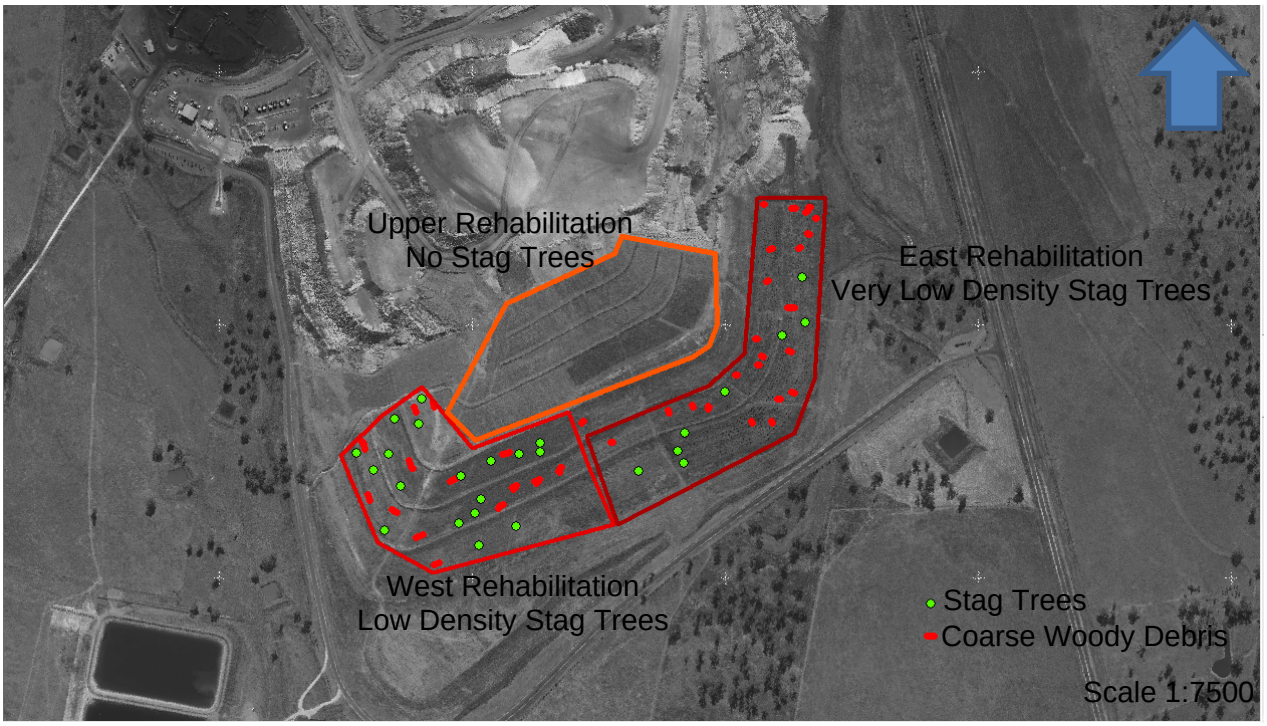

Figure 7: Location of stag trees and coarse woody debris augmented habitat at WCC

Nest boxes will be installed within Rehabilitation and BOA once revegetation is of sufficient maturity; or placed on stag trees or other mature trees in the BOA to supplement arboreal habitat (**Plate 8**). Nest boxes trees will be maintained and monitored within rehabilitation areas for the life of the mine to support use by hollow obligate species. Nest boxes will be used in preference to harvesting hollows from habitat trees in the clearing area because of Whitehaven Coal Group Safety procedures that prohibit the use of chainsaws and petrol powered devices at all open cuts. Pending any review to the procedures around the use of chainsaws, WCC will investigate the appropriate safe methods of hollow harvesting and installation within Rehabilitation and BOA.

While bush rock could be salvaged from the clearing areas, given the extended history of disturbance by agricultural and extractive industries onsite there is limited bush rock habitat. However, the mining process generates rock material and this is readily available in the overburden emplacement to be selectively placed within rehabilitation areas to provide shelter and basking habitat for reptiles.

8.6.2 Aquatic habitat structures

WCC will specifically create ephemeral aquatic habitat within Rehabilitation Areas, Biodiversity Offset Areas and adjacent to existing dams to be retained. Optimal habitat includes marshes, dams and streams with sedges and common rushes in unshaded locations, nearby grassland and sheltering sites of vegetation and rocks (**Plate 8**).

Plate 8: Habitat tree re-instatement (ELA 2010b) in the rehabilitation area, aquatic habitat and coarse woody debris placement (aquatic habitat, rock placement and nest box images by T Drysdale (AECOM 2010))

8.6.3 Food Resources

The plant species that have been selected as part of revegetation (**Section 8.5**), once established, will provide key forage habitat for a range of fauna, including threatened species based on the analysis of required habitat (**Section 4.6)**. In particular seasonal flowering eucalypt species, such as *Eucalyptus albens*, will provide winter inflorescence for winter migrants (i.e. Swift Parrot and Regent Honeyeater) as well as browse trees for other fauna such as Koala.

8.7 Weed Management

Weed management can be divided into control works/programs for noxious weeds and environmental weeds. Periodically WCC will engage a consultant to map weeds across the BOA to monitor changes in infestations and measure abundance. The baseline weed survey was undertaken in March 2013 with the results outlined in **Figure 8** and **Table 18**. After a couple of weed surveys are completed, this information will be used in time to develop specific completion criteria for weed management of the BOA. Surveillance of weed infestations is undertaken by informal (observation) and formal methods such as the quarterly inspections and weed surveys. WCC utilises only qualified weed control contractors that hold appropriate herbicide accreditation in accordance with the Pesticides Act 1999. In accordance with the legislation, WCC retains copies of the accreditation and daily records of weed control including the targeted weed, herbicide used, location and prevailing weather conditions. WCC also uses non-chemical weed control practices such as manual removal and slashing depending on the weed and season. Other methods such as low intensity ecological burns may be considered in time (**Section 8.13**).

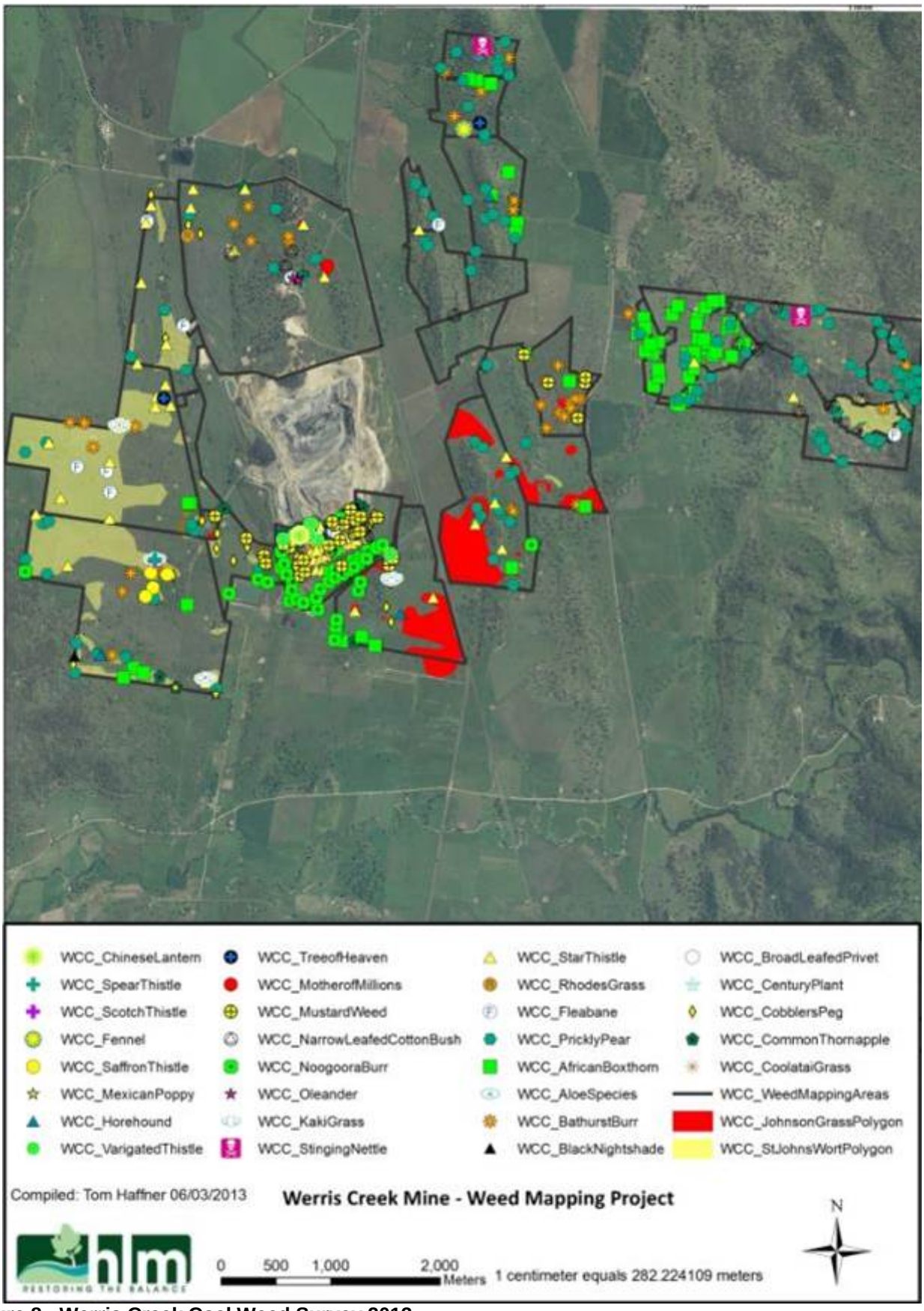

Figure 8: Werris Creek Coal Weed Survey 2013

Table 18: WCC Weed Control Program by Location and Infestation Size

WEED NAME	SCIENTIFIC NAME	NOXIOUS	TIMING	LOCATION – Area of Weed(ha)							
				MINE			EURUNDEREE	HILLVIEW	RAILWAY VIEW	MARENGO	GREENSLOPES /BANOOL
				REHAB	SOUTH	NORTH					
Spiny Burr Grass	*Cenchrus incertus*	W4	Sept	2	-	-	-	-	-	-	-
St John's Wort	*Hypericum perforatum*	W4	Oct to Feb	-	-	0.98	174	-	-	19	-
Prickly Pear	*Opuntia stricta*	W4	Aug	-	-	0.8	24	7	8	26	28
Noogoora Burr	*Xanthium pungens*	W4	Jan to Mar	13	-	-	0.25	-	1.5	-	-
Bathurst Burr	*Xanthium spinosum*	W4	Jan to Mar	-	-	1.8	6	-	4	0.5	0.6
Johnson Grass	*Sorghum Halepense*	W4	Feb	-	-	0.5		-	79	-	0.25
African Box Thorn	*Lycium ferocissimum*	W4	Mar	-	-	-	2.5	-	1	32	2
St Barnabys Thistle	*Centaurea soltitialis*	-	July to Mar	6	-	1.5	5	-	0.25	0.25	0.25
Tree of Heaven	*Ailanthus altissima*	-	June to July	-	-	-	<0.25	-	-	-	<0.25
Saffron Thistle	*Cathamus lanatus*	-	Oct	-	-	-	3.7	-	-	-	-

8.7.1 Noxious Weeds

WCC prioritises its weed control program by focusing on the noxious weeds as scheduled within the Liverpool Plains Local Government Area in accordance with the Noxious Weeds Act 2003. Given the previous agricultural land use and disturbance history, the BOA does contain a number of noxious weeds across a number of properties. **Table 18** outlines all the noxious weeds in order of priority targeted by WCC across the BOA and an estimate at the size of infestation. Spiny Burr Grass, St Johns Wort and Prickly Pear have the highest priority to be controlled.

8.7.2 Environmental Weeds

Several environmental weeds occur within the WCC and BOA, with severity of infestations dependant on vegetation condition classes and season. Generally speaking Class 1 and Class 2 vegetation within the BOA has the highest weed infestations and lowest native species richness. Environmental weeds will be targeted across the Rehabilitation and BOA (in particular targeting three environmental weeds in **Table 18**) whenever resources are available not targeting noxious weeds.

8.8 Vertebrate Pest and Overabundant Native Herbivore Management

WCC have devised a strategy for the management vertebrate pest and overabundant native herbivore species based around routine monitoring of vertebrate pests and native herbivores.

Vertebrate pest management in the BOA will focus on *Vulpes vulpes* (Fox), however *Felis catus* (Feral Cats) are likely to be present and their control will be undertaken if practical. These species have the potential to have detrimental effects on the biodiversity of the BOA. Vertebrate pests are known to impact upon native species diversity through competition with native predators (e.g. Little Eagle and *Dasyurus maculatus* (Spotted-tailed Quoll)) and through predation of native fauna, including birds (threatened and non-threatened woodland birds), small mammals and reptiles.

Feral pest and native herbivore management is to be undertaken in a responsible and humane fashion. Any pest control undertaken onsite will be in accordance with industry guidelines and the relevant legislation as outlined below in the relevant sections.

8.8.1 Vertebrate Pest Monitoring

Vertebrate pest monitoring involves periodic sandpad monitoring and motion camera surveillance. Sandpads will be set up across the BOA and monitored through either daily inspections or motion cameras. Sandpad monitoring techniques follow the CSIRO Sandplot monitoring methodology to determine which pests are present and statistically estimate the population size and whether a control program is undertaken. All observations are to be recorded and documented in a monitoring or inspection report and the pest management strategy may require adjustment depending on the results of monitoring.

The results of the baseline sandpad monitoring and the two fox baiting programs undertaken by WCC to date are outlined in **Table 19**. **Table 20** presents the sandplot methodology abundance ratings for ground-dwelling vertebrates in NSW eucalypt forests (The Sand Plot Technique: Sampling Ground-dwelling Vertebrates, NSW DEC and CSIRO, 2005). After a couple more sandpad and baiting programs are completed, this information will be used in time to develop specific completion criteria for pest and native herbivore management of the BOA.

Table 19: Results of Vertebrate Pest Monitoring and Baiting Programs at WCC

TARGET SPECIES	SANDPAD ABUNDANCE June 2012	SANDPLOT GUIDELINE	BAIT CONSUMPTION June 2012	BAIT CONSUMPTION March 2013
Fox	41	High	31.5% 17 of 54 presented	9.8% 17 of 174 presented
Macropod	35	High	Not Baited	Not Baited
Rabbit	3	Low	Not Baited	Not Baited
Pig	1	-	Not Baited	Not Baited

Table 20: Abundance Ratings for ground-dwelling vertebrates in NSW (DPI & CSIRO)

TARGET SPECIES	MINIMUM	MAXIMUM	SCARCE	LOW	MEDIUM	HIGH
Wild Dog	0.8	37.2	<5	5<10	10-20	>20
Fox	1.5	57.6	<5	5<15	5-40	>40
Macropod	0.5	15.9	<2	2<5	5-10	>10
Rabbit	1.7	19.3	<2	2<5	5-10	>10
Cat	2.2	42.9	<2	2<5	5-15	>15
Hare	1.3	33.3	<5	5<50	10-20	>20
Brushtail Possum	0.5	27.0	<2	2<5	5-10	>10
Wombat	0.8	34.5	<2	2<5	5-15	>10

8.8.2 Fox (including Wild Dog and Cat) Management

WCC will undertake baiting programs based on the recommendations of the vertebrate pest monitoring. WCC utilises only qualified personnel that hold appropriate accreditation in accordance with the Pesticides Act 1999. In accordance with the legislation, WCC retains copies of the accreditation and daily records of pest control including the targeted pest, poison used, location and prevailing weather conditions. WCC or pest contractor will liaise with Livestock Health and Pest Authority (LHPA) regarding the proposed baiting program and obtain the 1080 poison. Baiting methods are to align with the Code of Practice and Standard Operation Procedures – Ground Baiting of Wild Dogs and Foxes with 1080 – produced by NSW DPI. Prior to any baiting, neighbours within a 1 km radius of the baiting properties are to be notified 3-10 days prior to baiting.

Sodium monofluoroacetate (1080) is an odourless and tasteless poison that is added to meat baits to target foxes and wild dogs. Anecdotal observations and vertebrate pest monitoring have not identified any wild dogs within the BOA. Therefore, only baiting for foxes has been undertaken to date with success because of the initial high percentage of baits taken (**Table 19**) due to no recent experience with baiting. Bait stations are established by burying the poisoned meat bait adjacent to known track across the BOA depending on monitoring results. A fox attractant sprayed over the site to increase the potential of the bait to be found. Burying the bait minimizes the potential for a non-target species take and increases chance of identifying the animal. 1080 poison is harmless to native animals because the chemical compound is endemic to Australia and native animals have developed a resistance to the poison.

While 1080 is lethal to cats, it is not a scheduled method of control. Cats are likely to be present across the BOA and therefore a trapping and euthanisation program will be implemented where required by monitoring. In addition, trapping and night time shooting methods are other options that can be used by WCC to control foxes, wild dogs and cats across the BOA.

8.8.3 Rabbit Management

WCC will undertake baiting programs as determined by vertebrate pest monitoring to control *Oryctolagus cuniculus* (Rabbit). WCC utilises only qualified personnel that hold appropriate

accreditation in accordance with the Pesticides Act 1999. In accordance with the legislation, WCC retains copies of the accreditation and daily records of pest control including the targeted pest, poison used, location and prevailing weather conditions. WCC or pest contractor will liaise with LHPA regarding the proposed baiting program and obtain the Pindone poison. Pindone poison targets rabbits because of their low lethal dose threshold. Baits for rabbits are usually fermented oats with a period of free feeding required (i.e. un-poisoned baits to attract rabbits to feed at a site) before Pindone applied baits are placed in the field. Other measures that could be considered by WCC to control rabbit populations include ripping of warrens, trapping or shooting.

8.8.4 Feral Pig and Goat Management

Current monitoring results do not indicate that *Sus scrofa* (Feral Pig) are a significant issue across the BOA. Anecdotal observations and vertebrate pest monitoring have not identified any *Capra aegagrus hircus* (Wild Goat) within the BOA. WCC has previously undertaken a limited trapping trial for pigs without any success. However, if future monitoring events indicate that these species are an issue, trapping or ground shooting programs will be implemented.

8.8.5 Overabundant Native Herbivores

The current vertebrate pest and overabundant native herbivore monitoring program allows for the measure of native herbivore abundance. Flora and fauna monitoring also allows for observations to be recorded on herbivore abundance and impacts. Current monitoring results do not indicate that over-population of Eastern Grey Kangaroo is a significant issue across the BOA. If future monitoring events identify overabundant populations of Kangaroo, WCC will implement a shooting control program. Any proposed shooting program (including any shooting programs for pest species listed above) would require a detailed risk assessment and shooting plan developed and approved by WCC management. Also a current NSW Firearms License for the any shooter/s is a requirement. Unlike pests, because Kangaroo's are protected fauna within NSW, additional permits must be obtained from OEH under the National Parks and Wildlife Act 1974 for the shooter (Section 120 General Licence) and landowner (Section 121 Occupier's Licence). Passive management techniques for kangaroo populations (and also for goats and pigs) include the selective infilling of dams maybe considered across the BOA to disperse populations minimizing the potential for overgrazing.

8.8.6 Other Invasive Species

The presence, abundance and location of other invasive and aggressive species, such as Manorina melanocephala (Noisey Miner), Sturnus vulgaris (Common Starling) and Acridotheres tristis (Indian Myna) will be monitored during annual flora and fauna monitoring (**Section 9.4**). Where the annual flora and fauna monitoring report identifies trends towards increases in invasive and aggressive species, recommendations to control these populations may be implemented. Where native invasive species require control, as these are protected fauna within NSW, additional permits must be obtained from OEH under the National Parks and Wildlife Act 1974.

8.9 Fencing, Signage and Access Management

The WCC BOS has been planned to maximise the use of existing fences as boundaries for the BOA. Ongoing fence maintenance and access management to the BOA will be determined by informal observation, formal inspections and monitoring and will occur throughout the life of the mine. Fences and signage will be utilised to minimise potential for human disturbance either through authorised and unauthorised access as well as excluding stock by ensuring all relevant fences are stock proof. Where existing fences do not adequately restrict human or stock access from BOA, new fences will be

installed or repaired as required. Any new fences will consider using plain wire for the top and bottom strands to minimise the potential to catch native animals crossing with the fence. Additional to this, all internal fences will be removed over time depending on annual budgeting.

Signage to slow traffic movements along the mine access road will be installed to reduce the potential for vehicle collisions with fauna. This is considered adequate due to the limited grazing by native herbivores adjacent to the mine access road however specialised Koala and Eastern Grey Kangaroo deterrent fencing could be considered for high traffic and other operational areas if determined by risk that it is required and would be dependent on capital approval. Also there is minimal risk of human disturbance or unauthorised access within the mine boundary because the mine is staffed 24 hours per day ensuring there is regular surveillance particularly of the mine access road area. Signage will also be installed on all gates of the BOA outside of the mine site.

8.10 Narrawolga Axe Grinding Grooves and Aboriginal Heritage

During the development of the HMP, a search of the OEH Aboriginal Heritage Information Management System was undertaken that only identified three sites aboriginal heritage sites within 5km of WCC. Two of the known sites are to the north of the BOA and therefore not impacted by management of the BOA. The other known aboriginal heritage object at WCC is the Narrawolga Axe Grinding Groove site that was relocated to avoid being destroyed by mining in 2007. The Narrawolga Axe Grinding Groove site is currently temporary stored on the Eurunderee property adjacent to the Felstead sub domain. WCC has prepared a Heritage Management Plan (HMP) as required by Condition 32 of PA10_0059 and approved by DoP. The HMP has developed strategies to manage cultural heritage issues, impacts and discuss management strategies. The HMP outlines the process for the replacement of the Narrawolga Axe Grinding Grooves within the rehabilitation area after 2016, once the site that the grooves were originally located has been fully rehabilitated.

As there are no known aboriginal heritage sites within the BOA, it is not anticipated that there will be any potential conflicts between BOA restoration works and any aboriginal cultural heritage. If any unknown sites are found within the BOA, works will stop immediately and the notification process outlined in the HMP will be followed.

8.11 Erosion and Sedimentation Management

Soil erosion occurs when native vegetation has been removed exposing bare soils, making them susceptible to erosion where water flow is able to mechanically remove or disperse the soil. This often occurs along creek lines but can occur in bare paddocks where vegetation clearing or over grazing exposes bare soils. Bare soils in locations where high volumes of water occur can lead to severe soil erosion.

There is some potential for erosion to occur within the rehabilitation areas, with the performance criteria of erosion to not exceed 0.3m deep gully applying to this area only. Erosion within the rehabilitation area will be monitored through routine inspections by the environmental officer, LFA and other observations recorded during the flora and fauna monitoring. Erosion issues will be identified via this monitoring and inspection process and treated reactively to achieve the completion criteria.

There are a number of potential erosion issues within the BOA, in particular Black Gully in Sub-domain Hill which is deeply incised (**Plate 9**). This drainage channel is four to five metres deep and up to 20 metres wide in some areas. From quarterly monitoring of the creek line it appears since the removal of grazing that high flows are not causing active erosion and that the banks of the creek line are stabilising. This is evident through the presence of vegetation on the steep banks and no vertical walls being present along the creek line. Continued stock exclusion and quarterly monitoring will

determine the effectiveness of soil erosion management for Black Gully and if observation identifies that more active management or treatments are required, these will be implemented at that time.
No control of grassy or herbaceous weeds will occur along the creek line until there is greater than 50% cover of native vegetation, as all vegetation cover will aid in the stabilisation of the creek line. Selective weed control works will be required to prevent the creation of bare areas of soil.

Other incised gullies occur within the Valley and Upper Black Gully Sub-domains will also be monitored, though remediation is not at this stage considered necessary.

Plate 9: Example of gully erosion on the Railway View Domain.

8.12 Exclusion of Agriculture & Grazing

The grazing of the BOA by livestock has the potential to suppress the regrowth of native vegetation through physical damage causing soil compaction and erosion. Stock grazing will be excluded from the BOA by maintaining stock proof fencing around the boundary. Stock grazing will not be permitted on the BOA at any time.

8.13 Fire Management

The exclusion of grazing and agriculture from the BOA will aid restoration of the woodland vegetation communities; however, if not adequately managed, increasing biomass and fuel loads may create a fire hazard and create an imbalance between fire tolerant and fire sensitive species.

WCC commissioned an bushfire consultant to develop a Fire Management Strategy (FMS – HLM, 2013) to quantify current BOA fuel loads and determine what management actions are required (**Appendix I**). Long term fire management of the BOA will be implemented through measures such as hazard reduction, controlled (ecological) burns and maintaining fire fighting capabilities, which are summarised and discussed below.

The Protection of the Environment Operations (Clean Air) Regulation 2010 specifies that the burning of vegetation is prohibited except with approval in the LPSC local government area (Schedule 8 Part 2). While the Regulation has an exemption for bushfire hazard reduction work, discussions with the Rural Fire Service (RFS) indicated that they would not issue a hazard reduction certificate for controlled burns within the BOA due to concerns over the RFS's liability. The RFS indicated that WCC did not require any approvals under the Rural Fires Act 1997 as the activity was approved by PA10_0059 and EPBC Act Approval 2010/5577; unless any controlled burns were undertaken during

a fire permit period (typically September to March), then a Fire Permit would be required. WCC will obtain approval from Liverpool Plains Shire Council (Approval to Burn Vegetation) to comply with the Clean Air Regulation prior to undertaking any controlled burns. WCC will also notify the immediate neighbours to the proposed burn site and will place a community notice in the Werris Creek Flyer. WCC will consult with the RFS during the planning of any burns and afford the opportunity for local volunteer RFS brigades to be involved. If the RFS agree to be involved in the controlled burn, the RFS will appoint an incident controller and take over responsibility and management of the burn site.

8.13.1 Long Term Fire Management

The objectives of fire management across the BOA are:

- The protection of human life and safety;
- WCC mining operation asset protection and business continuity;
- Other infrastructure and rural asset protection on WCC owned land and adjacent private property; and
- Protection and maintenance of biodiversity within the BOA.

To achieve these objectives, WCC must balance between minimising fuel loads across the BOA to reduce risk of bushfires while also promoting ecological restoration of the BOA and increasing biomass. WCC propose to implement the following measures of hazard reduction, controlled (ecological) burns and maintaining onsite fire fighting capabilities. Local knowledge suggests that it has been a number of decades since any significant fire has occurred on WCC land. Based on no recent fire history, WCC's will target undertaking 100ha per year of control burns for the next 10 years. The goal being within the remaining life of the WCC mine, the majority of the BOA (~1320ha) will have had a controlled burn except for areas of sensitive vegetation (dry rainforest, creek and gullies) and inaccessible terrain remaining unburnt. This will allow WCC to monitor and assess what the appropriate fire intervals across the site acknowledging that research into fire intervals for grassy woodland have been suggested to be between eight and forty years (Bush Fire Coordinating Committee, 2008).

8.13.2 Bushfire Hazard Reduction

A fuel load assessment was undertaken by Hunter Land Management (HLM) in August 2012 as part of the FMS (**Appendix I**). Overall, the fuel loads across the BOA were low (<4t/ha); however, five sites recorded moderate fuel loads (4-8t/ha – Ryan, Ridge, Hillx2 and Flat) and three sites at Marengo property with high fuel loads (>8t/ha – Back Countryx2 and Ridge) as compared to Victorian Department of Sustainability and Environment Fuel Hazard Ratings. After a couple more fuel load assessments are completed, this information will be used in time to develop specific completion criteria for fire management of the BOA. These areas with higher fuel loads reflect areas that have had less grazing pressures, presumably due to their location on slopes and ridgelines. While these areas have a higher fuel load, this is not necessarily a bad management outcome because the result of successful woodland restoration is to increase biomass and biodiversity. The objective of fire management in these areas is to prevent a fire from igniting within; if a fire starts, then to prevent it from burning into or out of these areas.

The FMS also reviewed track condition, fire break condition and water accessibility and availability for the management of fires across the BOA. The FMS outlines a number of actions for WCC to implement over the next 3 years. One of the key actions was the establishment of fire breaks around the BOA (**Figure 9**). It is intended that boundary fire breaks will be maintained to 10m width and internal tracks acting as breaks will be maintained to 6m width in accordance with NSW Catchment Management Authority "Native Vegetation Management in NSW - What are the exemptions for routine

agricultural management activities in central NSW CMAs Info sheet 7c" (November 2005). Once established, maintenance of these breaks will be undertaken as required.

In additional to maintenance of tracks, breaks and water sources; WCC will implement other hazard reduction methods such as controlled (ecological) burns and paddock slashing. Burning and slashing reduce fuel loads by removing organic matter/biomass. The decision between what areas will have hazard reduction management will be determined by fuel load assessments, accessibility and obstacles in the field; and risks to humans/infrastructure/assets. As described below, there are other advantages to undertaking controlled burns at certain times of the year over slashing, that can enhance ecological restoration of the woodland vegetation communities and promote native species.

Figure 9: WCC BOA Fire Break Management.

8.13.3 Controlled Ecological Burns

Fire is an integral part of the Australian landscape and Australia's flora is adapted to be able to withstand and respond to the impact of fire. Different plant species utilise different responses to fire, including using fire to open woody seed pods, a reliance on fire at certain frequencies to provide an environment suitable for seeding or thick bark that protects plants from heat so the plant can re-sprout vegetatively. Ecological burns involve the use of fire to control exotic species and/or promote native flora species diversity, with fire being an important and often beneficial form of disturbance in box gum grassy woodland (Rawlings et al. 2010).

The long term fire management strategy for the WCC BOA is to target controlled burning 100ha per year. This will likely be completed during winter or early spring depending on the prevailing weather conditions and between the native grasses seeding and herbs/forbs flowering in autumn and spring respectively. Based on the experience gathered from the first series of ecological burns undertaken in August 2013, a controlled burn will be planned to be approximately 20ha and on average five burns will be undertaken per year. A controlled burn plan will be produced outlining key planning actions to be implemented and will be updated after the burn to map the exact area and a brief description of the burn outcomes and weather conditions. An example of a controlled burn plan is in **Figure 10**.

Planning for each controlled ecological burn will involve assessing the 20ha site in the field including:

- Fire breaks and whether further maintenance (slashing, dozing) is required;
- Water sources;
- Barriers (hills, ridges and fences); and
- Vegetation and habitat resources and whether small breaks (brushcutting/preburn around revegetation/regrowth, ground timber, stags and rocks) and where unburnt patches are required.

Burn sites will be assessed initially addressing areas of high fuel loads nearest to infrastructure but will be strategically selected to achieve a mosaic pattern across the BOA. Unburnt patches will be planned within or adjacent to burn sites. The decision to undertake a controlled burn will be made on the day based on the weather conditions by the RFS. Ecological burns are cool, low intensity fires that remove dry material but do not scorch native grasses and trees. This type of fire is easier to control because it is ignited on the downwind side of the burn site allowing the fire to burn into the wind. Preparations prior to the burn should have removed fuel loads around any revegetation or habitat to minimise the chance of burning or scorching as the “cool” fire front passes. Burning with the wind will be minimised to only when there is a light wind, sparse or green grass cover. The cool burn technique should remove weeds and open up the ground layer to provide access to resources for other native species. Given the low resilience of the rehabilitation area, controlled burns will not be considered for some time but fuel loads will be assessed overtime. Studies from Western Australia (Aloca, 2010) have shown that burning of 18 year old revegetation does not have any detrimental impact on forest restoration and improved the understorey vegetation by thinning the overstorey and releasing nutrients.

As described above, hazard reduction is required within the BOA to manage natural fuel load growth to mitigate uncontrolled fires particular in the derived grassland areas. Ecological burns could improve the condition of Class 3 grasslands while also installing buffer zones around the good Class 4 condition vegetation to mitigate potentially damaging hot wildfires. Fire management intent on managing annual exotic grasses should ideally occur in spring (i.e prior to seeding), whilst fire management to control biomass and increase native diversity could occur in autumn (Prober et al. 2004; Rawlings et al. 2010).

If any injured fauna are encountered during or post the controlled burn, the fauna will be wrapped in a blanket and placed in a cool, dark box to be delivered to nearest vet clinic (Quirindi). By using cool burn technics will minimise the chance of impacting on fauna because of the slow moving fire front, low flame height, leaving unburnt patches and burning around habitat features in each burn site will allow fauna to escape.

8.13.4 Fire fighting equipment

Controlled burns initiated by local RFS brigades will utilise RFS resources to manage and control fire. WCC will maintain adequate fire fighting capabilities on site to address and control any fire outbreaks in conjunction with and assist the Rural Fire Service and emergency services as required (Condition 40 Schedule 3 of PA10_0059). In particular:

- A provision of fire equipment will be kept on-site in accordance with the requirements of NSW Coal Mines Health and Safety Regulation 2008; and
- All fire fighting equipment will be kept in operational condition and routinely inspected to ensure that equipment is operational

Permanent water carts at WCC all are maintained with directional cannons and fire fighting hoses. The WCC mine rescue team train regularly in emergency response including fires. A Whitehaven Coal

requirement is that all vehicles approved to work onsite are as a minimum fitted with 9kg fire extinguishers and that staff are trained in the use of fire extinguishers as required.

Burn Plan Report		
Burn Plan Component	Details	Date
Burn Preparation Works	Boundaries of Site was slashed to 10m wide	28/06/13
	Juvenile and planted trees and logs where brush cut around to prevent excessive burning	05/08/13
Burn Day Conditions	Burn 1 (Flat Paddock) 12pm Humidity 47%, Temperature 16.7°C, Wind 347° @ 8.6m/s	06/08/13
	Burn 2 (North, Hill and Ridge Paddocks) 10am Humidity 47%, Temperature 16.7°C, Wind 347° @ 8.6m/s 12pm Humidity 43%, Temperature 21.3°C, Wind 233° @ 3.5m/s	13/08/13
Burn Ignition and Direction	Burn 1 (Flat Paddock) – ignition from south east corner – burnt into win – burn period from 12pm – 4pm	06/08/13
	Burn 2 (North Paddock) – ignition from south east corner – burnt into wind – burn period 10am – 1pm	13/08/13
	Burn 2 (Hill and Ridge Paddock) –ignition from main track on the southern side of site and burnt into wind – burn period 1pm – 6pm	13/08/13
Mop Up and Assessment	Burn 1 (Flat Paddock) – little to no mop up required – preparation work saved most trees and logs – cool burn	07/08/13
	Burn 2 (North) – little to no mop up required – preparation work saved most trees and logs – cool burn	14/08/13
	Burn 2 (Hill and Ridge Paddock) – some mop up required – several logs still burning following day – most regen was saved – some areas of hot burn due to time constraints	14/08/13

2013 1m² Quadrat Survey Results 24/06/13				
Quadrat	Bare Soil %	Leaf Litter %	Grass Cover %	Shrub/Tree %
A	<10%	<10%	80-90%	0%
B	<10%	<10%	80-90%	0%
C	<10%	10-20%	60-70%	<10%
D	<10%	10-20%	60-70%	<10%
E	<10%	30-40%	20-30%	10-20%
F	<10%	10-20%	60-70%	<10%
G	<10%	10-20%	60-70%	<10%
H	<10%	<10%	50-60%	10-20%
I	<10%	<10%	50-60%	10-20%
J	<10%	<10%	80-90%	0%
K	<10%	<10%	80-90%	0%

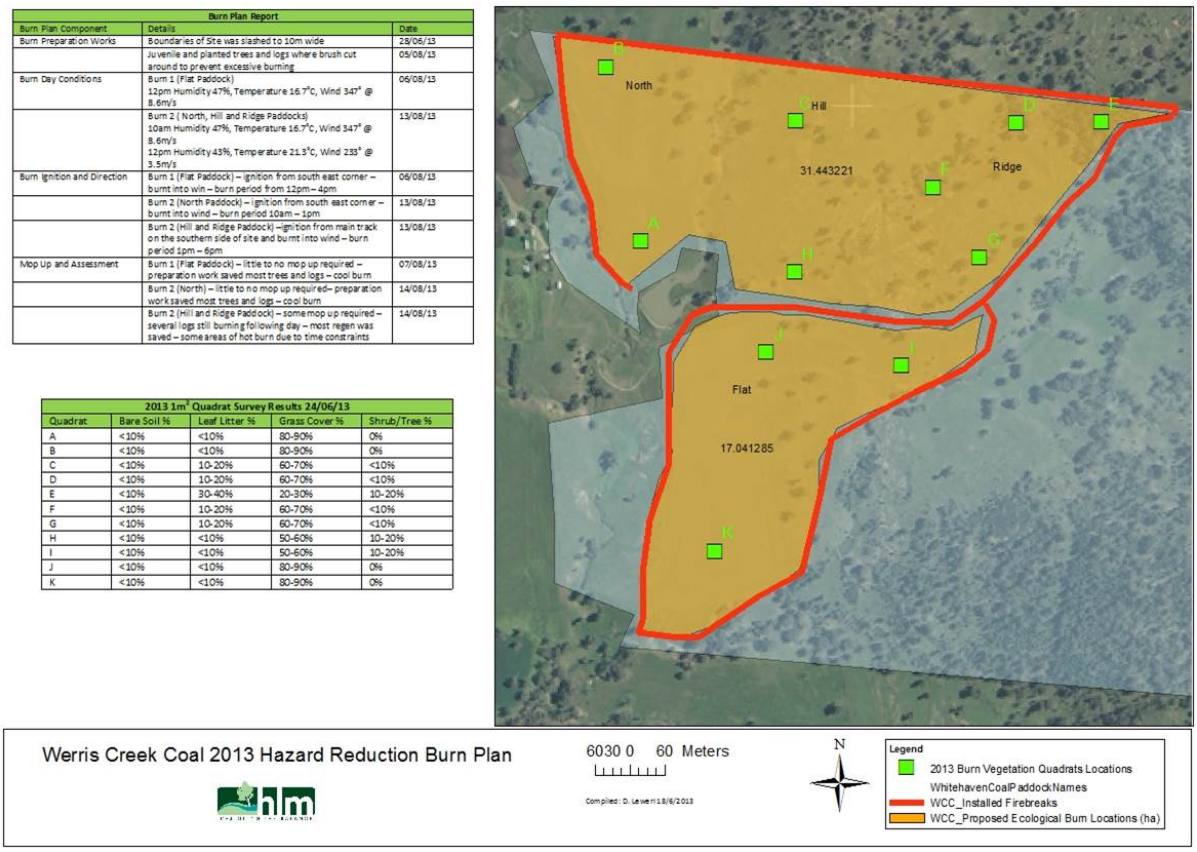

Figure 10: WCC Controlled Ecological Burn Plan

Any bushfires that do occur in the BOA will be co-ordinated with the RFS to extinguish or contain the spread of the fire. WCC will annually liaise with the RFS regarding proposed controlled burns within the BOA which increases awareness of the site and improve fire management strategies.

8.14 Salinity Management

Overburden and soil analysis undertaken as part of the Environmental Impact Statement and Environmental Assessments at WCC have not identified any material that is saline and would limit plant growth and development. As discussed in **Section 9**, WCC implements a soil sampling and analysis program across the BOA and rehabilitation areas and if saline material is encountered then soil amelioration options would be looked at and may involve the burying of saline soils.

8.15 Infrastructure Management and Rubbish Removal

Various pieces of infrastructure and assets are located within the BOA and will require ongoing access and maintenance. These items predated the establishment of the BOA and therefore the management of these assets will need to be integrated with the management of the BOA, however no new assets will be constructed within the current BOA. A summary of infrastructure and assets that will require management are included in **Table 21**.

Table 21: Infrastructure/Asset by BOA Location

MINE	REHAB	EURUNDEREE	HILLVIEW	RAILWAY VIEW	MARENGO	GREENSLOPES /BANOOL
• Telstra/ Private Phone/ Optic Line and Exchange • Powerline to Escott	• Weather Station and Lower Temperature Sensor	• Right of way access for neighbouring property	• Werris Creek Water Supply Line and Power Line	• Werris Creek Water Supply Line and Power Line • Powerline to Neighbouring Properties • Water Tanks for local water reticulation	• Powerline to Neighbouring Properties	• Werris Creek Water Supply Line and Power Line • Water Tanks for local water reticulation

Previous landowners of the BOA properties had created small rubbish dumps and/or former agriculture infrastructure or equipment had become dilapidated, broken down or collapsed within the BOA. The Eurunderee property requires the most rubbish removal with an old hay shed and other former agriculture items to be removed. Also the Marengo and Hillview properties are small quantities of material that will need to be cleaned up. From observation, all the material would be recyclable (i.e. scrap steel) or would be classed as "General Solid Waste – Non-putrescible" and can be disposed of at the mine or taken to the Quirindi or Werris Creek tips. None of the rubbish identified contains any hydrocarbon or chemical drums. If any rubbish was not to be classified as "General Solid Waste – Non-putrescible", then WCC would assess the waste in accordance with the Waste Classification Guidelines (DECC) and dispose of the material appropriately.

8.16 Management of Threatened Flora Species Digitaria Porrecta

As mentioned in **Section 4.6**, the first threatened flora species (*Digitaria porrecta* Finger Panic Grass) was identified at WCC monitoring Site 5 during 2012 (**Figure 12**). The threatened grass species, Digitaria porrecta (Finger Panic Grass) is listed as endangered under both the Threatened Species Conservation Act (TSC Act) and the Environment Protection and Biodiversity Conservation Act (EPBC Act) (**Plate 9**). The NSW Threatened Species website discusses known threats to *Digitaria porrecta* including grazing, tramping, fire, exotic grass competition and other disturbances but little is known how this actually impacts the species or how it recovers. Current management strategies implemented by WCC would appear adequate to manage the threats to *Digitaria porrecta* including the removal of grazing, limiting access to the BOA and weed control. WCC will install additional signs in the vicinity of the known population to further persuade access into the BOA. WCC will ensure Annual Floristic and Biometric Monitoring will continue at Site 5 to monitor progress of the species.

Plate 9: Digitaria Porrecta
Note: photo sourced from ausgrass2.myspecies.info

9 MONITORING

This section of the BOMP provides an overview of the soil, flora and fauna monitoring requirements for the BOA and rehabilitation areas at WCC.

The objective of the monitoring program is to evaluate the restoration progress of the BOA and rehabilitation towards achieving the required ecological community and land use objectives in accordance with the completion criteria. The monitoring program will report on the success of the management of ecological communities, whether this management is sustainable and to guide continual improvement in practices and the management of the BOA and rehabilitation areas.

The monitoring program is based on sound statistical principals and is guided by aspects of the flora and fauna assessment guidelines (DEC 2004). The monitoring program is broken up into the following components of Annual Soils Analysis, Annual Flora Monitoring, Annual Landscape Function Analysis and Annual Fauna Monitoring.

9.1 Annual Soil Analysis

On an annual basis, composite soil samples will be collected by the Environmental Officer from soils within the rehabilitation, BOA and soil stockpile areas and analysed by a Soil Laboratory. The soil analysis will test key chemical parameters (including pH and electrical conductivity) of soils at WCC. The soil test results will be compared against analogue woodland ecological communities sites to determine trends in soil/vegetation condition over time and progress towards achieving the completion criteria. Given the former agriculture land use of the BOA, there is potential that soils could contain high levels of nutrients that would be prohibitive to growth and restoration. Annual soil analysis will identify if such sites exist and methods to reduce soil nutrients (Phosphorus and Nitrogen) such as scalping will be considered.

9.2 Annual Floristic and Biometric Monitoring

WCC will engage qualified ecologists to undertake annual floristic and biometric monitoring in Spring concurrently with the Landscape Function Analysis (LFA) survey (**Section 9.3**). Floristic and biometric survey methodology will be similar to the Biobanking assessment methodology but varied so that the data collected is aligned to BOA and rehabilitation objectives and completion criteria.

The number of floristic/biometric/LFA plots has been developed based on forecast increases in the rehabilitation area as the mine progresses north and based on the area of management sub-domains.

Rehabilitation Area:

- One site per 30 ha of rehabilitated land (to allow for the expansion of rehabilitation areas over time).

Biodiversity Offset Area:

- A minimum of one site in each vegetation type class for each broad domain. Thus a total of 24 replicated sites are proposed across the BOA. The sites established in condition Class 4 for each vegetation type will also be referred to as ‘analogue’ sites.

Each vegetation monitoring site will be permanently marked by a star picket at the start and end of a 50m transect. Within each transect a 20mx20m quadrat (nested in the 20mx50m Biometric quadrat, see **Figure 11**), all vascular plant species observed in the plots are to be identified (where possible), recorded and compiled into the species list. Those species unable to be identified in the field are to be collected for later identification using a microscope and a combination of field guides, the Flora of New

South Wales (Harden 1992; 1993; 2000; 2002) and by comparison with herbarium specimens held in the Public Reference Collection of the National Herbarium of NSW in Sydney.

Biometric plot data were also collected at each plot using the Biobanking assessment methodology. This additional information collected includes:

- A 50m transect along which native over-storey cover, native mid-storey cover, native groundcover (grasses, shrubs and other) and exotic cover was recorded;
- A 50m x 20m quadrat in which the number of trees with hollows, over-storey regeneration and total length of logs will be recorded.

Photo monitoring is also to be implemented with two photos taken per plot, one from each end of the transect towards the centre of the transect.

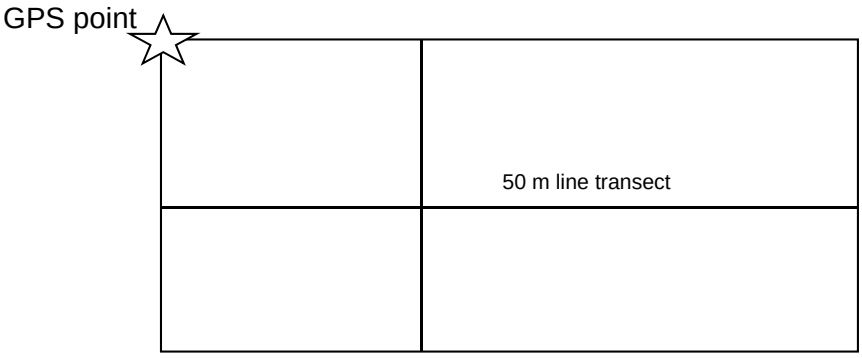

Figure 11: Vegetation assessment plot.

The results of monitoring activities across the WCC site will inform the success of the management of native flora communities, and to guide the continuous improvement of management strategies. Monitoring data and general observations will inform restoration and management strategies practices, which may be amended as information becomes available.

9.3 Annual Landscape Function Analysis

The Landscape Function Analysis (LFA) method was developed by the CSIRO specifically for monitoring soil surface condition within rangeland environments and more recently has been adapted to mine rehabilitation projects. The LFA method will be implemented within the WCC rehabilitation area, as LFA has been proven to be most informative when applied to these degraded landscapes that are being restored. LFA analysis will be undertaken using the same rehabilitation monitoring sites established for floristic and biometric monitoring. Comparative LFA analysis will be undertaken in Class 4 vegetation monitoring sites as analogue sites to demonstrate the status and progress of rehabilitation towards the higher condition vegetation.

The LFA methodology consists of the LFA tool that enables assessment of the landscape's ability to retain water and nutrients within the system. In terms of LFA, a soil landscape that is on a trajectory toward self sustainability (in context of vegetative cover and soil stability) would have:

- A high Landscape Organisation Index (LOI) i.e. a low number of bare soil patches (referred to as inter-patches) between obstruction components (referred to as patches) in the soil landscape, which would affect wind and water movement and the introduction and transportation of resources into and out of the system
- High Soil Surface Assessment indices, indicating that the site had favourable Nutrient, Infiltration and Stability characteristics

LFA components implemented at WCC include:

- Geographic setting of the site
- Landscape Organisation, and
- Soil Surface Assessment

9.3.1 Geographic Setting of the Site

A description of each site is to be recorded, including position in the landscape, GPS coordinates (GDA94 Zone 55), transect bearing, slope, aspect, vegetation type and land use. The following topographic classification was also used:

- Crest
- Upper slope
- Mid slope
- Lower slope
- Closed depression, or lake
- Flat
- Open depression or stream channel

9.3.2 Landscape Organisation

Landscape organisation characterises and maps the spatial patterns of resource loss or accumulation at a site. The procedure is as follows:

- The transect was located directly down slope using a 50 m tape within the 20x50m quadrat, bends and kinks were needed in some cases to ensure the tape was orientated down slope. The tape measure was made taut prior to recording measurements
- Along the 50m tape, the transect was divided into patches and inter-patches, with patch/inter-patch metrics for length and width recorded

According to the LFA, patches are long-lived/term features that obstruct or divert water flow and/or collect/filter out material from runoff (such as perennial grass plants, rocks > 10 cm, tree branches in contact with the soil) and where there is evidence of resource accumulation. Inter-patches are zones where resources such as water, soil materials and litter may be mobilised and freely transported either down slope when water is the active motive agent or down-wind when aeolian processes are active.

The following data was recorded for each patch/inter-patch along each transect:

- The distance and interval along the tape
- The patch width (only necessary for patches)
- The patch/inter-patch identification

Rill survey was only completed where rills occurred, with the following recorded:

- Rill base (eg Rocky, alluvium or gravel)
- Start of rill along the tape
- Finish of rill along the tape
- Rill width
- Rill depth

All data are to be entered into the LFA spreadsheets and used to calculate the results of the landscape organisation index.

9.3.3 Soil Surface Assessment

Each patch/inter-patch type identified in the landscape organisation data log is to be subject to soil surface property assessment according to the Soil Surface Assessment (SSA) Method, via a set of query zones located within examples of each patch and inter-patch type. In selecting query zones the following guidelines are to be observed:

- The transect data log is used to select 'query zones' along the same 50m tape measure. With query zones distributed along the full length of the transect
- The assessment aims for a minimum of five replicate query zones of each patch/inter-patch type (where possible) to improve statistical reliability. Sampling of five replicates is not always possible due to paucity of a given patch/inter-patch type, with a common example being "log" patches that once along a given transect
- Each query zone is sited symmetrically within the selected patch/inter-patch
- The standard query zone length is 1 metre. If the patch/inter-patch length is insufficient, for a 1 m query zone, simple fractions of a metre are to be used
- The boundaries between two patch/inter-patches are to be avoided where possible. The boundary should only be used where the start and/or end of the zone is very distinct

Within each query zone the appropriate score (refer to LFA manual) for each SSA indicator is to be recorded, indicators included:

- Rainsplash protection
- Perennial vegetation cover
- Litter cover, origin and decomposition
- Cryptogram cover
- Crust brokenness
- Soil erosion type and severity
- Deposited materials
- Soil surface roughness
- Surface nature (resistance to disturbance)
- Slake test
- Soil surface nature

9.4 Annual Fauna Monitoring

WCC will engage qualified ecologists to implement annual Spring fauna monitoring and Winter bird surveys targeting seasonal migrants to the Liverpool Plains region such as the Regent Honeyeater and Swift Parrot. Spring fauna monitoring will continue to target key fauna assemblages, containing indicator species typical of the local region. The following sections provide the details of the fauna monitoring.

Fauna monitoring is to be designed to enable comparison of threatened species and key indicator species (eg species that may inform success of ecological restoration and invasive species) presence and abundance as well as diversity between treatment sites (ie rehabilitation sites and class 1-3 vegetation) versus analogue sites (ie class 4 vegetation). Whilst it is not considered appropriate to identify presence and abundance of threatened species or key indicator species as performance

criteria, monitoring and reporting will allow for analysis of these species to identify trends that may reflect the effectiveness of restoration actions.

9.4.1 Winter fauna monitoring

Eight fauna monitoring sites are to be surveyed for winter season migrant birds (i.e .Regent Honeyeater and Swift Parrot), with survey sites including the sites surveyed in spring, though refined to primarily target those areas containing winter flowering Eucalypt species (i.e. *Eucalyptus albens*) (**Figure 12**). Discussion with the WCC Environmental Officer is to occur prior to the winter survey period to confirm flowering commencement. At each of the winter fauna monitoring sites, one 30 minute morning and one 30 minute afternoon bird census is to be completed. All bird species observed or heard calling are to be recorded in 5 minute increments to log the period and diversity of species recorded during the census and a measure of species abundance is also to be recorded.

9.4.2 Spring fauna monitoring

Up to 24 fauna monitoring sites have been selected for spring fauna monitoring (**Figure 12**). Spring fauna monitoring is to target four broad fauna assemblages, birds, herpetofauna, microchiropteran bats and nocturnal fauna, though all opportunistic observations will also be recorded. In addition to this, vertebrate pest monitoring can occur concurrently.

Bird census will replicate the winter bird census, with each site subject to one 30 minute morning and one 30 minute afternoon bird census. All bird species observed or heard calling are to be recorded in 5 minute increments to log the period and diversity of species recorded during the census. Measures of species abundance will also be incorporated in to the census, to allow for more rigorous data analysis and identification of trends.

Herpetofauna survey will involve general and targeted habitat (i.e. logs, bark, rocks) survey for 30 minutes at an appropriate time of the day (i.e. mid morning or afternoon). All species observed are to be recorded.

Microchiropteran bats will be sampled using a Anabat call recording device. Each site is to be subject to four hours of continual call recording, with calls to be analysed by a qualified Microchiropteran bat call analyst.

Nocturnal fauna surveys will include a 60 minute spotlight transect, traversed at 1km per hour and using a 50 watt spotlight. Each site is also to be subject to a 60 minute call playback and quiet listening census, with calls of the *Ninox connivens*(Barking Owl), *Ninox strenua* (Powerful Owl), *Tyto novaehollandiae* (Masked Owl) and *Phascolarctos cinereus* (Koala) to be played through a megaphone.

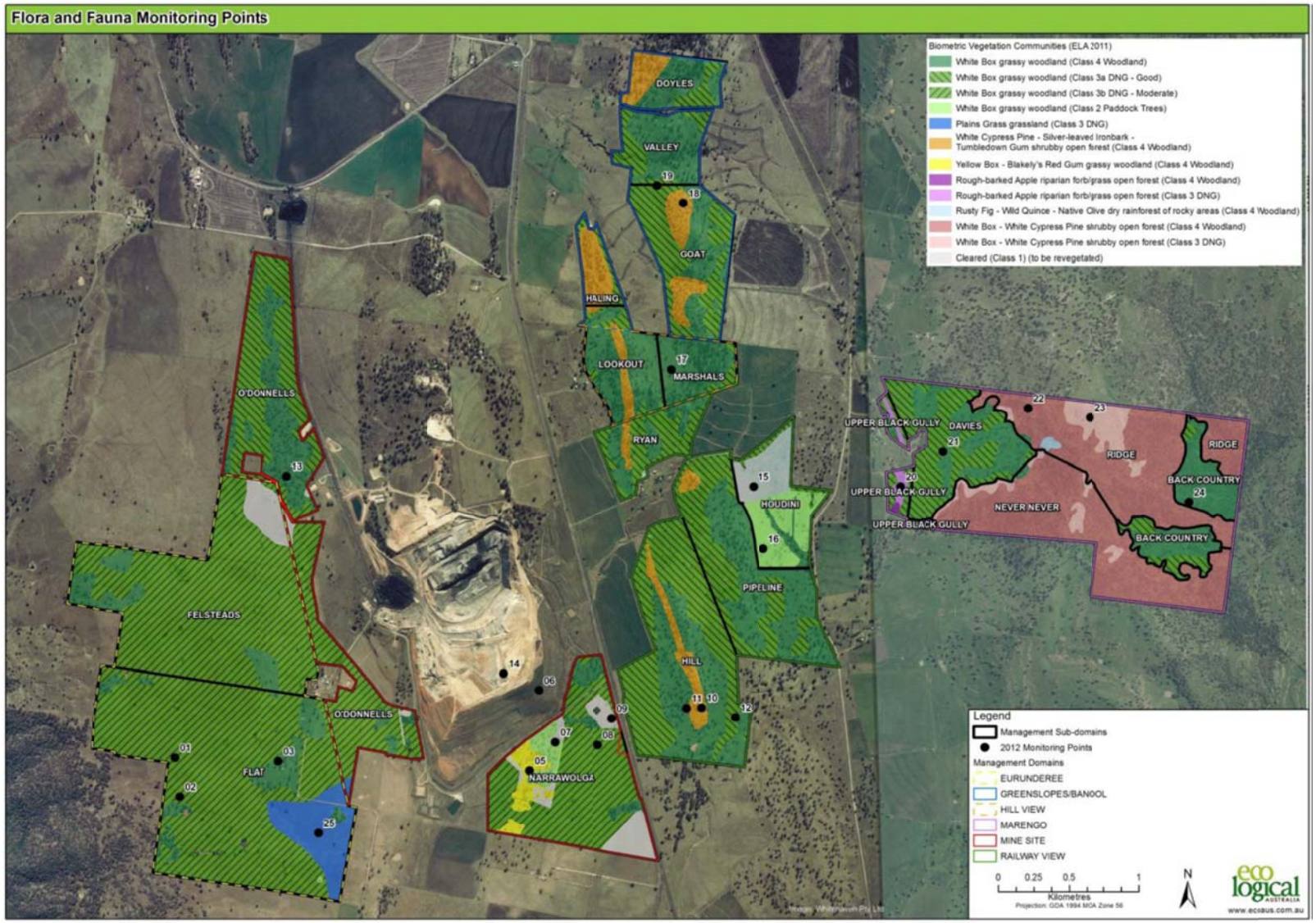

Figure 12: Flora and fauna monitoring sites within the WCC BOA.

10 INSPECTIONS

WCC undertakes two biodiversity related inspections, Clearing Inspection and Quarterly Inspections.

The Clearing Inspection is undertaken for areas identified as requiring to be cleared for either mining or ancillary activities. The Environmental Officer will visually inspect the proposed disturbance area to determine if any faunal habitat is present or vegetation species/communities not previously assessed in the LOM Project Environmental Assessment. If the inspection identifies habitat or unknown species, Ecologists will be engaged to complete Pre-Clearing, Clearing and Post Clearing Assessments of the proposed disturbance area (**Section 8.1**).

Quarterly Inspections of the BOA and rehabilitation involves a visual field based rapid assessment tool that provides an assessment of various landscape contributors and triggers appropriate remedial actions. Visual inspections will be undertaken by the Environmental Officer and include:

- Vegetation components (overstorey, understorey and ground cover where applicable);
- Presence of exotic weed and feral animals species;
- Surface stability and erosion issues;
- Presence of available microhabitat; and
- Disturbance factors including fire and unauthorised access e.g. rubbish dumpling.

Black Gully will be visually monitored as part of the quarterly and following high rainfall events to inspect for any active erosion. If slumping is occurring, appropriate action will be taken including for example seeking the advice of a geomorphologist to determine appropriate management actions to stabilise the creek bed and bank.

The Quarterly Inspection and Clearing Inspection templates are included in **Appendix F** and **J**.

11 TRAINING

Effective implementation and maintenance of this plan requires communication and training to all levels of operational, management and contract staff at WCC. In addition, all persons conducting work at WCC should be authorised as competent to perform their work or job. Management and monitoring within the BOA requires specialist skills and experience to operate safely and productively while mitigating potential environmental impacts. Where possible, environmental training required by this BOMP will be incorporated as part of the WCC training and competency management system approved by the Department of Resources and Energy.

Employees and contractors engaged in BOMP management activities and those responsible for implementing the BOMP may be required to undertake additional training. This training will be targeted to provide the appropriate level of skills and knowledge to employees and contractors enabling them to manage biodiversity issues in accordance with the BOMP. **Table 22** outlines the WCC training requirements for biodiversity management:

Table 22: WCC BOMP Training Program

Training	Who	Relevant Procedure	Frequency/When	Reference
Induction – Whitehaven Coal Generic and WCC Site Specific	All Employees All Contractors	Pegasus training	Biennial	Not Applicable
Clearing	Contractors Ecologist Environmental Officer	Section 8.1	Annual	Not Applicable
Weed Control	Contractor Environmental Officer	Section 8.6	Annual	Not Applicable
Herbicide Use	Contractor Environmental Officer	Not Applicable	5 years	Nationally Accredited Training RTC3704A & RTC3705A
Monitoring – Biometric and LFA Methods	Ecologists	Section 9.2 and 9.3	Biennial	Training in Biobanking and LFA NPW Act Licence
Fire Management	Contractor WCC Fire Response RFS	Section 8.13	3 Yearly	Whitehaven & Nationally Accredited Training
Pest Control	Contractor	Section 8.8	5 years	LHPA 1080/Pindone Authorised User

12 REPORTING

Reporting of monitoring and management information is an integral component of the WCC EMS. This section outlines the internal and external biodiversity monitoring and management reporting processes implemented at WCC. **Table 23** outlines the types of reports that include information; the reporting frequency, requirements, distribution and timing.

Table 23: Reporting schedules for Biodiversity Monitoring and Management

Report	Frequency	Requirements	Distribution	Timing
Biodiversity Non-Compliance or Incident	As required	Complete Whitehaven Coal Incident Report Form. Notification of biodiversity non-compliance or incident. Meet PA 10_0059 Schedule 5 Condition 6; EPL 12290 Condition R2 & R3 and Section 148 (Part 5.7) of the Protection of the Environment Operations Act 1997.	Whitehaven	Immediate
			OEH/EPA DSEWPaC DoP NSW Health Workcover LPSC Fire&Rescue	Earliest Opportunity (Material Harm) otherwise as soon as practicable
		Detailed report of biodiversity non-compliance/incident including cause/nature, date, time, duration and location of event; contact details of WCC representatives or witnesses; action taken and measures to prevent recurrence. *Meet PA 10_0059 Schedule 5 Condition 6and EPL 12290 Condition R2 & R3*.	OEH/EPA DoP	Within 7 working days of incident*
Complaints	As required	Complete Whitehaven Coal/WCC Complaints Form including complainant, complaint reported date & time, date & time of compliant event, complaint method, complainant details, complaint nature, actions taken and follow up contact.	WCC Complainant DoP/EPA (if requested)	As soon as practicable
	Monthly	Update Complaints Register with a summary of complaints received.	Website	Within 14 days of month end
Pre-clearing and clearing report	Following clearing events	Contractor to report on methods and results of pre-clearing and clearing surveys	WCC OEH	Following clearing
Quarterly Inspection Report	Quarterly	Summary of inspection results and complaints received collated into site report for Whitehaven Coal management.	WCC	Seven working days following inspection
Flora and Fauna Monitoring	Annually	Contractor to compile and analyse results of the winter and spring flora and fauna monitoring and submit to WCC	WCC	Following spring monitoring
AEMR	Annually	Summarise operational and environmental activities for the previous year including annual review requirements, review of compliance with MOP, PA, DSEWPAC and other approvals and description of non-compliance/exceedances, rehabilitation progress, comprehensive monitoring results and complaints information	DoP DRE WCC Website	Due by 31st May DSEWPAC report within 3 months of every 12 month anniversary

Further details on WCC incident and community complaint processes is provided in the WCC EMS in accordance with Whitehaven Coal incident reporting standard and relevant procedure.

13 REVIEW

A key component of this BOMP (as part of WCC EMS) is that WCC is able to review the effectiveness and performance of biodiversity management onsite. WCC will implement a number of review processes to ensure that there is continuous improvement of biodiversity management including:

- Biodiversity Offset Management Plan Review;
- Biodiversity Performance Annual Review; and
- Independent Environmental Audit

Any of these review mechanisms may trigger a revision of the BOMP in **Section 13.3** below.

13.1 Biodiversity Offset Management Plan Review

A protocol for the BOMP Review is provided in **Appendix G**. WCC will annually complete the BOMP Review Protocol prior to writing the Annual Review section of the AEMR. BOMP Review Protocol will outline the management measures implemented for the previous year, track progress against the objectives and targets, changes to risks, demonstrate whether accountabilities have been followed, and that inspections and reporting process have been completed. The outcomes from the BOMP Review will be incorporated into the Annual Review section of the AEMR.

13.2 Biodiversity Performance Annual Review

WCC will annually review its biodiversity performance and management as a part of writing the AEMR in accordance with PA 10_0059 (Schedule 5 Condition 3). The Biodiversity Performance Annual Review will include a comprehensive review of the biodiversity monitoring results and complaints over the period 1 April to 31 March and make comparison of these results against the:

- Completion Criteria and Objectives and Targets;
- Biodiversity monitoring results from previous years;
- Biodiversity impact predictions from the EA;
- Discuss any biodiversity non-compliances and what actions were taken;
- Identify any trends in biodiversity monitoring data;
- Identify any discrepancies between predicted and actual monitoring results and discuss potential causes;
- Outline management measures to be implemented over the next year to continual improve biodiversity management; and
- Outline whether a revision to the BOMP is required.

13.3 Independent Environmental Audit

WCC is required to undertake an Independent Environmental Audit (IEA) every three years in accordance with the PA 10_0059 (Schedule 5 Condition 8; and EPBC 2010/5571 Condition 4). The first IEA will be undertaken prior to June 2014 and every three years after. The IEA will:

- Be conducted by a suitably qualified, experienced and independent team of experts whose appointment will be endorsed by DoP;
- Include consultation with the relevant agencies;
- Assess the environmental performance of the project;
- Assess whether WCC is complying with the requirements of the PA 10_0059and including any assessment, plan or program required under these approvals; and
- Recommend appropriate measures or actions to improve environmental performance and rehabilitation at WCC.

13.4 Revision of Biodiversity and Offset Management Plan

The BOMP is planned to be revised after three years in 2015. However, in accordance with PA 10_0059, WCC will revise the BOMP following:

- The AEMR Annual Review (including the BOMP Review), where this review recommends a revision of the BOMP;
- A non-compliance incident report recommending a revision of the BOMP;
- IEA recommending a revision of the BOMP; or
- Modification of PA 10_0059 or Variation recommending a revision of the BOMP.

WCC would be required to submit the revised BOMP in consultation with the EPA for DoP's approval within 3 months of any triggering event listed above.

14 CONTINGENCY PLAN

WCC is required to implement a contingency plan to manage any unpredicted impacts and their consequences. In regards to contingency plans for biodiversity management, WCC have a number of management strategies that would identify unpredicted impacts and management measures to mitigate or ameliorate those impacts.

The need to implement biodiversity contingency plans will be identified by WCC using the reporting processes in **Table 24**.

Table 24: Identification of Biodiversity Contingency Plan Triggers

Reporting Process	BOMP Section	Frequency	Method
Community Complaint	12	As required	Complaint investigation identifies biodiversity impact outside predicted impact
Non-compliance (Serious Incident)	12	As required	Incident investigation identifies biodiversity impact outside predicted impact or non-compliance
Environmental End Of Month Report	12	Monthly	Biodiversity monitoring results identifies biodiversity impact outside predicted impact and trending away from performance targets (**Table 11**)
Quarterly Inspection	12	Quarterly	Observation on biodiversity identify impacts outside of predicted
Annual Monitoring Report	12	Annual	Biodiversity monitoring results trend outside predicted results and not towards the performance targets (**Table 11**)
Annual Environmental Management Report	12	Annual	Biodiversity monitoring results trend outside predicted results and not towards the performance targets (**Table 11**) or management measures not effective at mitigating management issues

A number of management measures and actions already discussed in the BOMP can be implemented as biodiversity contingency plans are outlined in **Table 25**.

Table 25: Biodiversity Management Contingency Plans

Contingency Plan	Method	BOMP Section
Community Complaint	Response to community complaint outlining contingency plan actions to be implemented to the satisfaction of the complainant and DoP/EPA if involved	12
Non-compliance (Incident)	Response to relevant government departments regarding non-compliance outlining contingency plan actions to be implemented to the satisfaction of the relevant government departments	12
Biodiversity Offset Strategy	Revise strategy if required to offset impacts further	8.2
Clearing	Following appropriate clearing process to mitigate impacts and adjust clearing protocols if necessary where inadequate	8.1
Revegetation	Following disturbance, undertake revegetation	8.3
Habitat Augmentation	If inadequate or insufficient habitat, implement additional habitat augmentation methods	8.4
Weed Control	If weed infestations are identified, additional weed control resources can be implemented	8.6
Pest/Feral	If pest populations are identified, additional pest control resources can be implemented	8.8

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APPENDIX A - Related correspondence with Government Agencies

NSW GOVERNMENT | Office of Environment & Heritage

Your reference:
Our reference: DOC12/53391.
Contact: Garry Germon (02) 68835338
Date: December 20, 2012

Mr Andrew Wright
Environmental Officer
Werris Creek Coal Pty Ltd

Dear Mr Wright

RE: Review of Biodiversity and Offset Management Plan

I refer to your email dated December 7, 2012 seeking comment from the Office of Environment and Heritage (OEH) on the adequacy of the Biodiversity and Offset Management Plan (BOMP) for the Werris Creek Coal Project.

OEH has reviewed the BOMP and has found that the information provided requires further clarification and revision. Key issues have been identified and comments provided in Attachment 1.

If you have any questions or wish to discuss matters further please contad Garry Germon on Ph (02) 68835338

Yours sincerely,

Todd Soderquist

DR TODD SODERQUIST

A/Manager Biodiversity Conservation Unit
North West Branch,
Conservation and Regulation Division
Office of Environment and Heritage

PO Box 2111 Dubbo NSW 2830
Level 1 48-52 Wingewarra Street Dubbo NSW
Tel: (02) 6883 5312 Fax: (02) 6884 8675
ABN 30 841 387 271
www.environment.nsw.gov.au

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

Our reference: 2012/11606

Contact Officer: Kynan Gowland
Telephone: (02) 6275 9322. Facsimile: (02) 6274 1878
Email: post.approvals@environment.gov.au

Mr Brian Cullen
General Manager, Technical Services
Whitehaven Coal Ltd
PO Box 125,
WERRIS CREEK NSW 341

Dear Mr Cullen

Werris Creek Life of Mine Extension Project (EPBC 2010/5571)

I refer to a letter dated 19 March 2013 from Jill Johnson, to the Approvals Monitoring North Section of the department, which attached a copy of the *Biodiversity and Offset Management Plan, Revision V10, June 2013,* as required under condition 2 of the approval decision dated 21 December 2011.

The *Biodiversity and Offset Management Plan, Revision V10, June 2013,* has been reviewed by officers of the department and has been found to meet the requirements of the condition. On this basis, and as delegate of the Minister for the Environment, Heritage and Water, I have decided to approve the plan.

In accordance with condition 2 of EPBC 2010/5571, the approved plan must be implemented. Under condition 6, if Whitehaven Coal Ltd wants to act other than in accordance with the approved plans, Whitehaven Coal Ltd must submit a revised plan for approval. Until the Minister (or his delegate) has approved the revised plan, Whitehaven Coal Ltd must continue to implement the approved plan.

In section 8.2.1 of the *Biodiversity and Offset Management Plan, Revision V10, June 2013,* reference is made to securing the biodiversity offset areas. Please note that condition 1 of the approval requires the registering of the mechanism to secure biodiversity offset areas within two years of the date of approval. Please advise the department when the conservation mechanism is registered.

As your project is now in the post-approval phase, the Approvals Monitoring North Section is the point of contact for further communication with the department. To avoid any potential delays in responding to future requests of the department relating to the above project please refer all correspondence to:

Approvals Monitoring North Section
Compliance and Enforcement Branch
Environment Assessment and Compliance Division
Department of Sustainability, Environment, Water, Population and Communities
GPO Box 787
CANBERRA ACT 2601

The department has an active monitoring program which includes monitoring inspections, desk top document reviews and audits. As part of this program we will be undertaking a review of our records to ascertain the present status of this project in relation to its conditions of approval. We will contact you again if we require further information.

Please ensure that you maintain accurate records of all activities associated with, or relevant to the conditions of approval, so that they can be made available to the department on request. Such documents may be subject to audit and used to verify compliance. Summaries of results of audits may be published by the department. Information about the monitoring and audit program can be found on the department's website at www.environment.gov.au/epbc/compliance/auditing.html.

We would appreciate if you could advise us of any changes to the project e.g. contact officer, company address, commencement date etc.

You should note that any transfer of this approval to another person must have the consent of the Minister under section 145B of the EPBC Act.

If you have any enquiries please contact Kynan Gowland on 02 6275 9322.

Yours sincerely

Deb Callister
Assistant Secretary
Queensland and Sea Dumping Assessment Branch
Environment Assessment and Compliance Division
5 August 2013

Note: Under s 491 of the *Environment Protection and Biodiversity Conservation Act 1999* it is an offence to knowingly provide false and/or misleading information to a departmental officer.

APPENDIX B - Environmental Policy

INTEGRATED MANAGEMENT SYSTEM	Document Owner:	Managing Director
	Revision Period:	3 Yearly
	Issue:	2
	Last Revision Date:	17/06/2009
	Date Printed:	18/06/2009

WHC_POLICY_HEALTH, SAFETY & ENVIRONMENT

Whitehaven intends to conduct business in a way that maintains a safe and healthy workplace for its employees, contractors, visitors and the surrounding community and will protect the environment in all stages of exploration, mining, processing and train loading.

Whitehaven aims to:

- Achieve zero injuries and occupational illnesses.
- Achieve zero equipment damage.
- Achieve zero environmental incidents

Whitehaven will strive to achieve these goals by:

- Ensuring health, safety and environment is considered in all planning and work activities.
- Involve employees through regular communication, consultation and training.
- Identifying and controlling all potential hazards in the workplace through hazard identification and risk analysis.
- Ensuring all incidents are reported, controlled and learning's applied and shared.
- Providing effective injury management and rehabilitation for all employees.
- Seeking continuous improvement in performance by taking into account employee & community concerns and advances in health, safety and environment.
- Complying with legislative and other requirements and providing necessary training and resources.

Whitehaven will ensure the availability of human, financial and physical resources to maintain and implement the Health and Safety Management System.

Responsibilities of people employed at Whitehaven Coal:

All persons employed by Whitehaven have a personal responsibility to comply with this policy and associated Health, Safety & Environment systems. No work is to be undertaken without a clear understanding of a safe method that minimizes the risk of injury, equipment damage and environmental harm.

Whitehaven employees shall:

- Work in a healthy, safe and environmentally responsible manner.
- Encourage others to work in a healthy, safe and environmentally responsible manner.
- Promptly report incidents, unsafe practices or conditions and environmental concerns as they become apparent.
- Co-operate with Management in the support of promotion of health and safety responsible environmental management in the work place.

This policy applies to all mines operated by Whitehaven Coal Limited and its subsidiaries.

.....

Tony Haggarty
Managing Director
17th June 2009

APPENDIX C - Data tables from flora and fauna monitoring Spring 2011

Summary of Biometric Assessment Methodology variables

Condition Class (Plot No)	Native species richness	Native overstorey PFC	Native midstorey PFC	Native Groundcover (shrubs)	Native Groundcover (grasses)	Native Groundcover (other)	Exotic plant cover	Exotic species (cover)	No. of Hollow bearing trees (HBTs)	Overstorey regen (No of species).	Coarse woody debris (m)
4 (3)	8 (23)	5	0	0	16	16	70	25	0	0	0
4 (5)	9 (23)	5	0	0	10	40	78	14	3	2	43
4 (11)	19 (23)	26	0	0	6	34	80	19	0	1	142
4 (10-Td)	7	0	0	0	0	36	88	19	0	0	0
3 (1)	6	0	0	0	0	4	90	11	0	0	0
3 (2)	10	0	0	0	12	20	88	20	0	0	0
3 (4)	21	0	0	2	34	20	52	19	0	1	0
3 (8)	2	0	0	0	0	4	94	9	0	0	0
3 (12)	5	0	0	0	17	16	76	15	0	0	0
2 (7)	10	0	0	0	8	12	88	11	2	2	18
1 (6)	3	0	0	0	0	0	50	16	0	0	0
1 (9)	5	0	0	0	8	0	94	20	0	0	0

Biodiversity Offset Area plot data

Scientific Name	Common name	Growth Form	Native/ Exotic	Important species	Annual/ Perennial	Family	3 (1)		3 (2)		3 (4)		4 (3)		4 (5)		1 (6)		2 (7)		3 (8)		1 (9)		4 (10 Td)		4 (11)		3 (12)	
Aira sp.		Grass	Exotic		Annual	Poaceae	0	0	1	10	0	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ajuga australis	Austral Bugle	Herb	Native	Important	Perennial	Lamiaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10	0	0
Ammi majus	Bishops-weed	Herb	Exotic		Annual	Apiaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	20	0	0	0	0	0	0
Anagallis arvensis	Blue Pimpernel	Herb	Exotic		A or P	Myrsinaceae	0	0	1	500	1	200	1	100	1	20	1	1000	0	0	5	500	1	100	0	0	0	0	0	0

Scientific Name	Common name	Growth Form	Native/ Exotic	Important species	Annual/ Perennial	Family	3 (1)		3 (2)		3 (4)		4 (3)		4 (5)		1 (6)		2 (7)		3 (8)		1 (9)		4 (10 Td)		4 (11)		3 (12)	
Aristida sp.		Grass	Native		Perennial	Poaceae	0	0	0	0	0	0	0	0	1	100	0	0	20	200	0	0	0	0	0	0	0	0	0	0
Arthropodium sp.		Herb	Native		Perennial	Anthericaceae	0	0	1	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asperula conferta	Common Woodruff	Herb	Native	Important	Perennial	Rubiaceae	0	0	0	0	0	0	0	0	1	1000	0	0	0	0	0	0	0	0	0	0	1	500	0	0
Austrodanthonia spp.		Grass	Native		Perennial	Poaceae	0	0	0	0	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Austrostipa aristiglumis	Plains Grass	Grass	Native		Perennial	Poaceae	0	0	0	0	1	100	0	0	0	0	0	0	0	0	0	0	30	1000	0	0	0	0	25	1000
Austrostipa bigeniculata		Grass	Native		Perennial	Poaceae	0	0	0	0	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	100	0	0
Austrostipa scabra	Speargrass	Grass	Native		Perennial	Poaceae	0	0	0	0	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	100	0	0
Austrostipa sp.		Grass	Native		Perennial	Poaceae	0	0	0	0	1	100	1	50	1	100	0	0	20	500	0	0	0	0	0	0	0	0	0	0
								10		100								100		50										
Avena sativa	Oats	Grass	Exotic		Annual	Poaceae	1	00	1	00	0	0	1	50	0	0	1	00	20	00	0	0	1	20	0	0	0	0	1	100
Avena sp.		Grass	Exotic		Annual	Poaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	500	0	0	0	0	0	0	0	0
Boerhavia dominii		Herb	Native		Perennial	Nyctagynaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	50	0	0
Bothriochloa macra	Redgrass, Redleg Grass	Grass	Native		Perennial	Poaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10	0	0
Briza minor	Shivery Grass	Grass	Exotic		Annual	Poaceae	1	100	1	500	0	0	1	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromus hordeaceus	Soft Brome	Grass	Exotic		Annual	Poaceae	0	0	10	100	1	500	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromus molliformis	Silky Brome, Soft Brome	Grass	Exotic		Annual	Poaceae	0	0	10	1000	1	500	25	1000	5	100	0	0	5	100	0	0	1	500	10	500	1	100	25	1000
Bromus. diandrus	Great Brome	Grass	Exotic		Annual	Poaceae	0	0	10	100	0	0	0	0	5	100	1	10	0	0	0	0	1	20	0	0	0	0	0	0
Bulbine bulbosa	Bulbine Lily, Native Onion, Native Leek, Golden Lily	Herb	Native	Important	Perennial	Asphodelaceae	0	0	0	0	0	0	0	0	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scientific Name	Common name	Growth Form	Native/ Exotic	Important species	Annual/ Perennial	Family	3 (1)		3 (2)		3 (4)		4 (3)		4 (5)		1 (6)		2 (7)		3 (8)		1 (9)		4 (10 Td)		4 (11)		3 (12)	
Calotis lappulacea	Yellow Burr-daisy, Yellow Daisy-burr	Herb	Native	Important	Perennial	Asteraceae	0	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capsella bursa-pastoris	Shepherd's Purse	Herb	Exotic		Annual	Brassicaceae	0	0	1	10	1	10	0	0	0	0	0	0	0	0	0	0	0	0	1	50	1	1	0	0
Carduus tenuiflorus	Winged Slender Thistle	Herb	Exotic		Annual	Asteraceae	1	50	1	5	0	0	1	10	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Carex inversa		Herb	Native		Perennial	Cyperaceae	0	0	0	0	0	0	1	20	0	0	0	0	0	0	0	0	0	0	0	0	1	50	0	0
Carthamus lanatus	Saffron Thistle	Herb	Exotic		Annual	Asteraceae	0	0	0	0	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100	0	0
Centaurea solstitialis	Maltese Cockspur, Cockspur Thistle, Saucy Jack	Herb	Exotic		Annual	Asteraceae	0	0	0	0	0	0	0	0	1	50	1	100	1	20	1	100	0	0	1	10	0	0	1	100
Cerastium glomeratum	Mouse-ear Chickweed	Herb	Exotic		Annual	Caryophyllaceae	0	0	2	1000	0	0	1	100	0	0	0	0	0	0	0	0	0	0	1	10	0	0	0	0
Cheilanthes austrotenuifolia	Rock Fern	Herb	Native		Perennial	Adiantaceae	0	0	0	0	0	0	1	50	0	0	0	0	1	50	0	0	0	0	0	0	0	0	0	0
Cheilanthes sieberi	Narrow Rock Fern	Fern	Native		Perennial	Adiantaceae	0	0	1	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	20	0	0	0	0
Chloris truncata	Windmill Grass	Grass	Native		Perennial	Poaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	500	0	0	0	0	0	0	0	0
Chloris ventricosa	Tall Chloris	Grass	Native		Perennial	Poaceae	0	0	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chondrilla juncea	Skeleton-weed	Herb	Exotic		Perennial	Asteraceae	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chrysocephalum apiculatum	Yellow Buttons, Common Everlasting	Herb	Native	Important	Perennial	Asteraceae	0	0	0	0	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chrysocephalum semipapposum	Clustered Everlasting	Herb	Native		Perennial	Poaceae	0	0	0	0	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cirsium vulgare	Spear Thistle	Herb	Exotic		Annual	Asteraceae	0	0	1	5	0	0	0	0	0	0	0	0	0	0	0	0	1	50	5	100	0	0	1	50
Conyza sp.	Fleabane	Herb	Exotic		Annual	Asteraceae	0	0	0	0	0	0	0	0	0	0	1	100	0	0	0	0	0	0	0	0	1	1	0	0

Scientific Name	Common name	Growth Form	Native/ Exotic	Important species	Annual/ Perennial	Family	3 (1)		3 (2)		3 (4)		4 (3)		4 (5)		1 (6)		2 (7)		3 (8)		1 (9)		4 (10 Td)		4 (11)		3 (12)	
Cyclospermum leptophyllum	Slender Celery	Herb	Exotic		Annual	Apiaceae	0	0	0	0	0	0	0	0	0	0	1	1000	0	0	0	0	0	0	0	0	0	0	0	0
Cynodon dactylon	Couch, Bermudagrass	Grass	Native		Perennial	Poaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100	0	0	0	0	0	0
Cyperus gracilis	Slender Flat-sedge	Sedge	Native		Perennial	Cyperaceae	0	0	0	0	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyperus sp.		Sedge	Native		Perennial	Cyperaceae	0	0	0	0	0	0	0	0	0	0	0	0	1	50	0	0	0	0	0	0	0	0	0	0
Daucus glochidiatus	Native Carrot	Herb	Native	Important	Annual	Apiaceae	5	100	1	1000	2	1000	0	0	1	50	0	0	1	100	0	0	0	0	1	500	1	20	1	500
Dichondra repens	Kidney Grass, Kidney Weed	Herb	Native		Perennial	Convolvulaceae	0	0	1	1000	1	1000	0	0	1	20	1	5	1	50	0	0	0	0	0	0	1	500	0	0
Dichopogon fimbriatus	Nodding Chocolate Lily	Herb	Native	Important	Perennial	Anthericaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0
Echium plantagineum	Paterson's Curse, Salvation Jane	Herb	Exotic		Annual	Boraginaceae	0	0	0	0	1	1	8	100	0	0	0	0	0	0	0	0	0	0	1	20	1	1	0	0
Enneapogon nigricans	Niggerheads	Grass	Native		Perennial	Poaceae	0	0	2	1000	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erodium cicutarium	Common Storksbill	Herb	Exotic		Annual	Geraniaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Eucalyptus (Revegetation)		Tree	Native		Perennial	Myrtaceae	0	0	0	0	0	0	0	0	0	0	1	8	0	0	0	0	0	0	0	0	0	0	0	0
Eucalyptus albens	White Box	Tree	Native		Perennial	Myrtaceae	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Eucalyptus dealbata	Tumbledown Red Gum	Tree	Native		Perennial	Myrtaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0
Eucalyptus melliodora		Tree	Native		Perennial	Myrtaceae	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Euchiton sphaericus		Herb	Native		Annual	Asteraceae	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	50	1	100
Fumaria sp.		Herb	Exotic		Annual	Fumariaceae	0	0	0	0	0	0	0	0	0	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0
Galium divaricatum	Slender Bedstraw	Herb	Native		Annual	Rubiaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	50	0	0	0	0	0	0

Scientific Name	Common name	Growth Form	Native/ Exotic	Important species	Annual/ Perennial	Family	3 (1)		3 (2)		3 (4)		4 (3)		4 (5)		1 (6)		2 (7)		3 (8)		1 (9)		4 (10 Td)		4 (11)		3 (12)	
Geranium solanderi	Native Geranium	Herb	Native		Perennial	Geraniaceae	0	0	1	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	500	1	5	0	0
Goodenia sp.		Herb	Native		Perennial	Goodeniaceae	0	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hirschfeldia incana	Hairy Brassica	Herb	Exotic		Annual	Brassicaceae	1	500	1	10	1	1	0	0	1	500	1	10	20	500	1	10	1	50	1	20	1	10	20	500
Hordeum leporinum	Barley-grass	Grass	Exotic		Annual	Poaceae	0	0	0	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0	1	100	0	0	0	0
Hypericum gramineum	Small St John's Wort	Herb	Native	Important	Perennial	Clusiaceae	1	50	2	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypericum perforatum	St John's Wort	Shrub	Exotic		Annual	Clusiaceae	0	0	0	0	0	0	1	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypochaeris glabra	Annual	Herb	Exotic		Perennial	Asteraceae	0	0	0	0	1	1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypochaeris radicata	Flatweed, Cat's-ear	Herb	Exotic		Perennial	Asteraceae	1	50	2	1000	0	0	5	1000	0	0	0	0	0	0	1	500	1	50	1	50	1	1000	0	0
Juncus sp.		Sedge	Native		Perennial	Juncaceae	0	0	0	0	0	0	0	0	1	5	0	0	0	0	0	0	1	2	0	0	0	0	0	0
Juncus subsecundus		Sedge	Native		Perennial	Juncaceae	0	0	0	0	0	0	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactuca serriola	Prickly Lettuce	Herb	Exotic		Biennial	Asteraceae	0	0	0	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lolium perenne	Perennial Ryegrass	Grass	Exotic		Perennial	Poaceae	50	1000	2	1000	1	500	5	500	5	100	0	0	20	500	0	0	5	1000	10	1000	2	1000	5	100
Lolium rigidum	Wimmera Ryegrass	Grass	Exotic		Annual	Poaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1000	0	0	0	0	0	0
Maireana enchylaenoides	Wingless Bluebush	Shrub	Native		Perennial	Chenopodiaceae	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iridaceae	Unknown Lily	Herb	Exotic		Annual	Iridaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Medicago polymorpha	Burr Medic	Herb	Exotic		Annual	Fabaceae - Faboideae	0	0	0	0	0	0	1	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medicago sativa	Lucerne	Herb	Exotic		Perennial	Fabaceae - Faboideae	0	0	0	0	0	0	0	0	1	50	0	0	0	0	0	0	2	1000	0	0	0	0	0	0
Medicago sp.	Medic	Herb	Exotic		A or P	Fabaceae - Faboideae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	50	1	20	0	0	1	50

Scientific Name	Common name	Growth Form	Native/ Exotic	Important species	Annual/ Perennial	Family	3 (1)		3 (2)		3 (4)		4 (3)		4 (5)		1 (6)		2 (7)		3 (8)		1 (9)		4 (10 Td)		4 (11)		3 (12)	
Medicago sp. (2)	Medic	Herb	Exotic		A or P	Fabaceae - Faboideae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	20
Mentha satureioides	Creeping Mint	Herb	Native		Perennial	Lamiaceae	0	0	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100	0	0	0	0
Microlaena stipoides	Weeping Grass	Grass	Native		Perennial	Poaceae	0	0	0	0	20	1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1000	0	0
Oxalis perennans		Herb	Native		Perennial	Oxalidaceae	0	0	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Oxalis sp.		Herb	Exotic		Perennial	Oxalidaceae	0	0	0	0	0	0	0	0	0	0	0	0	1	500	0	0	0	0	1	20	0	0	0	0
Paspalum dilatatum		Grass	Exotic		Perennial	Poaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	500	0	0	0	0	0	0
Petrorhagia nanteuilii	Proliferous Pink	Herb	Exotic		Annual	Caryophyllaceae	1	100	0	0	4	1000	1	100	1	50	0	0	1	50	1	50	0	0	1	20	1	50	1	50
Phalaris aquatica	Phalaris	Grass	Exotic		Perennial	Poaceae	0	0	0	0	0	0	0	0	0	0	1	50	0	0	0	0	1	1	0	0	0	0	0	0
Piptatherum miliacea	Rice Millet	Grass	Exotic		Perennial	Poaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1000	0	0	0	0	0	0
Plantago coronopus	Bucks Horn Plantain	Herb	Exotic		A or P	Plantaginaceae	0	0	0	0	0	0	1	10	1	20	0	0	0	0	1	50	0	0	0	0	0	0	0	0
Plantago lanceolata	Lambs Tongue	Herb	Exotic		Annual	Plantaginaceae	0	0	0	0	4	1	1	10	0	0	0	0	0	0	0	0	1	1000	0	0	0	0	0	0
Pratia concolor	Poison Pratia	Herb	Native		Perennial	Lobeliaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	50	0	0
Ranuculus sp.	Buttercup	Herb	Native		Perennial	Ranunculaceae	0	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rostraria cristata	Annual Cats Tail	Grass	Exotic		Annual	Poaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10	0	0
Rumex brownii	Swamp Dock, Slender Dock	Herb	Native		Perennial	Polygonaceae	1	20	0	0	1	5	1	5	0	0	1	50	1	10	0	0	1	100	1	10	1	50	0	0
Rumex sp.	Dock	Herb	Native		A or P	Polygonaceae	0	0	0	0	0	0	1	5	0	0	0	0	1	10	0	0	0	0	0	0	0	0	1	50
Salvia verbenaca	Wild Sage, Vervain	Herb	Exotic		Perennial	Lamiaceae	0	0	1	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100
Sclerolaena birchii	Galvanised Burr	Herb	Native		Perennial	Chenopodiacae	0	0	0	0	0	0	0	0	0	0	0	0	1	20	0	0	0	0	0	0	0	0	0	0

Scientific Name	Common name	Growth Form	Native/ Exotic	Important species	Annual/ Perennial	Family	3 (1)		3 (2)		3 (4)		4 (3)		4 (5)		1 (6)		2 (7)		3 (8)		1 (9)		4 (10 Td)		4 (11)		3 (12)	
Sida corrugata	Corrugated Sida	Herb	Native	Important	Perennial	Malvaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	20	0	0
Silybum marianum	Variegated Thistle	Herb	Exotic		Biennial	Asteraceae	0	0	0	0	0	0	0	0	0	0	1	10	0	0	0	0	0	0	1	20	2	500	1	20
Sonchus oleraceus	Common Sowthistle	Herb	Exotic		Annual	Asteraceae	0	0	0	0	1	1	1	20	1	100	1	100	0	0	0	0	0	0	0	0	1	100	1	20
Sonchus sp.	Sow thistle	Herb	Exotic		Annual	Asteraceae	1	50	0	0	0	0	0	0	0	0	0	0	1	20	0	0	0	0	0	0	0	0	0	0
Sporobolus creber	Western Rat-tail Grass	Grass	Native		Perennial	Poaceae	10	1000	0	0	1	100	25	100	0	0	0	0	0	0	0	0	0	0	1	20	0	0	0	0
Stachys arvensis	Stagger Weed	Herb	Exotic		Annual	Lamiaceae	0	0	0	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taraxacum officinale	Dandelion	Herb	Exotic		Annual	Asteraceae	1	50	1	100	1	10	1	100	1	50	1	10	1	20	0	0	1	50	0	0	1	50	0	0
Tragopogon dubius	Goats Beard	Herb	Exotic		Biennial	Asteraceae	0	0	0	0	0	0	0	0	0	0	1	100	0	0	0	0	1	500	0	0	1	2	1	100
Tragopogon porrifolius	Oyster Plant	Herb	Exotic		Biennial	Asteraceae	0	0	0	0	0	0	0	0	1	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tribulus terrestris	Calstrop	Herb	Exotic		Annual	Zygophyllaceae	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifolium angustifolium	Narrow-leaved Clover	Herb	Exotic		Annual	Fabaceae - Faboideae	0	0	1	1000	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trifolium arvense	Hare's-foot Clover	Herb	Exotic		Annual	Fabaceae - Faboideae	0	0	0	0	5	1000	1	50	0	0	1	1000	0	0	2	1000	0	0	5	1000	1	1000	1	50
Trifolium campestre	Hop Clover	Herb	Exotic		Annual	Fabaceae - Faboideae	1	100	1	1000	5	1000	10	1000	1	500	10	1000	0	0	1	500	0	0	5	1000	1	1000	5	500
Trifolium repens	White Clover	Herb	Exotic		Perennial	Fabaceae - Faboideae	0	0	0	0	0	0	0	0	0	0	5	1000	0	0	0	0	2	1000	0	0	0	0	0	0
Trifolium sp.	Clover	Herb	Exotic		Annual	Fabaceae - Faboideae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	50	0	0	0	0
Urtica urens	Small Nettle	Herb	Exotic		Annual	Urticaceae	1	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Veronica sp.	Speedwell	Herb	Exotic		Annual	Scrophulariaceae	0	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vicia sativa	Common Vetch	Herb	Exotic		Annual	Fabaceae - Faboideae	0	0	0	0	0	0	1	10	1	1000	0	0	1	20	0	0	1	100	0	0	0	0	0	0

Scientific Name	Common name	Growth Form	Native/ Exotic	Important species	Annual/ Perennial	Family	3 (1)		3 (2)		3 (4)		4 (3)		4 (5)		1 (6)		2 (7)		3 (8)		1 (9)		4 (10 Td)		4 (11)		3 (12)	
Vicia villosa	Russian Vetch	Herb	Exotic		A or B	Fabaceae - Faboideae	0	0	0	0	0	0	0	0	0	0	10	1000	0	0	0	0	0	0	0	0	0	0	0	0
Vittadinia muelleri		Herb	Native		Perennial	Asteraceae	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0
Vulpia sp.	Silvergrass	Grass	Exotic		Annual	Poaceae	0	0	1	1000	4	50	1	1000	0	0	0	0	0	0	0	0	0	0	25	1000	1	100	0	0
Wahlenbergiacommunis	Tufted Bluebell	Herb	Native		Perennial	Campanulaceae	1	50	0	0	1	1	1	100	1	20	0	0	0	0	1	50	0	0	0	0	1	100	0	0

Fauna of the Werris Creek Coal Mine site

Class	Family	Species	Common name	Apr04	May04	Jul04	Oct04	Mar06	Feb07	Mar08	Dec08	Mar09	Oct09	Nov09	Jan10	Apr10	Jul10	Nov10
Amphibia	Hylidae	*Litoria caerulea*	Green Tree Frog	x				x										
		Litoria peronii	Peron's Tree Frog	x					x					x				x
		Litoria rubella	Desert Tree Frog	x										x				
	Myobatrachidae	*Crinia signifera*	Common Eastern Froglet													x		x
		Limnodynastes dumerilii	Eastern Banjo Frog	x														
		Limnodynastes salmini	Salmon-striped Frog	x														
		Limnodynastes tasmaniensis	Spotted Marsh Frog	x														
		Neobatrachus sudelli	Painted Burrowing Frog	x														x
		Uperoleia laevigata	Smooth Toadlet	x										x				x
Aves	Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill														x	
	Accipitridae	*Elanus axillaris*	Black-shouldered Kite							x		x				x	x	
		Hieraaetus morphnoides	**Little Eagle**									**x**				**x**		**x**
	Anatidae	*Anas gracilis*	Grey Teal													x		
		Anas superciliosa	Pacific Black Duck			x	x			x						x	x	x
		Chenonetta jubata	Australian Wood Duck		x	x	x			x		x				x	x	
		Dendrocygna eytoni	Plumed Whistling-Duck													x		
	Ardeidae	*Egretta novaehollandiae*	White-faced Heron			x	x			x		x				x	x	x
	Artamidae	*Artamus cyanopterus*	Dusky Woodswallow		x	x	x			x	x	x				x		
		Cracticus nigrogularis	Pied Butcherbird		x	x	x				x	x				x	x	x
		Cracticus torquatus	Grey Butcherbird							x	x					x		x
		Gymnorhina tibicen	Australian Magpie		x	x	x			x	x	x				x	x	x

Class	Family	Species	Common name	Apr04	May04	Jul04	Oct04	Mar06	Feb07	Mar08	Dec08	Mar09	Oct09	Nov09	Jan10	Apr10	Jul10	Nov10
Aves		*Strepera graculina*	Pied Currawong				x									x		
	Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo			x	x			x	x	x				x		x
		Eolophus roseicapillus	Galah		x	x	x			x	x	x				x	x	x
		Nymphicus hollandicus	Cockatiel								x					x		x
	Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		x	x	x			x						x		x
		Coracina papuensis	White-bellied Cuckoo-shrike													x		
	Charadriidae	*Vanellus miles*	Masked Lapwing			x	x			x								
	Climacteridae	***Climacteris picumnus***	**Brown Treecreeper**													**x**		
	Columbidae	*Columba livia*	Rock Dove *									x				x		
		Geopelia striata	Peaceful Dove *			x	x											
		Ocyphaps lophotes	Crested Pigeon *								x	x				x		x
	Coraciidae	*Eurystomus orientalis*	Dollarbird			x	x											
	Corvidae	*Corvus bennetti*	Little Crow			x	x			x								
		Corvus coronoides	Australian Raven		x	x	x					x				x	x	
		Corvus mellori	Little Raven															x
	Cuculidae	*Scythrops novaehollandiae*	Channel-billed Cuckoo															x
	Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird													x		
	Dicruridae	*Grallina cyanoleuca*	Magpie-lark									x				x	x	x
	Dicruridae	*Rhipidura leucophrys*	Willie Wagtail		x	x	x					x				x	x	x
	Falconidae	*Falco berigoga*	Brown Falcon									x					x	x
		Falco cenchroides	Nankeen Kestrel		x	x	x			x		x				x	x	x
		Falco peregrinus	Peregrine Falcon			x	x					x						
	Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra			x	x			x		x				x	x	x
	Hirundinidae	*Cheramoeca leucosternus*	White-backed Swallow									x				x		
		Hirundo ariel	Fairy Martin															x
		Hirundo neoxena	Welcome Swallow													x	x	
		Petrochelidon nigricans	Tree Martin			x	x									x	x	x
	Maluridae	*Malurus cyaneus*	Superb Fairy-wren													x		
		Malurus lamberti	Variegated Wren									x						
	Meliphagidae	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater															x
		Lichenostomus chrysops	Yellow-faced Honeyeater													x		
		Lichenostomus penicillatus	White-plumed Honeyeater													x		x

Class	Family	Species	Common name	Apr04	May04	Jul04	Oct04	Mar06	Feb07	Mar08	Dec08	Mar09	Oct09	Nov09	Jan10	Apr10	Jul10	Nov10
Aves		*Manorina melanocephala*	Noisy Miner		x	x	x			x	x	x				x	x	x
		Philemon corniculatus	Noisy Friarbird		x	x	x									x		
	Motacillidae	*Anthus australis*	Australian (Richard's) Pitpit									x						
	Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush															x
		Pachycephala rufiventris	Rufous Whistler															x
	Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote		x	x	x										x	x
		Pardalotus striatus	Striated Pardalote		x	x	x									x		x
	Passeridae	*Passer domesticus*	House Sparrow													x		
	Petroicidae	***Melanodryas cucullata***	**Hooded Robin**				**x**											
		Microeca fascinans	Jacky Winter													x		
	Phasianidae	*Coturnix pectoralis*	Stubble Quail		x	x	x			x		x						
		Coturnix ypsilophora	Brown Quail													x	x	
	Podargidae	*Podargus strigoides*	Tawny Frogmouth		x	x	x					x						
	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe													x	x	x
	Psittacidae	*Alisterus scapularis*	Australian King-Parrot															x
		Glossopsitta concinna	Musk Lorikeet							x						x	x	x
		Glossopsitta pusilla	Little Lorikeet			x	x											
		Platycercus adscitus eximius	Eastern Rosella		x	x	x			x	x	x				x	x	x
		Psephotus haematonotus	Red-rumped Parrot			x	x			x	x	x				x	x	x
		Psephotus varius	Mulga Parrot			x	x											
	Strigidae	*Ninox novaeseelandiae*	Southern Boobook			x	x			x		x						
	Sturnidae	*Sturnus vulgaris* *	European Starling			x						x				x	x	x
		Turdus merula *	Common Myna									x						x
	Threskiornithidae	*Threskiomis molucca*	Australian White Ibis		x	x	x											
	Tytonidae	*Tyto alba*	Barn Owl									x				x		
Mammalia	Bovidae	*Bos taurus**	Cow			x				x						x		
	Canidae	*Canis (lupis) familiaris* *	Dog			x				x						x		
		Vulpes vulpes *	European Red Fox			x				x						x	x	x
	Felidae	*Felis catus**	Feral Cat			x				x								
	Leporidae	*Oryctolagus cuniculus* *	European Rabbit			x				x						x	x	
	Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo			x				x	x					x		
		Macropus robustus	Wallaroo			x										x	x	

Class	Family	Species	Common name	Apr04	May04	Jul04	Oct04	Mar06	Feb07	Mar08	Dec08	Mar09	Oct09	Nov09	Jan10	Apr10	Jul10	Nov10
		Macropus rufogriseus	Red-necked Wallaby			x												
	Muridae	*Mus musculus**	House Mouse			x				x						x		x
	Muridae	*Rattus rattus**	Black Rat			x										x		
	Phalangeridae	*Trichosurus velpecula*	Common Brushtail Possum			x				x						x	x	
	Tachyglossidae	*Tachyglossus aculeatus*	Short-beak Echidna			x										x		
Chiroptera (Bats)	**Emballonuridae**	***Saccolaimus flaviventrus***	**Yellow-bellied Sheath-tail Bat**							x		**x**				**x**		**x**
Chiroptera (Bats)	Molossidae	*Mormopterus species 3*	Undescribed Little Mastiff-bat @ 25KHz			*x*				x		x	x			x		x
		Mormopterus species 4	Undescribed Little Mastiff-bat @ 30KHz							x		x	x			x		x
		Austronomus australis	White-striped Free-tail (or Mastiff-bat) Bat			x				x		x				x		x
	Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat			x				x		x	x			x		x
		Chalinolobus morio	Chocolate Wattled Bat							x			x			x		x
		Falsistrellus tasmaniensis	**Eastern False Pipistrelle**										**x**			**x**		**x**
		Miniopterus schreibersii oceanensis	**Eastern Bent-wing Bat**			**x**							**x**			**x**		**x**
		Nyctophilus geoffroyi	Lesser Long-eared Bat			x												
		Nyctophilus sp.										x				x		x
		Scoteanax rueppellii	**Greater Broad-nosed Bat**			**x**							**x**			**x**		
		Scotorepens balstoni	Inland Broad-nosed Bat									x	x			x		x
		Scotorepens greyii	Little Broad-nosed Bat										x					
		Vespadelus darlingtoni	Large Forest Bat			x				x		x						
		Vespadelus vulturnus	Little Forest Bat							x			x	x	x	x	x	x
Reptilia	Agamidae	*Pogona barbata*	Eastern Bearded Dragon											x	x			
	Cheluidae	*Chelodina longicolli*	Eastern Snake-necked Turtle	x											x	x		x
	Elapidae	*Demansia psammophis*	Yellow-faced Whipsnake	x								x		x	x	x		
		Pseudechis guttatus	Blue-bellied Black Snake													x		
		Pseudonaja textilis	Eastern Brown Snake									x						x
	Gekkonidae	*Gehyra dubia*	Dubious Dtella													x		
		Gehyra variegata	Common Dtella	x					x			x				x		
		Gehyra variegata (egg shells)	Common Dtella															
		Oedura robusta	Robust Velvet Gecko													x		

Class	Family	Species	Common name	Apr04	May04	Jul04	Oct04	Mar06	Feb07	Mar08	Dec08	Mar09	Oct09	Nov09	Jan10	Apr10	Jul10	Nov10
		Strophurus williamsi	Eastern Spiny-tailed Gecko	x						x				x				
		Underwoodisaurus milii	Barking Gecko	x				x										
	Pygopodidae	*Delma inornata*	Plain Snake-lizard											x				
		Delma plebeia	Basalt Snake-lizard	x														
		Lialis burtonis	Burton's Snake-lizard	x				x										
	Scincidae	*Anomalopus leuckartii*	Two-clawed Worm-skink	x								x		x		x		
Reptilia	Scincidae	*Carlia tetradactyla*	Southern Rainbow Skink											x				
		Cryptoblepharus pannosus	Ragged Snakeeyed Skink															
		Cryptoblepharus pulcher	Elegant Snake-eyed Skink	x						x		x		x	x	x		x
		Ctenotus robustus	Eastern Striped Skink	x								x		x		x		
		Egernia striolata	Tree skink						x							x		x
		Eulamprus tenuis	Greater Bar-sided Skink	x						x				x	x	x		
		Lampropholis guichenoti	Pale-flecked Garden Sunskink															x
		Menetia greyii	Dwarf Skink	x				x	x							x		x
		Morethia boulengeri	Boulenger's Morethia	x						x		x		x	x	x		
		Unknown Reptile eggshells	(Possibly *M. boulengeri*)					x	x							x		
	Typhlopidae	*Ramphotyphlops wiedii*	Blind Snake	x														
Bold text denotes a threatened species																		
* Denotes an exotic species																		

APPENDIX D - MP RISK ASSESSMENT

A) Environmental Risk Assessment from LOM Project (R.W. Corkery & Co. 2010)

Biodiversity specific risk assessment extracted and modified from **Table 3.6** and **Table 6.1**

Identified Risk	Level / Scale of Potential Impact (if applicable)	Unmitigated			Mitigated		
		Consequence	Likelihood	Risk Rating	Consequence	Likelihood	Risk Rating
Loss of threatened fauna habitat		2	A	H	3	D	M
Threatened vegetation stress/death		1	C	L	1	C	L
Reduction in species diversity		2	A	H	1	B	M
Loss of threatened vegetation species communities		2	A	H	2	A	H
Reduction in threatened aquatic vegetation numbers	Increased stress to threatened aquatic fauna	1	C	L			
	Reduction in localised numbers of aquatic threatened fauna	2	D	L			
	Reduction in regional numbers of aquatic threatened fauna	3	E	M			

Biodiversity specific risks and impacts extracted from **Table 3.2**

Environmental Issue	Risk Source/ Potential Incident(s)	Potential Consequences	Receptor/ Surrounding Environment	Potential Environmental Impacts
Rehabilitation, Final Landform & Biodiversity Offsets	• Final Rehabilitation in not to or better then original landform and is not safe, stable or fit for purpose.	• Reduced land capability of the rehabilitated land. • Rework on rehabilitated areas.	• The Project Site (WCC mine site). • The end land user.	• Reduced amenity of the final landform. • Reduced productivity from the rehabilitated land.
	• Rehabilitation landform does not link or enhance surrounding native vegetation communities.	• Reduced habitat and corridors for native fauna. • Reduced vegetative species diversity.	• Rehabilitated land. • Native fauna.	• Reduction in native fauna species diversity.
	• Biodiversity offsets are not properly managed.	• Unintentional land clearing with the biodiversity offset area. • Weed infestation within the biodiversity offset area. • Degradation of the biodiversity offset area.	• Biodiversity offset areas.	• Reduction or degradation of biodiversity offset area. • Reduced species diversity. • Reduced population native fauna populations.
	• Modified final land use from what was originally in place.	• Less land available for its original use.	• Agricultural community. • Native fauna.	• Change in structure of vegetation communities. • Change in habitat.

B) Whitehaven Coal Broadbrush Environmental Risk Assessment for WCC (SMS, 2012)

Biodiversity specific risk assessment extracted and modified from WCC Broadbrush Risk Assessment. See Whitehaven Coal Risk Management Standard for risk matrix definitions.

Subprocess	Hazard	Causes	Existing Controls	Consequence	Likelihood	Risk Level	Additional Actions	Consequence	Likelihood	Risk Level
Flora	Disturbance beyond approval limits	1. Surveying error 2. Operator error	1. Pegged clearance limit 2. Pre-clearance inspections by independent ecologists 3. Flora assessment and communities mapped as part of Environmental Assessment 4. Biodiversity offset area	3	D	M				
Fauna	Adverse effect on fauna populations	1. Disturbance beyond approval limits	1. Pegged clearance limit 2. Pre-clearance inspections by independent ecologists 3. Threatened fauna assessment and communities mapped as part of Environmental Assessment 4. Biodiversity offset area sign posted	4	E	M	1. Investigate fencing biodiversity area			
Vegetation communities	Adverse effect on critically endangered vegetation communities	1. Disturbance beyond approval limits	1. Pegged clearance limit 2. Pre-clearance inspections by independent ecologists 3. Flora assessment and communities mapped as part of Environmental Assessment 4. Biodiversity offset area 5. EPBC Act approval obtained	4	E	M	1. Implement environmental awareness training for site personnnel 2. Investigate flagging tape boundary			

C) WCC Biodiversity Offset Management Plan Specific Risk Assessment (Ecological, 2012)

Hazard	Cause	Current Management Control	Risk	Additional Management Action
Endangered Ecological Communities	1. Vegetation clearing for mine footprint and ancillary works 2. Introduction of weeds from vehicle movements and operations	▪ Avoiding clearing where possible ▪ Existing BOS, rehabilitation and offset management to mitigate the loss of vegetation ▪ Pre-clearing and pre-start clearing inspections ▪ Annual flora and fauna monitoring ▪ Periodic inspections ▪ Weed control program	H	▪ LOM BOS increase in BOA managed and restored woodland
Koala	1. Habitat removal for mine footprint and ancillary works 2. Traffic collisions	▪ Existing BOS, rehabilitation and offset management to mitigate the loss of vegetation ▪ Pre-clearing and pre-start clearing inspections ▪ Staged clearing in Autumn (outside active breeding season)	M	▪ Installation of Koala proof and kangaroo inhibiting fencing ▪ Include targeted Koala monitoring techniques into the offset flora and fauna monitoring ▪ LOM BOS increase in BOA managed and restored woodland
Microchiropteran bats	1. Habitat removal for mine footprint and ancillary works 2. Disturbance of foraging patterns due to lighting	▪ Existing BOS, rehabilitation and offset management to mitigate the loss of vegetation ▪ Pre-clearing and pre-start clearing inspections ▪ Staged clearing in Autumn (outside of breeding and over-wintering periods) ▪ Annual flora and fauna monitoring	H	▪ Installation of Microchiropteran bat boxes within offset area and incorporate in to monitoring ▪ Stag tree habitat augmentation in rehabilitation areas ▪ LOM BOS increase in BOA managed and restored woodland
Woodland birds	1. Habitat removal for mine footprint and ancillary works 2. Disruption of homeranges and behavioural patterns due to noise and disturbance	▪ Existing BOS, rehabilitation and offset management to mitigate the loss of vegetation ▪ Pre-clearing and pre-start clearing inspections ▪ Staged clearing in Autumn (outside of migration periods for winter migrants) ▪ Annual flora and fauna monitoring	M	▪ Surveys for threatened winter migrant birds (Swift Parrot and Regent Honeyeater) ▪ Planting known food species into BOA and rehabilitation ▪ LOM BOS increase in BOA managed and restored woodland
Threatened Raptors	1. Habitat removal for mine footprint and ancillary works 2. Disruption of homeranges and behavioural patterns due to noise and disturbance	▪ Existing BOS, rehabilitation and offset management to mitigate the loss of vegetation ▪ Pre-clearing and pre-start clearing inspections ▪ Staged clearing in Autumn (outside of migration periods for winter migrants) ▪ Annual flora and fauna monitoring	M	▪ Stag tree habitat augmentation in rehabilitation areas ▪ LOM BOS increase in BOA managed and restored woodland

APPENDIX E - Procedures

Weed Control

All weed management works outlined in **Section 8.7** are assumed or recommended to be implemented on the basis that suitably qualified and experienced bush regeneration contractors will be engaged by WCC to conduct all management activities. Details of specific weed control techniques to be used such as hand pulling weeds, grass control and the use of herbicides are described in detail in Muyt (2001).

Species Name	Common Name	Recommend Control method(s)
Lycium ferocissimum	African Boxthorn	Use of Cut and Paint technique with non specific herbicide (e.g. Glyphosate)
Marrumbium vulgare	Horehound	Use of non specific herbicide (e.g.Glyphosate) prior to annual flowering
Echium plantagineum	Patterson's Curse	Spot Spray using a broadleaf herbicide (e.g. metsulfuron methyl)
Setaria sp.	Pigeon Grass	Regular slashing, spot spraying with grass specific herbicide (e.g. Fusillade)
Opuntia spp.	Prickly Pear	Dig out and dispose of appropriately
Carthamus lanatus	Saffron Thistle	Use of non specific herbicide (e.g. Glyphosate) prior to annual flowering
Hypericum perforatum	St. Johns Wort	Spot Spray using a broadleaf herbicide (e.g. metsulfuron methyl)

The following is a description of appropriate methods should WCC decide to carry out the management actions.

Weed Treatment

Weed control techniques within the BOA will be undertaken using minimal disturbance techniques so as to prevent minimal disturbance to the soil. Disturbance to the soil will result in increased weed germination and potentially lead to soil erosion.

Hand Pulling

Hand pulling of weeds includes:

- Selecting the most appropriate tool for the weed being removed (if required)
- Minimise soil disturbance by controlling weeds when the soil is moist
- Control plants before fruits or other propagules develop
- Remove excess soil from the root system when there is no risk of spreading vegetative material
- Cover disturbed soil or gaps with leaf litter and twigs
- Ensure bulbs, corms, tubers, rhizomes or stolons are carefully dug out
- Bag all propagules before removing them off-site (Muyt 2001)

Herbicide Use

Herbicides are required for use for the spraying of herbaceous and re-shooting woody weeds. Only a non-specific herbicide (e.g. glyphosate) will be used for this work. Herbicide use near waterways is not permitted as all waterways are ephemeral. No spraying will be undertaken in the vicinity of any waterways with flowing water.

Spot Spraying

Spot spraying will be required for seedlings and the regrowth of the woody weed African Boxthorn, as well as Horehound and Noogoora Burr. These species will be controlled using a non-selective herbicide mixed appropriately with water. When spot spraying, ensure the target plant has been correctly identified and that the target plant is sprayed with the herbicide. Off-target damage should be minimised through the correct identification of target weed species.

Primary Woody Weed Treatment (African Boxthorn)

Cut and Paint Technique

The plant needs to be actively growing with green foliage present. African Boxthorn usually begins actively growing in September and fruiting occurs in autumn and winter. Control will be undertaken during summer months prior to fruiting occurring. The plant needs to be cut horizontally as close to the base as possible and below any branches. Either a chainsaw, handsaw or secateurs can be used to make the cut, depending on the size of the plant. Remove any dirt from the stump and immediately apply the appropriately mixed herbicide directly to the stump using a dabber bottle or brush. Plants may re-sprout and follow up work maybe required.

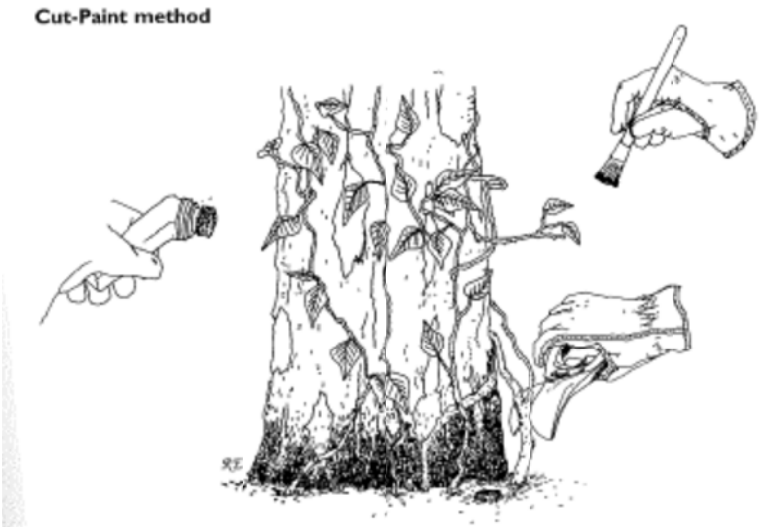

Figure 13: The cut and paint method

Drill and Fill Technique

This method is suitable for the control of large African Boxthorn plants. The drill and fill method involves drilling a hole into the base of a tree below any branches with a hand held drill bill and a 9 or 10mm drill bit at an angle of 40-60^{O}. The hole should only penetrate through the sap wood and not through to the heart wood. The hole should then be filled immediately with the appropriately mixed herbicide. An eye dropper or a squeeze bottle with a narrow nozzle can be used to fill the hole. If the plant re-sprouts follow up work will be required.

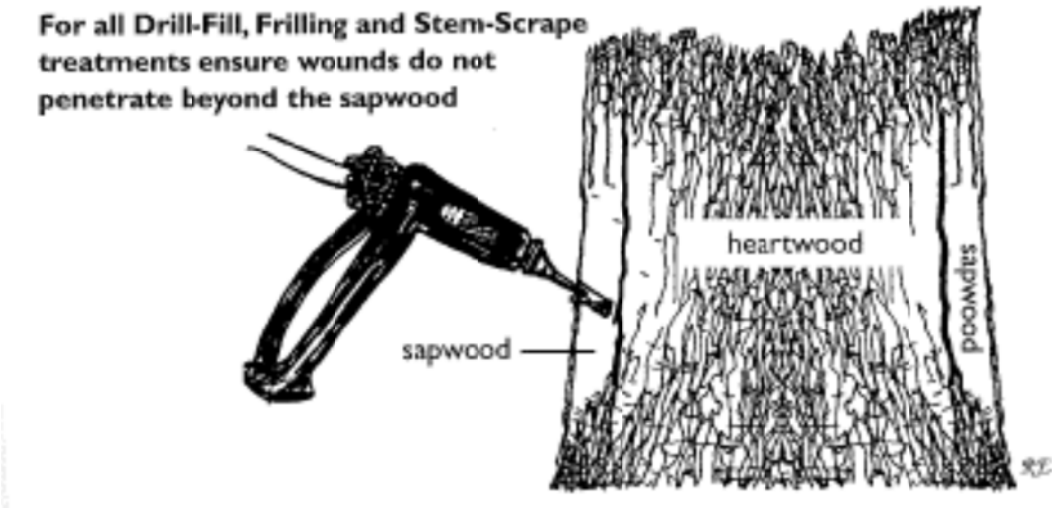

Figure 14: The drill and fill technique

The above images have been taken from Muyt (2001).

Secondary and Maintenance Woody Weed Treatment

- Regrowth of primary treated stumps will be spot sprayed with a non-specific herbicide.

Feral Animal Control

Pesticide Baiting

Pesticide Control Orders (PCOs) exist for the use of each of Pindone and 1080 under Part 4 of the NSW *Pesticides Act 1999* and associated regulations. These PCOs stipulate that only Authorised Control Officers are authorised to implement the use of concentrated Pindone and 1080 baits, although ready-made baits can be used by landowners/managers. Furthermore, as of 1 September 2005, training in the use of pesticides has been compulsory if pesticides are used in a job or business (including farming).

The following is a broad outline of the process for using each chemical, notwithstanding the requirement for the operator to be trained in the use of these chemicals. Advice should be sought from OEH as to the most effective methods to minimise off-target kills and animal ethics in relation to the disposal of un-used bait and carcases.

It is highly recommended that any baiting that takes place within the BOA is supported by a strategic off-site baiting program with cooperation from adjacent landowners.

All stock should be removed from the site prior to baiting program (Note that no domestic stock are allowed in the BOA).

Pindone (Rabbits)

- Under take baiting in summer or when there is limited green feed on the BOA
- Select appropriate sites – it is recommended to locate sites near known Rabbit harbour
- Acquire Pindone Baits (mixing of Pindone concentrate must be carried out by an Authorised Control Officer)
- 'Free feed' rabbits on non-toxic bait prior to baiting commencing
- Scatter bait in selected locations and repeat dose three to four days apart for the entirety of the baiting treatment period
- If possible destroy warrens once a kill of the rabbit population has been assured. This prevents recolonisation of warrens

1080 Baits (Foxes and Feral Pigs)

Foxes

- Seek approval from relevant agencies (e.g. LHPA, Dept Agriculture) for baiting program
- Notify neighbours
- Erect signage
- Acquire 1080 fox baits and feral pig baits
- Foxes using guidelines developed by DECCW (2008):
  a) Bury baits 8-10 cm below the surface.
  b) Place baits at least 500 metres apart or 1 per 10 ha (150 baits will be sufficient for the Whitehaven site).
  c) Conduct baiting in autumn (juveniles dispersing) and spring (breeding season).
  d) Check baits regularly and replace taken baits during treatment.
  e) Collect and dispose of unused baits after treatment.

Feral Pigs

- Establish bait stations near known areas of Feral Pig occupation (wallows, tracks, feeding areas, etc)
- Establish a pre-feed program over several months with small, strategically placed piles of grain or other food-stuffs
- Create muddy or sandy swept pads to identify if Feral Pigs are eating the pre-feed
- Over months gradually reduce bait stations to encourage Feral Pigs to feed from only a couple of points (or one central point if possible)
- Place baits at bait stations in clusters and monitor uptake daily and replace taken baits until uptake ceases
- Collect and dispose of unused baits after treatment

Native Vegetation Re-establishment
Revegetation

- Provenance plant nursery engaged to collect, propagate and supply locally endemic plants as tube stock;
- Species to be sourced from those listed in **Section 8.5**
- Petrol-driven augur used to dig holes
- Planting to be carried out in August or September, ideally on a cool day and after rain
- Plants to be planted with fertiliser pellets. One pellet per plant
- Plants are to be planted slightly below the surrounding surface, so that the 'dish' created around the plant collects and pools water
- Plants to be watered on the day of planting and twice in the following week
- Tree-guards are to be installed

Re-introduction of Logs

The reintroduction of logs will occur through time. Logs are not to be sourced from the BOA. No logs are to be removed from the BOA.

APPENDIX F - Inspection Proforma

Who: **Date of Inspection:**

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Eurunderee Biodiversity Offset Area: Felstead				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				
Fence and Access Management				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Erosion and Sedimentation				
Fire Management				
Other				
Eurunderee Biodiversity Offset Area: Flat				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				
Mine Site Biodiversity Offset Area: O'Donnells				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Weeds				
Pests				
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				
Mine Site Biodiversity Offset Area: Narrawolga				
Seed Collection				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Railway View Biodiversity Offset Area: Hill				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Other				
Railway View Biodiversity Offset Area: Pipeline				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				
Fence and Access Management				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Erosion and Sedimentation				
Fire Management				
Other				
Railway View Biodiversity Offset Area: Houdini				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				
Railway View Biodiversity Offset Area: Ryan				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Weeds				
Pests				
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				
Marengo Biodiversity Offset Area: Upper Black Gully				
Seed Collection				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Marengo Biodiversity Offset Area: Davies				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Other				
Marengo Biodiversity Offset Area: Ridge				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				
Fence and Access Management				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Erosion and Sedimentation				
Fire Management				
Other				
Marengo Biodiversity Offset Area: Never Never				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				
Marengo Biodiversity Offset Area: Back Country				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Weeds				
Pests				
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				
Hillview Biodiversity Offset Area: Marshalls				
Seed Collection				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Hillview Biodiversity Offset Area: Lookout				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Other				
Greenslopes/Banool Biodiversity Offset Area: Haling				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				
Fence and Access Management				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Erosion and Sedimentation				
Fire Management				
Other				
Greenslopes/Banool Biodiversity Offset Area: Goat				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				
Greenslopes/Banool Biodiversity Offset Area: Valley				
Seed Collection				
Revegetation – Regrowth – Planting				
Habitat Augmentation				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Weeds				
Pests				
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				
Greenslopes/Banool Biodiversity Offset Area: Doyles				
Seed Collection				

Inspection Item	Yes/ No	Photo/Co-ordinates	Comment	Action Completed
Revegetation – Regrowth – Planting				
Habitat Augmentation				
Weeds				
Pests				
Fence and Access Management				
Erosion and Sedimentation				
Fire Management				
Other				

Signed: **Date:**

APPENDIX G - Review Proforma

BOMP Section	Clause	Compliant	Evidence/Comment	Recommendation
2.0	Responsibilities			
3.0	Requirements			
6.0	Biodiversity Risk Assessment			
7.1	Completion Criteria			
7.2	Objectives and Targets			
8.1	Clearing			
8.2	Biodiversity Offset Strategy			
8.4	Seed Collection and Propagation			
8.5	Revegetation • Cover Crop • Overstorey • Understorey			
8.6	Habitat Augmentation • Terrestrial and arboreal habitat structures • Aquatic habitat structures • Food resources			

8.7	Weed Management			
8.8	Control of Feral and overabundant native herbivores			
8.9	Fence and Access Management • Koala/Kangaroo Proof Fence			
8.10	Narrawolga Axe Grinding Grooves and Aboriginal Heritage			
8.11	Erosion and Sedimentation Control (if required)			
8.12	Exclusion of Grazing			
8.13	Fire Management • Ecological Burns • Hazard Reduction Burning • Fire Fighting Equipment			
8.14	Salinity			
9.0	Monitoring • Soil • Vegetation • Fauna			
10.0	Inspections			
11.0	Training			
12.0	Reporting			
13.0	Reviews			

APPENDIX H – BOA Land Titles

BAXTER GEO CONSULTING PTY LTD

ACN 104 693 736 ABN 51 104 693 736
2/13 Hill Street, Tamworth, 2340 P.O. Box 1402, Tamworth, 2340
Telephone: 02-6766 6499 Facsimile: 02-6766 6599
email: peter@baxtergeo.com

SURVEYING - DEVELOPMENT PLANNING & CO-ORDINATION

CLIENT: WERRIS CREEK COAL PTY LIMITED

PLAN SHOWING LAND PARCELS AND CONSERVATION AREAS IN THE BIO DIVERSITY STRATEGY FOR WHITEHAVEN COAL AT WERRIS CREEK COLLIERY

DATE: 13th July 2013 Rv. A

DRAWING No.: 0570-130713

Rv	DATE	REVISIONS
A	13-07-13	INITIAL ISSUE

DESIGN: AW
DRAWN: PJB
CHECKED: PJB

Co-Ord System: MGA 56
Red Ratio: 1:25,000 @ A3
Plot size issued : A3

GREEN SLOPES

HILL VIEW

MARENGO

MINE

MINE

RAILWAY VIEW

EURUNDEREE

Mine Lot	DP	All / Part	Cat	Small		
19	751017	Part	739	1788	AC 8384-58	Betalpha Pty Ltd
73	751017	Part	1326	1788	AC 8384-58	Betalpha Pty Ltd
74	751017	Part	1326	1788	AC 8384-58	Betalpha Pty Ltd
75	751017	Part	1326	1788	AC 8384-59	Betalpha Pty Ltd
83	751017	Part	1534	1788	AC 15372-44	Betalpha Pty Ltd
90	751017	Part	1708	1788	AC 15372-44	Betalpha Pty Ltd
92	751017	Part	1803	1788	AC 15372-44	Betalpha Pty Ltd
123	751017	Part	2339	1788	AC 8658-14	Betalpha Pty Ltd
126	751017	Part	2339	1788	AC 8658-14	Betalpha Pty Ltd
127	751017	All	2339	1788	AC 8658-14	Betalpha Pty Ltd
128	751017	All	2339	1788	AC 8658-14	Betalpha Pty Ltd
129	751017	Part	2339	1788	AC 8658-14	Betalpha Pty Ltd
131	751017	Part	2339	1788	AC 15372-44	Betalpha Pty Ltd
132	751017	Part	2339	1788	AC 15372-44	Betalpha Pty Ltd
134	751017	Part	2335	1788	AC 15372-44	Betalpha Pty Ltd
217	751017	Part	3062	1788	AC 15372-44	Betalpha Pty Ltd
225	751017	Part	3496	1788	AC 15372-44	Betalpha Pty Ltd
4	1022826	All			FI 4/1022826	Betalpha Pty Ltd
2	1085891	Part			FI 2/1085891	Betalpha Pty Ltd

deree t	DP	All / Part	Cat	Small		
9	751017	All	1041	1788	AC 15372-44	Betalpha Pty Ltd
4	751017	All	1535	1788	AC 15372-44	Betalpha Pty Ltd
7	751017	All	1535	1788	AC 15372-44	Betalpha Pty Ltd
9	751017	All	1708	1788	AC 15372-44	Betalpha Pty Ltd
0	751017	Part	1708	1788	AC 15372-44	Betalpha Pty Ltd
1	751017	All	1709	1788	AC 15372-44	Betalpha Pty Ltd
2	751017	Part	1803	1788	AC 15372-44	Betalpha Pty Ltd
1	751017	Part	2339	1788	AC 15372-44	Betalpha Pty Ltd
4	751017	Part	2335	1788	AC 15372-44	Betalpha Pty Ltd
9	751017	All	3372	1788	AC 15372-44	Betalpha Pty Ltd
5	751017	Part	3496	1788	AC 15372-44	Betalpha Pty Ltd
6	751017	All	3496	1788	AC 15372-44	Betalpha Pty Ltd
7	751017	Part	3062	1788	AC 15372-44	Betalpha Pty Ltd

Greenslopes Lot	DP	All / Part	Cat	Small		
X	381273	Part			AC 6646-228	Werris Creek Coal Pty Limited
1	455119	Part			AC 12504-241	Werris Creek Coal Pty Limited
2	455119	Part			AC 12504-241	Werris Creek Coal Pty Limited
96	751017	Part	1712	1788	AC 6646-228	Werris Creek Coal Pty Limited
107	751017	Part	2338	1788	AC 12504-241	Werris Creek Coal Pty Limited

Hill View Lot	DP	All / Part	Cat	Small		
1	981722	Part			FI 1/981722	Betalpha Pty Ltd

Marengo Lot	DP	All / Part				
73	751034	Part	4308	1788	FI 73/751034	Werris Creek Coal Pty Limited

Railway View Lot	DP	All / Part	Cat	Small		
71	403895	All			FI 71/403895	Werris Coal Pty Limited
44	751017	Part	1037	1788	FI 44/751017	Werris Coal Pty Limited
45	751017	All	1038	1788	FI 45/751017	Werris Coal Pty Limited
78	751017	Part	1322	1788	FI 78-751017	Werris Coal Pty Limited
79	751017	Part	1322	1788	FI 79/715017	Werris Coal Pty Limited
144	751017	Part	2343	1788	FI 144/751017	Werris Coal Pty Limited
147	751017	All	2978	1788	FI 147/751017	Werris Coal Pty Limited
264	751017	All	4318	1788	FI 265/751015	Werris Coal Pty Limited
1	1094005	Part			AC 2990-170	Werris Coal Pty Limited
2	1094005	Part			AC 2990-170	Werris Coal Pty Limited
258	1101474	All			FI 258/1101474	Werris Coal Pty Limited

IMPORTANT NOTES AND CAUTIONS

THESE NOTES FORM AN INTEGRAL PART OF THIS PLAN.

THIS PLAN HAS BEEN PREPARED TO IDENTIFY LAND PARCELS AFFECTED BY A CONSERVATION AGREEMENT UNDER THE WHITEHAVEN COAL – WERRIS CREEK BIO–DIVERSITY STRATEGY.

THE POSITION AND EXTENT OF THE CADASTRAL UNDERLAY IMAGE IS APPROXIMATE ONLY.

BOUNDARY LOCATIONS WILL BE SUBJECT TO IDENTIFICATION BY A REGISTERED SURVEYOR AND FIELD SURVEY IN ACCORDANCE WITH THE REQUIREMENTS OF THE LAND TITLES OFFICE.

THE FINAL PLAN WILL BE IN A FORMAT THAT SATISFIES THE REQUIREMENTS OF THE LAND TITLES OFFICE.

A NUMBER OF PLANS MAY BE REQUIRED TO BE LODGED WITH THE LAND TITLES OFFICE TO ESTABLISH THE CONSERVATION AREA EASEMENT ON THE INDIVIDUAL TITLES.

PLAN SHOWING BIO-DIVERSITY STRATEGY ILLUSTRATING LAND PARCELS

APPENDIX I – Fire Management Strategy

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HUNTER LAND MANAGEMENT

Fire Management Strategy

Whitehaven Coal – Werris Creek Coal

August 2013

This Fire Management Strategy was produced for Andrew Wright of Whitehaven Coal – Werris Creek Coal in August 2013 which details results and recommendations based on field inspection conducted in July 2012 and the outcomes of controlled burns undertaken in August 2013.

SUBMITTED TO	DATE	REVISION
Andrew Wright	20/8/2012	1.0
Andrew Wright	23/8/2013	2.0

This document can only be considered as having permission for final distribution if an original signature of an authorized representative of Hunter Land Management Pty Ltd is found below:

20/8/2012

_____ _____

SIGNATURE DATE

Joshua Frappell (Senior Environmental Consultant) – HUNTER LAND MANAGEMENT PTY LTD

HUNTER LAND MANAGEMENT

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1. Introduction

1.1 Overview

The following Fire Management Strategy (FMS) was produced for Whitehaven Coal, Werris Creek Coal (WCC) following inspections undertaken by Hunter Land Management in July 2012 and amended following controlled burns in August 2013. These inspections and their subsequent results have contributed to the creation of this FMS for the Werris Creek Coal and Biodiversity Offset Area for three years period 2012-2015. This FMS is a risk mitigation tool developed to document the actions to be implemented to reduce risks and provide management techniques necessary to address fire hazards prone to the Biodiversity Offset Areas and the mining operations currently occurring onsite.

The scope of works involved the following;

- Fuel Load Assessment
- Fire Break Assessment
- Water Source Assessment
- Access and Track Assessment
- Asset Protection Zones
- Control Burning Assessment

1.2 Site Description

Werris Creek Coal Mine is located within the North West Slopes and Plains of New South Wales approximately 45km southwest of Tamworth. The mine is currently located approximately 4km south of Werris Creek and 11km north-northwest of Quirindi. The areas inspected consisted predominately of White Box grassy woodlands comprised with exotic pastures and historic cropping lands. As stated in the PA10-0059, the Biodiversity Offset Area covers a total of 1300ha plus 600ha of mine rehabilitation at the end of the mining operations. The Biodiversity Offset Areas contain several identified threatened species listed under the NSW Threatened Species Conservation Act, 1995 and as identified in the WCC Biodiversity Impact Assessment, 2010.

2. Methodology

The following sub headings express methodologies undertaken to attain data enabling the development of this FMS specific for WCC Biodiversity Offset Areas.

2.1 Fuel Load Assessment

Fuel load analysis was conducted by using representative 1 metre square quadrants to assess ground cover and fuel loads. The weight of all debris and plausible fire fuel loads was used to extrapolate the rate from grams per square metre to tonnes per hectare. These results are then able to be compared to the 'Overall fuel hazard assessment guide', 4th Edition July 2010, Indicative Fuel Loads (t/ha).

2.2 Firebreak Conditions

Fire break conditions were assessed on face value. Land with average ground cover over the height of one metre was labelled as being overgrown. Tree branches and other plants were visually inspected and were deemed unsatisfactory if they were within 1-2 metres of the firebreak depending on the size of the tree and fire break type.

2.3 Water Source Inspection

Monitoring and inspection of adequate water sources was based upon field analysis of proximity of water bodies to potentially hazardous areas as well as assessment of access to those water sources from main tracks.

2.4 Access and Track Assessment

Access tracks were assessed on their ability to accommodate Rural Fire Services (RFS) Fire Fighting Truck or 4WD Utilities towing 1400-1600L Water tanks.

2.5 Asset Protection Zone Assessment

Asset Protections Zones (APZ's) were assessed based on their ability to provide a buffer around buildings and various infrastructures from hazardous materials, high fuel loads and bushfires. To assist in the inspection of APZ's a predetermined record sheet was used. This record sheet was produced internally by HLM in accordance with the NSW RFS consideration as well as previous experience.

2.6 Controlled Burning Assessment

Controlled burn areas were assessed taking into account various attributing factors such as proposed burn location, suitability and distance from mitigating controls such as water sources and access. Sites were considered for control burning when they were deemed to have a high fuel load, dense vegetative growth (elevated fuel loads) and poor grazing levels.

3. Asset Protection Zone Assessment

3.1 Overview

Asset Protection Zones (APZ) are intended to provide a buffer from fire prone or hazardous materials or areas to assets (predominately buildings). Their aim is to minimise fuel load levels and reduce potential radiant heat levels, flame contact, ember and smoke attack on life and property.

An Asset Protection Zone (APZ) is composed of an **Inner Protection Areas** (**IPA**) and an **Outer Protection Area** (**OPA**). The **IPA** is the first area of land surrounding the asset, the depth of which is determined by slope and vegetation. A correctly established and maintained IPA should be a mown, slashed and maintained area such as a lawn cleared of all shrubs and most trees to minimise any potential fuel loads that could endanger the dwelling it is trying to buffer and protect.

"*Retained trees must be separated by at least two meters between canopies. Under storey vegetation should be removed and branches should not overhang the building. Preference should be given to the retention of trees without rough or fibrous bark which may enable a fire to "climb"'* (NSW RFS, 2007)

The IPA should include a perimeter road, track or provide suitable access for fire fighters and fire fighting vehicles. **Maintenance of this area is the responsibility of the property owner**.

3.2 Assets

Numerous assets were identified in the field inspection including

- Water/Dam Pumps
- Mining Operations including buildings, explosive magazines, vehicles, and rail infrastructure.
- Lease housing on Biodiversity Offset Areas (Marengo house)
- Shed, Monitoring Station and old housing on Eurunderee.
- Main Road into the Mining facility

3.3 Photos of Inspected Assets

Picture 1: Remnant Housing and Shed on Eurunderee – note maintained lawn areas on the South and Eastern sides.

Picture 2: Backyard of House on Eurunderee – note encroaching vegetation (*Bidens pilosa*) a suitable fast burning fuel for grass fires, requires fire break

Picture 3: Eurunderee Open Shed and Storage, with monitoring equipment, agricultural accessories and fuels – note gravelled protection zone in foreground, requiring grass maintenance behind the shed to ensure limited grass fire intrusion.

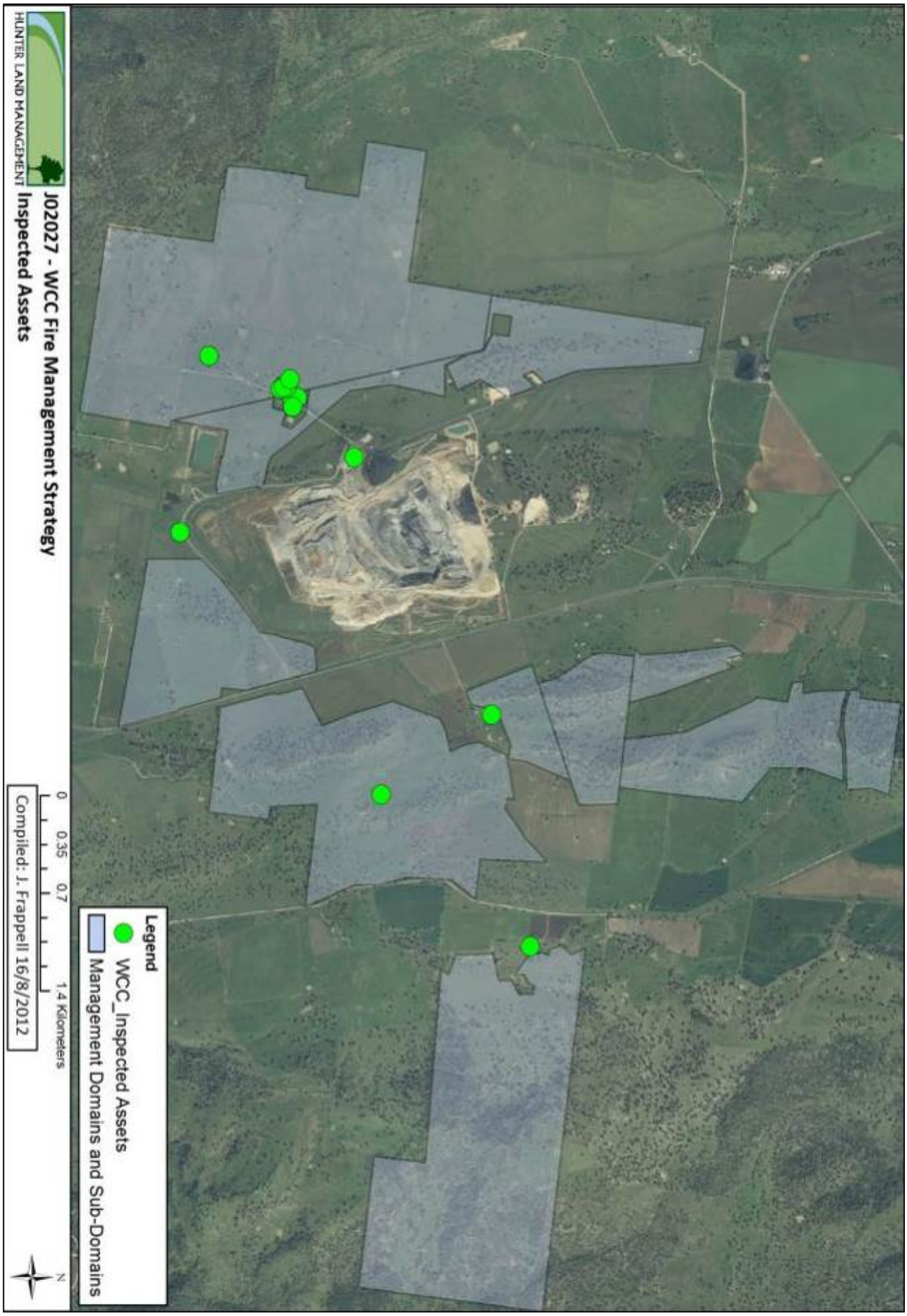
Picture 4: Main Access Road – Note maintained grass on edge of road (mown strip) and unconnected trees on the right hand side. Road also acts as a firebreak if a fire were to develop and progress from the South to the mining area.

3.4 Results

Overall, most assets inspected were observed to be in a reasonable to good condition in terms of surrounding grass levels and proximity of any intrusive material which would increase the progression and development of a fire if a bushfire was to occur. Most installed asset protection zones were maintained, however further works to increase efficiency and practicality were noted, such as increasing the buffer area of the Eurunderee house and nearby shed which exhibited a high grass fire danger from surrounding non-grazed grasslands particularly from the 'Flat' subdomain and 'Felsteads' subdomain. Marengo house was observed to be regularly maintained with mown short grass along with no continuous canopy cover encroaching on the house itself or within a threating distance to the actual house. Dense grasslands and a small plot of a White Box vegetation community in the surrounding sub domains (Upper Black Creek and Davies) however pose an initial threat to the Marengo asset protection zone, particularly ember attack.

Picture 5: Marengo House with surrounding isolated trees surrounding – note cropping paddock in foreground, providing an eastern APZ.

3.5 Inspected Assets Overview



3.6 Recommendations

As a result of the field observations the following recommendations for future fire management are to be considered;

- Implement a regular regime of maintenance for all asset protection zone inspected assets. Maintenance is to ensure that asset protection zones are practical and act as a suitable buffer between asset and non-maintained vegetation. It is recommended the regime be conducted at a minimum once per month in the cooler seasons (when vegetative growth is minimal) increasing to fortnightly as a minimum in warmer weather conditions.
- Install an appropriate APZ for the house of Eurunderee which boarders the fence line and create a suitable buffer between backyard and native vegetation which was observed to be encroaching on the property, increasing the fire threat for this particular house.
- Ensure that tenants of Marengo house maintain yard maintenance and maintain the already present asset protection zone. Ensure vegetation in Upper Black Gully does not encroach on Marengo house. Constant mowing and trimming of branches in trees surrounding will limit fuel loads around the house and shed, limiting chances of a fire sustaining in the area.
- Storage Sheds in Eurunderee are to increase size of already maintained grasses (Refer to Picture 3). Along with the dilapidated house nearby. This house is to be either removed (possible fuel source) or an APZ installed.
- Hay Shed in 'Flat' Eurunderee has been removed.
- Continue roadside grass maintenance to ensure high grass levels do not encroach on the sealed main road. The main road is a primary asset by which all traffic traverses frequently, and in the case of a bushfire, this too is the primary emergency route. All efforts should be made to ensure vegetation is cleared from this area with minimal continuous canopies enabled to grow. Efforts should be made to remove debris from this area, such as roadside rubbish and vegetation debris which add to the currently low observable fuel load. Maintenance for this particular asset is to occur regularly on a fortnightly regime in seasons of growth (September to April), monthly in seasons of minimal growth (May – August).
- Standards for Asset Protection zones are to line up with the NSW RFS Standards (Appendix1)

4. Wet Fuel Load Monitoring

4.1 Overview

The spread of bushfires and fire in the Australian setting is dictated by surface and near surface fuel layer depths along with the density and establishment of understorey and shrub layers.

Wet fuel loads were taken across the whole of the Biodiversity Offset Area (BOA) in areas which were deemed representative to the particular area of study. Fuel load weights were recorded and compared against the Department of Sustainability and Environment (DSE) Victorian Government standards which provided categorisation and hazard levels as in Figure 1.

	Fuel hazard rating				
Fuel	Low	Moderate	High	Very High	Extreme
Bark	0	1	2	5	7
Elevated	0–1	1–2	2–3	3–5	5–8
Near-surface	1–2	2–3	3–4	4–6	6–8
Surface	2–4	4–10	8–14	12–20	16–20+

Figure 1: DSE Thresholds of Fuel Loads (t/ha)

4.2 Results

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1	Flat	0.3	Low	High grass Levels (80cm to 1m), increasing suspended fuel loads. High Grass Fire Risk. Approximately 70m from Water Source	
2	Flat	0.42	Low	Open Paddock, High Grass Fire Risk. Grass Height approximately 80cm to 1m. Tufted Grass plots. Approximately 200m from water source	NA

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
3	Flat	0.46	Low	Grassed Paddock, 10m from water source. High Grass Fire threat. Suitable area to ecologically burn with controls installed.	
5	Flat	0.8	Low	Open Grassed Paddock. Approximately 200m from water source. High Grass density levels	

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
6	Flat	4.25	Moderate	Patchy Eucalypt plot. Considerable leaf litter and bark build up surrounded by Open grass paddocks, high in density and at risk of grass fire. Approximately 150m from water source	
7	Flat	0.60	Low	Scattered Trees, small leaf litter build up, 5m from water source. Long Grasses surrounding	
10	Flat	0.63	Low	Open Grassed Paddock. Approx 300m from WCC Water Source, 50m from neighbours water source. Grass Fire Risk	NA

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
12	Flat	0.53	Low	Open Grassed Paddock. Firebreak installed adjacent to study location. Approximately 10m from water source – however empty	
14	Flat	0.84	Low	Open Grass Paddock. High density of Grasses increasing suspended fuel load and risk of grass fire	NA
15	Flat	0.76	Low	Open Paddock. Grass Levels 50cm to 1m. Extreme Grass Fire risk. 15m from water source.	

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1620	Felsteads	0.53	Low	Grazed Paddock with tufted grasses spread throughout. Still high Risk of Grass fire. Water Source 300m from study location. Low fuel load due to grazing suppression.	
1621	Felsteads	0.08	Low	High Grazing Pressure in paddock. Segmented grass tufted in general area, limiting grass fire intensity and risk in area. 5m from adequate water source.	

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1622	Felsteads	0.31	Low	Study area close to proposed new explosives magazine. Grazed Paddock with suppressed grass coverage. Low Fuel load. Limited joining of long (Red Grass) plots. Low grass fire risk in general area. Approximately 400m from water source.	
	Felsteads/ O'Donnells	-	-	Northern Boundary. Grazed verse Non-Grazed areas. O'Donnells paddock high in grass density and at higher risk of grass fire then Felsteads.	

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1623	Felsteads	0.62	Low	Patchy Grassed Paddock with grazing occurring suppressing fuel loads. 10m from water source. Grass levels range from 80cm to 100cm. Grass Fire Risk. Area suitable for ecological burn	
1625	Flat	1.3	Low	Back of Eurunderee House. Note mown yard, yet encroaching vegetation. Firebreak to be installed as ember attack may occur in a grass fire.	
1628	Mine Ops	1.01	Low	Study Location near main access road and mine offices. 10m off road needs to be slashed and regularly maintained to increase buffer between vegetation and infrastructure in case of grass fire amplified by winds.	NA

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1629	Mine Rehab	0.55	Low	Rehab area – 4 years old. Dead grass tufts with low fuel load recorded. Will increase as trees grow and drop leaves/bark. Main road acts as firebreak between natural vegetation and rehab. Mown roadsides to be regularly maintained to ensure firebreak is efficient in reducing risk of grass fire.	
1630	Narrawolga	1.92	Low	Open Paddock, recently slashed with recently planted trees throughout area. Dense vegetation cover under scattered mature trees which are isolated by slashing and maintenance works. Close proximity to water supply if grass fire was to occur (100m)	

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1632	Narrawolga	1.12	Low	Dense infestation of *Bidens pilosa* mainly under mature trees as similar to 1630. With surrounding grass lands slashed and maintained.	
1633	Narrawolga	0.56	Low	Open grassed paddock which is a high density of grass coverage ranging in heights. Study area 50m off boundary with a neighbouring house visible. Risk of grass fire if area isn't maintained. Note neighbours maintained grass paddock to the right of the fence line.	

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1634	Narrawolga	1.2	Low	Maintained open paddock, recently slashed with plotted tall grasses underneath scattered trees. Approximately 200m from water source. Low grass fire risk with appropriate maintenance.	
1637	Narrawolga	2.86	Low	Main Road Access. Maintained roadside decreasing threat of a progressive fire. Road as fire break. Maintenance to continue to limit vegetation growth and to address fire risk.	NA
1638	Pipeline	0.55	Low	Grassed paddock with scattered trees. Trees observed on ridgeline which have an elevated fuel load to that of the lower areas.	
1639	Pipeline	0.56	Low		

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1640	Pipeline	3.07	Low	Fuel Load taken from under trees representing ridgeline trees and scattered trees throughout open grass paddock. Leaf litter contributing to higher fuel load. In an event of a grassfire these tree plots will become threatened.	
1641	Hill	0.43	Low	Grass paddock, with scattered trees on ridge line. Water tank in close proximity to studied location. Water Tank, powerlines and electrical implements on tank require vegetation maintenance in that vegetation surrounding is mown and cleared to reduce hazard in an event of a fire.	NA
1642	Hill	1.04	Low	Open grass paddock with scattered trees averaging 2t/ha underneath. Current paddock grazed reducing fuel loads settled beneath grass cover. Grass fire risk still evident	NA

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1643	Hill	2.68	Low	Non grazed grass paddock with dense grass cover. Single plots of trees scattered throughout. Grass fire threat high. Required maintenance	
1644	Hill	4.08	Moderate	Open Paddock. Heavily grassed on creekline. Scattered trees with immediate fuel loads of 2-3t/ha with leaf litter and bark increasing fire threat.	NA
1646	Hill	2.38	Low	Open grass paddock – non grazed. Heavily grassed averaging 50-90cm in height with interlocking foliage increasing grass fire hazard.	

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1647	Hill	3.02	Low	Non grazed paddock as similar to 1646. Grazed versus non grazed in adjacent image to compare fire hazard mitigation – note interlocking foliage of grass on right of fence line, which records a higher fuel load and overall fire risk.	
1648	Hill	4.15	Moderate	Low to Moderate grazed paddock, with scattered trees with limited to low connectedness. Tufted grasses adding to fuel load record along with leaf litter and bark.	NA
1649	Hill	1.05	Low	Low lying area below White Box vegetation community on hills and ridgeline. Leaf litter adding to fuel loads under trees however, grassed areas of the paddock appropriate to the area.	

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1650	Pipeline	1.47	Low	Grazed paddock with ridgelines averaging fuel loads of 4-5t/ha. Good grazing level reducing fuel load which is recorded in open grassed areas.	
1651	Pipeline	1.26	Low	Grazed paddock bordering Houdini. Low fuel loads recorded due to grazing pressures. Segmented tufted grasses with green growth beneath, continual grazing ideal to reduce fuel loads of this area.	

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1653	Pipeline	0.67	Low	Grass paddock which requires a firebreak to ensure property neighbouring is protected in the event of a grass fire. Grass levels in this area to be continually grazed to reduce fuel loads and fire threat.	
1654	Houdini	0.50	Low	Cropped and Grazed open paddock. Low vegetation cover at present with singular trees in paddock. Low fuel load as all vegetation suppressed and cropped. Edges of paddock have tufted grasses however immediate and average of area extremely low fire threat/risk	

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1655	Houdini	0.28	Low	Cropping paddock with remnant vegetation post cropping activities. Limited to no fire hazard in immediate paddock.	
1657	Houdini	0.50	Low		
1658	Marengo House	0.60	Low	Non grazed area, typical of Railway View paddocks. Scattered trees especially in Upper Black Creek. Fuel loads 3-4t/ha in creekline. Grasses surrounding Marengo house provide adequate firebreak and APZ between natural vegetation and household. Maintained lawns recorded a low fuel load and exhibited a low fire threat. 50m from suitable water source	
1659	Davies	1.10	Low	Non grazed low lying open paddock with grasses developed into interlocking foliage covers. High grass fire threat if not addressed. Area proposed to be burnt providing a large firebreak between Marengo house and dense native vegetation in surrounding areas (Never Never and Ridge)	NA

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1663	Ridge	9.14	High	Dense natural vegetation with connected canopies. High fuel loads beneath trees mainly consisting of leaf litter and small branches. Shrubs and understorey pose a significant threat in the case of a fire, fueling the progression of a fire.	
1664	Ridge	2.01	Low	Open grass section on ridgeline surrounded by dense vegetation. Dense grasses with significant fuel loads beneath threatened by encroaching natural dense vegetation	

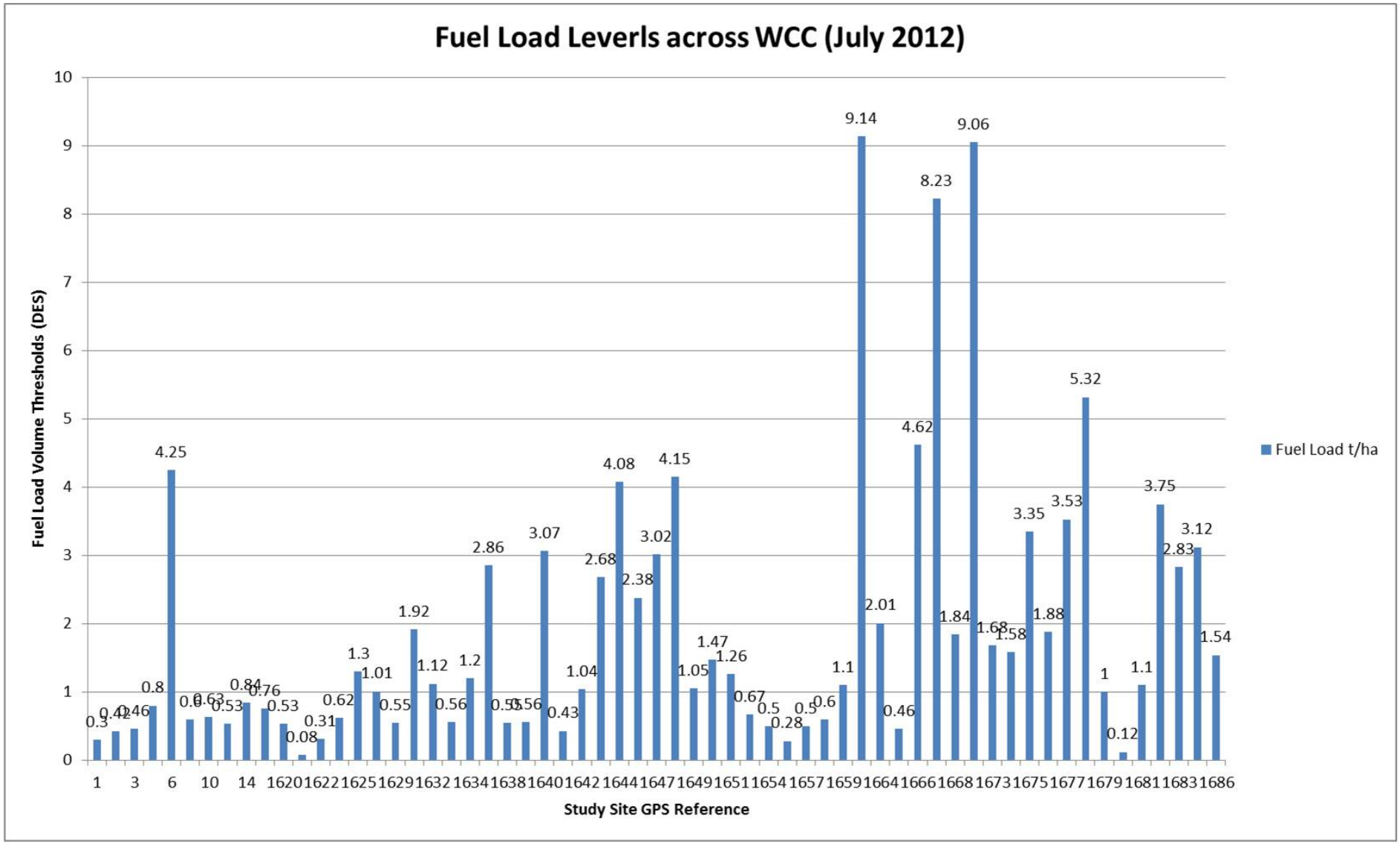
Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1665	Never Never	0.46	Low	Fuel load taken from beneath Pine trees. Low fuel load at present however expected to increase in dry climatic conditions, with the components of the pine tree highly prone to fire. Observed in surrounding gullies that fuel load is approximately 6-10t/ha	
1666	Ridge	4.62	Moderate	Scrub area with intermittent grass coverage. Leaf litter dominates fuel load along ridgeline. General low lying area risk of grass fire, ridgelines with dense vegetation cover at risk of bushfire.	
1667	Back Country	8.23	High	Dense eucalypt forest, highly prone to bushfire. Need to install firebreak on boundary fenceline to protect property as well as neighbouring property in case of fire initiating in the Marengo property.	NA

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1668	Back Country	1.84	Low	Similar scenario to 1667. Grass areas of paddock represented in fuel load recorded however surrounding bushland poses a high fire risk and hazard to property and surrounds.	NA
1670	Back Country	9.06	High	Similar to 1667. Dense leaf litter and interlocking canopies and sub-canopies. High fire risk and hazard.	
1673	O'Donnells	1.68	Low	Study area within close proximity to mining operations and assets. 10m from suitable water source and mining operation water carts. Open grass area with sparse tree cover.	NA

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1674	O'Donnells	1.58	Low	Open paddock with dense grass cover adding to deposited fuel loads. Suspended grass cover and foliage at a high grass fire risk. Main road noted to have regular slashing and maintenance which is to continue to act as a firebreak between paddock vegetation and mining on the eastern side of the road.	
1675	Lookout	3.35	Low	Neighbouring house nearby, possibly threatened by the high grass density and relative fuel load recorded. Ridgeline scattered with White Box tree communities adding to fuel loads on ridgeline with leaf litter and branches.	NA
1676	Lookout	1.88	Low	Area in close proximity to Ryan household. Paddock currently grazed with grass slopes and tufts. Grazing has suppressed the general area from having any decent fuel load deposited.	NA
1677	Lookout	3.53	Low	Open grazed paddock with old grass tufts non palateable for grazing stock. This grass has a suspended fuel load which has a considerable grass fire threat to the area.	NA
1678	Ryan	5.32	Moderate	Study location representative of scattered trees in general area. Fuel load increased by leaf litter and bark deposits. Surrounding area grassed paddocks at relative risk of grass fire.	NA
1679	Hailing	1.00	Low	Area in close proximity to neighbouring property. Need to ensure fire break between property and neighbouring household. Recently fenced section which has seen clearing of vegetation in general vicinity. Need to ensure grazing continues to suppress vegetation in area and limit fire risk and fuel loads.	NA

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1680	Goat	0.12	Low	Grazed paddock with segmented short areas of grass with unpalatable grasses sprawling. Need to address grass build up to ensure fuel load doesn't increase from current low ranking.	
1681	Goat	1.1	Low	As per 1680	NA
1682	Marshalls	3.75	Low	Representative fuel load recording of trees on ridgeline throughout Goat and Hailing paddocks.	
1683	Valley	2.83	Low	Grass plains surrounded by ridgelines and fuel loads as recorded in 1682. Segmented cleared areas suppressed by grazing pressures. Unpalatable red grass tufts posing grass fire threat.	

Site Code	Sub Domain Zone	Fuel Load t/ha	Range	Comments	Site Photos
1685	Doyles	3.12	Low	Ridgeline in Doyles dominant in trees. In close proximity to an asset (water tank). Patchy grassed areas throughout.	
1686	Valley	1.54	Low	Open grass paddock surrounded by trees with significant fuel loads underneath. Grass fire risk with red grass not being consumed by grazing animals.	


Fuel Load Leverls across WCC (July 2012)
Fuel Load Volume Thresholds (DES)
Study Site GPS Reference
Fuel Load t/ha
0
1
2
3
4
5
6
7
8
9
10
1 3 6 10 14 16 20 16 22 16 25 16 29 16 32 16 34 16 38 16 40 16 42 16 44 16 47 16 49 16 51 16 54 16 57 16 59 16 64 16 66 16 68 16 73 16 75 16 77 16 79 16 81 16 83 16 86
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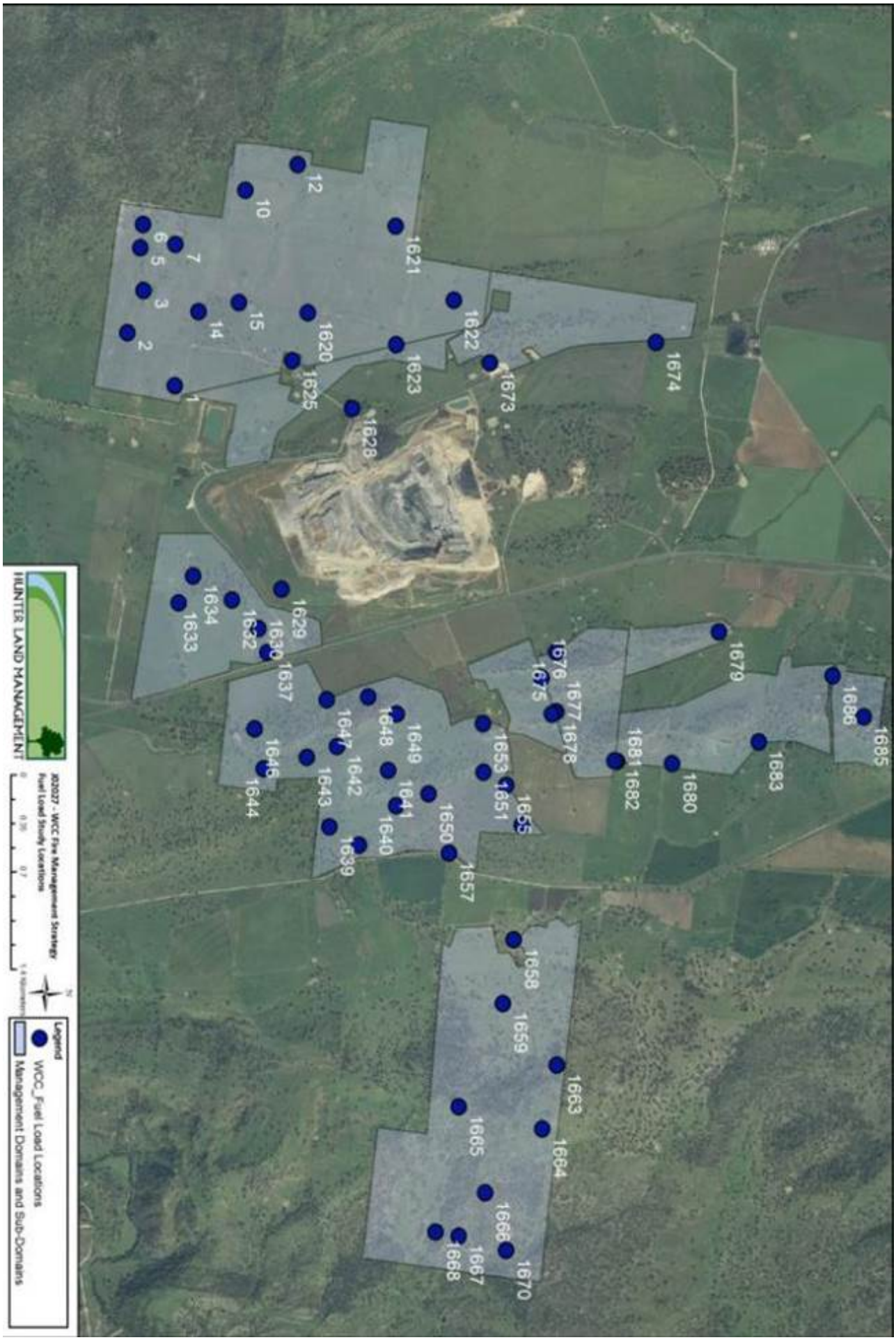
4.3 Discussion and Recommendations

Upon primary inspection and fuel loads assessed and evaluated the following recommendations develop the following management strategy

- Fuel loads solely represent dominant vegetation communities thriving in sub-domains. A majority of landholdings were dominant of the White Box grassy woodlands community recording a low to medium fine fuel load, ranging between 0 to 4 tonnes of fine fuel per hectare. Although these fuel loads were notably low in hazard, the suspended fuel loads and dense grass cover with interlocking foliage has resulted in an observable high fire hazard which in the event of a fire will see assets and the biodiversity offset area exceedingly threatened.
- Ridgelines scattered with White Cypress Pines and White Box Woodlands recorded hypothesised Medium to High fuel loads, attributed by bark and leaf litter deposited beneath. Marengo domain dominant with a White Box/White Cypress Pine shrubby open forest exhibited high fuel loads which are reflected in Figure 2. These areas are of high bushfire risk which are to be isolated to reduce a fires sprawl in the case of a bushfire.
- Limited management activities in the BOA's such as minimal to no grazing along with minimal agricultural activities such as slashing and tilling has resulted in natural revegetation with most areas dense in vegetation cover and excessive vegetation height with grasses ranging between 50cm to 120cm tall. These factors have influenced the fire hazard and issues attributed to fires.
- Slashing of open areas to supress dense and thick grass cover. Slashing will enable grasses to be mown down, supressing the growth and sprawl of the grass (particularly in the cooler months). Mown grass will deteriorate to organic mulch, compacting into the soil structure and creating a lower fire risk upon compaction compared to the current erect, expanding, dense and growing grasses highly threatened by grass fires. Slashing maintenance is advised in areas where assets are located. Maintenance of these areas will provide the establishment of Asset Protection Zones (APZ's). It is recommended that mowing of asset areas is to be done on a monthly regime in the cooler months, increasing maintenance to a fortnightly regime in the growing and high fire danger months. Paddock slashing is to occur in the cooler months typically May – September to reduce flint hazards causing fires.
- Controlled burning is recommended to reduce fuel loads. A type of controlled burning; eccological burns involve using fire to manage vegetation density, species type, biomass and soil nutrients. Proposed ecological burns locations are for the grassy woodland vegetation communities outlined in Section 8 of this Fire Management Strategy.

4.4 Fuel Load Monitoring Overviews



5. Access and Track Assessment

5.1 Overview

Overall the condition of permanent tracks throughout the BOA's were identifiable as some had recently been slashed and graded (Firebreaks). Most of the tracks were notably to be accessible throughout wet conditions in a standard four wheel drive. Tracks were accessed to ensure that in the event of a fire, fire fighting crews of the Rural Fire Service (RFS) could traverse throughout the areas without problematic issues such as bogging's or wedging's between trees.

5.2 Track Recommendations

As a result of the track inspection the following actions are recommended to ensure practicality and suitability is maintained for both fire response teams along with various workers on the BOA's;

- Note track condition when traversing BOA's. Changes in track conditions can hamper suitability and practicality.
- Note all weather and wet weather tracks, this will ensure that the BOA's will be able to traversed throughout various weather conditions.
- Ensure that vegetation encroaching on tracks from surrounding vegetation communities is regularly maintained (mown, slashed, brushcut, cut down) this will provide ease of access to areas by the RFS and response teams in situations such as grass fires and bushfires if the scenario occurred. Also regular maintenance will ensure main roads and tracks are suitable to be safely travelled upon and practical.
- Installation of primary tracks throughout Railway View, Hillview, Marengo and Greenslopes was undertaken in June 2013.

5.3 Track Overview

6. Firebreak Assessment

6.1 Overview

The key to effective firebreaks are their location and that upon installation they are maintained regularly and continually protect the property and assets within. Firebreaks serve a major purpose in fire management in that firebreaks are a physical clearing which segments areas from neighbouring vegetation and limits the chance of fires progressing into other areas. Firebreaks also serve as fighting front whereby RFS crews and response teams can traverse and implement back-burning to reduce a fire front from progressing.

6.2 Discussion and Recommendations

It was observed that in July 2012 Eurunderee property has 10m dozed fire breaks along the boundary and 6m slashed breaks along internal tracks. In June 2013, dozed firebreaks were installed at Marengo, Railway View, Hillview and Greenslopes with 10m dozed breaks along boundaries and 6m dozed breaks on internal tracks. These firebreaks were observed to be breaking the grassed vegetation which now is a physical barrier if a grass fire was to occur. The following actions are recommended;

- Installation of firebreaks along all boundary fence lines of all management domains was completed in June 2013. This will ensure the BOA within the bounds have enhanced protection from fires which may occur outside the landholdings. Firebreaks along the boundaries will also ensure that if a fire is to occur on WCC BOA's, neighbouring properties and houses have a lowered chance of fire jumping boundaries and impacting on the neighbours landholdings.

Picture 6: Firebreak installed on Eurunderee (Flat). Eastern boundary line

Picture 7: Firebreak installed on Eurunderee (Flat) South-Western boundary fence line.

6.3 Firebreak Overview

7. Water Supply

7.1 Overview

Water supply and access are vital assets in fire management to which in the inspection numerous water sources were inspected to decipher if current water sources throughout the BOA were acceptable to supply water to fire fighting crews in the event of a local bushfire and grassfire.

Identification and signage of water sources is a good way to improve knowledge of water sources, especially to possible outside services such as the NSW RFS. The RFS has an identification scheme which includes signage of dams, pools etc.

Dams and remote water points provide an important role in the fast and effective control of fires by allowing quick fill turnaround times and varied source points when dealing with a moving front. Signage along with mapping provided to emergency crews in the event of a fire will enable unfamiliar workers of the area become familiar with water sources immediately enabling efficient fighting of fires in the local area.

7.2 Discussion and Recommendations

A majority of dams in the BOA were noted to be of large sizes suitable in filling fire vehicles and tanks with water in response to a fire event. The following are recommended for the highest of practicality and resourcefulness;

- Installation of NSW RFS signage on all dams across the BOA's. The Static Water Supply (SWS) signage is a program aimed at identifying properties with a water supply such as dams, creeks that can be used for firefighting purposes. The RFS will install at their discretion SWS signs on tracks throughout the BOA's which will inform fire crews of SWS nearby and GPS any dams and water sources on the BOA's.
- Conduct annual inspections of all water sources and dams on the BOA's and assess their suitability for use in emergency scenarios.
- Install and maintain tracks to water sources throughout the BOA to ensure water sources can be readily and easily accessed.

Picture 8: Adequate water supply in an inspected dam in Eurunderee.

7.3 Water Source Overview

8. Controlled Burning

8.1 Overview

The exclusion of grazing and agriculture from the BOA will aid restoration of the woodland vegetation communities; however, if not adequately managed, increasing biomass and fuel loads may create a fire hazard and create an imbalance between fire tolerant and fire sensitive species. Ecological burns involve the use of fire to control and promote flora within a certain landscape. Ecological burns are used to manage fuel loads or biomass, soil and landscape nutrients along with species diversity. With the exclusion of grazing, perennial and annual weeds and grasses have increased the fire threat for the BOA, although not directly recorded in fuel loads at the time of inspection are a threat as they are dense in coverage, foliage interlocking with a dried and suspended fuel load all of which are at a high risk in the event of a grass fire. As the management of the Biodiversity Offset Area is for woodland restoration, ecological burns will be used to balance the potential for increased fuel loads and mitigating impacts on biodiversity.

8.2 Fire Management Objectives

The objectives of fire management across the BOA are:

- The protection of human life and safety;
- WCC mining operation asset protection and business continuity;
- Other infrastructure and rural asset protection on WCC owned land and adjacent private property; and
- Protection and maintenance of biodiversity within the BOA.

WCC's will target undertaking 100ha per year of control burns for the next 10 years. The goal being within the remaining life of the WCC mine, the majority of the Biodiversity Offset Area (~1320ha) will have had a controlled burn reducing fuel loads except for areas difficult to burn due to sensitive vegetation and inaccessible terrain. To achieve these objectives, To achieve these objectives, WCC will initially target controlled burns adjacent to houses and other assets/infrastructure both owned by WCC and neighbours within and next to Biodiversity Offset Area (Figure Below). Controlled burns in future years will target those areas with the highest fuel loads and strategic sites (mosaic) for biodiversity protection subject to the next revision of the FMS.

8.3 Approvals Required for Controlled Burns

The Protection of the Environment Operations (Clean Air) Regulation 2010 specifies that the burning of vegetation is prohibited except with approval in the LPSC local government area (Schedule 8 Part 2). While the Regulation has an exemption for bushfire hazard reduction work, discussions with the Rural Fire Service (RFS) indicated that they would not issue a hazard reduction certificate for controlled burns within the BOA due to concerns over the RFS's liability. The RFS indicated that WCC did not require any approvals under the Rural Fires Act 1997 as the activity was approved by PA10_0059 and EPBC Act Approval 2010/5577; unless any controlled burns were undertaken during a fire permit period (typically September to March), then a Fire Permit would be required. WCC will obtain approval from Liverpool Plains Shire Council (Approval to Burn Vegetation) to comply with the Clean Air Regulation prior to undertaking any controlled burns. WCC will also notify the immediate neighbours to the proposed burn site and will place a community notice in the Werris Creek Flyer. WCC will consult with the RFS during the planning of any burns and afford the opportunity for local volunteer RFS brigades to be involved. If the RFS agree to be involved in the controlled burn, the RFS will appoint an incident controller and take over responsibility and management of the burn site.

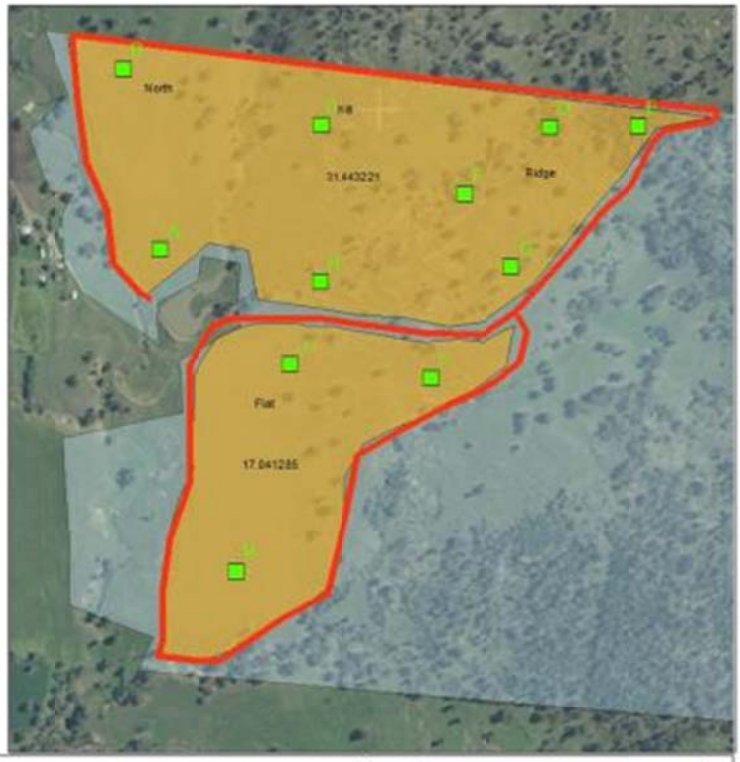
8.4 Recommendations

The following recommendations have been developed for Biodiversity Offset Area for the period 2012 to 2015.

- WCC will plan for on average five individual 20ha controlled burns per year. Prior to each controlled burn, a "Planning" Controlled Burn Plan will be prepared for each 20ha site proposed for an ecological burn. The "Planning" Controlled Burn Plan will outline the status of fire breaks, water sources, barriers and vegetation and whether any further actions are required;
- Ecological burns require a cool low intensity burn to remove dry material but not scorch native grasses and trees. This is achieved by igniting the fire on the downwind side of the burn site allowing the fire to burn into the wind. Burning with the wind will be minimised to only when there is a light wind, sparse or green grass cover.
- WCC will consult with the RFS during the planning of any burns and afford the opportunity for local volunteer RFS brigades to be involved.
- Preparations prior to the burn should have removed fuel loads around any revegetation or habitat to minimise the chance of burning or scorching as the "cool" fire front passes.
- If the RFS agree to be involved in the controlled burn, the RFS will appoint an incident controller and take over responsibility and management of the burn site. The decision to undertake a controlled burn and how it will be burnt will be made on the day based on the weather conditions by the RFS.
- The results of the controlled burn will be documented on an update of the "Post"Controlled Burn Plan outlining the burnt and unburnt areas, results of quadrats plots and a brief description of the burn outcomes and weather conditions.
- Standards for an Ecological burn are too closely adhere to the RFS Standards for Low Intensity Bush Fire Hazard Reduction Burning (Appendix 2)

Burn Plan Report		
Burn Plan Component	Details	Date
Burn Preparation Works	Boundaries of Site was slashed to 10m wide	18/06/13
	Juvenile and planted trees and logs where brush cut around to prevent excessive burning	05/08/13
Burn Day Conditions	Burn 1 (Flat Paddock) 12pm Humidity 47%, Temperature 16.1°C, Wind 160° @ 6.4m/s	06/08/13
	Burn 2 (North, Hill and Ridge Paddocks) 10am Humidity 45%, Temperature 16.7°C, Wind 347° @ 8.4m/s 12pm Humidity 48%, Temperature 21.3°C, Wind 298° @ 3.5m/s	13/08/13
Burn Ignition and Direction	Burn 1 (Flat Paddock) – ignition from south east corner – burnt into wind – burn period from 12pm – 4pm	06/08/13
	Burn 2 (North Paddock) – ignition from south east corner – burnt into wind – burn period 10am – 1pm	13/08/13
	Burn 2 (Hill and Ridge Paddock) –ignition from main track on the southern side of site and burnt into wind – burn period 1pm – 6pm	13/08/13
Mop Up and Assessment	Burn 1 (Flat Paddock) – little to no mop up required – preparation work saved most trees and logs – cool burn	07/08/13
	Burn 2 (north) – little to no mop up required– preparation work saved most trees and logs – cool burn	14/08/13
	Burn 2 (Hill and Ridge Paddock) – some mop up required – several logs still burning following day – most region was saved – some areas of hot burn due to time constraints	14/08/13

2013 1m² Quadrat Survey Results 24/06/13				
Quadrat	Bare Soil %	Leaf Litter %	Grass Cover %	Shrub/Tree %
A	<10%	<10%	80-90%	0%
B	<10%	<10%	80-90%	0%
C	<10%	10-20%	60-70%	<10%
D	<10%	10-20%	60-70%	<10%
E	<10%	30-40%	20-50%	10-20%
F	<10%	10-20%	60-70%	<10%
G	<10%	10-20%	60-70%	<10%
H	<10%	<10%	50-60%	10-20%
I	<10%	<10%	50-60%	10-20%
J	<10%	<10%	80-90%	0%
K	<10%	<10%	80-90%	0%



Werris Creek Coal 2013 Hazard Reduction Burn Plan

6030 0 60 Meters

N

Legend
- 2013 Burn Vegetation Quadrats Locations
- WhitehavenCoalPaddockNames
- WCC_Installed Firebreaks
- WCC_Proposed Ecological Burn Locations (ha)

9. WCC Fire Management Strategy – Action Table

Action Number	IMPLEMENTATION ACTIONS	Frequency	Timing	Responsibility	Completion Date	Actual Completion Date
1	Installation of priority firebreaks as per recommendations	Once	As soon as possible and as approved	WCC Environmental Department	September 2012	July 2012 & June 2013
2	Installation of SWS signage	Once	As soon as possible and as approved	WCC Environmental Department	September 2012	Ongoing
3	Maintenance of APZ's in lines with recommendations	Monthly as a minimum	Monitoring should take place fortnightly from September to March and monthly at other times	WCC Environmental Department	December 2015.	Ongoing
4	Track Maintenance and Dam Access Install/Maintenance	Biannually	April, October	WCC Environmental Department	October 2015	Ongoing
	Fuel Load Maintenance via slashing	Four times yearly	January, April, July, October	WCC Environmental Department	October 2015	Ongoing
5	Ecological Burns (100ha) in proposed locations	Annually	June – Early August	WCC Environmental Department	August 2015	70ha burnt in 2013
6	Invite local RFS Captain annually (preferably prior to fire season) to inspect fire controls, access etc…	Annually	August	WCC Environmental Department	August 2015	Ongoing

10. References

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PA10_0059_000. Project Approval Werris Creek Coal, 25 October 2011

11. Appendix

11.1 APZ Standards

11.2 Bushfire Hazard Reduction Burning Standards

standards

for asset protection zones

protection

NSW RURAL FIRE SERVICE

STANDARDS FOR ASSET PROTECTION ZONES

INTRODUCTION 3

WHAT IS AN ASSET PROTECTION ZONE? 3

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WHERE SHOULD I PUT AN APZ? 4

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INTRODUCTION

For thousands of years bush fires have been a natural part of the Australian landscape. They are inevitable and essential, as many Australian plants and animals have adapted to fire as part of their life cycle.

In recent years developments in bushland areas have increased the risk of bush fires harming people and their homes and property. But landowners can significantly reduce the impact of bush fires on their property by identifying and minimising bush fire hazards. There are a number of ways to reduce the level of hazard to your property, but one of the most important is the creation and maintenance of an Asset Protection Zone (APZ).

A well located and maintained APZ should be used in conjunction with other preparations such as good property maintenance, appropriate building materials and developing a family action plan.

WHAT IS AN ASSET PROTECTION ZONE?

An Asset Protection Zone (APZ) is a fuel reduced area surrounding a built asset or structure. This can include any residential building or major building such as farm and machinery sheds, or industrial, commercial or heritage buildings.

An APZ provides:

- a buffer zone between a bush fire hazard and an asset;
- an area of reduced bush fire fuel that allows suppression of fire;
- an area from which backburning may be conducted; and
- an area which allows emergency services access and provides a relatively safe area for firefighters and home owners to defend their property.

Potential bush fire fuels should be minimised within an APZ. This is so that the vegetation within the planned zone does not provide a path for the transfer of fire to the asset either from the ground level or through the tree canopy.

WHAT WILL THE APZ DO?

An APZ, if designed correctly and maintained regularly, will reduce the risk of:

- direct flame contact on the asset;
- damage to the built asset from intense radiant heat; and
- ember attack on the asset.

WHERE SHOULD I PUT AN APZ?

An APZ is located between an asset and a bush fire hazard.

The APZ should be located wholly within your land. You cannot undertake any clearing of vegetation on a neighbour's property, including National Park estate, Crown land or land under the management of your local council, unless you have written approval.

If you believe that the land adjacent to your property is a bush fire hazard and should be part of an APZ, you can have the matter investigated by contacting the NSW Rural Fire Service (RFS).

There are six steps to creating and maintaining an APZ. These are:

1. Determine if an APZ is required;
2. Determine what approvals are required for constructing your APZ;
3. Determine the APZ width required;
4. Determine what hazard reduction method is required to reduce bush fire fuel in your APZ;
5. Take measures to prevent soil erosion in your APZ; and
6. Landscape and regularly monitor in your APZ for fuel regrowth.

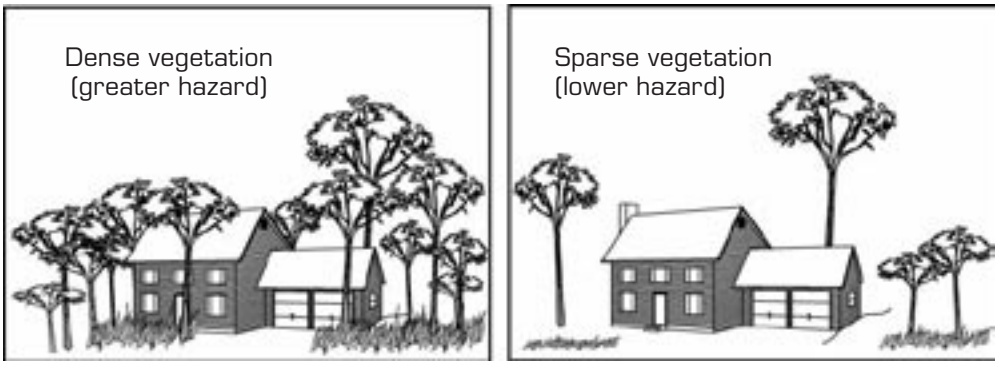
STEP 1. DETERMINE IF AN APZ IS REQUIRED

Recognising that a bush fire hazard exists is the first step in developing an APZ for your property.

If you have vegetation close to your asset and you live in a bush fire prone or high risk area, you should consider creating and maintaining an APZ.

Generally, the more flammable and dense the vegetation, the greater the hazard will be. However, the hazard potential is also influenced by factors such as slope.

- A large area of continuous vegetation on sloping land may increase the potential bush fire hazard.
- The amount of vegetation around a house will influence the intensity and severity of a bush fire.
- The higher the available fuel the more intense a fire will be.



Isolated areas of vegetation are generally not a bush fire hazard, as they are not large enough to produce fire of an intensity that will threaten dwellings.

This includes:

- bushland areas of less than one hectare that are isolated from large bushland areas; and
- narrow strips of vegetation along road and river corridors.

If you are not sure if there is a bush fire hazard in or around your property, contact your local NSW Rural Fire Service Fire Control Centre or your local council for advice.

STEP 2. DETERMINE WHAT APPROVALS ARE REQUIRED FOR CONSTRUCTING YOUR APZ

If you intend to undertake bush fire hazard reduction works to create or maintain an APZ you must gain the written consent of the landowner.

Subdivided land or construction of a new dwelling
If you are constructing an APZ for a new dwelling you will need to comply with the requirements in *Planning for Bushfire Protection*. Any approvals required will have to be obtained as part of the Development Application process.

Existing asset
If you wish to create or maintain an APZ for an existing structure you may need to obtain an environmental approval. The RFS offers a free environmental assessment and certificate issuing service for essential hazard reduction works. For more information see the RFS document *Application Instructions for a Bush Fire Hazard Reduction Certificate* or contact your local RFS Fire Control Centre to determine if you can use this approval process.

Bear in mind that all work undertaken must be consistent with any existing land management agreements (e.g. a conservation agreement, or property vegetation plan) entered into by the property owner.

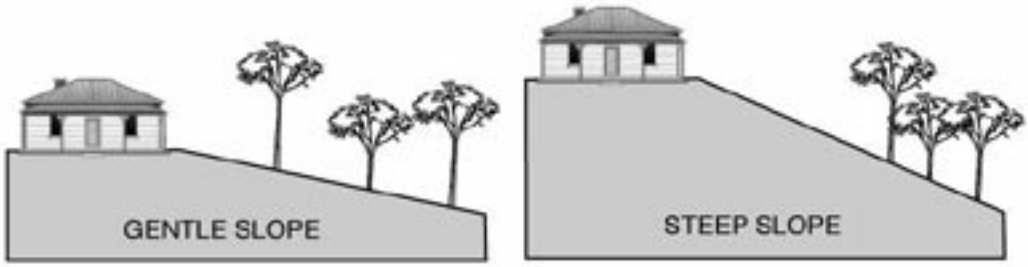
If your current development consent provides for an APZ, you do not need further approvals for works that are consistent with this consent.

If you intend to burn off to reduce fuel levels on your property you may also need to obtain a Fire Permit through the RFS or NSW Fire Brigades. See the RFS document *Before You Light That Fire* for an explanation of when a permit is required.

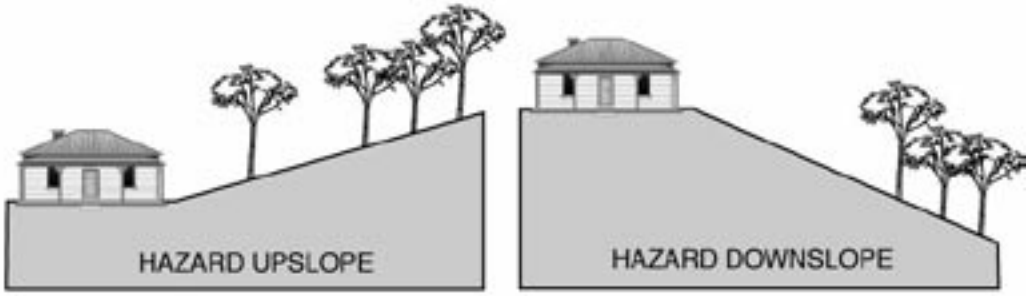
STEP 3. DETERMINE THE APZ WIDTH

The size of the APZ required around your asset depends on the nature of the asset, the slope of the area, the type and structure of nearby vegetation and whether the vegetation is managed.

Fires burn faster uphill than downhill, so the APZ will need to be larger if the hazard is downslope of the asset.



Gentle slopes require a smaller APZ distance than steep slopes



A hazard downslope will require a greater APZ distance then a hazard upslope of the asset

Different types of vegetation (for example, forests, rainforests, woodlands, grasslands) behave differently during a bush fire. For example, a forest with shrubby understorey is likely to result in a higher intensity fire than a woodland with a grassy understorey and would therefore require a greater APZ width.

A key benefit of an APZ is that it reduces radiant heat and the potential for direct flame contact on homes and other buildings. Residential dwellings require a wider APZ than sheds or stockyards because the dwelling is more likely to be used as a refuge during bush fire.

Subdivided land or construction of a new dwelling
If you are constructing a new asset, the principles of *Planning for Bushfire Protection* should be applied. Your Development Application approval will detail the exact APZ distance required.

Existing asset
If you wish to create an APZ around an existing asset and you require environmental approval, the Bush Fire Environmental Assessment Code provides a streamlined assessment process. Your Bush Fire Hazard Reduction Certificate (or alternate environmental approval) will specify the maximum APZ width allowed.

For further information on APZ widths see *Planning for Bushfire Protection* or the *Bush Fire Environmental Assessment Code* (available on the RFS website), or contact your local RFS Fire Control Centre.

STEP 4. DETERMINE WHAT HAZARD REDUCTION METHOD IS REQUIRED TO REDUCE BUSH FIRE FUEL IN YOUR APZ

The intensity of bush fires can be greatly reduced where there is little to no available fuel for burning. In order to control bush fire fuels you can reduce, remove or change the state of the fuel through several means.

Reduction of fuel does not require removal of all vegetation, which would cause environmental damage. Also, trees and plants can provide you with some bush fire protection from strong winds, intense heat and flying embers (by filtering embers) and changing wind patterns. Some ground cover is also needed to prevent soil erosion.

Fuels can be controlled by:

1. raking or manual removal of fine fuels
Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire.

Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.

2. mowing or grazing of grass
Grass needs to be kept short and, where possible, green.

3. removal or pruning of trees, shrubs and understorey
The control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation.

Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by two to five metres. A canopy should not overhang within two to five metres of a dwelling.

Native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.

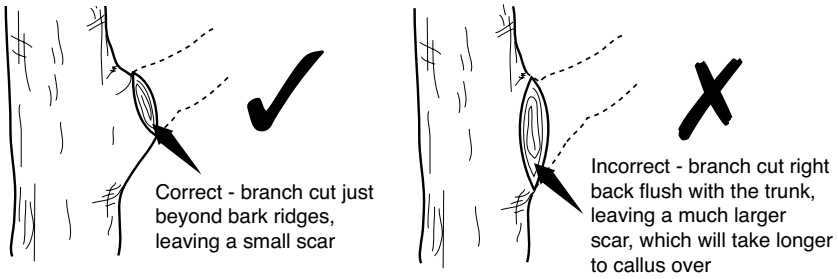
When choosing plants for removal, the following basic rules should be followed:

1. Remove noxious and environmental weeds first. Your local council can provide you with a list of environmental weeds or 'undesirable species'. Alternatively, a list of noxious weeds can be obtained at **www.agric.nsw.gov.au/noxweed/;**
2. Remove more flammable species such as those with rough, flaky or stringy bark; and
3 Remove or thin understorey plants, trees and shrubs less than three metres in height

The removal of significant native species should be avoided.

Prune in acordance with the following standards:

- Use sharp tools. These will enable clean cuts and will minimise damage to the tree.
- Decide which branches are to be removed before commencing work. Ensure that you maintain a balanced, natural distribution of foliage and branches.
- Remove only what is necessary.
- Cut branches just beyond bark ridges, leaving a small scar.
- Remove smaller branches and deadwood first.



There are three primary methods of pruning trees in APZs:

1. Crown lifting (skirting)
Remove the lowest branches (up to two metres from the ground). Crown lifting may inhibit the transfer of fire between the ground fuel and the tree canopy.

2. Thinning
Remove smaller secondary branches whilst retaining the main structural branches of the tree. Thinning may minimise the intensity of a fire.

3. Selective pruning
Remove branches that are specifically identified as creating a bush fire hazard (such as those overhanging assets or those which create a continuous tree canopy). Selective pruning can be used to prevent direct flame contact between trees and assets.

Your Bush Fire Hazard Reduction Certificate or local council may restrict the amount or method of pruning allowed in your APZ.

See the *Australian Standard 4373 (Pruning of Amenity Trees*) for more information on tree pruning.

4. Slashing and trittering
Slashing and trittering are economical methods of fuel reduction for large APZs that have good access. However, these methods may leave large amounts of slashed fuels (grass clippings etc) which, when dry, may become a fire hazard. For slashing or trittering to be effective, the cut material must be removed or allowed to decompose well before summer starts.

If clippings are removed, dispose of them in a green waste bin if available or compost on site (dumping clippings in the bush is illegal and it increases the bush fire hazard on your or your neighbour's property).

Although slashing and trittering are effective in inhibiting the growth of weeds, it is preferable that weeds are completely removed.

Care must be taken not to leave sharp stakes and stumps that may be a safety hazard.

5. Ploughing and grading
Ploughing and grading can produce effective firebreaks. However, in areas where this method is applied, frequent maintenance may be required to minimise the potential for erosion. Loose soil from ploughed or graded ground may erode in steep areas, particularly where there is high rainfall and strong winds.

6. Burning (hazard reduction burning)
Hazard reduction burning is a method of removing ground litter and fine fuels by fire. Hazard reduction burning of vegetation is often used by land management agencies for broad area bush fire control, or to provide a fuel reduced buffer around urban areas.

Any hazard reduction burning, including pile burns, must be planned carefully and carried out with extreme caution under correct weather conditions. Otherwise there is a real danger that the fire will become out of control. More bush fires result from escaped burning off work than from any other single cause.

It is YOUR responsibility to contain any fire lit on your property. If the fire escapes your property boundaries you may be liable for the damage it causes.

Hazard reduction burns must therefore be carefully planned to ensure that they are safe, controlled, effective and environmentally sound. There are many factors that need to be considered in a burn plan. These include smoke control, scorch height, frequency of burning and cut off points (or control lines) for the fire. For further information see the RFS document *Standards for Low Intensity Bush Fire Hazard Reduction Burning,* or contact your local RFS for advice.

7. Burning (pile burning)
In some cases, where fuel removal is impractical due to the terrain, or where material cannot be disposed of by the normal garbage collection or composted on site, you may use pile burning to dispose of material that has been removed in creating or maintaining an APZ.

For further information on pile burning, see the RFS document *Standards for Pile Burning.*

In areas where smoke regulations control burning in the open, you will need to obtain a Bush Fire Hazard Reduction Certificate or written approval from Council for burning. During the bush fire danger period a Fire Permit will also be required. See the RFS document *Before You Light that Fire* for further details.

STEP 5. TAKE MEASURES TO PREVENT SOIL EROSION

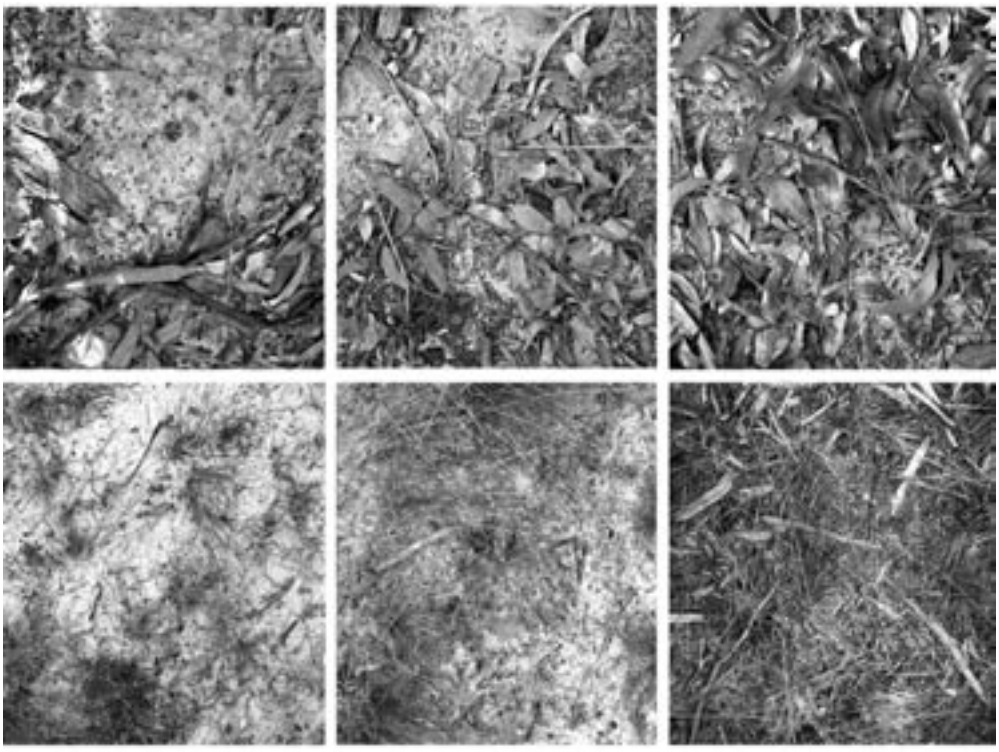
While the removal of fuel is necessary to reduce a bush fire hazard, you also need to consider soil stability, particularly on sloping areas.

Soil erosion can greatly reduce the quality of your land through:

- loss of top soil, nutrients, vegetation and seeds
- reduced soil structure, stability and quality
- blocking and polluting water courses and drainage lines

A small amount of ground cover can greatly improve soil stability and does not constitute a significant bush fire hazard. Ground cover includes any material which directly covers the soil surface such as vegetation, twigs, leaf litter, clippings or rocks. A permanent ground cover should be established (for example, short grass). This will provide an area that is easy to maintain and prevent soil erosion.

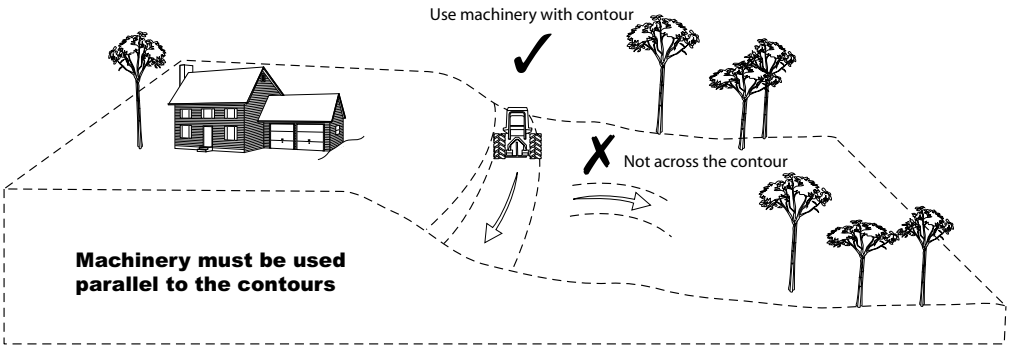
When using mechanical hazard reduction methods, you should retain a ground cover of at least 75% to prevent soil erosion. However, if your area is particularly susceptible to soil erosion, your Hazard Reduction Certificate may require that 90% ground cover be retained.



50% **75%** **100%**

Ground Cover

To reduce the incidence of soil erosion caused by the use of heavy machinery such as ploughs, dozers and graders, machinery must be used parallel to the contours. Vegetation should be allowed to regenerate, but be managed to maintain a low fuel load.

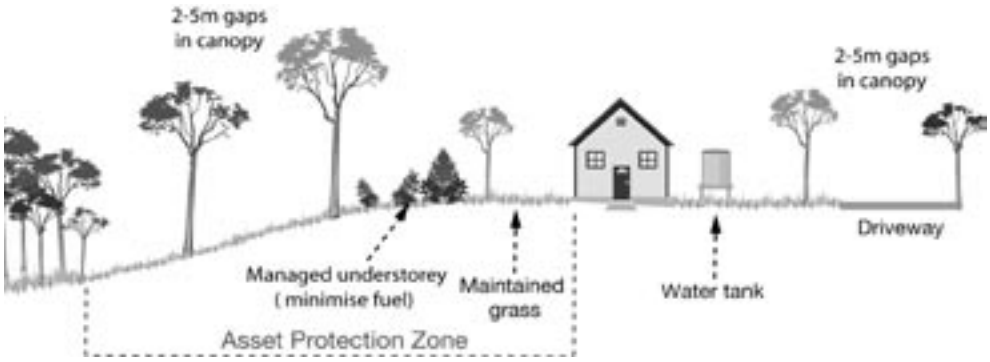


STEP 6. ONGOING MANAGEMENT AND LANDSCAPING

Your home and garden can blend with the natural environment and be landscaped to minimise the impact of fire at the same time. To provide an effective APZ, you need to plan the layout of your garden to include features such as fire resistant plants, radiant heat barriers and windbreaks.

Layout of gardens in an APZ
When creating and maintaining a garden that is part of an APZ you should:

- ensure that vegetation does not provide a continuous path to the house;
- remove all noxious and environmental weeds;
- plant or clear vegetation into clumps rather than continuous rows;
- prune low branches two metres from the ground to prevent a ground fire from spreading into trees;
- locate vegetation far enough away from the asset so that plants will not ignite the asset by direct flame contact or radiant heat emission;
- plant and maintain short green grass around the house as this will slow the fire and reduce fire intensity. Alternatively, provide non-flammable pathways directly around the dwelling;
- ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low-flammability plants and non flammable ground cover such as pebbles and crush tile; and
- avoid erecting brush type fencing and planting "pencil pine" type trees next to buildings, as these are highly flammable.



Removal of other materials
Woodpiles, wooden sheds, combustible material, storage areas, large quantities of garden mulch, stacked flammable building materials etc. should be located away from the house. These items should preferably be located in a designated cleared location with no direct contact with bush fire hazard vegetation.

Other protective features
You can also take advantage of existing or proposed protective features such as fire trails, gravel paths, rows of trees, dams, creeks, swimming pools, tennis courts and vegetable gardens as part of the property's APZ.

PLANTS FOR BUSH FIRE PRONE GARDENS

When designing your garden it is important to consider the type of plant species and their flammability as well as their placement and arrangement.

Given the right conditions, all plants will burn. However, some plants are less flammable than others.

Trees with loose, fibrous or stringy bark should be avoided. These trees can easily ignite and encourage the ground fire to spread up to, and then through, the crown of the trees.

Plants that are less flammable, have the following features:

- high moisture content
- high levels of salt
- low volatile oil content of leaves
- smooth barks without "ribbons" hanging from branches or trunks; and
- dense crown and elevated branches.

When choosing less flammable plants, be sure not to introduce noxious or environmental weed species into your garden that can cause greater long-term environmental damage.

For further information on appropriate plant species for your locality, contact your local council, plant nurseries or plant society.

If you require information on how to care for fire damaged trees, refer to the Firewise brochure *Trees and Fire Resistance; Regeneration and care of fire damaged trees.*

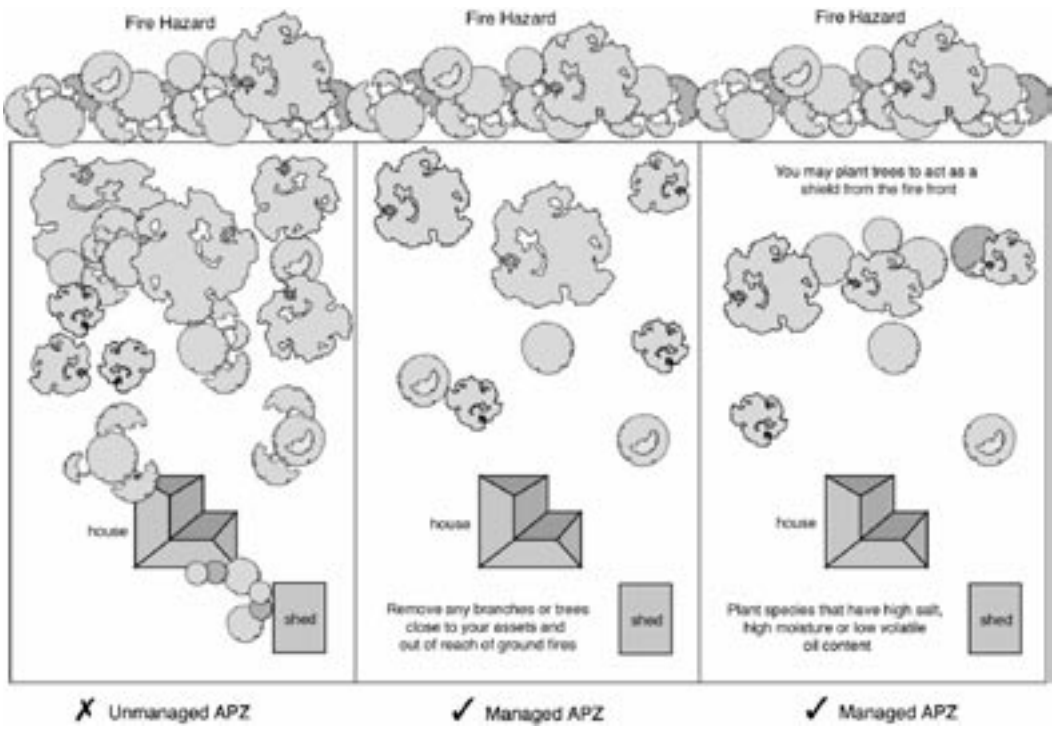
WIND BREAKS

Rows of trees can provide a wind break to trap embers and flying debris that could otherwise reach the house or asset.

You need to be aware of local wind conditions associated with bush fires and position the wind break accordingly. Your local RFS Fire Control Centre can provide you with further advice.

When choosing trees and shrubs, make sure you seek advice as to their maximum height. Their height may vary depending on location of planting and local conditions. As a general rule, plant trees at the same distance away from the asset as their maximum height.

When creating a wind break, remember that the object is to slow the wind and to catch embers rather than trying to block the wind. In trying to block the wind, turbulence is created on both sides of the wind break making fire behaviour erratic.



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 Low Intensity Bush Fire Hazard Reduction Burning
- 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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standards

for low intensity bush fire hazard reduction burning (for private landholders)

low intensity

NSW RURAL FIRE SERVICE

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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.

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.

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.

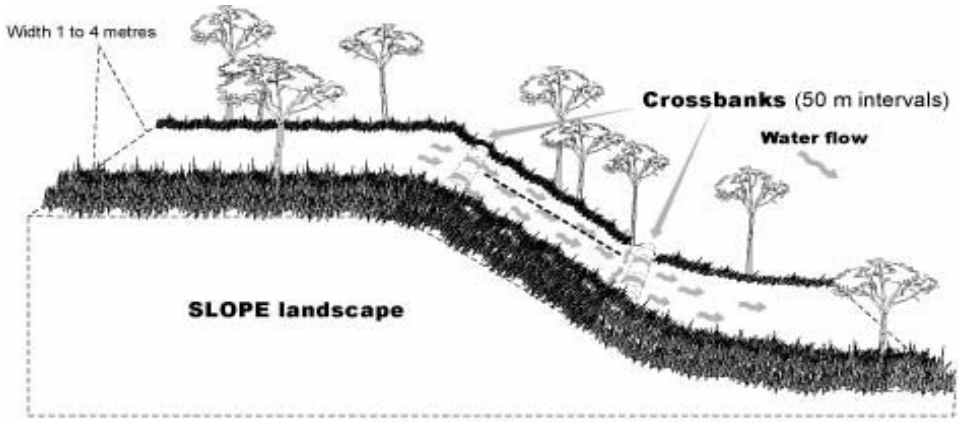
Rake the accumulated litter into the area on the side of the trail that will be burned, and spread the litter out over a wide area. Clear around the base of trees for approximately one metre and also around any large logs lying on the ground close to the control line. This will prevent the fire travelling 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.

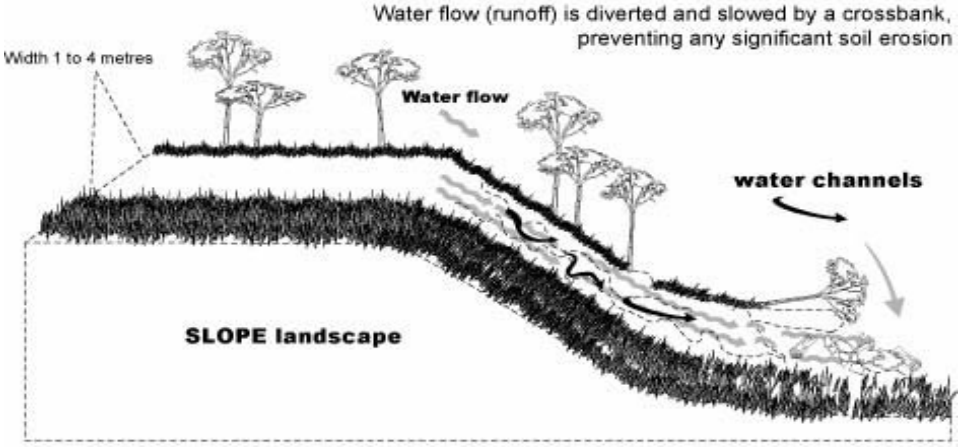
Control lines constructed down slopes (perpendicular to contours) with a width greater than one metre, require drainage structures to minimise water flow and subsequent soil erosion. There are many types of drainage structures, but the most simple to construct and possibly the most effective are crossbanks.

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 contolled 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.

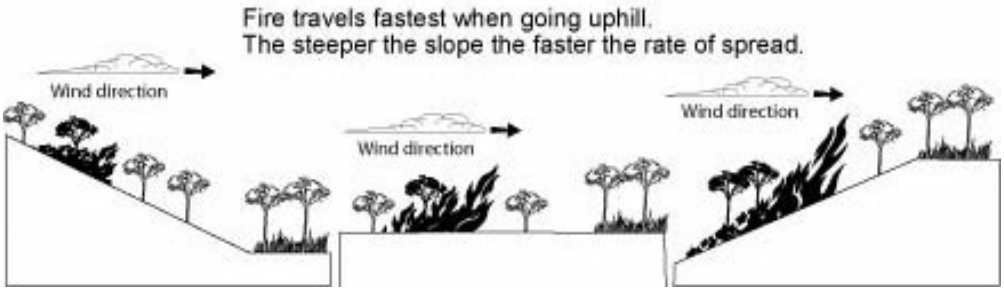
As an alternative, you may contact the local RFS Fire Control Centre to be given the Forest Fire Danger Index (FFDI) score and ways to measure your fuel load, to determine if the conditions are suitable to burn. An FFDI score is calculated based on all the weather elements and gives the best indication 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.

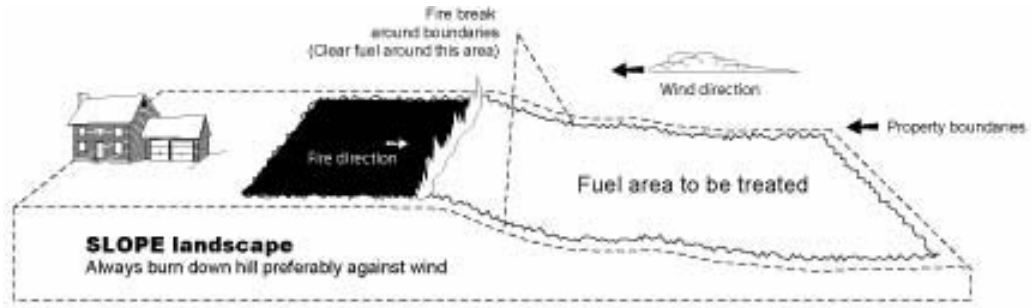
Fuel Load (t/ha)	Forest Fire Danger Index (FFDI)						
	2	4	6	8	10	15	>15
5	burn	burn	burn	burn	burn	burn	don't
10	burn	burn	burn	burn	burn	don't	don't
15	burn	burn	burn	burn	don't	don't	don't
20	burn	burn	don't	don't	don't	don't	don't
>25	burn	don't	don't	don't	don't	don't	don't

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.



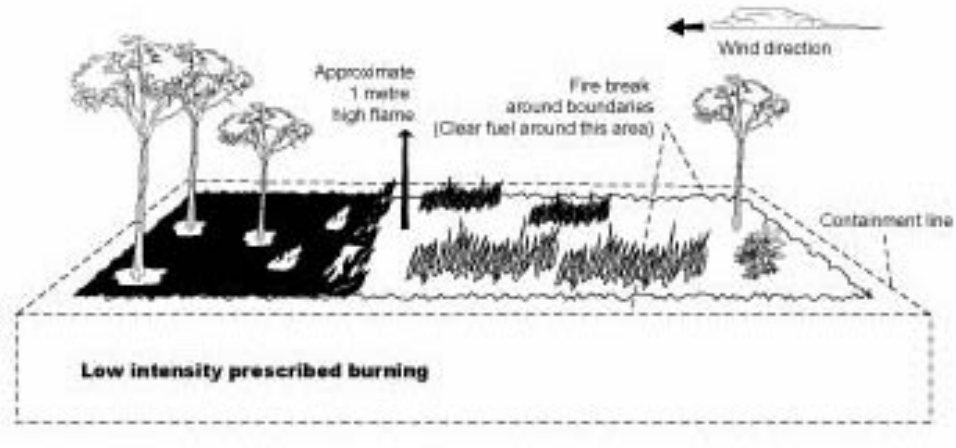
STEP 7. LIGHTING PATTERNS

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).

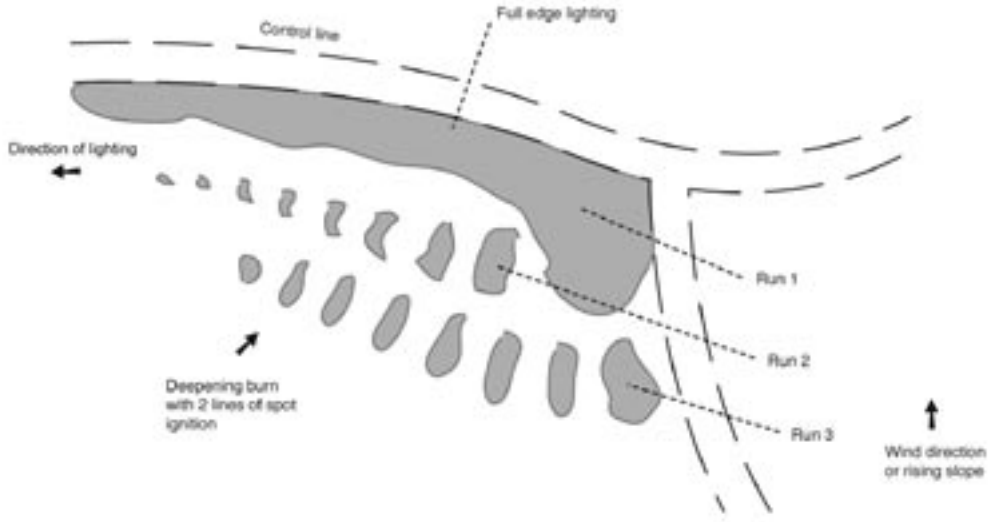
Lighting patterns to minimise environmental impacts:

- 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.

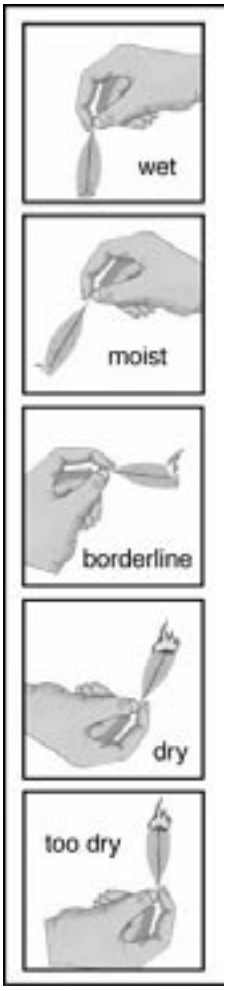
STEP 8. CONDUCT A TEST BURN

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

(b) Light a small test fire.

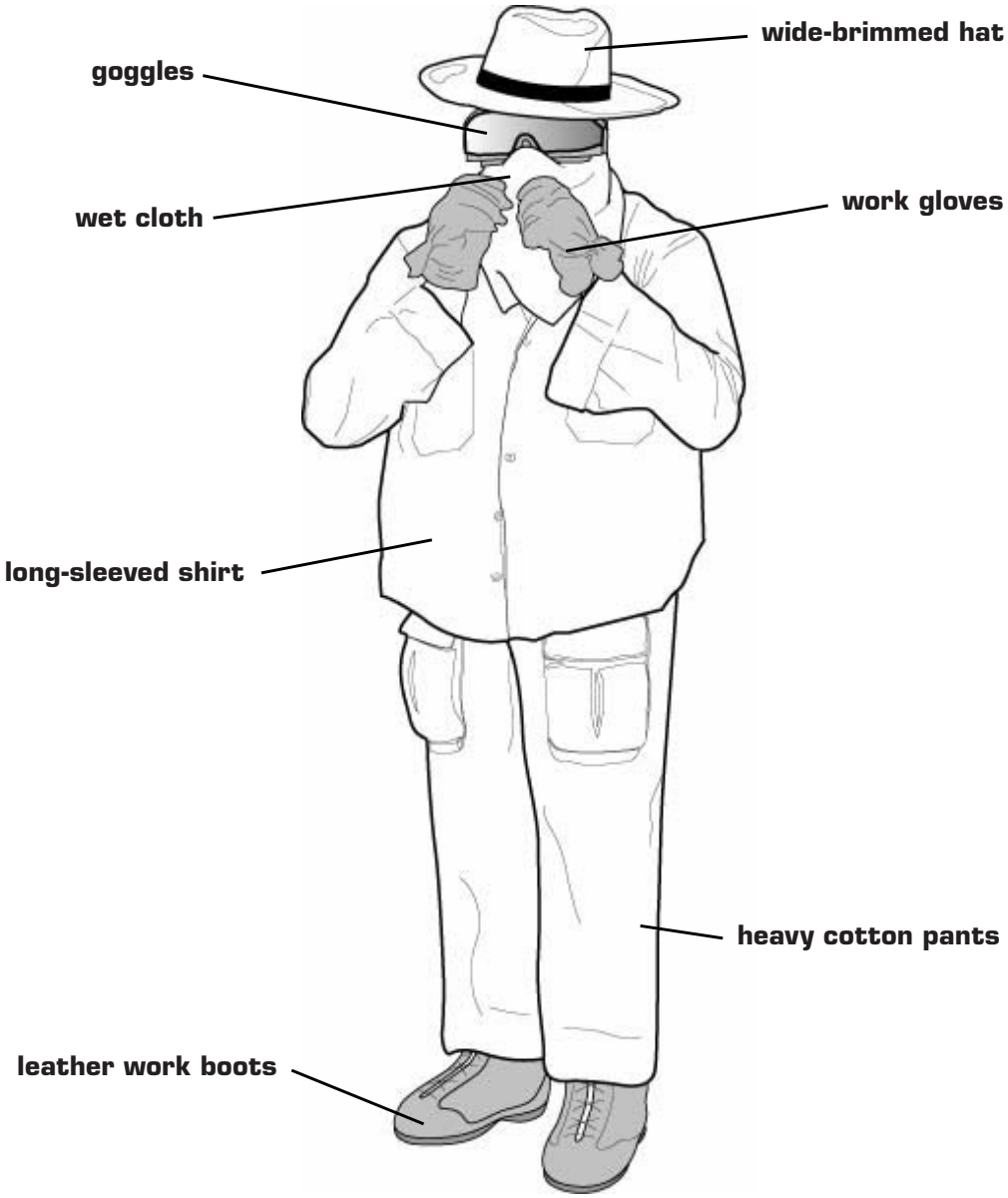
Having assessed that weather conditions are within a desirable range (Step 5), and with suppression equipment close at hand, light a test fire in a prepared area approximately five metres square on flat ground. Observe the test fire flame heights and rate of spread. If the height of flames burning in 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.



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.

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.**

Produced by the NSW Rural Fire Service, Locked Mail Bag 17, GRANVILLE, NSW 2142. Ph. 1800 679 737
www.rfs.nsw.gov.au

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APPENDIX J – Clearing Checklist

Clearing Checklist	Comment	Signoff	Date
Mine Planning Engineer determines the clearing area required for the next 12 months of mining.		Mine Planning Engineer	
Clearing area in accordance with PA 10_0059 and MOP		Environmental Officer	
Clearing activities will be scheduled outside of periods of fauna breeding or hibernation/torpor			
Clearing area visually inspected: - Pegged? - Any faunal habitat present? - Species/communities not previously assessed? - Ecologists required for Pre-Clearing, Clearing and Post Clearing Assessments?			
Any unexpected heritage (both aboriginal or historical)			
Pre Clearing Assessment			
Hollow bearing trees, hollow logs and other habitat features such as rocks are to be located and recorded by GPS, marked in the field by marking paint or similar and data documented on field sheets.		Ecologist	
Evening/nocturnal surveys will be undertaken to gauge fauna activity			

Clearing Checklist	Comment	Signoff	Date
Threatened plant species identified			
The presence of seed for collection and salvageable habitat resources identified			
The presence environmental and noxious weeds identified.			
Clearing and Post-clearing Assessment			
Prior to felling, each tree will be visually inspected for the presence of fauna and shaken		Ecologist	
Dozer or excavator “slow drop” tree			
Once on the ground, each hollow will be inspected for the presence of fauna, with the aid of a burrow-scope if required.			
If any injured or juvenile fauna are identified, they will be captured and transported to either WIRES or a veterinary hospital. Other fauna captured but not requiring care will be released into the same habitat near the point of rescue.			
Hollow bearing trees will be left on the ground overnight			
Report based on the results of the Pre-clearing, Clearing and Post-clearing Assessment.		Environmental Officer	

Clearing Checklist	Comment	Signoff	Date
The report is to be provided to OEH			
Clearing Area Management and Habitat Salvaged			
Weeds Sprayed and Area/Quantity		Environmental Officer	
Seed Collected from Species and Weight			
Number of Trees Cleared			
Number of Hollow Bearing Trees Cleared			
Number of Timber salvaged			
Number of Hollows salvaged			

Clearing Checklist	Comment	Signoff	Date
Number of Rocks salvaged			