RAVENSWORTH
OPEN CUT

GLENCORE

Biodiversity Offset Management Plan

Number: RAVOC-1007099517-20 **Status:** Final **Effective:** 13 July 2021
Owner: Environment and Community Coordinator **Version:** 4.0 **Review:** 13 July 2024

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1. Introduction

1.1 Background

The Ravensworth Complex is located between the townships of Singleton and Muswellbrook, in the Upper Hunter Valley region of New South Wales (NSW) (refer to ***Figure 1-1***).

The Ravensworth Operations Project Approval (PA 09_0176) was granted on 11 February 2011 by the Minister for Planning and has subsequently been modified on three occasions: 16 August 2013, 19 December 2014 and 16 February 2016.

Ravensworth Operations also hold Development Consent DA 104/96 for the Ravensworth Underground Mine (RUM). DA 104/96 was approved on 20 November 1996 and has been modified on nine occasions (the latest being on 20 June 2013). RUM was placed in Care and Maintenance in October 2014.

PA 09_0176 and DA 104/96 allow for the expansion of existing approved mining operations at the Ravensworth Complex and enables the consolidation of existing approvals for open cut mining and infrastructure within the Ravensworth area. Specifically, the approval consolidates existing Project Approvals for the Narama Mine, Ravensworth West Mine, Cumnock Open Cut, RUM surface facilities and Ravensworth Coal Handling Preparation Plant (RCHPP). The Ravensworth Complex and associated Biodiversity Offset Areas (BOAs) are shown in ***Figure 1-2***.

PA 09_0176 has provided for the integration of operational aspects of the surface mining operations in the area, allowing for a consistent and integrated approach to environmental management and mine planning. The Ravensworth Complex is committed to implementing continued mining operations in the context of updated and contemporary environmental management requirements.

A number of company entities and joint venture partners are responsible for managing the operations which are undertaken at the respective facilities which comprise the Ravensworth Complex. For the purpose of this management plan, these respective entities will collectively be referred to as the Ravensworth Complex, with all activities ultimately being undertaken by Glencore Coal Assets Australia (GCAA) managed businesses.

1.2 Purpose

This Biodiversity Offset Management Plan (BOMP) details the biodiversity management, monitoring and rehabilitation requirements for the Ravensworth Complex, in accordance with the requirements of PA 09_0176, DA 104/96 and their associated Environmental Assessment (EA) documents.

The purpose of this BOMP is also to describe the ecological management strategies, procedures, controls and monitoring programs that are to be implemented for the management of flora and fauna at the Ravensworth Complex. This document also includes management, monitoring and rehabilitation requirements for the Ravensworth North, Hillcrest, Clifton and Stewart BOAs (see ***Figure 1-2***).

This BOMP has been updated to address the requirements of the Department of Planning Industry and Environment (DPIE) *Draft Environmental Management Plan Post Approval Guideline* (DPIE, 2018). It also follows the requirements of the GCAA *HSEC Protocol 11.18 Biodiversity Offset Management*.

1.3 Scope

This document applies to all personnel involved in the management and monitoring of biodiversity at the Ravensworth Complex and associated Ravensworth North, Hillcrest, Clifton and Stewart BOAs.

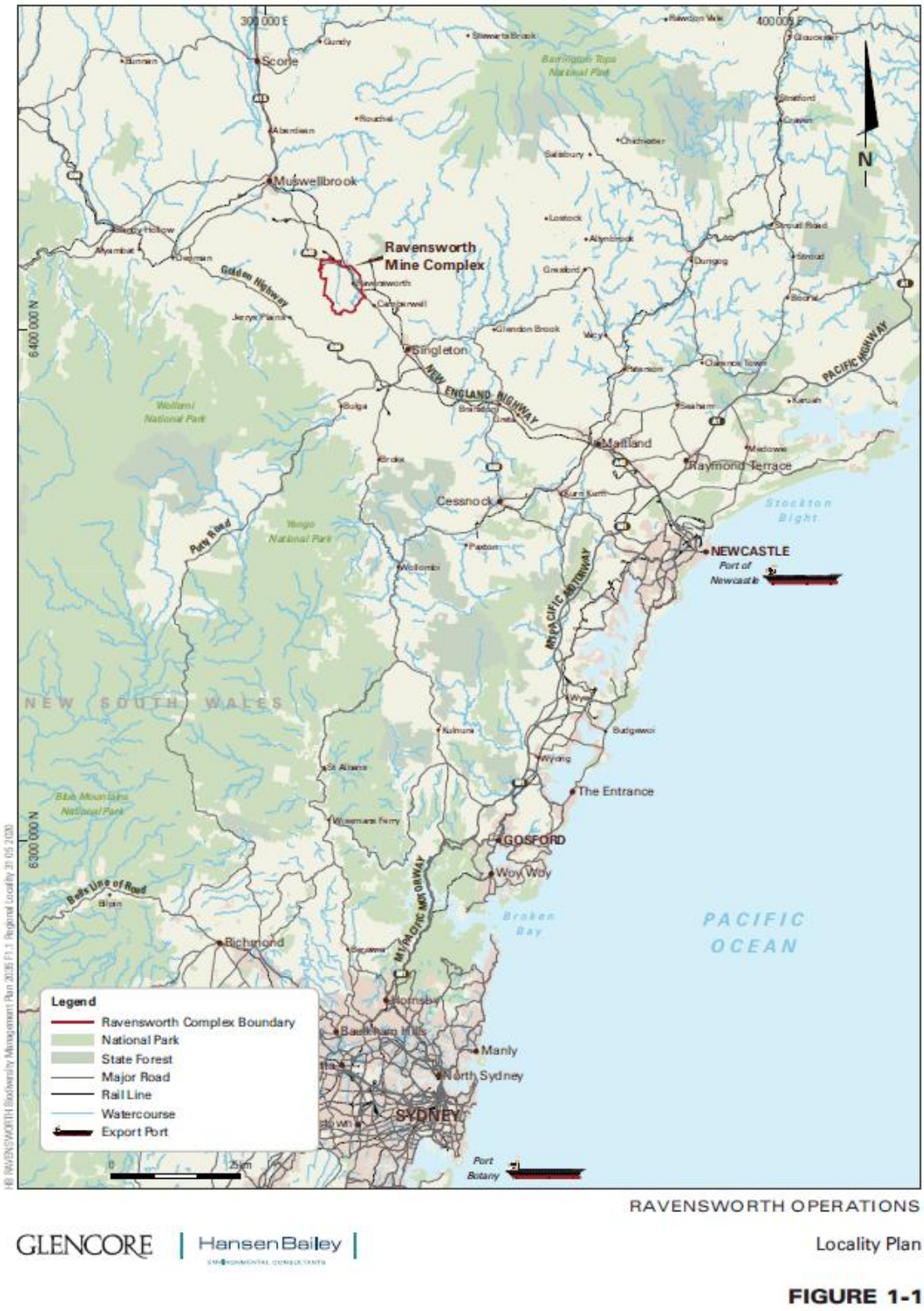


Figure 1-1 – Locality Plan

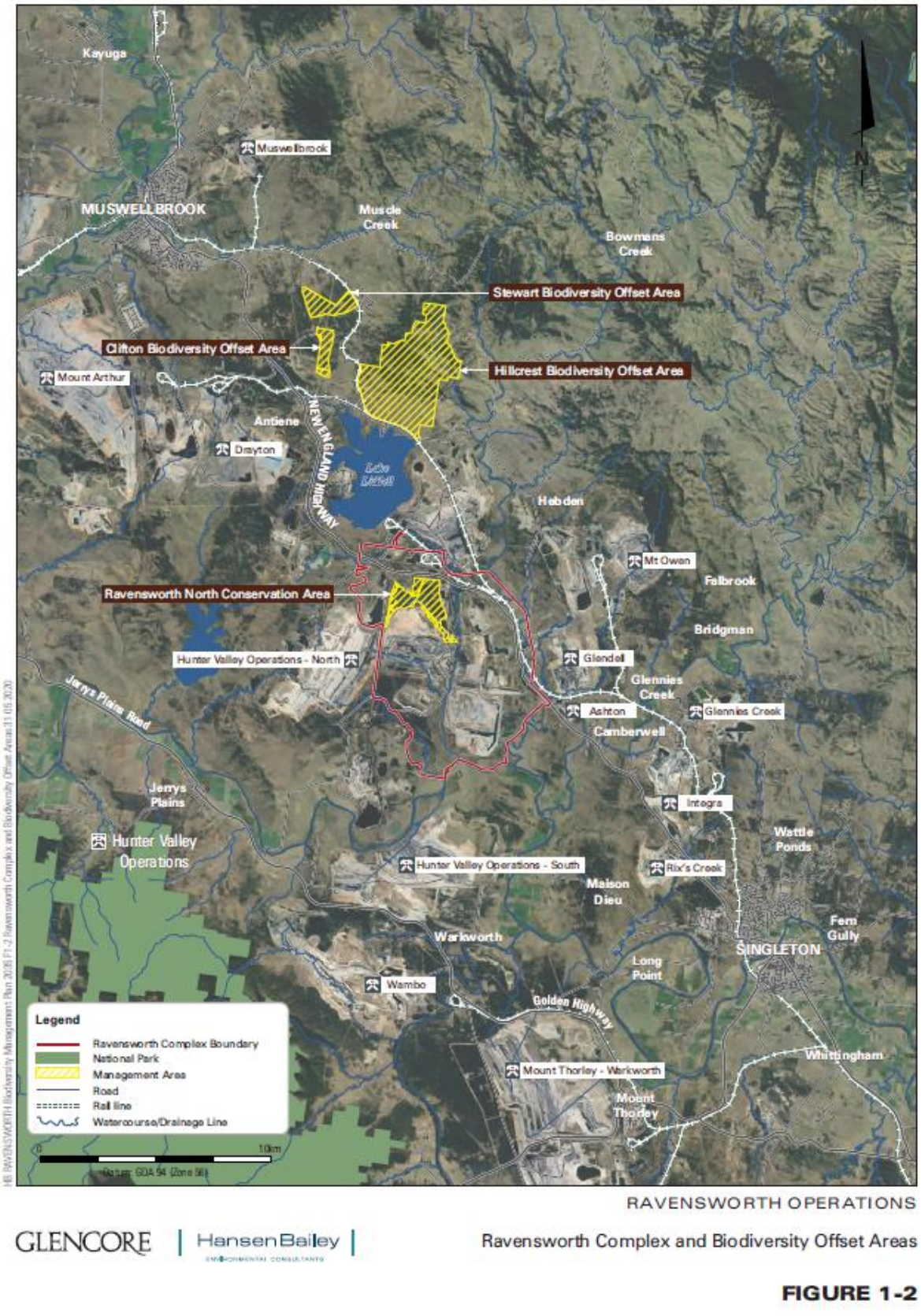


Figure 1-2 – Ravensworth Complex and Biodiversity Offset Areas

1.4 Integration of Ravensworth Underground Mine with Ashton Underground Mine

The Ashton Underground Mine and the RUM share a common mining lease boundary and the approved underground mining areas are separated (at their closest) by approximately 45 metres.

The Department of Planning and Environment (DPE) approved Modification 11 to the Ashton Coal Project Development Consent DA-309-11-2001-i and Modification 10 to the RUM Development Consent DA 104/96 on 6 July 2022. These modifications allow for the integration of the two neighbouring underground mines and enable Ashton Coal Operations Pty limited (ACOL) to access and extract approved but unmined coal resources from a portion of the RUM (***Figure 1.3***). The modifications allow for connections to be made between the two neighbouring mines via non-subsiding first workings. ACOL will utilise its existing longwall mining equipment and employees to mine the Pikes Gully and Middle Liddell coal seams at the RUM.

ACOL will handle, process and transport coal from the RUM in the same manner it handles coal from its Ashton Underground Mine. Run of Mine (ROM) coal will be transferred via underground conveyors to the Ashton Mine Complex and through to the Ashton pit top, via its existing coal clearance system. ROM coal will be processed at Ashton's CHPP prior to being loaded onto trains for transportation to market using the existing rail infrastructure.

Rejects and tailings generated from the processing of the RUM ROM coal will be emplaced in the existing North East Open Cut void and Ravensworth Void 4 Tailings Dam.

Water and gas from the RUM will also be transferred to the Ashton Mine Complex to be managed within the existing water and gas management system.

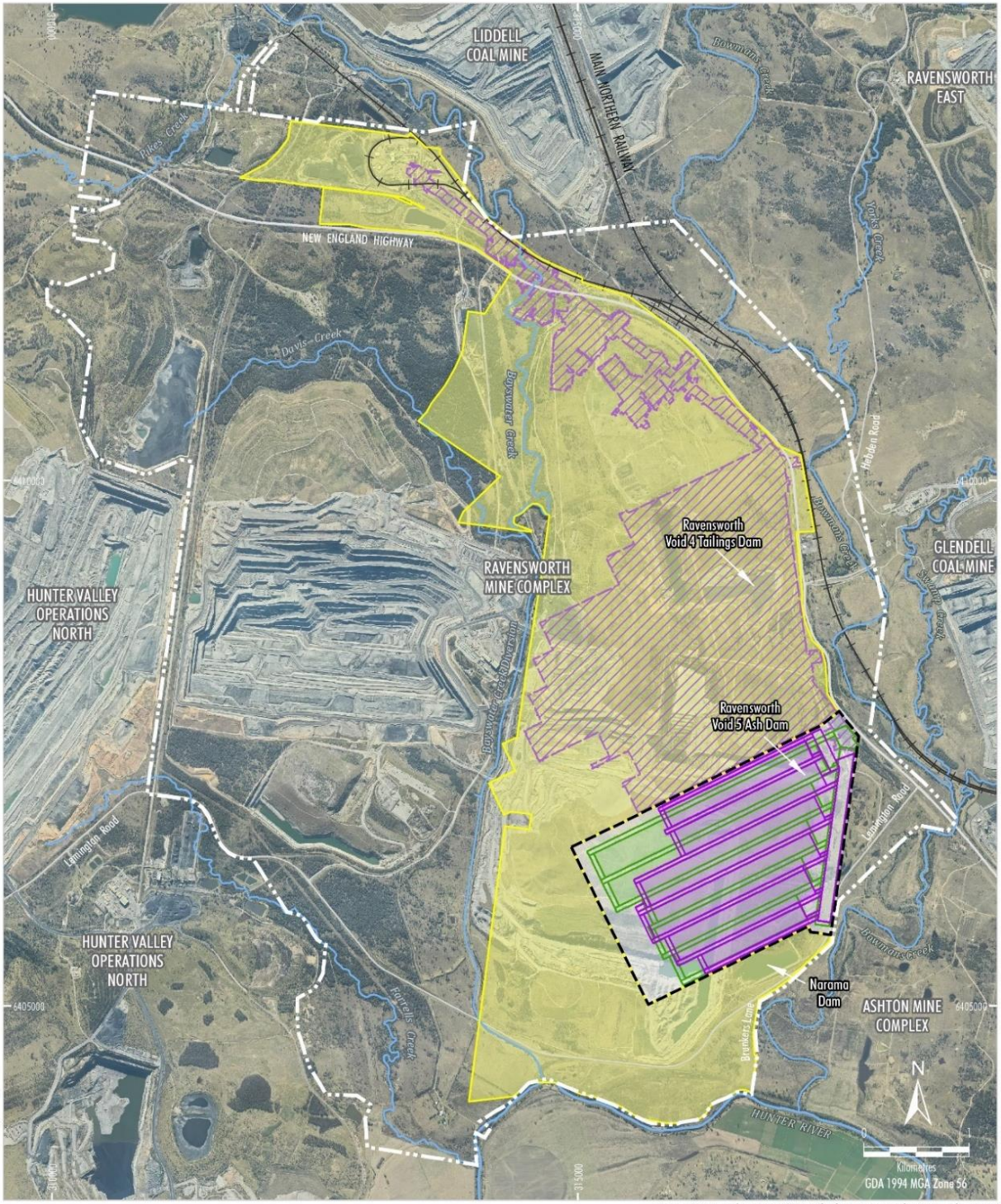
The area of the RUM that will be managed and operated by ACOL under the RUM Development Consent DA 104/96 is shown on ***Figure 1.3*** (referred to as the ACOL-operated RUM).

ACOL will implement the management, monitoring and reporting outlined in the Ashton Coal Project environmental management plans and strategies during mining of the ACOL-operated RUM.

The remaining areas of the approved RUM (i.e. outside of the ACOL-operated RUM) including the completed Pikes Gully seam Longwalls 1-9 as well as open cut mining activities associated with the Ravensworth Operations Project (Project Approval 09-0176) are managed in accordance with this Environmental Management Strategy (and the associated Ravensworth Complex environmental management plans) and the RUM Rehabilitation Management Plan.

Regular meetings will be held between Glencore and ACOL to discuss the following:

- planned Glencore and ACOL activities within the ACOL-operated RUM and surrounds;
- potential interactions between the Ravensworth Operations Project and the ACOL-operated RUM, including any relevant consequences of subsidence;
- environmental monitoring results relevant to the ACOL-operated RUM; and
- data and report sharing.



Source: NSW Spatial Services (2021) Orthophoto: Ravensworth Mine Complex (2021)

LEGEND

- Ravensworth Open Cut Operations Development Consent Boundary
- Ravensworth Underground Mine
- Completed Pikes Gully Seam Workings
- Indicative Pikes Gully Seam Longwall Layout
- Indicative Middle Liddell Seam Longwall Layout
- Ravensworth Underground Mine - Management Responsibility under Development Consent DA 104/96
- Operational Area to be managed by Resource Pacific Pty Ltd (Glencore) #
- Operational Area to be managed by Ashton Coal Operations Ltd (Yancoal) # ^

YANCOAL
ASHTON UNDERGROUND MINE
ACOL's Management Responsibility Under Development Consent DA 104/96

The Ravensworth Underground Mine includes ancillary infrastructure and surface disturbance associated with underground mining including, but not limited to, ventilation, gas management and water management infrastructure and subsidence monitoring, management and remediation activities.

^ This area is called the 'ACOL-operated portion of the RUM' in the Management Plan.

Figure 1-3 – ACOL's Management Responsibility Under Development Consent DA 104/96

1.5 Statutory Requirements

Compliance with relevant legislation, standards and codes is managed at the Ravensworth Complex in accordance with the Ravensworth Complex Environmental Management Strategy (EMS).

A summary of the legislation relevant to the BOMP is provided below.

1.5.1 Mining Act 1992

The NSW *Mining Act 1992* (Mining Act) is administered by Regional NSW (RNSW) – Mining Exploration and Geosciences (MEG) and the RNSW – Resources Regulator (Resources Regulator), on behalf of the Minister for Regional New South Wales, Industry and Trade. These regulatory departments, amongst other legislative instruments, places controls on methods of exploration and mining, the disposal of mining waste, land rehabilitation, and environmental management activities.

1.5.2 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval from the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance (MNES). These matters are:

- *Listed threatened species and ecological communities;*
- *Migratory species protected under international agreements;*
- *Ramsar wetlands of international importance;*
- *The Commonwealth marine environment;*
- *World Heritage properties;*
- *National Heritage places;*
- *Great Barrier Reef Marine Park;*
- *Nuclear actions; and*
- *A water resource, in relation to coal seam gas development and large coal mining development.*

In accordance with the EPBC Act, an approval was granted by the then Department of the Environment (DoE, now known as the *Department of Agriculture, Water and the Environment* (DoAWE)) on 8 April 2011 (EPBC No. 2010/5389) for the extension of the open cut mine and associated infrastructure at the Ravensworth Complex. The EPBC Act approval placed 17 conditions on the development.

The Ravensworth Complex has in place and approved Federal Offset and Green and Golden Bell Frog Management Plan to address the requirements of EPBC Act approval. In 2019, the Ravensworth Complex secured the Ravensworth North, Hillcrest Clifton and Stewart Offset Areas under Conservation Agreements with the Chief Executive of the then Office of Environment and Heritage (OEH, now Biodiversity Conservation Division (BCD)). Copies were also sent to DoAWE in May 2020, who confirmed that the Conservation Agreements addressed the Conditions 2 and 3 of EPBC No. 2010/5389.

1.5.3 Biodiversity Conservation Act 2016

The purpose of the *NSW Biodiversity Conservation Act 2016* (BC Act) (formerly governed by the *NSW Threatened Species Conservation Act 1995*) is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development (as described in section 6 (2) of the *Protection of the Environment Administration Act 1991*). The BC Act provides protection for threatened species native to NSW.

The impact assessment completed as part of the *Ravensworth Operations Project Environmental Assessment* (EA) (Umwelt, 2010) resulted in the identification of a potential significant impact on one threatened fauna species and one Endangered Ecological Community (EEC). A detailed impact mitigation package consisting of standard impact mitigation strategies (such as post mining rehabilitation, preclearance and tree felling procedures) and a biodiversity offset strategy (for PA 09_0176 and EPBC No. 2010/5389) was developed in order to ameliorate the predicted impacts on these ecological features.

The *Threatened Species Conservation Act 1995* (TSC Act) was repealed by Schedule 10 to the *Biodiversity Conservation Act 2016 No 63* (BC Act) with effect from 25 August 2017.

This BOMP provides further detail for the mitigation measures recommended by the Ravensworth Operations EAs, in order to ameliorate the impact of mining activities on threatened species, endangered populations and EECs found within the Ravensworth Complex.

1.5.4 Rural Fires Act 1997

The *Rural Fires Act 1997* (Rural Fires Act) controls the management of bushfires and controlled burning in NSW. The Rural Fires Act requires Ravensworth Operations to take all practical steps to prevent bushfires and to minimise the danger of the spread of bushfires on or from land under its control (including offset and revegetation areas).

1.6 Requirements for this plan

Requirements for this BOMP, as defined by the conditions of PA 09_0176 and DA 104/96 are outlined below in ***Table 1-1***. A reference has been included to where these conditions are addressed in this plan.

Schedule, Condition	Requirement	Section in Document
Project Approval PA 09_0176		
3, 38	The Proponent shall prepare and implement a Biodiversity Management Plan for the project to the satisfaction of the Director-General. This plan must:	This document
3, 38 (a)	be prepared in consultation with OEH, NOW and Council, and be submitted to the Director-General for approval by the end of December 2011;	14
3, 38 (b)	describe how the implementation of the offset strategy would be integrated with the overall rehabilitation of the site;	7.10
3, 38 (c)	include: • a description of the short, medium, and long term measures that would be implemented to: – implement the offset strategy; and	4, 5 & 6
	– manage the remnant vegetation and habitat on the site and in the offset areas;	
	• detailed performance and completion criteria for implementation of the offset strategy;	
	• a detailed description of the measures that would be implemented over the next 3 years, including the procedures to be implemented for: – implementing revegetation and regeneration within the disturbance areas and offset areas, including establishment of canopy, sub-canopy (if relevant), understorey and ground strata;	
	– maximising salvage and beneficial use of resources in areas that are to be impacted, including vegetative, soil and cultural heritage resources;	5.3 & 7.3
	– protecting vegetation and soil outside the disturbance areas;	5.3.1 & 5.3.7
	– rehabilitating creeks and drainage lines on the site (both inside and outside the disturbance areas), to minimise net loss of stream length and aquatic habitat;	7.6
	– managing salinity;	7.2

Schedule, Condition	Requirement	Section in Document
	– conserving and reusing topsoil;	7.3
	– undertaking pre-clearance surveys;	7.1
	– managing impacts on fauna;	5.3.1 & 5.3.7
	– landscaping the site and along public roads to minimise visual and lighting impacts, including along the New England Highway and the realigned Lemington Road;	7.9
	– collecting and propagating seed;	5.3.6
	– salvaging and reusing material from the site for habitat enhancement;	5.3.7
	– salvaging, transplanting and/or propagating threatened flora and native grassland;	7.4
	– controlling weeds and feral pests;	5.3.9, 5.3.10 & 5.3.11
	– managing grazing and agriculture on site and in the offset areas;	5.3.5
	– controlling access; and	5.3.1
	– bushfire management;	5.3.12
	• a program to monitor the effectiveness of these measures, and progress against the performance and completion criteria;	6
	• a description of the potential risks to successful revegetation, and a description of the contingency measures that would be implemented to mitigate these risks; and	9.4
	• details of who would be responsible for monitoring, reviewing, and implementing the plan.	1.7
Development Consent DA 104/96		
3, 6	The Applicant shall prepare and implement an Extraction Plan for any second workings on site, to the satisfaction of the Director-General. The plan must include a:	
3, 6(i)	• Biodiversity Management Plan, which has been prepared in consultation with OEH and DRE, which: – includes a program of works to ensure that overall terrestrial and aquatic biodiversity values are the same or better than existed in the locality prior to longwall mining;	6 &7
	– provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna.	6 & 7
EPBC 2010/5389		
4	To offset the impacts to the habitat for the Swift Parrot, Regent Honeyeater and Grey-headed Flying-fox, and Green and Golden Bell Frog, the person taking the action must submit to the Minister for approval an Offset Management Plan for the Ravensworth North, Hillcrest, Clifton and Stewart Offset Areas within 3 months of the date of this approval.	This document
	This revised Offset Management Plan must include, at a minimum, the following information, details of management actions to protect and enhance the extent and condition of the threatened species habitat values including rehabilitation, weed control, fire management, erosion and sediment control, management of livestock and restrictions on access of no less than:	7

Schedule, Condition	Requirement	Section in Document
	i. 96 hectares of habitat for the Regent Honeyeater, Swift Parrot and Grey-headed Flying-Fox in the Clifton Offset Area; and ii. 165 hectares of habitat for the Regent Honeyeater, Swift Parrot and Grey-headed Flying-Fox in the Stewart Offset Area; and iii. 144 hectares of habitat for the Regent Honeyeater and Swift Parrot and Grey-headed Flying-Fox in the Ravensworth North Offset Area; and iv. 1,398 hectares of habitat for the Grey-headed Flying-Fox in the Hillcrest Offset Area; v. 1,231 hectares of habitat for the Regent Honeyeater and Swift Parrot in the Hillcrest Offset Area; and vi. 437.68 hectares of habitat for the Green and Golden Bell Frog within the Ravensworth North and Hillcrest offset areas, as described in the Public Environment Report dated October 2010 and as per the request for variation dated 25 May 2012.	

Table 1-1 – Ravensworth Complex Approval Requirements for the BOMP

1.7 Roles and Responsibilities

The roles and responsibilities associated with this BOMP are presented in ***Table 1-2***.

Role	Responsibilities
Operations Manager	• Confirm sufficient resources are allocated for the implementation of this BOMP; • Authorise internal and external reporting requirements as well as subsequent revisions of this BOMP.
Technical Services Manager (Mine Planner)	• Confirm the mine planning process integrates rehabilitation planning so that sufficient time and resources are allocated to allow for the implementation of ecological management and rehabilitation strategies for the approved Ravensworth Complex Disturbance Areas; • Design rehabilitation and confirm rehabilitation activities are consistent with the requirements of this plan; • Confirm the GCAA Ground Disturbance Permit (GDP) process is implemented well in advance of clearing activities; • Confirm the rehabilitation schedule is consistent with Ravensworth Complex approvals and associated commitments; and • Confirm future amendments to the mine plan do not cause any unauthorised impact on the flora and fauna features within the Ravensworth Complex and the BOAs.
Environment and Community Manager (ECM)	• Coordinate the day to day implementation of this BOMP, including review and approval of the design and implementation of rehabilitation and other ecological management activities; • Coordinate the implementation of the management requirements of this BOMP for BOAs and rehabilitation areas; • Authorise clearing activities in accordance with the BOMP through the GCAA GDP process; • Confirm sufficient time and resources are allocated to allow for the implementation of ecological management and rehabilitation strategies; • Confirm sufficient resources and time is allocated to implement the BOMP monitoring programs; • Confirm the results of the BOMP monitoring programs are utilised to refine closure criteria as well as to evaluate the effectiveness of rehabilitation / revegetation practices so as to facilitate continual improvement; • Periodically review progress against mine closure objectives and rehabilitation criteria; • Confirm all internal and external reporting requirements are met;

Role	Responsibilities
	• Confirm all relevant records are effectively maintained onsite; and • Confirm all personnel involved in the carrying out and monitoring of BOMP activities and values are appropriately qualified, licensed and experienced to undertake the task.
Environment and Community Coordinator (ECC)	• Coordinate the implementation of the BOMP, as delegated by the ECM; • Coordinate environment inspections of rehabilitation / revegetation as per the requirements of the Ravensworth Complex SD Management System; • Coordinate monitoring requirements as per the BOMP and GCAA standards; and • Coordinate reporting requirements relating to rehabilitation / revegetation activities and the BOAs in the Annual Review.
Department Managers	• Comply with the requirements of the BOMP, including reporting requirements; • Confirm personnel and contractors carry out work in accordance with the BOMP; and • Confirm all personnel have received the appropriate training for their responsibilities.
Mining, construction and land management personnel and contractors	• Undertake all activities directly in accordance with the requirements of the BOMP.
All employees and contractors	• Confirm the implementation of the BOMP and Ravensworth Complex approvals with respect to their specific work practices; • Act in accordance with the management procedures or protocols outlined in this BOMP; and • Confirm any potential or actual issues, including environmental incidents, are reported to the immediate supervisor.

Table 1-2 – Roles and Responsibilities

2. Commitments

All management commitments outlined within this management plan including timing are outlined in **Table 2-1** below. Management commitments requiring actioning will be entered into the Ravensworth Compliance Management system (CMO) and actioned, records of documentation associated with the management commitments will be maintained within the compliance management system.

Commitment No.	Management Plan Commitment	Section in Document
1	Minimum twice a year BOA inspections to identify fence conditions	5.3
2	Repair damaged fences as identified in inspections	5.3
3	Remove any redundant fencing identified in inspections	5.3
4	Develop a GIS database of all BOA access tracks	5.3
5	Minimum twice a year BOA inspections to identify track conditions	5.3
6	Repair degraded tracks as identified in inspections	5.3
7	Asbestos identified and contaminated areas secured by Year 3 (2017)	5.3
8	Asbestos removed from BOAs where possible and not impacting heritage features by Year 3 (2017)	5.3
9	Superfluous infrastructure removed from all BOAs by Year 3 (2017)	5.3
10	Minimum twice a year BOA inspections to identify presence of rubbish	5.3
11	Remove reported dumped rubbish	5.3
12	Establish photo monitoring points within all offset areas by Year 3 (2017)	5.3
13	Minimum twice a year BOA inspections to identify newly eroded areas	5.3
14	Remediate eroded areas in accordance with Aboriginal and Cultural Heritage Management Plan (ACHMP)	5.3
15	Monitor performance of erosion works annually	5.3
16	All stock removed from RNOA, Southern HOA, COA and SOA	5.3
17	All stock removed from Northern grazing management zone HOA	5.3
18	Minimum twice a year BOA inspections to determine presence of rogue stock and assess conditions of fences	5.3
19	Removed reported rogue stock and repair damaged fences	5.3
20	Seed collectors are to be appropriately trained	5.3
21	Develop seed collection procedure based on Florabank (2013)	5.3
22	Implement seed collection procedure from Year 3 (2017)	5.3
23	Establish preclearing, habitat salvage procedures	5.3
24	Salvaged habitat features placed in BOAs and in onsite rehabilitation	5.3
25	Map revegetation areas and target vegetation communities	5.3
26	Develop detailed PCs for all management zone types	5.3
27	Develop a revegetation program and incorporate measurement criteria into BOA annual monitoring	5.3
28	Implement revegetation program	5.3
29	Minimum twice a year BOA inspections to determine condition and success of revegetation program	5.3
30	BOA monitoring undertaken annually to measure outcomes of revegetation program	5.3
31	Weed extent and density mapping updated annually	5.3
32	Minimum twice a year BOA inspections to monitor weed occurrences and successes of management programs	5.3
33	On ground weed management program undertaken	5.3
34	Minimum twice a year BOA inspections to monitor vertebrate pest populations and successes of management programs	5.3
35	Wild dog and fox pest management program undertaken	5.3
36	Wild pig pest management program undertaken	5.3
37	Other pest management undertaken	5.3

Commitment No.	Management Plan Commitment	Section in Document
38	Development of a bushfire management plan	5.3
39	Review fuel loads and any required reduction measures annually	5.3
40	Habitat enhancement of existing dams within RNOA and south of HOA by Year 3 (2017)	5.3
41	Construct 10 new Green and Golden Bell Frog ponds in the RNOA by Year 3 (2017)	5.3
42	Annual bird census monitoring completed in conjunction with vegetation condition assessment	6.1
43	Targeted surveys for Swift parrot and Regent honeyeater will take place annually during winter	6.2
44	Surveys for micro bats will occur biennially (every second year 2016, 2018 etc.)	6.3
45	Nocturnal surveys for the Green and Golden Bell Frog should be conducted on at least 4 different nights in appropriate season (November to February) and weather conditions (warm still nights within one week of rainfall >50mm)	6.4
46	Fauna monitoring will be undertaken at permanent monitoring locations biennially (2016, 2018 etc.) for RNOA due to the adverse impacts from adjacent mining operations	6.5
47	Establish vegetation condition assessment by Year 3 (2017)	6.1, 6.6
48	Establish bird census monitoring by Year 3 (2017)	6.1
49	Establish targeted threatened bird monitoring by Year 3 (2017)	6.2
50	Establish micro bat monitoring by Year 3 (2017)	6.3
51	Establish Green and Golden Bell Frog habitat assessment by Year 3 (2017)	6.4
52	Establish fauna monitoring by Year 3 (2017)	6.5
53	All translocation/salvage works will be subject to ecological monitoring, and will be reported on in the Annual Review. Further research initiatives will also be reported in the Annual Review.	7.4
54	An update to the Bushfire Management Plan will be undertaken on a regular basis	7.5
55	Outcomes of rehabilitation inspections and monitoring will be recorded and any required reasonable and feasible management actions that are identified as part of the inspection, are to be implemented	7.11
56	In the event that further threatened species are identified at the Ravensworth Complex, the monitoring program will incorporate surveys to adequately assess and monitor these species	7.11
57	The ECM will report to the Operations Manager the results of investigations of any complaints or any unauthorised clearing or other activities not in accordance with Project Approval conditions relating to this BOMP	9.1
58	An annual Ecological Monitoring Report will be prepared and will document the monitoring methods and results from the winter monitoring period through to the autumn monitoring period	9.2
59	The annual Ecological Monitoring Report will be summarised as part of the Ravensworth Complex Annual Review	9.2
60	BOA inspection report/form – Minimum twice a year	9.2
61	Weed management report - Upon completion of each control program	9.2
62	Vertebrate pest management report - Upon completion of each control program	9.2
63	Annual biodiversity monitoring	9.2
64	Ravensworth Complex Annual Review	9.2

Table 2-1 – Commitments within this management plan

3. Biodiversity Offset Areas

3.1 Biodiversity Offset Area Locations

As identified in Condition 33 of Schedule 3 of the PA 09_0176, the Ravensworth North, Hillcrest, Clifton and Stewart BOAs are required to focus on the re-establishment of:

- Significant and/or threatened plant communities, including:
  - Central Hunter Grey Box – Ironbark Woodland;
  - Central Hunter Ironbark – Spotted Gum – Grey Box Forest;
  - River-flat Eucalypt Forest;
  - Hunter Floodplain Red Gum Woodland Complex;
- Significant and/or threatened plant species, including:
  - Weeping Myall (*Acacia pendula*);
  - River Red Gum (*Eucalyptus camaldulensis*); and
- Habitat for significant and/or threatened animal species, including:
  - Green and Golden Bell Frog (*Litoria aurea*).

The locations of the Ravensworth Complex BOAs are as follows (refer to ***Figure 1-2***):

- **Ravensworth North Offset Area** (RNOA) covers approximately 284 ha and is located directly to the north of Ravensworth North Mine.
- **Hillcrest Offset Area** (HOA) is located approximately six kilometres to the north of the Ravensworth Complex and represents approximately 1,402 ha of ecologically significant vegetation and fauna habitats.
- **Clifton Offset Area** (COA) is approximately 107 ha in size, located approximately 6 km northwest of the Ravensworth Complex.
- **Stewart Offset Area** (SOA) is approximately 165 ha in size, located approximately 6 km northwest of the Ravensworth Complex.

The existing ecological features of each of these BOAs are discussed in ***Section 4***.

3.2 Land Tenure and Land Uses

All four BOAs are under the management of Ravensworth Operations.

RNOA is bound on all sides by land managed in association with the Upper Hunter Coal Mining industry. COA and SOA border mainly rural residential and semi-rural residential lands. Some of this land is under management of Macquarie Generation and the majority of surrounding lands have a current or recent grazing history. In most cases, land surrounding COA and SOA is similarly vegetated to that of the BOAs. HOA is surrounded by rural residential land to the North, East and West, while the land to the South is under management of Macquarie Generation and the Australian Rail Track Corporation.

Power line easements traverse HOA, SOA and COA, which provide additional management complexities and access requirement to the BOAs (see ***Section 5.3***).

3.3 Land Security

Schedule 3, Condition 35 of PA 09_0176 requires the Ravensworth Complex to make suitable arrangements to provide appropriate long term security for Ravensworth North and Hillcrest BOAs by December 2012, and for Clifton and Stewart BOAs by December 2013. Ravensworth Operations requested and was granted, by OEH (now BCD) and DPIE, an extension for the registration of a legally binding conservation covenant over the offset areas until 30 June 2018. Ravensworth Operations Project submitted signed copies of the conservation covenants in June 2017 for approval and registration. Ravensworth Operations received approval from the Chief Executive of the then OEH (now BCD) for long term security of the BOAs in 2019. Copies of these agreements were provided to DoAWE in May 2020, who confirmed that the Conservation Agreements addressed the Conditions 2 and 3 of EPBC No. 2010/5389.

Condition 35 also requires the Ravensworth Complex to provide long term security for the woodland vegetation to be established in the Rehabilitation Area at least two years prior to completion of mining activities within the project area. The Ravensworth Complex has a requirement to establish a minimum of 1,767 ha of woodland vegetation in the Rehabilitation Area, and will make suitable arrangements to protect the rehabilitated vegetation closer to the end of mining activities, currently planned for 2039.

4. Baseline Environment

4.1 Existing Environment of the Ravensworth Complex

The Ravensworth Complex consists of a number of existing and former mining operations and associated infrastructure. The current Narama open cut mine and RUM are located within the eastern extent of the Ravensworth Complex, along with the voids associated with the former Ravensworth South and Ravensworth No.2 mines. The RUM surface facilities are located adjacent to the Ravensworth Coal Terminal facility in the northern extent of the Ravensworth Complex.

The Ravensworth Complex occurs within part of a relatively large area of regenerating native vegetation of approximately 1,200 ha. The native vegetation within Ravensworth Complex has been cleared for historical agricultural land uses, which has resulted in native vegetation communities being characterised by extensive areas of regrowth (20-30 years old) with few tree hollows. This pattern of historical clearing of native vegetation has resulted in the highly fragmented nature of vegetation within the Hunter Valley floor, which is reflected through relatively little canopy connectivity between Ravensworth Complex and other valley floor remnants, and substantial areas of derived grasslands in and around the Ravensworth Complex.

The following sections of the BOMP provide brief descriptions of the ecological features of the Ravensworth Complex and its four BOAs from surveys conducted between 2007 and 2009, however further detail regarding the ecological features can be found within the Ecological Assessment (Umwelt, 2010b).

4.1.1 Vegetation Communities

The distribution of vegetation communities recorded in the Ravensworth Complex is shown on ***Figure 4-1***. The following vegetation communities were recorded:

- Central Hunter Box-Ironbark Woodland;
- Central Hunter Bulloak Forest Regeneration;
- Central Hunter Ironbark – Spotted Gum – Grey Box Woodland;
- Central Hunter Swamp Oak Forest;
- Hunter Valley River Oak Forest;
- River-flat Eucalypt Forest;
- Hunter Floodplain Red Gum Woodland;
- Derived Grassland;
- Planted Areas; and
- Rehabilitation.

The dominant communities identified at the Ravensworth Complex are Central Hunter Box-Ironbark Woodland and Derived Grassland with Central Hunter Bulloak Forest Regeneration. A number of small patches of planted native vegetation occur within the Ravensworth Complex associated with mine rehabilitation. Planted areas are located along the New England Highway, Lemington Road and Old Lemington Road and are comprised of endemic and non-endemic eucalypt species. Two variants of Derived Grassland are present at the Ravensworth Complex: high to moderate quality native grassland located between remnants of Central Hunter Box-Ironbark Woodland and low quality derived grassland occurring on the floodplains of the Hunter River, Bowmans Creek and Bayswater Creek. Hunter Floodplain

Red Gum Woodland was recorded on the floodplains of the Hunter River and Bayswater Creek, in the south and central portion of the Ravensworth Complex.

4.1.2 Flora

A total of 368 species were recorded within the Ravensworth Complex, of which 275 (75%) are native and 93 (25%) are introduced species. Three species were from the Class *Filicopsida* (ferns), and 365 from *Magnoliopsida* (flowering plants) (of which 109 were from sub-class *Liliidae* (monocots) and 256 from subclass *Magnoliidae* (dicots)). Flora species were recorded from a wide representation of plant families, 71 in total. The most speciose families were found to be grasses, *Poaceae* (74 species), daisies*, Asteraceae* (48 species), peas, *Fabacea*e (34 species) and chenopods, Chenopodiace*ae* (14 species).

Seven listed noxious weed species were recorded in the Ravensworth Complex; creeping pear (*Opuntia humifusum*), prickly pear (*Opuntia stricta* var. *stricta*), tiger pear (*Opuntia aurantiaca*), blackberry (*Rubus fruticosus* sp. agg), galvanised burr (*Sclerolaena birchii*), nodding thistle (*Carduus nutans*) and weeping willow (*Salix* x *sepulcralis* var. *sepulcralis*).

4.1.3 Fauna

A total of 180 fauna species have been recorded during surveys of Ravensworth Complex, including:

- 116 bird species from 42 families, with *Meliphagidae* (honeyeaters) recording nine species and the *Petroicidae* (robins) and *Artamidae* (woodswallows) each with six species. Raptor diversity was moderate with six species recorded including the wedge-tailed eagle (*Aquila audax*);
- 18 reptile species comprising six reptile families, with the skink family (*Scincidae*) being the most well represented;
- 14 frog species comprising seven species of *Myobatrachidae* (southern frogs) and six tree frogs from the family *Hylidae*. Frog species diversity was considered to be high for the central Hunter Valley area and frog abundance was considered to be very high during both the 2008 and 2009 targeted frog surveys;
- 32 mammal species with the most common family (*Vespertilionidae*) recording 11 species. One arboreal mammal species has been recorded, being the common brushtail possum (*Trichosurus vulpecula*). Additional arboreal species known to occur in the central Hunter Valley have not been recorded on site most likely due to the general lack of suitable hollow resources. Ground dwelling mammals are represented by four species: the yellow-footed antechinus (*Antechinus flavipes*) and common dunnart (*Sminthopsis murina*) and the brown antechinus (*Antechinus stuartii*);
- Two species of macropod were recorded comprising the eastern grey kangaroo (*Macropus giganteus*) and red-necked wallaby (*Macropus rufogriseus*); and
- Seven introduced species were recorded including house mouse (Mus musculus), feral dogs (*Canis familiaris*), fox (Vulpes vulpes) and the rabbit (*Oryctolagus cuniculus*).

4.1.4 Aquatic Species

The Ravensworth Complex supports very limited aquatic vegetation with low species diversity. Instream vegetation was dominated by the introduced sharp rush (*Juncus acutus* subsp. *acutus*), often forming dense infestations and out-competing native instream species.

Bowmans Creek supports the greatest range of aquatic species due to the regular presence of water in the creek. Commonly recorded species included common reed (*Phragmites australis*) and cumbungi (*Typha orientalis*) in addition to the introduced sharp rush. Fennel pondweed (*Potamogeton pectinatus*) and water milfoil (*Myriophyllum aquaticum*) were also identified.

The Ravensworth Complex supports 20 clean water farm dams, however, the aquatic vegetation occurring were found to be very species poor, and frequently very sparsely distributed. Common species recorded in or on the edges of farm dams included swamp lily (*Ottelia ovalis*), water ribbons (*Triglochin procerum*), *Eleocharis equisetina, Juncus continuus*, cumbungi (*Typha orientalis*), lesser joyweed (*Alternanthera denticulata*), water pepper (*Persicaria hydropiper*), water plantain (*Alisma plantago-aquatica*) and the introduced parrots feather (*Myriophyllum aquaticum*), dirty Dora (*Cyperus difformis*) and sharp rush (*Juncus acutus* subsp*. acutus*).

A total of 25 aquatic fauna species were recorded, comprising two vertebrate and 23 invertebrate species. The most commonly encountered species included the *ostracoda*, mosquito larvae, back swimmers, the introduced *Physidae* snail and water boatmen. All of these species are considered to be very tolerant of pollution and poor water quality. Three families (*Leptoceridae*, *Baetidae* and *Acarina*) were recorded that are considered to be sensitive or very sensitive to disturbance and pollution, recorded from sites in Davis Creek and the surveyed farm dam.

Three aquatic vertebrates were recorded, being eastern snake-necked turtle (*Cheladonia longicollis*), European carp (*Cyprinus carpio*) and mosquito fish (*Gambusia holbrooki*). Previous surveys of fish in Bowmans Creek identified a total of nine species (including two species of crustaceans) (Roberts and Murray 2005). The most abundant species recorded were the mosquito fish (*Gambusia holbrooki*) and long-finned eel (*Anguilla reinhardtii*) with small numbers freshwater catfish (*Tandanus tandanus*), striped gudgeon (*Gobiomorphus australis*) and the introduced goldfish (*Carassius auratus*) recorded (Roberts and Murray, 2005).

4.2 Existing Environment of the Ravensworth North Offset Area

The RNOA is within the Ravensworth Complex Project Boundary and includes each of the broad habitat types identified in the Ravensworth Complex, with Central Hunter Box – Ironbark Woodland being the dominant vegetation type. Habitat condition assessment data indicates that the RNOA provides similar habitat characteristics and is in a comparable condition to the approved disturbance areas. The RNOA provides known habitat for the Green and Golden Bell Frog (*Litoria aurea*). The locations of the Green and Golden Bell Frog recorded in the RNOA and the location and types of vegetation communities occurring are shown on ***Figure 4-7*** and ***Figure 4-2***, respectively.

The RNOA is contiguous with the disturbance area approved under PA 09_0176 and generally provides a direct offset in terms of the vegetation communities, ecological condition, fauna habitat and threatened species known to occur in the disturbance area for the Ravensworth Complex.

The RNOA is considered to provide a 'like-for-like' offset in term of ecological values. The BOA is also expected to provide a significant area of potential habitat through the reestablishment of the existing vegetation communities, including those outlined in ***Section 4.8***.

4.3 Existing Environment of the Hillcrest Offset Area

The HOA was selected to form part of the biodiversity offset strategy due to the presence of regionally significant vegetation communities, particularly the Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC and Barrington Footslopes Dry Spotted Gum Forest, which are structurally and floristically similar to Central Hunter Box – Ironbark Woodland. The HOA represents approximately 1,403 ha of ecologically significant vegetation and fauna habitats and is considered a significant addition to flora and fauna species conservation outcomes in the Hunter Valley. The location of vegetation communities occurring in the HOA are shown on ***Figure 4-3***.

4.4 Existing Environment of the Clifton Offset Area

The COA is made up of recovering woodland distributed in patches throughout the property. The COA has good connectivity to adjacent woodland vegetation, particularly with areas to the north and west and has a good habitat connection to SOA (approximately 750m to the north), and Condran Offset Area (a Bulga Coal Management Pty Ltd BOA directly bordering COA to the east). Likely regeneration of derived grassland within COA would greatly improve habitat corridor linkages in the area. The location of vegetation communities occurring in the COA are shown on ***Figure 4-4***.

4.5 Existing Environment of the Stewart Offset Area

The majority of SOA contains good condition eucalypt forest, providing high quality habitat for threatened fauna species identified within the Ravensworth Complex Project Boundary. The SOA is located in close proximity to the COA (approximately 750m to the south) with connective vegetation between them, and these properties provide similar habitat to that found at Ravensworth Complex. The location of vegetation communities occurring in the SOA are shown on ***Figure 4-5***.

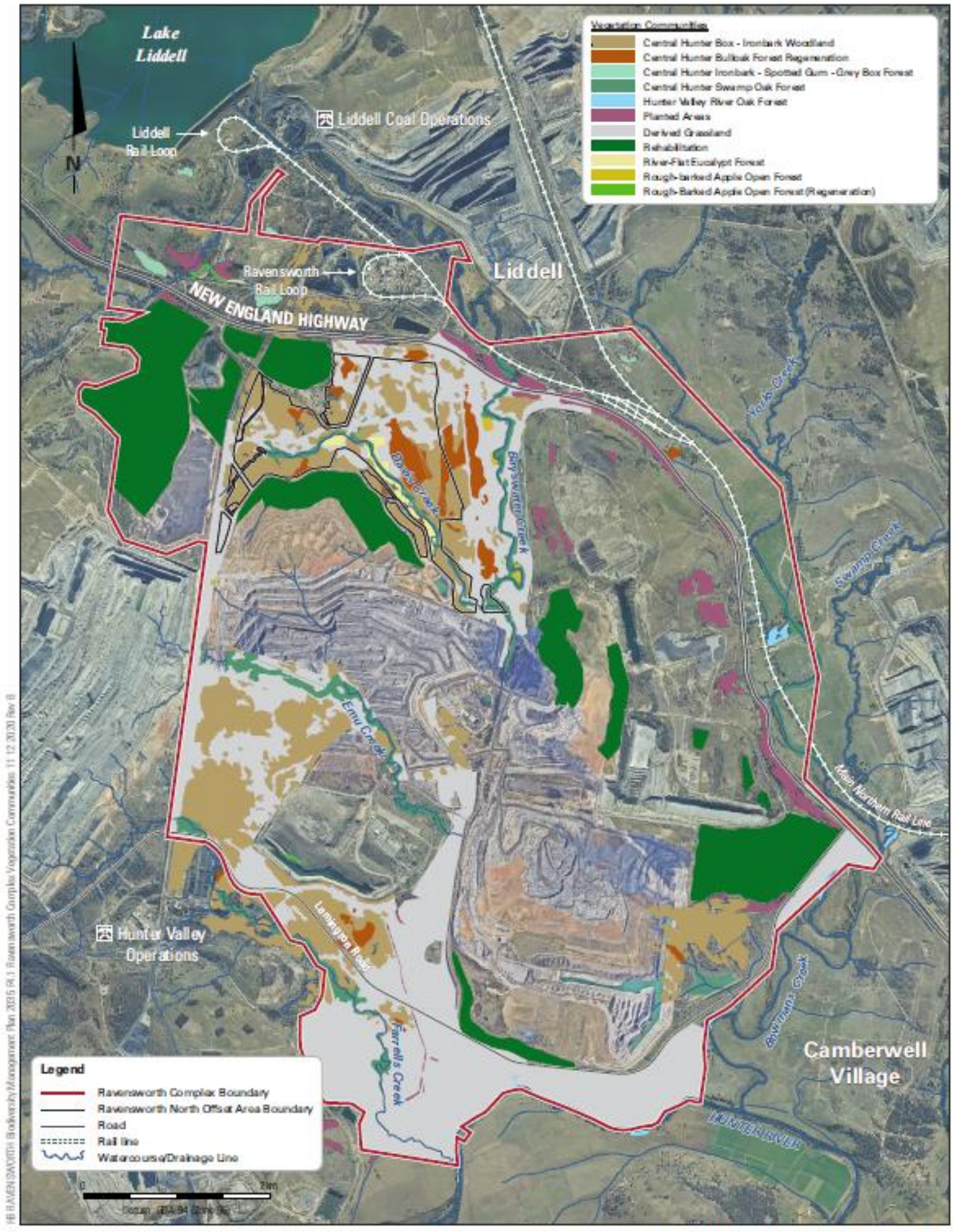


Figure 4-1 – Ravensworth Complex Vegetation Communities (2007 – 2009)

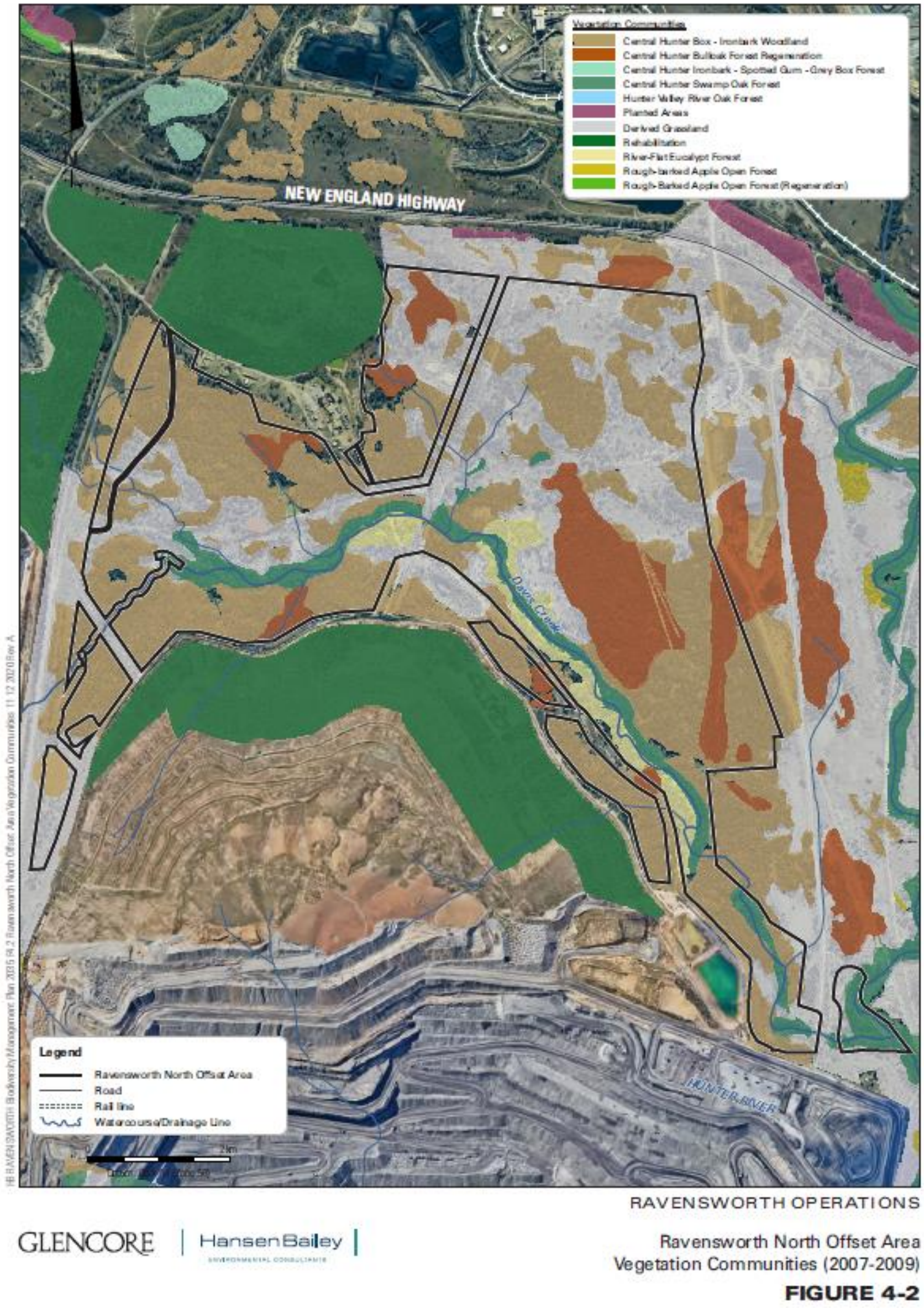


Figure 4-2 – Ravensworth North Offset Area Vegetation Communities (2007 – 2009)

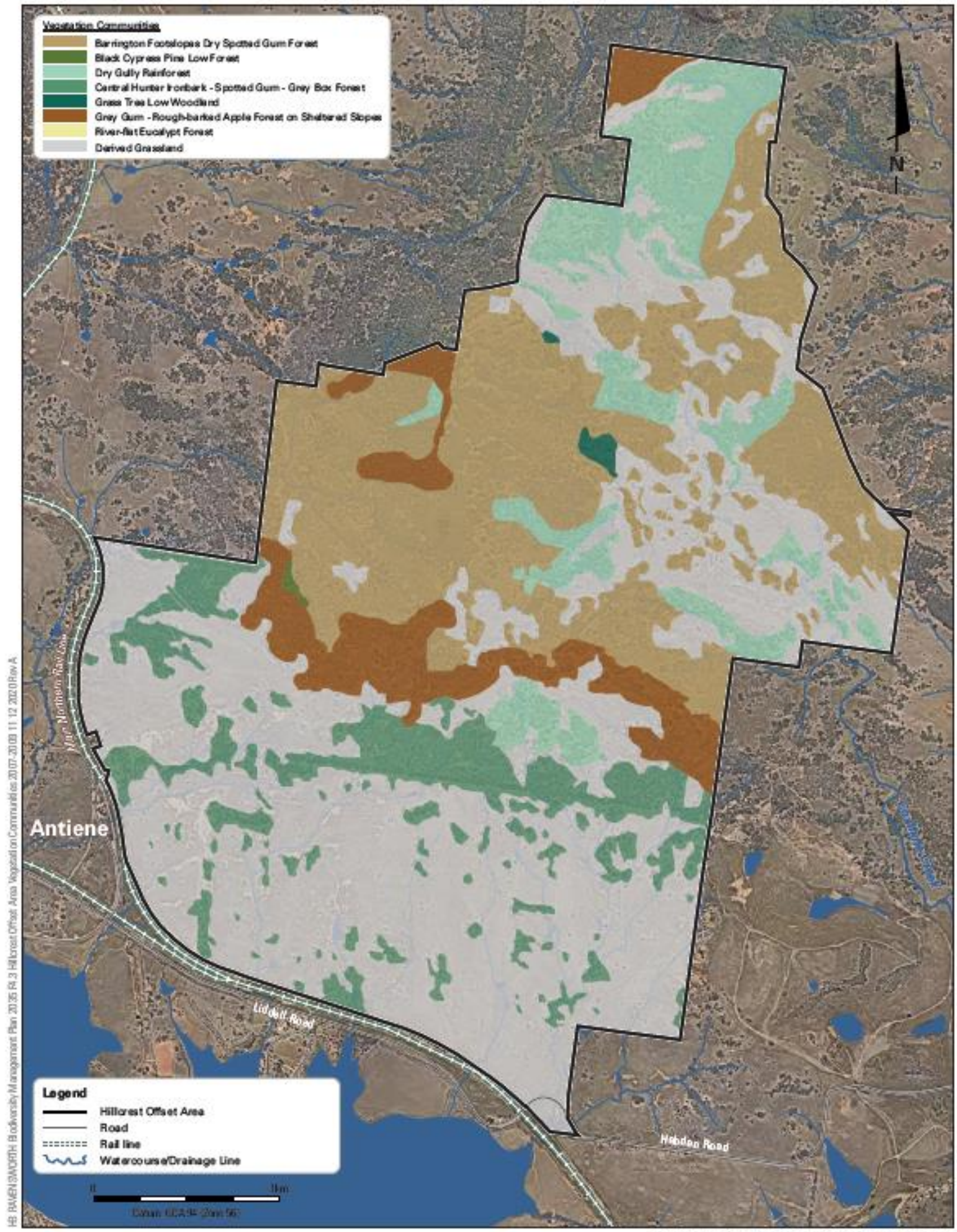


Figure 4-3 – Hillcrest Offset Area Vegetation Communities (2007 – 2009)

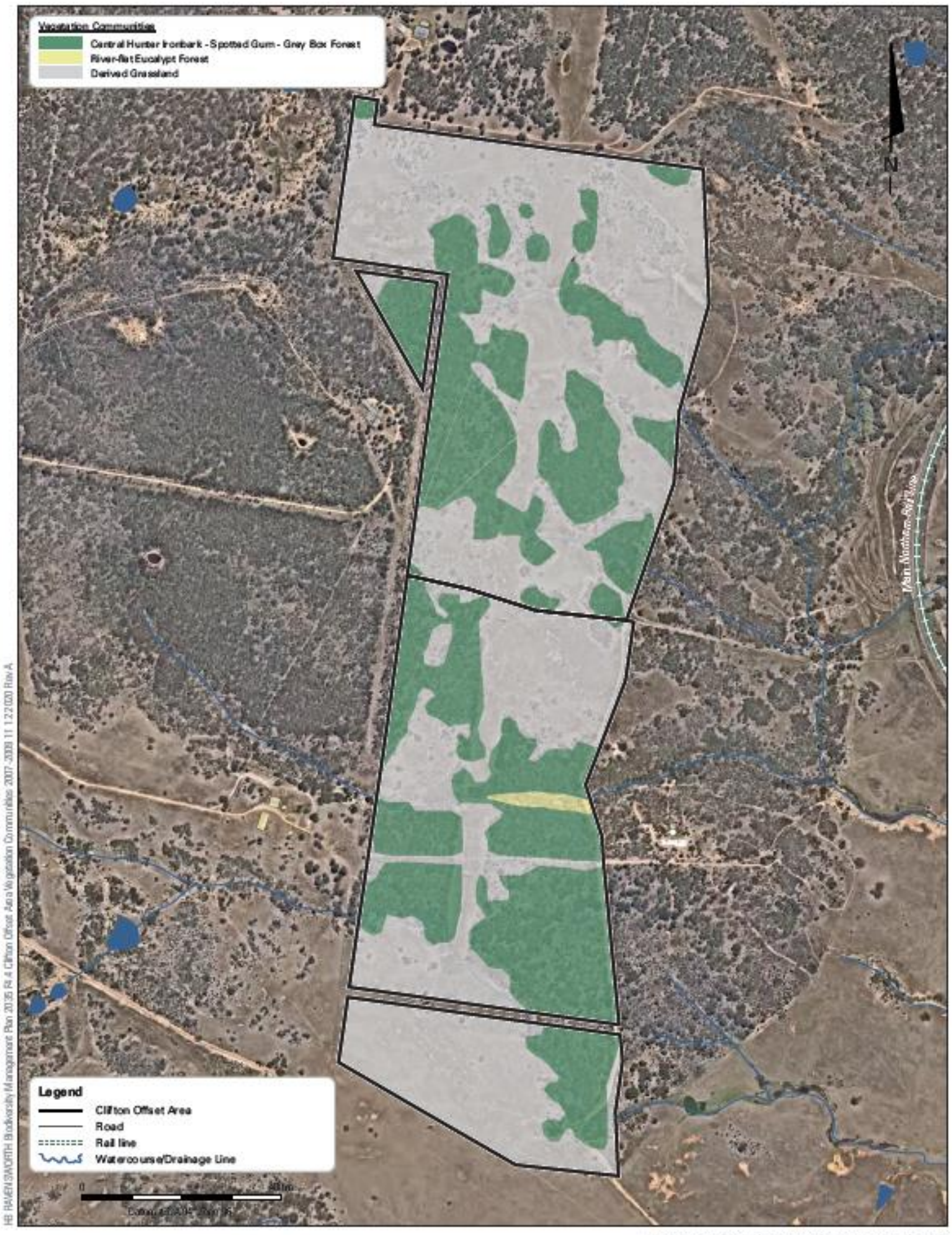


Figure 4-4 – Clifton Offset Area Vegetation Communities (2007 – 2009)

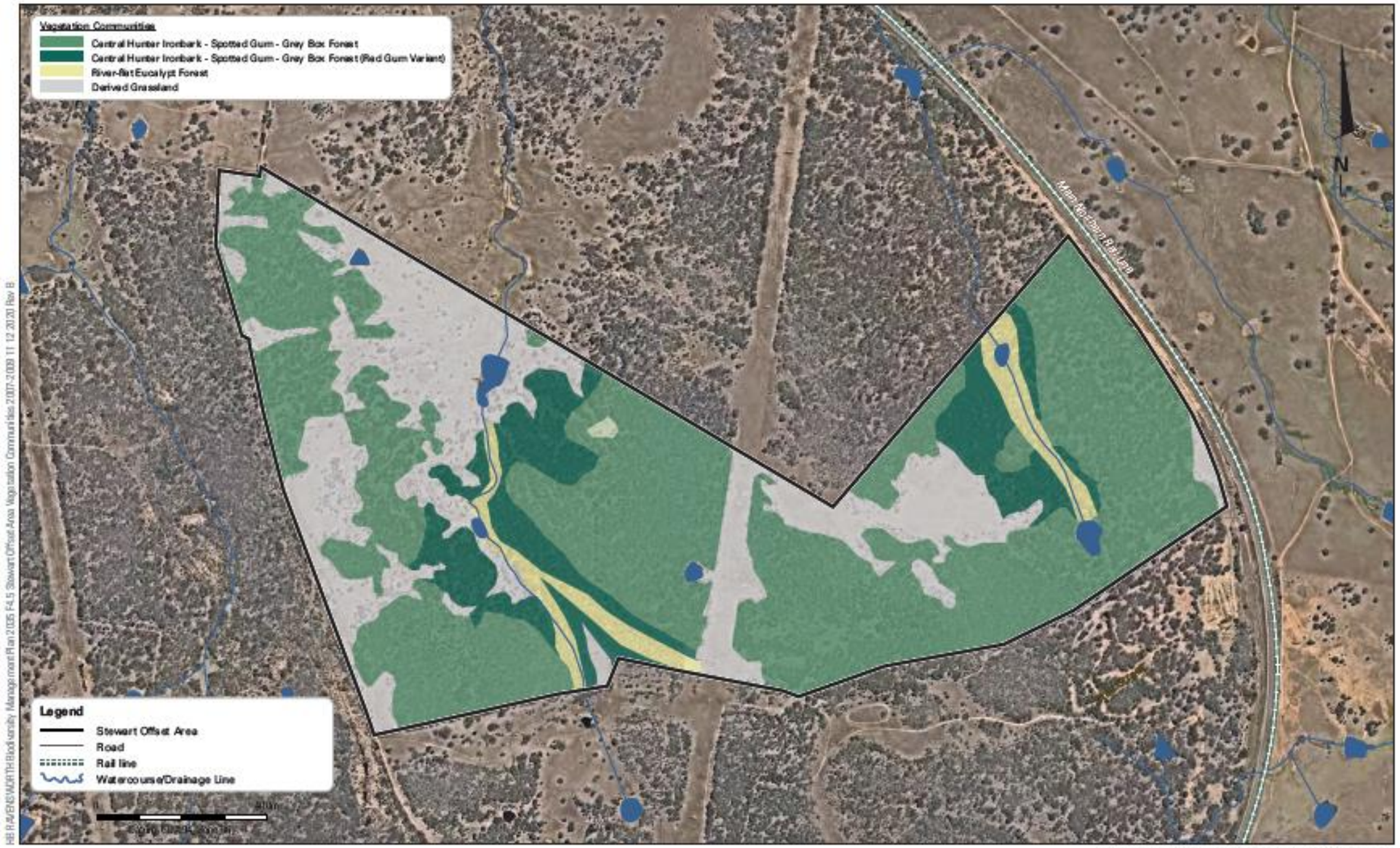


Figure 4-5 – Stewart Offset Area Vegetation Communities (2007 – 2009)

4.6 Climatic Information

Total rainfall recorded at the Ravensworth Complex weather station during 2019 was 354mm, which was significantly lower than the long-term annual average of 645.9mm recorded at Jerrys Plains between 1884 and 2014 (Bureau of Meteorology). The average temperature recorded at Ravensworth Complex in 2019 was 19.5°C.

Long-term temperature data is provided by the Bureau of Meteorology (BoM) station at Lostock Dam (Station 061288). January is the hottest month of the year, with an average daily maximum temperature of 29.8°C. The highest temperature recorded by the Lostock Dam Station was 44.4°C in January 2020. July is the coldest month of the year, with an average daily minimum temperature of 6.5°C. The lowest temperature recorded by the Lostock Dam Station was -1.7°C in July 1970.

4.7 Landform, Geology, Soils and Erosion

The Ravensworth Complex and associated BOAs are situated in the central to northern portions of the Hunter Valley, characterised by relatively gentle undulating hills, broad river valleys, floodplains, and exposed rocky outcrops. The area lies at the intersection of the north eastern margin of the Sydney basin and the south eastern margin of the New England fold belt. It is primarily underlain by four major geological strata:

- Undifferentiated Carboniferous sedimentary and volcanic strata (Cu);
- Mulbring Sandstone (Pmm);
- Branxton Formation (Pmb); and
- Singleton Coal Measures (Ps).

Soil landscapes present in the Ravensworth Complex include Liddell, Hunter and Bayswater. Soils associated with the landscapes present in the BOAs can generally be described as sodic or dispersive soils which can be highly erodible if exposed by removal of vegetation. Lower gullies of HOA may also be prone to salinity issues, likely evident through the presence of Spiny Rush (*Juncus acutus*), a salt tolerant species. Areas of the BOAs affected by erosion issues may require more detailed soil testing prior to earthworks and stabilisation measures such as revegetation.

4.8 Vegetation Communities, Threatened and Migratory Species

4.8.1 Vegetation Communities of the Ravensworth Complex and BOAs

4.8.1.1 Ravensworth Complex

Of the vegetation communities recorded within the Ravensworth Complex, the following are EECs, as listed under the BC Act (none listed under the EPBC Act) where noted during field work undertaken from 2007 to 2009:

- River-flat Eucalypt Forest - recorded adjacent to Davis Creek to the north of the proposed eastern emplacement area, covering an area of approximately 24 ha. As outlined in the EA (Umwelt 2010), the Ravensworth Complex mine plan was revised to avoid direct impacts on this EEC;
- Hunter Floodplain Red Gum Woodland - recorded on the floodplain of Bayswater Creek and Pikes Gully and in a small patch on the Hunter River floodplain, covering a total of 5.5 ha. It is anticipated that <1 ha of this EEC will be impacted as a result of Ravensworth Complex operations;

- Central Hunter Box – Ironbark Woodland - the most extensive woodland community in the Ravensworth Complex with approximately 939 ha of this EEC identified; and
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest - recorded in an isolated location to the south of Davis Creek covering an area of approximately 4.5 ha. It is anticipated that four hectares of this EEC will be impacted as a result of Ravensworth Complex operations.

4.8.1.2 Ravensworth North Offset Area

Surveys of the RNOA identified five vegetation communities, including two non-native communities (refer to ***Figure 4-2***). These vegetation communities were aligned with vegetation map units as described in the Hunter Remnant Vegetation Project (Peake 2006), where possible. The dominant communities identified in the RNOA are Central Hunter Box Ironbark Woodland and Derived Grassland, with Central Hunter Bulloak Forest Regeneration also occurring. The area of each vegetation community occurring in the RNOA is provided in ***Table 4-1*** below.

Vegetation Community	Approximate Area (ha)
Central Hunter Box – Ironbark Woodland (EEC)	124
Central Hunter Bulloak Forest Regeneration	35
Central Hunter Swamp Oak Forest	24
River-flat Eucalypt Forest (EEC)	20
Derived Grassland	80
Total	**284**
Note: EECs provided in this table are listed under the BC Act	

Table 4-1 – Vegetation Communities occurring in RNOA

4.8.1.3 Hillcrest Offset Area

Surveys of the HOA identified eight vegetation communities (refer to ***Figure 4-3***).

The vegetation communities were aligned with vegetation map units as described in the Hunter Remnant Vegetation Project (Peake 2006), where possible. However, four of these communities have not been described by Peake (2006): Black Cypress Pine Low Forest; Dry Gully Rainforest; Grass Tree Low Woodland; and Grey Gum, Rough-barked Apple Forest on Sheltered Slopes. ***Table 4-2*** outlines the area of each vegetation community mapped in the HOA during detailed flora and vegetation mapping surveys.

Vegetation Community	Area (ha)
Barrington Footslopes Dry Spotted Gum Forest	378
Black Cypress Pine Low Forest	1
Central Hunter Ironbark – Spotted Gum – Grey Box Forest (EEC)	138
Dry Gully Rainforest (VEC)	161
Grass Tree Low Woodland	4
River-flat Eucalypt Forest (EEC)	2
Grey Gum – Rough-barked Apple Forest on Sheltered Slopes	82
Derived Grassland	636
Total	**1,402**
Note: EECs and vulnerable ecological communities (VECs) provided in this table are listed under the BC Act	

Table 4-2 – Vegetation Communities of HOA

4.8.1.4 Clifton Offset Area

The majority of the COA comprises Derived Grassland, with Central Hunter Ironbark – Spotted Gum – Grey Box Forest covering most of the remainder of the site (as shown in ***Figure 4-4***). The total areas covered by each vegetation community are provided in ***Table 4-3***.

4.8.1.5 Stewart Offset Area

Central Hunter Spotted Gum Ironbark Grey Box Forest dominate the SOA, with areas of Derived Grassland and a small area of riparian woodland that conforms to the River–flat Eucalypt Forest EEC (as shown in ***Figure 4-5***). The area of each vegetation community recorded in the SOA is shown in ***Table 4-4***.

Vegetation Community	Area (ha)
Central Hunter Ironbark – Spotted Gum - Grey Box Forest (EEC)	45
River-flat Eucalypt Forest (EEC)	1
Derived Grassland	61
Total	**107**
Note: EECs provided in this table are listed under the BC Act.	

Table 4-3 – Vegetation Communities of COA

Vegetation Community	Area (ha)
Central Hunter Ironbark – Spotted Gum – Grey Box Forest (EEC)	115
River-flat Eucalypt Forest (EEC)	7
Derived Grassland	43
Total	**165**
Note: EECs provided in this table are listed under the BC Act	

Table 4-4 – Vegetation Communities of SOA

4.8.2 Flora Species of the Ravensworth Complex and BOAs

4.8.2.1 Ravensworth Complex

Three endangered flora populations have been recorded within the Ravensworth Complex. These are:

- Weeping myall – *Acacia pendula;*
- River red gum – *Eucalyptus camaldulensis*; and
- Tiger orchid - *Cymbidium canaliculatum.*

Weeping myall (*Acacia pendula*) has been recorded at four locations within the Ravensworth Complex (records near Narama Mine are considered as one location) as shown on ***Figure 4-6***. A planted area adjacent to Old Lemington Road contains a large number of planted weeping myall, and the remaining three locations of weeping myall refer to individual trees.

Three records of river red gum (*Eucalyptus camaldulensis*) were recorded within the Ravensworth Complex along the Hunter River, which generally consisted of single trees in each case. The locations of these records are shown on ***Figure 4-6***.

Since the completion of the Ecological Assessment (Umwelt, 2010b), 3 records of the tiger orchid (*Cymbidium canaliculatum*) have been made during field surveys. Two of these records were in vegetation cleared ahead of mining in Ravensworth North, with the two plants relocated to within the bounds of RNOA. The third record was adjacent to mine rehabilitation in Ravensworth North with the plant and its host tree left in situ. The three current locations of tiger orchid are shown in ***Figure 4-6***. This species is listed as an endangered population in the Hunter Catchment under the BC Act.

4.8.2.2 Ravensworth North Offset Area

A total of 155 flora species were recorded within the RNOA from 45 families. Of the 155 species recorded, 121 (78%) were native and 34 (22%) were introduced. A full list of the flora species recorded in the RNOA is presented in Appendix 7 of the EA (Umwelt, 2010). The list of flora species observed within the RNOA during monitoring will be updated and included within the relevant monitoring reports.

No records of weeping myall (*Acacia pendula*) or river red gum (*Eucalyptus camaldulensis*) have been recorded within the RNOA, however, potential habitat for weeping myall exists. The habitats of the RNOA are less likely to support the river red gum.

4.8.2.3 Hillcrest Offset Area

A total of 305 flora species were recorded in the HOA during surveys, of which 252 are native and 53 (21%) are introduced species. This is a relatively low diversity of weed species considering the highly disturbed nature of the southern section of the HOA. One threatened flora species (*Cymbidium canaliculatum*) was recorded in the HOA during targeted threatened flora surveys in 2013, as shown on ***Figure 4-8***.

4.8.2.4 Clifton Offset Area

To date, 172 vascular plant species have been detected in the COA, of which 81% are native. Weed cover is very low although two noxious weed species; Prickly Pear and African Olive have been detected on the COA in low densities.

4.8.2.5 Stewart Offset Area

To date, 124 vascular plant species have been detected in the SOA, of which 83% are native. Weed cover is very low, and only one noxious weed species; Prickly Pear, has been detected in the SOA. The environmental aquatic weed; *Juncus acutus* has also been recorded in some dam habitats.

4.8.3 Fauna Species and Habitat of the Ravensworth Complex and BOAs

4.8.3.1 Ravensworth Complex

Thirteen threatened species (as listed under the BC Act) were recorded at Ravensworth Complex either as part of the survey for the EA (Umwelt, 2010), or from other sources such as previous surveys, database searches or literature reviews. The location of each of the threatened species is shown on ***Figure 4-6***. The listed threatened species include:

- Green and golden bell frog (*Litoria aurea*);
- Masked owl (*Tyto novaehollandiae*);
- Brown treecreeper (eastern subspecies) (*Climacteris picumnus victorae*);
- Speckled warbler (*Chthonicola saggitatus*);
- Scarlet robin (*Petroica boodang*);
- Hooded robin (south eastern form) (*Melanodryas cucullata cucullata*);
- Grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Eastern Coastal freetail bat (*Mormopterus norfolkensis*);

- Little bent-wing bat (*Miniopterus australis*);
- Eastern bent-wing bat (*Miniopterus schreibersii oceanensis*);
- Eastern false pipistrelle (*Falsistrellis tasmaniensis*); and
- Large-footed myotis (*Myotis adversus*).

Threatened fauna species locations were restricted to areas of remnant woodland/forest vegetation within the Umwelt (2010) survey area, with no records obtained from the grassland habitats (refer to ***Figure 4-6***). Five vulnerable woodland bird species and five vulnerable species of microbat were recorded widely across the Ravensworth Complex during surveys undertaken for the EA (Umwelt, 2010).

4.8.3.2 Ravensworth North Offset Area

Three broad fauna habitat formations were identified in the RNOA: woodland, riparian and grassland habitats. A total of 103 fauna species were recorded by Umwelt (2010) during surveys of the RNOA conducted for the EA, being:

- 51 bird species comprising 26 families. Four of those species recorded are listed as migratory and nine are listed marine species which are protected under the schedules of the EPBC Act;
- Nine reptile species comprising three families, with the skink family (*Scincidae*) being the best represented;
- Nine frog species comprising five species of *Myobatrachidae* (southern frogs) and four tree frogs from the family *Hylidae*. Frog species abundance was considered to be very high during both the 2008 and 2009 targeted frog surveys. The vulnerable Green and Golden Bell Frog (*Litoria aurea*) was recorded on submerged vegetation in a farm dam. This species has previously been recorded in the RNOA (see ***Figure 4-7***).
- 26 mammal species were recorded including one vulnerable species; the grey-headed flying fox (*Pteropus poliocephalus*). The location of the grey-headed flying fox (*Pteropus poliocephalus*) is shown on ***Figure 4-7***.

The RNOA provides known habitat for eight threatened species, including:

- Green and Golden Bell Frog (*Litoria aurea*);
- Grey-crowned babbler (eastern subsp.) (*Pomatostomus temporalis temporalis*);
- Grey-headed flying fox (*Pteropus poliocephalus*);
- Hooded robin (south-eastern form) (*Melanodryas cucullata cucullata*);
- Scarlet robin (*Petroica boodang*);
- Speckled warbler (*Chthonicola sagitatta*);
- Brown treecreeper (eastern subsp.) (*Climacteris picumnus victoriae*); and
- Eastern bent-wing bat (*Miniopterus schreibersii oceanensis*).

Given the similarity of habitat type and condition of the RNOA to the approved disturbance area for the Ravensworth Complex, it is likely that other threatened fauna species recorded from that area would use the habitats of the RNOA.

4.8.3.3 Hillcrest Offset Area

The HOA includes dry rainforest, forest, grassland and aquatic fauna habitat, with forest the dominant habitat type in the HOA. Analysis of condition assessment data indicates the HOA provides similar habitat characteristics and is generally in better, or at least comparable, condition to the approved disturbance area for the Ravensworth Complex.

A total of 106 fauna species were recorded during surveys of the HOA. A list of all fauna species recorded within the HOA is presented in Appendix 7 of the EA (Umwelt, 2010).

The HOA provides known habitat for 12 threatened species (refer to ***Figure 4-8***), including:

- Spotted-tailed quoll (*Dasyurus maculatus*);
- Masked owl (*Tyto novaehollandiae*);
- Large-eared pied bat (*Chalinolobus dwyeri*);
- Eastern bent-wing bat (*Miniopterus schreibersii oceanensis*);
- Large-footed myotis (*Myotis adversus*);
- Eastern free-tailed bat (*Mormopterus norfolkensis*);
- Squirrel glider (*Petaurus norfolcensis*);
- Koala (*Phascolarctos cinereus*);
- Grey-crowned babbler (eastern subsp.) (*Pomatostomus temporalis temporalis*);
- Speckled warbler (*Chthonicola sagitatta*);
- Brown treecreeper (eastern subsp.) (*Climacteris picumnus victoriae*); and
- Varied sittella (*Daphoenositta chrysoptera*).

4.8.3.4 Clifton Offset Area

Four general fauna habitat types are located within the COA. Each of these broad habitat types has a range of characteristics which influence the habitat value, and the range of fauna species which are likely to be identified within each type. The broad habitat types recorded within the COA comprise woodland, riparian, grassland and aquatic habitat.

One threatened fauna species, the large-eared pied bat (*Chalinolobus dwyeri*), was recorded during preliminary surveys of the COA, and potential habitat was identified for a number of threatened species. The Green and Golden Bell Frog (*Litoria aurea*) has not been identified in the COA. The location of each of the threatened species is shown on ***Figure 4-9***.

4.8.3.5 Stewart Offset Area

SOA is predominantly vegetated and contains open grassy woodland, grassland and aquatic habitats suitable for a range of fauna species. The woodland occurs both in a mature and regenerating form, but there is a lack of complex habitat features, such as hollow-bearing trees. Connectivity to adjoining patches of woodland on other private property is maintained to the west of the SOA and to a lesser degree to the south and north.

Five threatened fauna species have been recorded within the SOA during ecological surveys to date. These include the:

- Swift Parrot (*Lathamus discolor*);

- Little Lorikeet (*Glossopsitta pusilla*);
- Grey-crowned Babbler (*Pomatostomus temporalis*);
- Hooded Robin (*Melanodryas cucullata*); and
- Speckled Warbler (*Chthonicola sagittata*).

The location of each of the threatened species identified within the SOA is shown on ***Figure 4-10***.

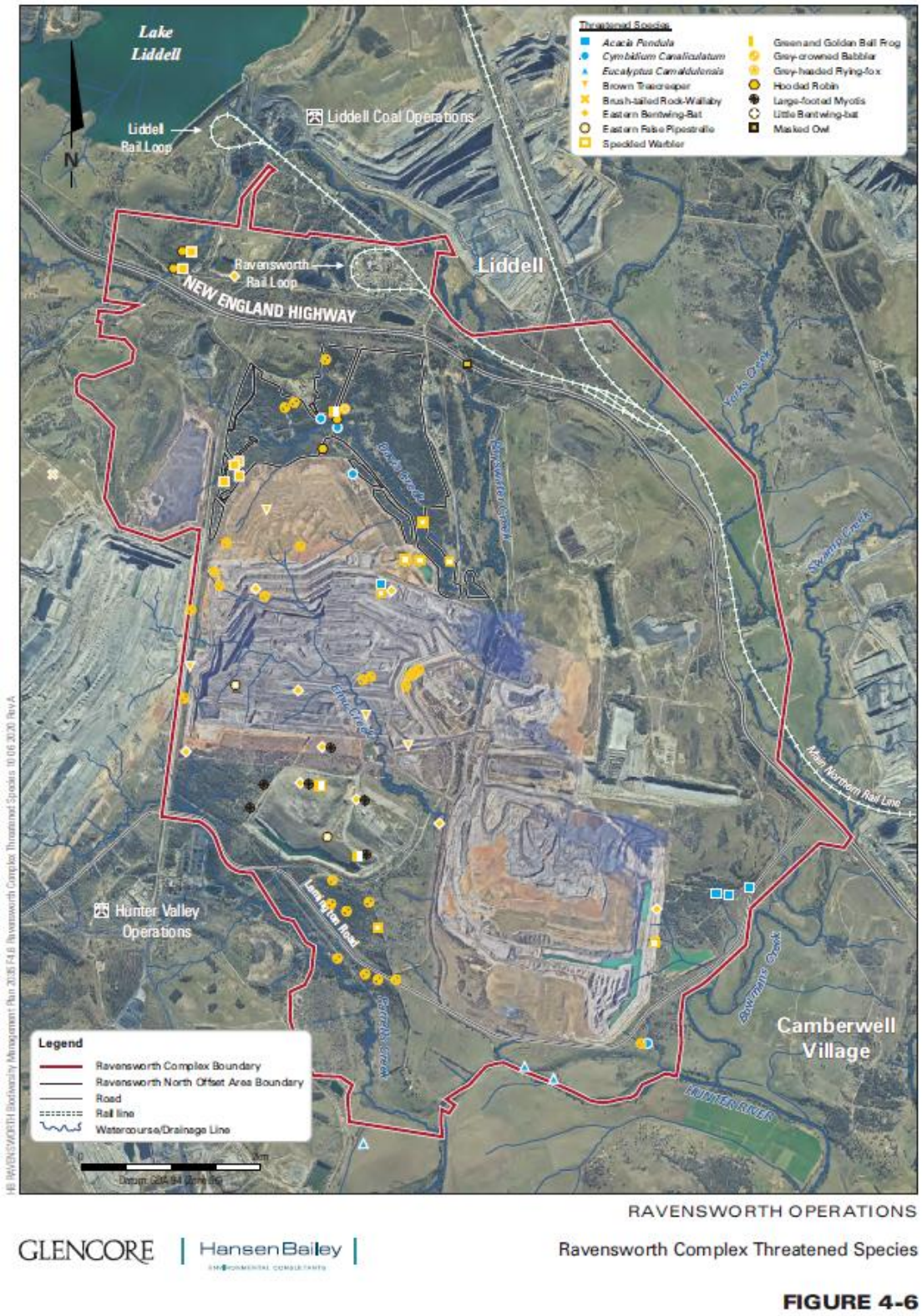


Figure 4-6 – Ravensworth Complex Threatened Species

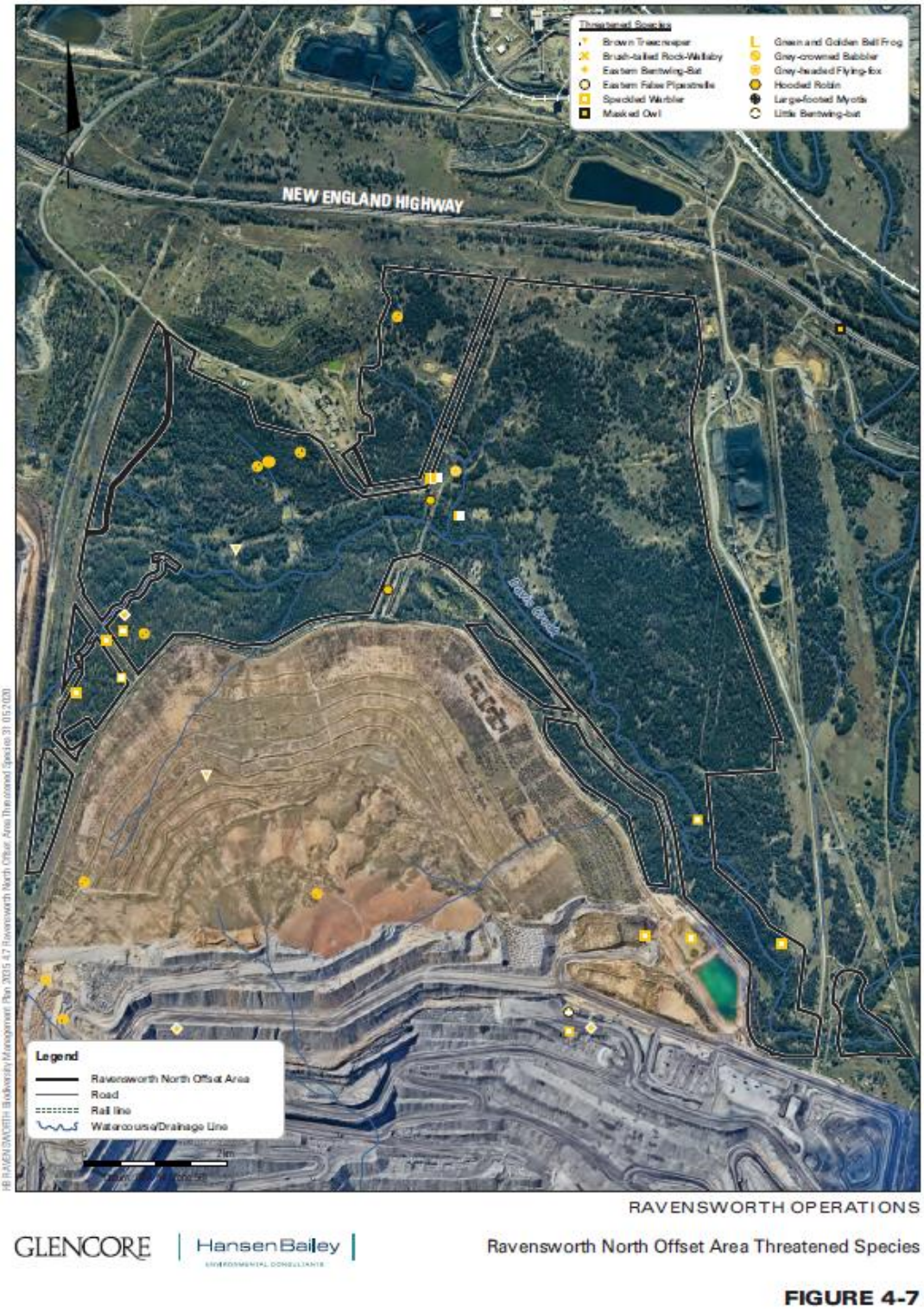


Figure 4-7 – Ravensworth North Offset Area Threatened Species

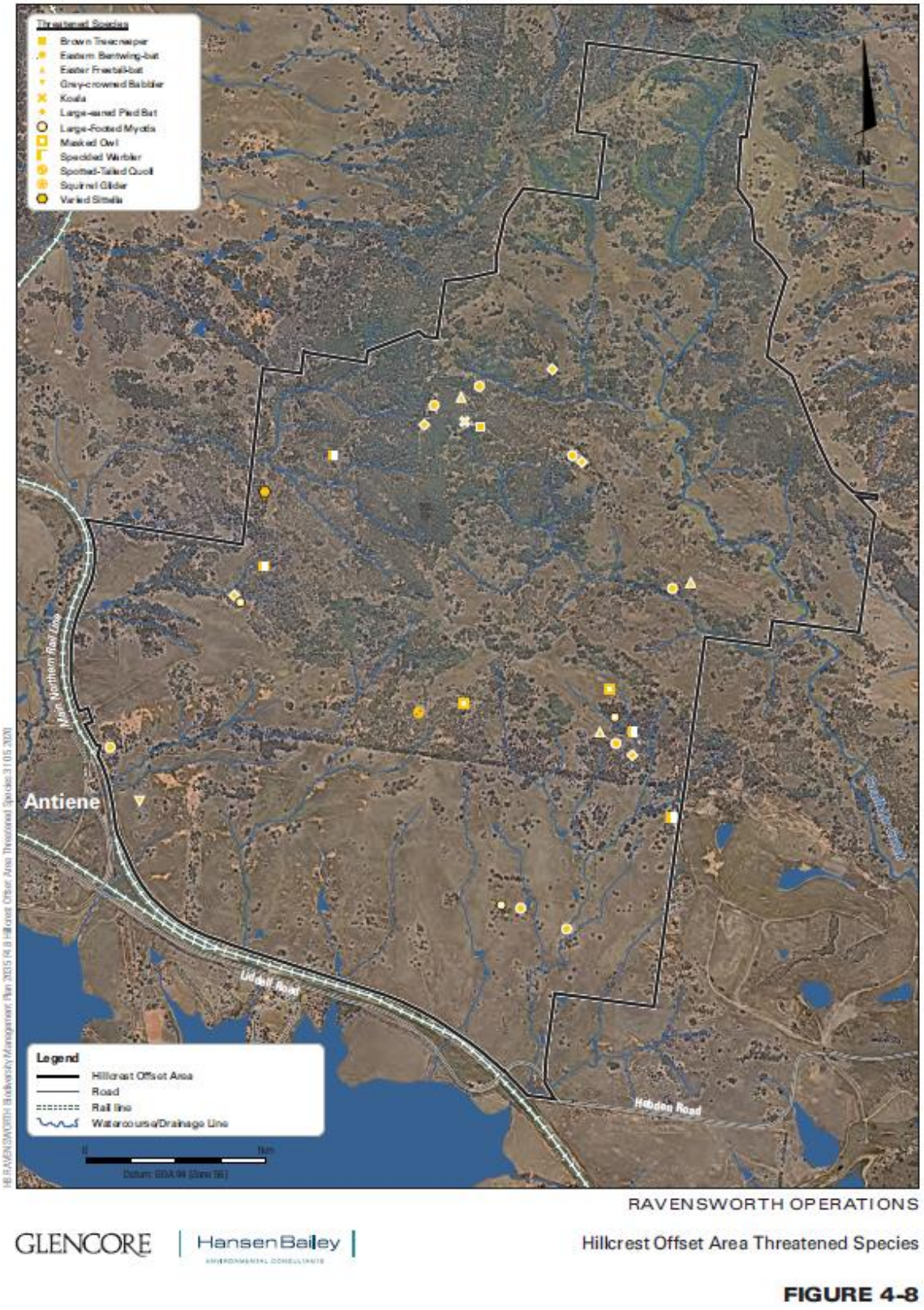


Figure 4-8 – Hillcrest Offset Area Threatened Species

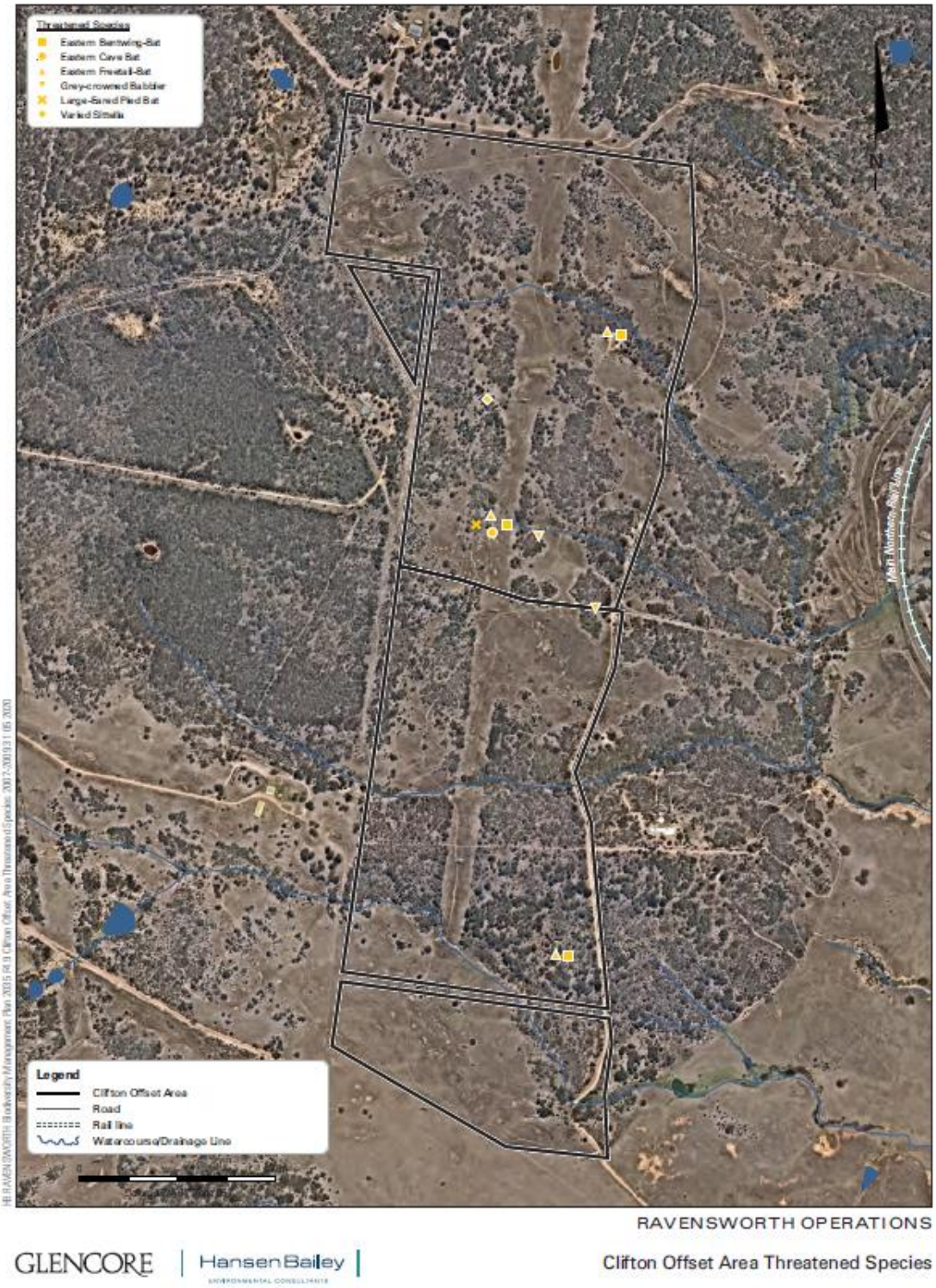


Figure 4-9 – Clifton Offset Area Threatened Species

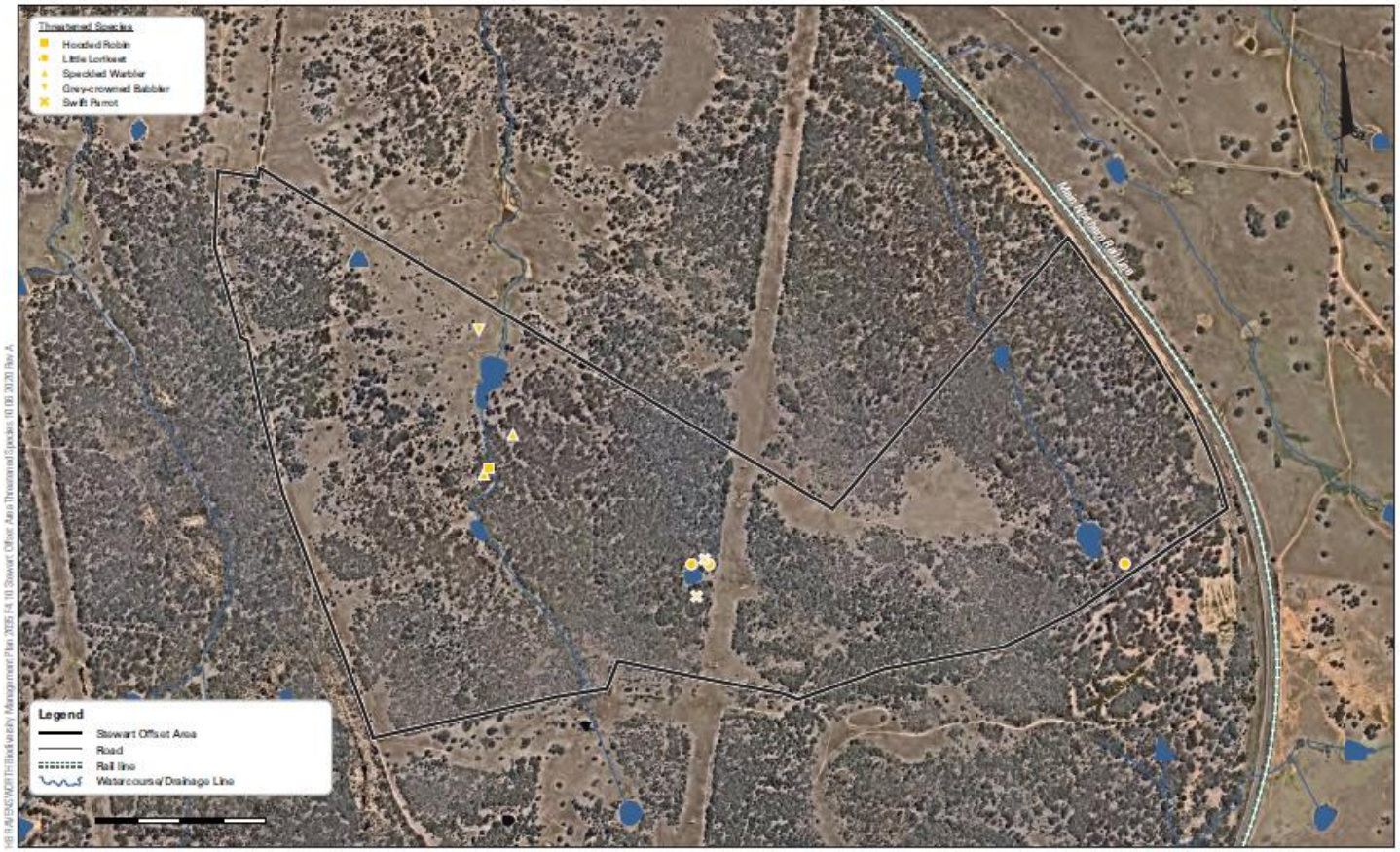


Figure 4-10 – Stewart Offset Area Threatened Species

4.8.4 Threatened Aquatic Species at Ravensworth Complex and BOAs

The Hunter River catchment does not provide habitat for any of the threatened aquatic species, populations and EECs listed under the *Fisheries Management Act 1994*. No threatened aquatic species were recorded during the EA (Umwelt, 2010) and none are expected to occur at the Ravensworth Complex or BOAs.

4.8.5 Threatened and Migratory Species

Table 4-5 below provides detail of threatened and migratory species identified within the Ravensworth Complex and BOAs. 'X' indicates the species has been recorded from within the area. ***Table 4-5*** includes those species identified during ecological monitoring within the BOAs since 2012.

Species	Status*		RNOA	HOA	COA	SOA
	BC Act	EPBC Act				
River-flat Eucalypt Forest	EEC		X	X	X	X
Hunter Floodplain Red Gum Woodland	EEC					
Central Hunter Box – Ironbark Woodland	ECC		X			
Central Hunter Ironbark – Spotted Gum – Grey Box Forest	EEC			X	X	X
Weeping myall – *Acacia pendula*	EP					
River red gum – *Eucalyptus camaldulensis*	EP					
Green and Golden Bell Frog (*Litoria aurea*)	E	V	X			
Masked owl (*Tyto novaehollandiae*)	V			X		
Brown treecreeper (eastern subspecies) (*Climacteris picumnus victorae*)	V		X	X		
Speckled warbler (*Chthonicola sagittatus*)	V		X	X	X	
Scarlet robin (*Petroica boodang*)	V		X	X		X
Hooded robin (south eastern form) (*Melanodryas cucullata cucullata*)	V		X			
Grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)	V		X	X	X	X
Varied sittella (*Daphoenositta chrysoptera*)	V		X	X	X	X
Little lorikeet (*Glossopsitta pusilla*)	V			X	X	X
Swift parrot (*Lathamus discolor*)	E	E				X
Black falcon (*Falco subniger*)	V		X			
Blue-billed Duck (*Oxyura australis*)	V		X			
Grey-headed flying fox (*Pteropus poliocephalus*)	V	V	X			
Eastern Coastal freetail bat (*Mormopterus norfolkensis*)	V			X		X
Little bent-wing bat (*Miniopterus australis*)	V					
Eastern bent-wing bat (*Miniopterus schreibersii oceanensis*)	V		X	X		
Eastern false pipistrelle (*Falsistrellis tasmaniensis*)	V					
Large-footed myotis (*Myotis adversus*)	V			x		
Large bent-winged bat (*Miniopterus orianae oceanensis*)	V		X	X	X	X
*EEC- Endangered Ecological Community, EP – Endangered Population, E – Endangered, V – Vulnerable						

Table 4-5 – Threatened and Migratory Species identified within the BOAs

4.9 Introduced Species within the BOAs

4.9.1 Weeds

Due to the relatively undisturbed nature of the majority of the offset properties and areas within Ravensworth Complex, large weed infestations tend to be restricted to more disturbed areas such as those that have been cleared for grazing (particularly at the southern end of the HOA) and riparian areas. The weeds outlined in ***Table 4-6*** will be strategically targeted throughout all BOAs and throughout Ravensworth Complex, with other noxious and perennial weeds being included in the targeted weed programme if they are detected on site. Weed distribution and abundance will be further recorded during monitoring and control activities and will be included in subsequent management programmes.

Scientific Name	Common Name	Ravensworth Complex	RNOA	HOA	COA	SOA
Carduus nutans	Nodding Thistle	X	X			
Cirsium vulgare	Spear Thistle	X	X	X		X
Galenia pubescens	Galenia	X	X	X	X	
Gomphocarpus fruticosus	Narrow-leaved Cotton Bush	X	X	X	X	X
Hypericum perforatum	St John's Wort		X	X		
Juncus acutus	Sharp Rush	X	X	X	X	X
Lantana camara	Lantana		X	X		
Lycium ferocissimum	African Boxthorn		X	X		
Olea europaea ssp. cuspidata	African olive	X	X	X	X	X
Opuntia humifus	Creeping Pear	X	X	X	X	X
Opuntia orantiaca	Tiger Pear	X	X	X		X
Opuntia stricta	Prickly Pear	X	X	X	X	
Rubus fruticosus	Blackberry	X	X	X		
Salix sp.	Willow	X	X			
Sonchus oleraceus	Common Sowthistle		X	X	X	
Asparagus aethiopicus	Asparagus Fern				X	
Heliotropium amplexicaule	Blue Heliotrope				X	
Hyparrhenia hirta	Coolatai Grass	X	X	X	X	
Bryophyllum delagoense	Mother of Millions			X		
Senecio madagascariensis	Fireweed	X	X	X	X	X
Carthamus lanatus	Saffron Thistle	X		X		
Solanum elaeagnifolium	Silverleaf Nightshade			X	X	X
Cestrum parqui	Green Cestrum		X			
Onopordum acanthium	Scotch Thistle	X	X	X		X

Table 4-6 – Weeds within Ravensworth Complex and BOAs

4.9.2 Vertebrate Pest Species and Problematic Native Herbivores

Vertebrate pest animal activity is to be expected at all sites with eradication of feral pests unlikely to be achievable, largely due to the fact that they occur throughout the general area. A list of pest species identified in the Ravensworth Complex and BOAs is included in ***Table 4-7***.

Wild dogs and foxes in particular are wide-ranging and will simply move into 'vacated' territories once another individual has been removed. Therefore, all feral pest management should be undertaken in response to monitoring activities and triggers that indicate that feral pest management is required. The pests outlined in ***Table 4-7*** will continue to be strategically targeted throughout all BOAs and throughout Ravensworth Complex.

Mosquito Fish (*Gambusia holbrooki*), a significant aquatic pest, have previously been recorded within one dam in the SOA and one dam in the HOA. Mosquito Fish can predate on the larvae and tadpoles of Green and Golden Bell Frogs and other amphibians and predation by the species is listed as key threatening process under the BC Act. The species has subsequently been targeted to remove from dams and waterways within the BOAs. Mosquito Fish presence will continue to be monitored during the annual biodiversity monitoring program and any presence will trigger an action to remove Mosquito Fish from the dams they are found in, they will be drained and allowed to dry out before re-filling again.

Unmanaged macropod populations could have a detrimental impact on any revegetation efforts within the BOAs. The removal or reduction in numbers of domestic stock will likely influence a growth in population sizes of macropods with vegetation monitoring and population counts directing any management actions.

Scientific Name	Common Name	Ravensworth Complex	RNOA	HOA	COA	SOA
Canis lupus familiaris/dingo	Wild Dog/Dingo	X	X	X	X	X
Lepus capensis	Brown Hare		X	X		
Oryctolagus cuniculus	European Rabbit	X	X	X	X	X
Vulpes	European Red Fox	X	X	X	X	X
Sus scrofa	Wild Pig			X	X	X
Felis catus	Cat					X
Gambusia holbrooki	Mosquito Fish			X		X

Table 4-7 – Vertebrate Pests within Ravensworth Complex and BOAs

4.10 BOA Management Zone Stratification

The four BOAs are stratified into vegetation management zones based upon condition (see ***Table 4-8***). Areas deemed to be in 'good' condition will require ongoing maintenance and monitoring and are unlikely to require any significant remediation. Areas referred to as 'cleared', will require revegetation (either assisted or unassisted). Areas identified as being in 'good' condition derived grassland that will be converted to their most suitable EEC. Areas identified as being in 'poor' condition are derived grasslands that have been eroded, in most cases through historic overgrazing. Stabilisation and earthworks may be required for these management zones.

Biometric Vegetation Type or Target Vegetation Type	Condition	RNOA	HOA	COA	SOA
Central Hunter Bulloak Forest regeneration	Good	34.7	0	0	0
Central Hunter Swamp Oak Forest	Good	23.6	0	0	0
Central Hunter Ironbark - Spotted Gum - Grey Box Forest	Good	0	139.2	0	95.5

Biometric Vegetation Type or Target Vegetation Type	Condition	RNOA	HOA	COA	SOA
Central Hunter Ironbark - Spotted Gum - Grey Box Forest (Red Gum Variant)	Good	0	0	0	18.7
Central Hunter Box-Ironbark Woodland	Good	124	0	42.8	0
River-flat Eucalypt Forest	Good	19.1	1.6	0.5	7.1
Barrington Footslopes Dry Spotted Gum Forest	Good	0	378.6	0	0
Dry Gully Rainforest	Good	0	160.3	0	0
Grey Gum - Rough-barked Apple Forest on Sheltered Slopes	Good	0	81.8	0	0
Grass Tree Low Woodland	Good	0	3.6	0	0
Black Cypress Pine Low Forest	Good	0	1.2	0	0
Derived Grassland	Cleared	78.5	577.3	61.0	42.0
Eroded Derived Grassland	Poor	0	58	2	0.4
Total*		**279.9**	**1,401.6**	**106.3**	**163.7**
*Totals indicate areas of vegetation only. Parts of the BOAs are not vegetated, such as tracks, and therefore the total property area is greater than the combined vegetation areas.					

Table 4-8 – BOA Management Zones

5. LAND MANAGEMENT STRATEGIES

5.1 Objectives for BOAs

The primary objective of the establishment of the BOAs is to protect and enhance the extent and condition of EECs and threatened species habitat values within the BOAs. The key management measures identified to enhance the quality and extent of EECs and threatened species habitat in the BOAs include active and passive regeneration and revegetation initiatives and are described in the Offset Area Management Programme (Ravensworth Operations, 2019) (Document: RAVOC-1007099517-20) (OAMP). The specific objectives and target criteria for revegetation and regeneration activities to be implemented in the BOAs to mitigate against the impact to threatened species include the following:

- Re-establish vegetation in disturbed areas consistent with remnant vegetation communities;
- Augment existing vegetation to compensate (in part) for the loss of vegetation as a result of mining at the Ravensworth Complex;
- Provide increased connectivity from the BOAs to the north, south and east, particularly to the rehabilitation associated with adjacent GCAA operations;
- Re-establish or augment fauna habitats consistent with extant fauna habitats of the BOAs and provide increased habitat for displaced fauna;
- Re-establish and augment threatened species habitat; and
- Provide opportunities to re-establish or augment regionally significant vegetation communities.

5.2 Measurement Criteria for BOAs

Preliminary criteria have been developed to establish whether the Ravensworth North, Hillcrest, Clifton and Stewart BOAs are meeting the OAMP regeneration and revegetation objectives as outlined in **Section 5.1**. These include:

- Revegetation areas within the offset areas contain flora species assemblages characteristic of the analogue native vegetation communities;
- Second generation tree seedlings within revegetation zones are present or likely to be present, based on monitoring in comparable analogue sites;
- More than 75% of trees are healthy and growing as indicated by long-term monitoring within revegetation areas;
- There is no significant weed infestation such that weeds do not comprise a significant proportion of species in any stratum; and
- A range of vegetation structural habitats exist (e.g. Structural habitats such as Eucalypts, shrubs, ground cover, developing litter layer etc.) that are commensurate with the type of fauna communities that exist within the area.

A description of the criteria implementation and the type of land management measures to be implemented in order to achieve these objectives and criteria for the BOAs is outlined in **Section 5.3**.

5.2.1 Process for Review and Refinement of Criteria

As a requirement of GCAA's Closure Criteria Development and Rehabilitation Monitoring Annexure, the preliminary criteria will be reviewed and revised in consultation with DPIE and MEG throughout the life of the Ravensworth Complex, with the criteria to be used as the basis for further refinement following:

- The development of specific criteria for each BOA;
- Ecological management activities;
- Consideration of the results of rehabilitation monitoring programs; and
- Consideration of stakeholder feedback.

It is envisaged that this process will occur as part of subsequent reviews of the BOMP that are submitted to DPIE.

The progress against the completion criteria will be assessed and discussed in the annual documentation of monitoring results and summarised in the Annual Review, including the identification of any failures of the criteria, and measures taken to address any such issue. Results of any such actions undertaken will be reported in the Annual Review. The monitoring program developed to assess the performance of the BOAs is outlined in **Section 6**.

5.3 Management of BOAs

The BOAs will be managed for the protection and enhancement of EECs, threatened species and threatened species habitat. Opportunities exist for improved outcomes for EEC extent and condition, as well as threatened species within the BOAs through habitat creation and augmentation initiatives.

The proposed regeneration and revegetation strategy within the BOAs will be a combination of:

- Strategies to encourage passive regeneration of vegetation species;
- Assisted regeneration;
- Specific measures to enhance habitat value for significant fauna communities; and
- Remediation of identified degraded areas.

A range of management actions will be employed within each of the BOAs to confirm that EECs and threatened species habitat quality is maintained and revegetation/regeneration activities are successful. General management actions include:

- Staged removal and management of stock (completed and only rogue stock management now required);
- Fencing or access control to prevent access by stock, and control access by vehicles or humans (unless required for land management activities or other activities);
- Signage to identify revegetation and regeneration areas;
- Weed management;
- Sediment and erosion control;
- Control of feral animals;
- Bushfire management; and
- Monitoring and maintenance.

All activities within the BOAs will also be undertaken in accordance with the Ravensworth Complex ACHMP and OAMP. The OAMP outlines the program of conservation management activities for the BOAs, while the ACHMP details the measures that will be undertaken to manage any required impacts upon Aboriginal cultural heritage features, particularly during the completion of the required remediation works on heavily eroded drainage lines within the HOA.

Critical to the success of the BOAs is the implementation of the Ravensworth Biodiversity Offset Area Management Program, which outlines the specific details and schedule of management actions to be implemented. This program details both State and Federal approval requirements and schedules timeframes and targets to achieve objectives identified for the management of BOAs.

The Ravensworth Complex will achieve its primary objectives for the management of its BOAs via a suite of management strategies and annual works programs, as detailed in the following sections.

5.3.1 Fencing, Gates and Signage

Domestic grazing stock has been removed from all BOAs. Stock proof boundary fences has been installed or repaired around BOAs (HOA, SOA and COA) with a purpose to exclude domestic stock. Where stock is not found on adjacent lands, as in the case of RNOA, fauna friendly barbless plain wire fences will be utilised and maintained for the purpose of defining the BOA boundary and deterring unauthorised entry. As of May 2020, all boundary fences are installed and in suitable condition.

Internal fauna friendly fencing will also be used along legal Rights of way (ROW) through the BOAs to deter unauthorised entry. All other internal superfluous fencing will be removed with any timber strainer posts or splits left in situ as habitat features. As of November 2014, all known redundant fencing had been removed (see ***Table 5-1***).

Vehicle access gates will be installed where a fence intersects a roadway or track and will be secured with a Ravensworth Complex controlled lock. Single use 'emergency access' locks may be used where access through the BOA is required by a neighbouring land occupier in the event of a life threatening emergency, such as an approaching bushfire.

All BOA boundary gates have signs affixed that identify the property, alert visitors to the restrictions on access and provide a Ravensworth Complex site contact number.

Motion sensing still cameras may also be utilised to monitor and manage unauthorised access to the BOAs.

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
Install or repair boundary fences restricting unauthorised access to property and controlling livestock movements	All	All boundary fences in place and gates secured				Completed
Erect restricted access signage on all external gates	All	All signage in place				Completed

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
Install dividing fence between Northern grazed section of HOA and Southern un-grazed section of HOA		Stock proof dividing fence in place				All stock removed from HOA (North and South) Fences inspected and maintained
Minimum twice a year BOA inspections to identify fence conditions	All	To be completed in January and July each year	To be completed in January and July each year	To be completed in January and July each year	To be completed in January and July each year	Completion of inspection form
Repair damaged fences as identified in inspections	All	Damaged critical fences repaired within one week, non-critical fences repaired within one month	Damaged critical fences repaired within one week, non-critical fences repaired within one month	Damaged critical fences repaired within one week, non-critical fences repaired within one month	Damaged critical fences repaired within one week, non-critical fences repaired within one month	All fences in good condition
Remove any redundant fencing identified in inspections	All	Remove all fencing identified during inspections within one month	Remove all fencing identified during inspections within one month	Remove all fencing identified during inspections within one month	Remove all fencing identified during inspections within one month	All internal redundant fencing is removed from BOAs

Table 5-1 – Fencing, Gates and Signage Performance Criteria (PC) and Completion Criteria (CC)

5.3.2 Access Tracks

Tracks within all BOAs play an important role in allowing access in order to implement management actions identified in this BOMP while also allowing for bushfire control and asset protection. Through the BOA induction process, all personnel will be made aware of the importance of driving on designated tracks and minimise driving within offset areas. Access tracks have been mapped across all BOAs and are regularly inspected and maintained as required. All access track mapping is stored in a GIS database (see ***Table 5-2***).

Prior to the construction of new access tracks / roads within the BOAs (including any works requiring additional ground disturbance), due diligence ecological inspections will be undertaken by a suitably qualified ecologist to search for threatened flora species, endangered populations and important habitat for threatened fauna species (including the Green and Golden Bell Frog), such as hollow-bearing trees and dams.

Any ground disturbance within the BOAs will be carried out under the GDP process outlined in **Section 5.3.4**. Should threatened flora species, endangered populations and important habitat be identified, the Ravensworth Complex will implement measures to minimise impacts on these features,

including the redesign of the layout of access tracks/roads. The measures to be undertaken to minimise impacts of access tracks on threatened species, populations and habitat features include:

- Designing the access tracks for the minimisation of environmental impacts including minimising the length and width of the track;
- Designing tracks to minimise potential impact on high quality Green and Golden Bell Frog habitat and habitat trees in the BOAs;
- Undertaking pre-clearance surveys (through the GDP process) in the proposed areas for track construction to determine constraints to track construction;
- Where clearance of habitat trees is required, undertaking clearing activities in accordance with site procedures including the Ravensworth Complex Ground Disturbance and Pre-Clearance Procedure (RAVCX-1962359669-17)
- Topsoil stripped for the construction and maintenance of tracks will be stockpiled onsite for reuse in other areas on the BOA.

In accordance with the Rural Fires Act, in the event of a declared bushfire emergency, all efforts will be made to reduce and/or eliminate the fire hazard/risk. This may include the construction of emergency access tracks/roads to enable fire fighting personnel access to the fire front and/or the construction of fire breaks without undertaking a due diligence assessment prior to clearing activities.

Erosion and sediment control structures as outlined in **Section 5.3.4** will, where necessary, be established in conjunction with any tracks constructed through the BOAs. Construction of erosion and sediment control structures will also be considered in the maintenance of access tracks.

5.3.3 Rubbish Management

Superfluous infrastructure and materials associated with the previous land use of grazing, is widespread throughout the Ravensworth Complex BOAs.

HOA has 4 unoccupied dwellings and associated outbuildings on the property all of which are in a dilapidated and non-repairable state. Some of these structures contain asbestos, which has been investigated and found to be stable in situ. As an interim management measure, areas where asbestos has been identified have been fenced off and signposted to alert visitors to the hazard (see ***Table 5-3***). These structures were assessed in 2018 for their heritage value and two of the structures were found to have local heritage listings in the Muswellbrook Shire. These two structures (known as Hillcrest and Fairview) were securely fenced to prevent access. One of the four structures (known as Northern Valley Cottage) is situated in dense scrub and is very difficult to access. This structure has also been fenced and signposted. The previous structure remaining on the HOA (known as Rose Cottage) has been demolished and removed.

RNOA contains scattered redundant infrastructure from historical grazing and mining land uses. Examples of this redundant infrastructure include: water tanks, pipe work, and disused signage.

COA and SOA are relatively free of rubbish. The only significant rubbish or domestic waste within these BOAs include an old car body located on the COA and an old trailer chassis on the SOA.

Ideally, rubbish and superfluous infrastructure will be removed from the BOAs; however, there can be several complications in the removal process, including health implications (e.g. asbestos or needle stick injuries), contaminated land issues and the possibility of causing more disturbance in the removal process. Rubbish and abandoned farm structures can also provide important habitat for fauna, including reptiles and roosting structures for microchiropteran bats. For these reasons the rubbish identified throughout the BOAs will be characterised using the following categories:

- Rubbish to be removed - Debris that clearly have no health issues, that offer minimal habitat value and that would not result in extensive damage in the removal process;
- Rubbish to be left in-situ – Rubbish that presents major health concerns if removed and/or provide important habitat value and/or would cause extensive damage if removed; and
- Rubbish to be investigated – Debris that would ideally be removed but may have health and safety, contamination and/or biodiversity values and require further investigation by qualified personnel.

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
Develop a GIS database of all internal BOA access tracks	All	All internal tracks mapped and GIS database developed				Completed
Minimum twice a year BOA inspections to identify track conditions	All	To be completed biannually, generally in March and September	To be completed biannually, generally in March and September	To be completed biannually, generally in March and September	To be completed biannually, generally in March and September	Completion of inspection reports
Repair degraded tracks as identified in inspections	All	Action and repair track damage	Action and repair track damage	Action and repair track damage	Action and repair track damage	Tracks in good, useable condition

Table 5-2 – Access Track Management Performance Criteria (PC) and Completion Criteria (CC)

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
Asbestos identified and contaminated areas secured	HOA	All occurrences of asbestos identified and contaminated areas fenced and signposted				Completed
Asbestos removed from BOAs where not impacting on a heritage item	HOA	Asbestos removed from four unoccupied dwellings in HOA where not impacting on a heritage item				No asbestos found within BOAs or areas containing asbestos securely fenced preventing access
Superfluous infrastructure removed from all BOAs	All	Identify and remove all superfluous infrastructure from BOAs				No superfluous infrastructure found within BOAs

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
	SOA	Remove old trailer chassis from SOA				
	COA	Remove old car body from COA				
Minimum twice a year BOA inspections to identify presence of rubbish	All	To be completed biannually, generally in January and July	To be completed biannually, generally in January and July	To be completed biannually, generally in January and July	To be completed biannually, generally in January and July	Completion of inspection reports
Remove reported dumped rubbish	All	Categorise identified rubbish and action accordingly	Categorise identified rubbish and action accordingly	Categorise identified rubbish and action accordingly	Categorise identified rubbish and action accordingly	No rubbish found in BOAs

Table 5-3 – Rubbish Management Performance Criteria (PC) and Completion Criteria (CC)

5.3.4 Erosion, Sedimentation and Soil Management

The Ravensworth Complex will implement erosion and sediment control measures in the BOAs, to mitigate against potential land degradation from the occurrence of erosion where it occurs (see ***Table*** 5-4).

Where possible, controls will be developed and implemented in accordance with relevant guidelines for erosion and sediment control, including:

- Managing Urban Stormwater: Soils and Construction (the Blue Book) Volume 1 (Landcom, 2004); and
- Managing Urban Stormwater: Soils and Construction (the Blue Book) Volume 2E Mines and Quarries (Landcom, 2008).

Further assessment has identified that a number of Aboriginal cultural heritage sites exist in portions of the HOA that were identified for the repair and remediation of heavily eroded drainage lines. Therefore, appropriate approvals to facilitate the management of these Aboriginal cultural heritage sites is required prior to the conduct of the proposed earthworks to remediate and control erosion in these areas. In 2019, Ravensworth Operations submitted a revised ACHMP to DPIE and BCD for approval to facilitate the required management actions for these Aboriginal cultural heritage sites.

In areas where Aboriginal cultural heritage sites do not exist, the following types of sediment and erosion controls have been utilised:

- Bulk earthworks to repair existing erosion as well as reshaping the land to a more stable profile. Clearing existing vegetation in order to repair erosion will be avoided where possible, if vegetation clearing is required, preclearance surveys will be undertaken prior to any ground disturbance works to determine constraints to erosion control repair work in accordance with the GDP process, further discussed below. Where possible, clearance of habitat trees will not be undertaken in order to undertake earthworks for erosion control. If clearance is required, it will be undertaken in accordance with Ravensworth Complex Ground Disturbance and Pre-Clearance Procedure (RAVCX-1962359669-17) and the GDP process;

- Prior to revegetation activities, the substrate will be characterised to determine the type and application rate that may be required for the addition of soil ameliorants (e.g. gypsum, lime, fertiliser, Organic Growth Medium (OGM), biosolids etc.);
- Earthworks may be required and where soil compaction is high the final shaped surfaces may be deep ripped where practicable and appropriate parallel with the contour;
- Suitable erosion control measures (e.g. catch drains, sediment dams, sediment fencing, rock check dams, turf and rock lined drains, erosion control matting, adding mulch or soil, revegetation and hydromulching) may be implemented to minimise soil loss from areas undergoing rehabilitation;
- Where appropriate and practical, structures such as tree hollows, boulders, logs and other woody debris (salvaged from the proposed disturbance area) may be incorporated into the final landform; and
- The planting and or direct seeding of native species of local provenance in the first instance, where sufficient local provenance seed is available. However, where adverse seasonal conditions (i.e. drought) affect the availability of local provenance seed, supplementation with non-local provenance seed may be required.

Passive remediation techniques will be preferentially used in areas which contain cultural heritage sites and any Aboriginal cultural heritage management measures will be carried out under guidance from the Ravensworth Complex ACHMP.

Erosion, in varying degrees, is present on all four BOAs (RNOA, HOA, COA and SOA). Gully and surface erosion can be found throughout the southern parts of HOA due to its land use history of heavy clearing and intensive grazing. Gully erosion is found to a lesser degree in RNOA, SOA and COA. It is expected that a combination of stock removal, remediation techniques and revegetation will eventuate in a stable landform.

A number of photo monitoring points have been established across the BOAs, with monitoring undertaken every six months. Any areas of new erosion identified will be reviewed and remedial actions undertaken if required.

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
Establish photo monitoring points within all offset areas	All	Photo points set up and photographic record started	Photographic record developed	Photographic record developed	Photographic record developed	Photo points set up and photographic record developed
Minimum twice a year BOA inspections to identify newly eroded areas	All	To be completed biannually, generally in January and July	To be completed biannually, generally in January and July	To be completed biannually, generally in January and July	To be completed biannually, generally in January and July	Completion of inspection reports
Remediate eroded areas *artefacts present in	Eroded Derived Grassland (HOA* – 58Ha)	Erosion control works carried out on areas	Continue monitoring and management of SOA,	Vegetation established on previously	Vegetation established on previously	Previously eroded areas on SOA and COA stable

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
HOA preventing earthworks *	Eroded Derived Grassland (SOA – 0.4Ha) Eroded Derived Grassland (COA 2Ha)	affected by erosion in SOA and COA. Approval required for management of Aboriginal heritage items within the HOA	COA erosion control works. Erosion control works carried out on areas affected in the HOA.	eroded areas.	eroded areas.	and well vegetated.
Monitor erosion control works	All	Monitor completed erosion works, and action repairs if required	Monitor completed erosion works, and action repairs if required	Monitor completed erosion works, and action repairs if required	Monitor completed erosion works, and action repairs if required	Erosion control works are successful

Table 5-4 – Erosion, Sedimentation and Soil Management Performance Criteria (PC) and Completion Criteria (CC)

5.3.5 Stock Management

The majority of vegetation within the BOAs displays some level of impact from grazing, whether by introduced stock, feral animals such as rabbits and pigs or by native animals (mainly macropods). The intensity of this impact varies throughout the BOAs, with the vegetation across the areas displaying historic grazing impacts ranging from slight to moderately severe. The grassland formation shows the highest level of impact, however all vegetation formations show some degree of disturbance from grazing.

Table 5-5 outlines the actions that will be undertaken regarding stock in BOAs, including:

- Grazing by domestic stock has ceased in the RNOA, SOA, HOA and COA; and
- Any rogue stock will be removed as soon as possible from BOAs when identified during inspections.

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
All stock removed from RNOA, Southern HOA, COA and SOA.	All	No stock grazing in RNOA, Southern HOA, COA and SOA.				Completed
All stock removed from Northern Grazing Management Zone of HOA	North HOA	No stock grazing in Northern Grazing Management Zone of HOA				All stock removed from HOA

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
Minimum twice a year BOA inspections to determine presence of rogue stock and assess condition of fences	All	To be completed biannually, generally in January and July	To be completed biannually, generally in January and July	To be completed biannually, generally in January and July	To be completed biannually, generally in January and July	Completion of inspection reports
Remove reported rogue stock and repair damaged fences	All	Action and remove reported rogue stock and repair damaged fences	Action and remove reported rogue stock and repair damaged fences	Action and remove reported rogue stock and repair damaged fences	Action and remove reported rogue stock and repair damaged fences	No rogue stock in BOAs and fences in good condition

Table 5-5 – Stock Management Performance Criteria (PC) and Completion Criteria (CC)

5.3.6 Seed Collection and Propagation

A seed collection procedure has been developed for use at Ravensworth Complex and within BOAs (see ***Table 5-6***). Local provenance seed from vegetation within BOA and onsite will be collected and propagated to be used for revegetation and rehabilitation, as they are most adapted to local conditions. Seed collection will be conducted in the offset areas and onsite opportunistically throughout the year to ensure a range of seeds from different species are collected. All seed collection will be carried out in accordance with the Florabank *Guidelines and Model Code of Practice*. Seed collection will be performed by experienced and qualified personnel.

Hand removal will be the main method of seed collection to reduce injury to plant material and minimise contamination from other species. Seed is gathered by hand stripping from plants and dropped into seed harvesting bags. Secateurs are used to remove capsules and seed from smaller shrubs and grasses, where Telescopic Pole pruners are used for taller shrubs and trees. Drop sheets are used for those species that shed seed easily when dehiscing (e.g. *Daviesia*). Bagging of some plants may occur to ensure capture of some sequentially ripening species (e.g. *Grevillea*). Key species may be photographed and a sample taken to allow easier identification of species found on site. Seed and capsules are then placed in collection bags labelled with the following information: Genus and Species, Dates, GPS coordinates, Geographical location, Number of parent plants collected from, and plant community.

The 'Grasshopper', a harvesting machine towed by a light vehicle will be the main method of seed collection in grasses. It uses a non-destructive harvesting technique allowing multiple harvests of stands of grass resulting in an increased yield of viable seed.

The 'Grasshopper' has adjustable brushes and harvest height to ensure no disturbance of ripe seed from the towing vehicle. The process involves the seed being carried into a hopper via airflow generated by the brush where it is then removed by the operator from the sides of the unit. Seed is then transported to the cleaning facility where it will undergo further treatment.

Seed will be stored off-site by experienced and qualified staff in accordance with the Florabank *Guidelines and Model Code of Practice*. Seed is stored in heat-sealed laminated polymer bags after the addition of carbon dioxide. This ensures the elimination of any potentially destructive insects or larvae

within the bags. Bags are then packed in vermin proof containers and placed in a cool-room for storage where a constant temperature of 12°C is maintained to ensure optimum viability when dispersing seed on rehabilitation or propagation prior to planting out. Some native grasses have extended ripening periods ranging from 3-12 months depending on the species. This ripening process can be accelerated through appropriate storage techniques ranging from warmer storage through to stratification allowing for optimal germination at propagation time.

5.3.7 Habitat Augmentation

Where practical, salvage of habitat structure in areas that are to be impacted will take place. Habitat structure may include logs, hollows, and rock piles. This habitat structure will be utilised in offset areas and in onsite rehabilitation to provide compensatory habitat for hollow dependent native fauna species (both threatened and non-threatened) (see ***Table 5-7***).

Salvaged hollows (where possible) will be placed in rehabilitation areas within the BOAs and onsite. A range of hollow size classes will be provided, thus increasing the quality of habitat for target threatened species. Hollows will be placed both on the ground and affixed to trees (once the host vegetation reaches suitable maturity).

The augmentation of ground cover within the BOAs will serve to increase the availability and quality of habitat and will increase protective cover for small terrestrial fauna species, such as reptiles, amphibians, small mammals and ground-foraging birds.

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
Seed collectors are to be appropriately trained	All	Continuous	Continuous	Continuous	Continuous	Continuous
Develop seed collection procedure based on Florabank (2013)	All	Seed collection procedure developed				Complete
Implement seed collection procedure	All	Seed collection will be conducted in the offset areas and onsite throughout the year	Seed collection will be conducted in the offset areas and onsite throughout the year	Seed collection will be conducted in the offset areas and onsite throughout the year	Seed collection will be conducted in the offset areas and onsite throughout the year	Local provenance seed resource harvested for use in remediation and rehabilitation

Table 5-6 – Seed Collection and Propagation Performance Criteria (PC) and Completion Criteria (CC)

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
Establish pre-clearing, habitat	All	Pre-clearing and habitat feature				Complete

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
salvage procedures		relocation procedures developed and in use				
Salvaged habitat features placed in BOAs and in onsite rehabilitation	All	Habitat features relocated to BOAs and onsite rehabilitation areas	Habitat features relocated to BOAs and onsite rehabilitation areas	Habitat features relocated to BOAs and onsite rehabilitation areas	Habitat features relocated to BOAs and onsite rehabilitation areas	Habitat features in place and being monitored and maintained

Table 5-7 – Habitat Augmentation Performance Criteria (PC) and Completion Criteria (CC)

5.3.8 Revegetation and Rehabilitation

All BOAs will be subject to regeneration and revegetation activities in order to improve ecological values, EEC extent and condition and threatened species habitat (see ***Table 5-8***). BOAs will be revegetated, either passively or in an assisted fashion utilising tree plantings and other techniques.

Areas of vegetation will be established within the BOAs, whereby currently disturbed vegetation communities will be revegetated to their target benchmark communities. The following principles will be applicable to revegetation activities within the BOAs:

- A revegetation program has been established following the completion of further monitoring, investigation and planning into the BOAs ability to self-regenerate. This program is undertaken on an annual basis and will accurately plan and document the revegetation / management methodology. This program will aim to minimise lag time in habitat replacement;
- Revegetation areas within the BOAs contain flora species assemblages that are characteristic of the analogue native vegetation communities;
- A range of vegetation structural habitats exist (e.g. eucalypts, shrubs, ground cover, developing litter layer) that are commensurate with the type of fauna communities that exist within the area;
- All planting or seeding required under the program, within revegetation areas will be designed with structural and floristic diversity suitable to meet the benchmark vegetation community targets;
- Where practicable, revegetation will involve the use of local provenance seed that will either be utilised for direct seeding or for the propagation of tube stock for planting. Local provenance will be utilised as a first preference;
- Revegetation areas will be subject to a formal care and maintenance program that will be developed to include the control of weeds, replacement of failed plantings and bushfire protection;
- Second generation tree seedlings within the BOA revegetation zones are present or likely to be present, based on monitoring in comparable analogue sites;
- More than 75 % of trees are healthy and growing as indicated by long term monitoring within revegetation areas; and

- Revegetation areas will be subject to regular inspections to determine the success of the revegetation measures and to ensure the program meets its objectives.

In addition to establishment of BOAs, Condition 32 under Schedule 3 of PA 09_0176 requires the establishment of 1,767 ha of woodland. Condition 33 under Schedule 3 of PA 09_0176 states that rehabilitation should be focused on the following EECs:

- Central Hunter Grey Box – Ironbark Woodland;
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest;
- River-flat Eucalypt Forest; and
- Hunter Floodplain Red Gum Woodland Complex.

The target EECs and the assemblage of species that comprise those communities are listed in ***Appendix A***. The species to be utilised in revegetation will be selected from these lists based on factors including seasonal availability, suitability for direct seeding and success of past revegetation using that species. Annual rehabilitation inspections (as discussed in Section 7.11.2) will confirm whether the revegetation areas are trending towards the target EEC(s).

The BOAs were selected for the quality and composition of the vegetation communities present. It is expected that natural regeneration will be sufficient to achieve the areas of vegetation required by PA 09_0176. However, assisted regeneration techniques may be employed if natural regeneration is not progressing as desired. Triggers for assisted regeneration may include the following:

- Presence of bare areas larger than 20 m^2;
- Less than 75% of trees and shrubs are classified as 'healthy' during ecological monitoring;
- One or more target species required for an EEC (as listed in *Error! Reference source not found.*) a re missing from the monitoring quadrats for two consecutive monitoring periods; and
- The Site Value Score (as determined in accordance with the BBAM) for a quadrat has decreased for two consecutive monitoring periods.

Ravensworth North Offset Area

In accordance with Condition 32 of Schedule 3 of PA 09_0176, the RNOA is required to be a minimum size of 284 ha of vegetated habitat. The RNOA provides high quality vegetation communities (including EECs), fauna habitat and known threatened species habitat. The regeneration of vegetation communities in RNOA may involve a combination of assisted and passive regeneration techniques. Through building on existing remnants, regeneration is proposed for areas of Derived Grassland (approximate area: 65 ha) in the RNOA. Management zone specific preliminary criteria will be developed through annual monitoring. If annual monitoring finds that natural regeneration is not successful, a detailed revegetation plan will be developed. The plan will focus on ensuring regeneration of ecological communities and species as required in Condition 33 of Schedule 3 of PA 09_0176. Each of the woodland vegetation communities identified in the RNOA is expected to increase in area as a result of regeneration activities.

Hillcrest Offset Area

PA 09_0176 requires the HOA to be no less than 1,402 ha in size. The HOA has been divided into two areas in relation to the natural and assisted regeneration, remediation and management of the site. The northern portion of the HOA incorporates the valley foot slopes and comprises well vegetated areas and high quality vegetation communities. The southern portion of the HOA occurs on the Hunter Valley floor and has been heavily cleared and grazed in the past.

Hillcrest Offset Area (South)

Natural Regeneration

Much of the HOA is expected to naturally regenerate following the reduction and ultimate removal of grazing pressure by domestic stock. It is proposed to remove cattle grazing in areas of high quality Derived Grassland and the larger woodland remnants of the Southern section of HOA. It is envisaged that over time the Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC will naturally regenerate in these areas without any additional assistance other than weed and vertebrate pest management. In some cases, specific planting might be required, particularly in exposed slopes void of remnant vegetation. Management zone specific preliminary criteria will be developed through annual monitoring. If annual monitoring finds that natural regeneration is not successful, a detailed revegetation plan will be developed. The plan will focus on ensuring regeneration of ecological communities and species as required in Condition 33 of Schedule 3 of PA 09_0176. As with the RNOA remnant, the removal of grazing will allow those flora species represented in the soil seed bank to germinate and create a self-sustaining vegetation community commensurate with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest currently occurring in the BOA and wider central Hunter Valley.

Through building on existing remnants, natural regeneration of HOA (South) is proposed for approximately 300 ha.

Remediation of Degraded Areas

Portions of the HOA (South) are subject to severe erosion and degradation in creeks, on slopes and in gullies. It is expected that with the removal of stock from these areas the continued degradation will ease or cease. A range of techniques will be employed to remediate the degraded land, as stated in **Section 5.3.4**.

Remediated creeks and gullies will be planted with species characteristic of River-flat Eucalypt Forest in the central Hunter Valley while adjacent slopes will be planted with species characteristic of Central Hunter Ironbark - Spotted Gum - Grey Box Forest.

Approximately 107 ha of the HOA (South) may require remediation works.

Hillcrest Offset Area (North)

The HOA (North) provides high quality vegetation communities, EECs / VECs, fauna habitat and known threatened species habitat. This portion of the HOA is considered to be in good condition with little evidence of ongoing disturbance or areas requiring active revegetation. The regeneration of vegetation communities in HOA (North) is expected to include passive measures, which will consist of the management of grazing and weed and feral animal control.

Through building on existing remnants, natural regeneration is expected to occur on approximately 228 ha of HOA (North). Management zone specific preliminary criteria will be developed through annual monitoring. If annual monitoring finds that natural regeneration is not successful, a detailed revegetation plan will be developed. The plan will focus on ensuring regeneration of ecological communities and species as required in Condition 33 of Schedule 3 of PA 09_0176. All of the vegetation communities identified in the HOA are expected to increase in area as a result of grazing management.

Clifton Offset Area

PA 09_0176 requires COA to be a minimum of 107 ha in size. COA provides high quality vegetation communities, EECs, fauna habitat and known threatened species habitat. The COA is considered to be in good condition with little evidence of ongoing disturbance or areas requiring active remediation. The regeneration of vegetation communities in the COA is expected to include passive measures, which will consist of the exclusion of grazing and weed and feral animal control.

Through building on existing remnants, natural regeneration is proposed for approximately 61 ha of COA. Natural regeneration is expected to result in an increase in the area of Central Hunter Ironbark -

Spotted Gum - Grey Box Forest EEC in areas currently comprising Derived Grassland. Management zone specific preliminary criteria will be developed through annual monitoring. If annual monitoring finds that natural regeneration is not successful, a detailed revegetation plan will be developed. The plan will focus on ensuring regeneration of ecological communities and species as required in Condition 33 of Schedule 3 of PA 09_0176.

Stewart Offset Area

PA 09_0176 requires the SOA to be a minimum of 165 ha in size. The SOA provides high quality vegetation communities, EECs and fauna habitat and known threatened species habitat. The regeneration of vegetation communities in the SOA is expected to include passive measures, which will consist of the exclusion of grazing and weed and feral animal control.

Through building on existing remnants, natural regeneration is proposed for approximately 43 ha of the SOA. Natural regeneration is expected to result in an increase in the area of the Central Hunter Ironbark - Spotted Gum - Grey Box Forest EEC in areas currently comprising derived grassland. Management zone specific preliminary criteria will be developed through annual monitoring. If annual monitoring finds that natural regeneration is not successful, a detailed revegetation plan will be developed. The plan will focus on ensuring regeneration of ecological communities and species as required in Condition 33 of Schedule 3 of PA 09_0176.

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	CC
Map revegetation areas and target vegetation communities	All	Revegetation and target communities mapped				Complete
Develop detailed PCs for all management zone types	All	Detailed criteria developed based on annual monitoring of analogue sites				Criteria developed
Develop a revegetation program and incorporate measurement criteria into BOA annual monitoring	All	Revegetation program completed and measurement criteria incorporated into annual monitoring				Revegetation and Monitoring Program developed
Implement revegetation program	All	Undertake assisted regeneration and revegetation under guidance of revegetation program and results of monitoring	Undertake assisted regeneration and revegetation under guidance of revegetation program and results	Undertake assisted regeneration and revegetation under guidance of revegetation program and results	Undertake assisted regeneration and revegetation under guidance of revegetation program and results	Ongoing

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	CC
			of monitoring	of monitoring	of monitoring	
Minimum twice a year BOA inspections to determine condition and success of revegetation program.	All	To be completed biannually, in January and July	To be completed biannually, in January and July	To be completed biannually, in January and July	To be completed biannually, in January and July	Completion of inspection forms
BOA Monitoring undertaken to measure outcomes of revegetation program.	All	To be completed annually	To be completed annually	To be completed annually	To be completed annually	Completion of monitoring reports and recommendations incorporated into revegetation program.

Table 5-8 – Revegetation and Rehabilitation Performance Criteria (PC) and Completion Criteria (CC)

5.3.9 Weed Management

The principle criteria for weed management is that there are minimal weed infestations, such that they do not comprise a significant proportion of species in any stratum. ***Table 5-9*** outlines actions that will be undertaken regarding weed management in BOAs, which will include:

- Existing weed management controls and methods used at Ravensworth Complex will be utilised within BOAs;
- Emerging threatening weeds, such those identified in **Section 4.9** will be targeted by control programs;
- Monitoring of weed occurrences and effectiveness of management programs will be undertaken through at least biannual BOA inspections, through annual BOA monitoring, and through observations noted during management programs;
- Weed control methods will be implemented and undertaken in consultation with suitably qualified experts, as required, and may include hand removal, mechanical removal and application of approved herbicides, when favourable conditions prevail; and
- Ongoing consultation with the relevant authorities regarding weed listings, weed occurrence and management technologies.

PC and CC	Management Zones	Year 3 PC	Year 6 PC	Year 9 PC	Year 12 PC	CC
Weed extent and density mapping	All	GIS weed management database updated seasonally, in March, June, September and December	GIS weed management database updated seasonally in March, June, September and December	GIS weed management database updated seasonally in March, June, September and December	GIS weed management database updated seasonally in March, June, September and December	Ongoing
Minimum twice a year BOA inspections to monitor weed occurrences and successes of management programs	All	To be completed biannually, in January and July	To be completed biannually, in January and July	To be completed biannually, in January and July	To be completed biannually, in January and July	Completion of inspection forms
On ground weed management program	All	Seasonal weed management programs carried out as required	Seasonal weed management programs carried out as required	Seasonal weed management programs carried out as required	Seasonal weed management programs carried out as required	Emergent weeds effectively controlled and significant infestations reduced in size and contained

Table 5-9 – Weed Management Performance Criteria (PC) and Completion Criteria (CC)

5.3.10 Vertebrate Pest Management

An increase in feral and pest species within the BOAs has the potential to increase impacts on existing native species, particularly via predation and habitat destruction. The following management controls will be undertaken to control feral and pest animals in the BOAs:

- Monitoring of vertebrate pest populations and effectiveness of management programs will be undertaken through at least biannual BOA inspections, through annual BOA monitoring, and through observations noted during management programs. A particular focus will be made to vertebrate pest impact on vegetation establishment;
- Pest control methods will be implemented and undertaken in consultation with suitably qualified experts, as required, and may include baiting, trapping, and free range shooting;
- Ongoing collaboration with management authorities such as the Local Land Services on regional approached to pest management; and
- Based on monitoring, vertebrate best control works will be undertaken periodically to ensure the suppression and management of feral and pest animal populations (see ***Table 5-10***).

PC and CC	Management Zones	Year 3 PC	Year 6 PC	Year 9 PC	Year 12 PC	CC
Minimum twice a year BOA inspections to monitor vertebrate pest populations and successes of management programs	All	To be completed biannually, in January and July	To be completed biannually, generally in January and July	To be completed biannually, generally in January and July	To be completed biannually, generally in January and July	Completion of inspection forms
Wild dog and fox pest management program	All	Annual baiting programs carried out	Annual baiting programs carried out	Annual baiting programs carried out	Annual baiting programs carried out	Instances of vertebrate pest detection reduced to acceptable levels
Wild pig pest management program	All	Targeted trapping and shooting carried out	Targeted trapping and shooting carried out	Targeted trapping and shooting carried out	Targeted trapping and shooting carried out	Instances of vertebrate pest detection reduced to acceptable levels
Other pest management programs (i.e. cat, rabbit, goat)	All	Periodic management programs carried out as required by monitoring results	Periodic management programs carried out as required by monitoring results	Periodic management programs carried out as required by monitoring results	Periodic management programs carried out as required by monitoring results	Instances of vertebrate pest detection reduced to acceptable levels

Table 5-10 – Vertebrate Pest Management Performance Criteria (PC) and Completion Criteria (CC)

5.3.11 Hygiene Protocol

Chytridiomycosis (chytrid fungus) is a fatal disease of amphibians and is caused by the chytrid fungus *Batrachochytrium dendrobatidis*. Access to the RNOA, as well as areas within the Ravensworth Complex disturbance footprint (which are mapped as having high potential habitat value) need to be managed in order to minimise the potential spread of the chytrid fungus. The chytrid fungus has been implicated in the decline of the Green and Golden Bell Frog (DECC 2007). A hygiene protocol to minimise the threat of the spread of chytrid fungus has been prepared to minimise the potential spread of the pathogen into the known and potential habitat areas of the Green and Golden Bell Frog within the BOAs and the Ravensworth Complex disturbance footprint. The Green and Golden Bell Frog Hygiene Protocol has been developed in consideration with the *Hygiene Protocol for the Control of Disease in Frogs* (NPWS 2001).

The Hygiene Protocol applies to both the construction and operational phases of the Ravensworth Complex. The Hygiene Protocol includes a procedure for disinfecting vehicles, equipment and personnel prior to entry into RNOA or high quality habitat dams.

5.3.12 Bushfire Management

Vegetation within the BOAs will require appropriate bushfire management to provide necessary protection for the significant ecological features known to occur (see ***Table 5-11***). The Ravensworth Offset Area Bushfire Management Plan has been developed to meet statutory land management requirements, assess bushfire hazards through fuel load and terrain assessment, and outline management approaches including the development and ongoing maintenance of Strategic Fire Advantage Zones (SFAZ) and Land Management Zones (LMZ).

The reduction of fuel loads by mechanical means and through the use of fire are also considered in the plan as prevention measures to reduce the likelihood of uncontrollable wildfire. The utilisation of a mosaic of prescribed ecological burns may provide some temporal benefit in fuel reduction in the BOA. Any fuel reduction burns will be conducted at a time when it is likely to cause minimal impact to threatened species or endangered ecological communities. The best time will be decided after careful consideration of the fire ecology of the threatened species or vegetation community and consultation with the rural fire service for controlled burning.

5.4 Specific Flora and Fauna Management Strategies and Monitoring

5.4.1 Construction of Supplementary Habitat for the Green and Golden Bell Frog

The Green and Golden Bell Frog (*Litoria aurea*) was detected in the RNOA during surveys in 2001 and 2009. This population forms part of the Upper Hunter Green and Golden Bell Frog Key Population and therefore is considered to be an important population for the survival of the species in NSW.

Supplementary habitat for the Green and Golden Bell Frog (*Litoria aurea*) will be constructed to provide a habitat linkage between Davis and Bayswater Creeks, within and adjacent to RNOA. A series of 10 ponds that provide suitable habitat for the Green and Golden Bell Frog will be established within RNOA (see ***Table 5-12***) and will feature the following habitat components:

- Dams will be unshaded;
- Dams will be free of predatory Mosquito Fish (*Gambusia holbrookii*);
- Adjacent diurnal sheltering sites (piles of rocks and/or logs);
- Contouring of banks to increase the area of shallow reed beds; and
- Woodland and open grassland habitats in proximity to constructed Green and Golden Bell Frog habitats.

A further 10 ponds will be constructed in rehabilitated vegetation to provide additional fauna microhabitats in the post mining landscape. These dams will be constructed to provide habitat for the Green and Golden Bell Frog. These works will involve the following actions:

- Earthworks will be undertaken to create ponds with contoured banks and shallow profiles that can be planted to provide wide areas of shallow reedbeds for Green and Golden Bell Frogs to shelter and forage in, as well as deeper central areas;
- Ponds will be allowed to refilled with water; and
- Ponds will be re-planted with a variety of species of emerging vegetation.

In addition to the new ponds, existing farm dams in the RNOA and HOA (South) will be augmented in order to provide suitable habitat for the Green and Golden Bell Frog. Strategies to improve the habitat value of these dams will include (but not be limited to):

- Exclusion of stock to improve water quality, where required;
- Supplementary planting of suitable emergent vegetation, where required;
- Emplacement of microhabitats suitable for Green and Golden Bell Frogs such as logs, rocks, woodland and grassland; and

Implementation of a monitoring program for the Green and Golden Bell Frog and predatory Mosquito Fish (*Gambusia holbrookii*) (see **Section 6.4**).

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	CC
Development of a Bushfire Management Plan	All	BOA Bushfire Management Plan completed				Complete
Undertake community consultation with neighbouring managers to foster fire prevention and cooperation.	All	To be completed annually	To be completed annually	To be completed annually	To be completed annually	Ongoing
Review fuel loads and any required fuel reduction measures	All	To be completed annually	To be completed annually	To be completed annually	To be completed annually	Ongoing

Table 5-11 – Bushfire Management Performance Criteria (PC) and Completion Criteria (CC)

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
Habitat enhancement of existing dams within RNOA and in the south of HOA	All	Existing dams enhanced and habitat established				RNOA and HOA Dams enhanced and being monitored and maintained.
Construct 10 new Green and Golden Bell Frog ponds in RNOA	All	Ponds constructed and pond habitat established				New frog ponds in place and being monitored and maintained

Table 5-12 – Green and Golden Bell Frog Habitat Augmentation Performance Criteria (PC) and Completion Criteria (CC)

6. Biodiversity Monitoring Program

6.1 General Ecosystem Monitoring

The Ravensworth Biodiversity Offset Area Management Program contains a detailed program that will be implemented to monitor the effectiveness of measures that have been proposed to achieve the management objectives of the BOAs. A summary of the Biodiversity Monitoring Program for the BOAs is summarised in the following sections.

6.1.1 Vegetation Condition Assessment

Data collected in 2013 under the vegetation condition monitoring methodology forms the baseline dataset (Year 0 data) for assessing vegetation condition in the BOAs.

Under this methodology a total of 28 vegetation condition assessment sites were established across the BOAs (see ***Table 6-1***). Within each BOA, an equal number of sites were established within grassland habitats and woodland/forest habitats. ***Table 6-1*** lists the vegetation communities in which sites were established and the number of sites within each BOA. Assessment will be undertaken for threatened ecological communities and species consistent with Condition 33 of Schedule 3 of PA 09_0176.

Vegetation Community	RNOA (# of sites)	HOA (# of sites)	COA (# of sites)	SOA (# of sites)
Central Hunter Box-Ironbark Woodland	2			
Central Hunter Ironbark - Spotted Gum – Grey Box Forest		3	3	2
Central Hunter Ironbark - Spotted Gum – Grey Box Forest (Red Gum Variant)				1
Central Hunter Swamp Oak Forest	1			
Barrington Footslopes Dry Spotted Gum Forest		1		
Grey Gum - Rough-barked Apple Forest on Sheltered Slopes		1		
Derived Grassland	3	5	3	3
Total	**6**	**10**	**6**	**6**

Table 6-1 – Vegetation Communities Containing Vegetation Condition Assessment Sites

At each vegetation condition assessment site, 20 x 50 metre quadrats have been permanently marked by placement of a star picket in the centre point of the eastern boundary and the centre point of the western boundary with the location recorded using a handheld GPS unit.

The purpose of surveying the vegetation condition assessment sites is to collect data on the species composition, structure and condition in representative areas of the different habitat types present in the BOAs. Data collection is to occur at the initiation of the management process to continue over consecutive years to allow for ongoing monitoring to determine the health and condition of the habitat. Data collection will follow the *BioBanking Assessment Methodology* (OEH, 2008) (BBAM).

Surveys of the vegetation condition assessment sites included the following:

- Collection of data from a 20m x 20m plot positioned within the 50m x 20m plot (identified between two permanent star pickets), including:
  - Floristic data:
    - All vascular flora species present;

  - The stratum in which each species occurred;
  - The relative frequency of occurrence of each plant species (using a modified Braun-Blanquet scoring system (Braun-Blanquet, 1927);
- Within the 50m x 20m plot, structural data will be collected along a 50m transect which includes:
  - Structural data:
    - Native canopy (tree) projective foliage cover (PFC);
    - Native midstorey PFC (i.e. cover of native shrubs/small trees >1m);
    - Native groundcover PFC (< 1m);
    - Weed canopy/midstorey PFC (i.e. cover of weeds >1m);
    - Weed groundcover PFC (< 1m);
    - Mosses and lichens % cover;
    - Organic litter % cover;
    - Rock/bare ground % cover;
- Collection of data from the 20m x 50m quadrat will also include:
  - Regeneration of canopy species;
  - Evidence of disturbance by feral animals;
  - Fallen logs and dead standing timber;
  - Photographs of the quadrat, with the orientation being from the star picket in the north east corner, looking south west.

The flora species recorded in each quadrat will be compared to the species lists in *Error! Reference s ource not found.* to determine whether the species composition of the rehabilitation is consistent with the target vegetation communities. If any key target species are missing from the quadrats, those deficiencies will be addressed through adaptive management works.

6.1.1.1 Bird Census

The purpose of the annual bird census survey is to measure the success of regeneration of grassland to woodland/forest habitats within the BOAs. This is achieved by comparing bird assemblages and diversity in grassland sites to results obtained in adjacent existing woodland/forest habitats within the BOAs. Bird census monitoring sites were established in 2012 and occur at the same locations as the vegetation condition assessment sites. At each site, bird species will be surveyed using a 2 ha area search for 30 minutes. All bird species observed and heard calling will be recorded. This monitoring will be completed annually in conjunction with the vegetation condition assessments.

6.2 Targeted Threatened Bird Survey

The purpose of a targeted threatened bird survey is to collect data on the use of the BOAs by the EPBC Act listed Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) as these species have the potential to occur in the Hunter Valley during winter. Swift Parrots have been observed foraging on SOA (see ***Figure 4-10***). Diurnal surveys to target the Swift Parrot and Regent Honeyeater will be undertaken at a minimum of two points within each BOA. Each point will be surveyed for a period of 30 minutes and all threatened bird species observed or heard calling will be recorded. Targeted surveys for Swift Parrot and Regent Honeyeater will take place annually during winter to maximise the detection of these species.

6.3 Microbat Survey

The purpose of a microbat survey is to assess whether the habitats being created within the BOAs are commensurate with the native fauna occurring within the existing woodland/forest habitat. Surveys for small insectivorous bats (microbats) were initially undertaken in 2012 using ultrasonic call detection methods. Surveys for microbats will occur every second year (i.e. 2016, 2018, etc) at each BOA.

6.4 Green and Golden Bell Frog Survey

The purpose of a targeted Green and Golden Bell Frog (*Litoria aurea*) survey is to collect data to provide a better understanding of the local population of the species and assess the quality of habitat within RNOA and HOA. Surveys will occur annually and target dams and habitats previously identified as moderate/high quality habitat within RNOA and HOA.

Diurnal surveys included visual inspections of the habitat to determine the presence of Mosquito Fish (*Gambusia holbrooki*), an assessment of the quality of habitat and searches for individual Green and Golden Bell Frogs.

Nocturnal surveys included spotlight searches for individual Green and Golden Bell Frogs with the aid of call playback.

Surveys will be undertaken in accordance with the Commonwealth *Survey Guidelines for Australia's Threatened Frogs* (DEWHA 2010), which recommend that nocturnal surveys should be conducted on at least four different nights, in appropriate seasons (November to February) and weather conditions (warm still nights within one week of rainfall >50mm).

6.5 Fauna Monitoring

Fauna monitoring will be undertaken at permanent monitoring locations every second year for the RNOA (i.e. 2016, 2018, etc) due to the potential for adverse impacts from adjacent mining operations.

Fauna monitoring will be employed for the other BOAs if the general ecosystem monitoring undertaken indicates deterioration in habitat quality.

At each fauna monitoring point, a range of fauna survey techniques will be employed to determine ongoing fauna use of habitat within the BOA, specifically targeting key threatened species known to occur in the BOAs and the wider Ravensworth Complex. The types of surveys that will be required to undertake adequate monitoring of fauna include:

- Diurnal and nocturnal bird surveys;
- Spotlighting;
- Herpetological surveys; and
- Hair funnels to detect terrestrial and arboreal mammals.

Fauna surveys will specifically target threatened species previously recorded, or with potential to occur, within the area. Fauna surveys will be undertaken in accordance with *Threatened Species Survey and Assessment: Guidelines for development and activities* (working draft) (DEC 2004).

6.6 Analysis of Results

The results of all biodiversity monitoring will be analysed and compared to previous survey results to determine general trends and as necessary, appropriate management measures will be implemented as a result of monitoring outcomes (see ***Table 6-2***).

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
Establish vegetation condition assessment	All	28 vegetation condition assessment sites established across BOAs and monitoring undertaken annually	Monitoring undertaken annually	Monitoring undertaken annually	Monitoring undertaken annually	Completion of monitoring reports and results used to direct management objectives
Establish bird census monitoring	All	Establish monitoring at vegetation condition assessment sites and monitoring undertaken annually	Monitoring undertaken annually	Monitoring undertaken annually	Monitoring undertaken annually	Completion of monitoring reports and results used to direct management objectives
Establish targeted threatened bird monitoring	All	Establish monitoring sites across BOAs and monitoring undertaken annually during winter	Monitoring undertaken annually during winter	Monitoring undertaken annually during winter	Monitoring undertaken annually during winter	Completion of monitoring reports and results used to direct management objectives
Establish microbat monitoring	All	Microbat monitoring sites established across BOAs and monitoring undertaken biennially	Monitoring undertaken biennially	Monitoring undertaken biennially	Monitoring undertaken biennially	Completion of monitoring reports and results used to direct management objectives

PC and CC	Management Zones	Year 3 PC (2017)	Year 6 PC (2020)	Year 9 PC (2023)	Year 12 PC (2026)	Status
Establish Green and Golden Bell Frog habitat assessment	All	Assessment of sites established in moderate/high quality habitat within RNOA and HOA and monitoring undertaken annually	Monitoring undertaken annually	Monitoring undertaken annually	Monitoring undertaken annually	Completion of monitoring reports and results used to direct management objectives
Establish fauna monitoring	All	Fauna monitoring sites established and monitoring undertaken biennially in RNOA and systematically in other BOAs if habitat deterioration detected	Monitoring undertaken biennially in RNOA and systematically in other BOAs if habitat deterioration detected	Monitoring undertaken biennially in RNOA and systematically in other BOAs if habitat deterioration detected	Monitoring undertaken biennially in RNOA and systematically in other BOAs if habitat deterioration detected	Completion of monitoring reports and results used to direct management objectives

Table 6-2 – Biodiversity Monitoring Performance Criteria (PC) and Completion Criteria (CC)

7. Additional management and monitoring measures for disturbance and rehabilitation areas (excluding BOAs)

The following management measures are conducted in all areas of the Ravensworth Mine Complex as shown on ***Figure 1-2*** excluding the RNOA.

7.1 Pre-clearing Surveys

Prior to any ground disturbing activities, a GDP is required to be approved by the Environment and Community Manager (ECM) or their delegate, Mine Surveyor and Task Coordinator. The purpose of the GDP is to ensure that the required environmental approvals have been received and appropriate environmental management controls have been implemented prior to the commencement of work. Controls outlined on the GDP are to be implemented before any ground disturbing activities may commence.

A pre-clearing survey procedure has also been developed for the Ravensworth Complex and BOAs to minimise the impact of clearing on native species (both threatened and non-threatened), as well as significant habitat features. A series of operational procedures and forms have been developed to minimise the impact of vegetation clearing on native species. Ravensworth Operations maintains a pre-clearing survey procedure and form for Ravensworth Complex. The procedure and form are regularly reviewed and updated. Pre-clearing surveys will be required before areas of woody native vegetation (including shrublands and scattered trees within grassland) are to be cleared. In all cases, a suitably qualified ecologist is required to complete the pre-clearing surveys. The pre-clearing surveys and tree felling procedures aim to identify significant ecological features within areas to be cleared and make all reasonable attempts to minimise the impact of the clearing on them.

7.2 Salinity Management

Any potential saline water run-off from stockpiles or stripped soil surfaces will be captured within the Ravensworth Complex dirty water management system. Dams and drainage lines within the water management system are inspected and monitored on a regular basis.

Dams within the water management system are regularly monitored and managed to minimise the potential for environmental harm. Ravensworth Complex is also a participant of the Hunter River Salinity Trading Scheme (HRSTS) and as such has specific licence conditions relating to monitoring of mine water during discharge events. Mine water transfer is also managed through the Greater Ravensworth Water Sharing System (GRWSS). The GRWSS involves the sharing of water resources across a number of Glencore operations in the Ravensworth region. The GRWSS facilitates effective management of water across the participating sites, enables the sharing and beneficial use of water between operations and helps to reduce the potential impacts associated with saline mine water discharge into the Hunter River system by reducing the amount of discharge required.

7.3 Topsoil Management

A Topsoil Stripping Management Plan (Document: RAVCX-307024981-5670) has been established for the Ravensworth Complex. The purpose of this plan is to detail the process to be followed to maximise the opportunity to salvage and beneficially re-use topsoil in rehabilitation. As per the GCAA and Topsoil Stripping and Handling Procedure Management Plan requirements, all relevant information

on topsoil characteristics and stripping details is recorded on a database for later inclusion on a *Rehabilitation Establishment and Methodology Record Form.* Where there are opportunities to salvage topsoil-type material for rehabilitation purposes, measures will be adopted to protect its quality and enhance rehabilitation outcomes. Topsoil and subsoil stripping is to be undertaken in accordance with the GDP process and the Topsoil Stripping Management Plan. In general, topsoil and subsoil stripping is to involve the key considerations as outlined below:

- Pending the outcomes of soil characterisation where appropriate and practical, treatment of the soils to address potential rehabilitation constraints is to be undertaken. This may include but is not necessarily limited to the application of gypsum to overcome potential sodicity issues, microbial treatments to enhance microbial activity in soil and the addition of mulch material from clearing as a means to increase soil carbon;
- Where possible, topsoil and subsoil will be stripped when moist to help maintain soil structure and to reduce dust generation. Topsoil stripping is not recommended when topsoil is completely saturated, as it may result in compaction, loss of structure and microorganisms;
- Topsoil and subsoil stripping activities are to be restricted on extremely windy and dry days to minimise the potential for dust generation;
- Topsoil and stripping depths are to be undertaken in accordance with the relevant Ravensworth North Topsoil Stripping Plan using appropriate equipment (i.e. dozer or scraper);
- Pending the outcomes of topsoil and subsoil characterisation analysis where feasible and practical, soil stripping techniques may be adjusted to maximise the viability of the soil seed bank as well as facilitate the segregation of topsoil and subsoil layers;
- Wherever possible, topsoil is to be transferred directly from stripping and re-spread to areas that have been reshaped for rehabilitation, eliminating the need for storage and rehandling;
- Where required, machinery used to handle and transport topsoil shall be washed down prior to and at the completion of works to minimise the transfer of weeds; and
- The potential for cultural heritage items in the area to be stripped will be considered prior to the commencement of works through the GDP process. If any items of cultural significance are identified during works appropriate actions will be undertaken in accordance with the Ravensworth Complex ACHMP.

All relevant information on topsoil characteristics and stripping details will be recorded for later use in rehabilitation planning and the interpretation of rehabilitation monitoring results.

7.4 Transplanting Threatened Flora and Native Grassland

Condition 38(c) of Schedule 3 of PA 09_0176 requires that the BOMP include a detailed description of what measures would be implemented for "…*salvaging, transplanting and/or propagating threatened flora and native grassland, based on additional survey and research*."

Condition 33 of Schedule 3 of PA 09_0176 states that rehabilitation and offsetting is to be focused on the re-establishment of the following threatened flora species:

- Lobed Blue-grass (*Bothriochloa biloba*);
- Weeping Myall (*Acacia pendula*); and
- River Red Gum (*Eucalyptus camaldulensis*).

Accordingly, these species are considered to be the highest priority species from a management perspective. As explained in **Section 7.1**, pre-clearing surveys are undertaken prior to disturbing areas of native vegetation. As part of the GDP process, the ECM (with advice from ecologists conducting

pre-clearing surveys) will identify whether it is practicable to relocate individuals of priority threatened flora species (if present).

It is considered that the Lobed-Blue-grass is the only priority threatened flora species which is able to be translocated. Weeping Myall and River Red Gums are unlikely to survive a relocation given their overall size and complex root structures.

If translocation is considered practicable by the ECM, it will be included as a requirement of the GDP. The individuals of the priority flora species will be translocated to either a BOA or to an active rehabilitation area. The translocation methodology will be developed by the ECM on a case by case basis in consultation with ecologists.

As little is currently known about the methods or success rates for translocating threatened flora species (in general) or native grasslands, translocation effects (where undertaken) will be treated as research-based experimental procedures. Detailed records will be maintained on works relating to this requirement, and these will be reviewed regularly in order to assess their success and make improvements to the methodology (if required). All translocation/salvage works will be subject to ecological monitoring, and will be reported on in the Annual Review. Further research initiatives will also be reported in the Annual Review.

7.5 Bushfire Management

Appropriate bushfire management is required to protect life and property, while providing necessary protection to the significant ecological features of the area. An emergency response plan has been prepared for Ravensworth Complex and related management actions will be undertaken in accordance with that plan and the Ravensworth Offset Area Bushfire Management Plan. The Ravensworth Offset Area Bushfire Management Plan outlines bushfire management actions, which prioritise the protection of life and property, along with the significant ecological features within the BOAs. Bushfire management planning for the BOAs will consider:

- Exclusion of bushfire from rehabilitation, revegetation and regeneration areas to allow replanted and regenerating communities to mature (nominally at least 15 years, but dependent on the success of plant establishment and the vegetation community present);
- Consideration of known records of threatened species, endangered populations and EECs (see **Section 4.8**);
- Asset and livestock protection; and
- Appropriate incorporation of all relevant ecological requirements into the Ravensworth Offset Area Bushfire Management Plan.

Reviews of the Ravensworth Offset Area Bushfire Management Plan will be undertaken by Ravensworth Operations on a regular basis.

7.6 Creek Rehabilitation

Creek rehabilitation will be undertaken in accordance with the Ravensworth Complex Creek Diversion Management Plan (CDMP). The CDMP provides a framework for the rehabilitation of the existing Bayswater Creek Diversion and construction, design and management of the Emu Creek diversion.

The final landform (post rehabilitation works) for Emu Creek will contain drainage channels that will replace the current channel, post closure.

Plans to restore riparian habitat and in-stream aquatic habitat within Bayswater Creek and Emu Creek are briefly outlined below, and will be further detailed within the CDMP and the MOP. Detailed

rehabilitation planning will be informed by aquatic ecological monitoring to be undertaken within the Ravensworth Complex.

The design and construction of the drainage channels within the post-mining final landform will include:

- Dams and drainage channels with shallow sloping edges to allow the planting of aquatic macrophytes and sedges;
- A meandering design to slow down water movement and retain water within the landscape longer;
- Drainage channels with features to enhance habitat complexity such as pool and riffle sequences;
- Salvaged habitat features such as fallen timber and boulders will be carefully positioned within the bed of drainage channels and edges of dams to provide in-stream structures and habitat; and
- Reconstructed or augmented aquatic habitats will be included within the monitoring program.

7.7 Management of Grazing and Agriculture

All rehabilitation areas will be fenced to exclude stock or human access, where appropriate. Domestic stock will be removed from all native vegetation post-mining rehabilitation areas.

Appropriate signage will be installed to identify specific significant ecological features, where necessary to prevent accidental damage.

7.8 Rehabilitation of Disturbed Areas

In general, rehabilitation activities at the Ravensworth Complex will be undertaken in spring and autumn, however, opportunistic rehabilitation may be practised if areas become available for seeding or planting in summer and winter. After surface soil amelioration and tillage is completed for any given area, rehabilitation will commence as soon as practicable.

The rehabilitation strategy for the Ravensworth Complex primarily involves the establishment of self-sustaining ecosystems, which will link to remnant stands of native vegetation.

In regards to native ecosystem establishment, rehabilitation will primarily involve direct seeding of native species along with a cover crop or other organic material (e.g. wood mulch if available) as required to prevent soil loss and add biomass to the profile.

A range of techniques will be employed to remediate disturbed land, including the following:

- Prior to revegetation activities, the substrate will be characterised to determine the type and application rate that may be required for the addition of soil ameliorants (e.g. gypsum, lime, fertiliser, biosolids etc.);
- Where appropriate and practical, soil ameliorants will be applied for incorporation into the final shaped surface;
- Where tree establishment is planned, final shaped surfaces will be deep ripped, where practical, parallel with the contour prior to the application of seed to provide for an adequate seed bed;
- Suitable erosion control measures (e.g. catch drains, sediment dams, silt fences, mulches etc.) will be implemented to minimise soil loss from areas undergoing rehabilitation;
- Where appropriate and practical, structures such as tree hollows, logs and other woody debris will be incorporated into the final landform to augment the habitat value of the proposed vegetated corridors;

- The installation of appropriate habitat structures (e.g. woody debris, rocks, ponds) where practical; and
- The planting and or direct seeding of native species of local provenance, where available.

Rehabilitation techniques will be refined over the life of mining operations through an ongoing process of research, trialling, monitoring and improvement.

Further details on the management of rehabilitation activities for the Ravensworth Complex are included in the Mining Operations Plan (MOP) approved from time to time by the Resources Regulator.

7.9 Visual and Lighting Impact

The design of the mine plan has considered potential visual impacts on surrounding areas, considering the distance to potentially affected areas and shielding provided by natural topographic features and the landforms associated with rehabilitated mining areas at the Ravensworth Complex. Ravensworth Complex has been designed to maximise the shielding afforded by these features as far as practicable.

The impacts of the potential views of the Ravensworth Complex are not considered significant due to long distances, transient nature of views, and the potential views being consistent with the established mining operations within the surrounding area.

Ravensworth Complex has committed to the implementation of a range of strategies to further minimise potential visual impacts on the surrounding area including maximising rehabilitation of disturbed areas, minimising potential night lighting impacts, and the use of strategic tree screening plantings to minimise potential views from the surrounding road network including the New England Highway and Lemington Road.

7.10 Rehabilitation Objectives

The primary rehabilitation objectives are described in the Rehabilitation Management Plan (RMP) (known as the MOP) for the Ravensworth Complex.

The progressive rehabilitation strategy has been designed to meet land use objectives in accordance with Condition 41 of Schedule 3 of PA 09_0176. However, in recognition of the likely operational life of the Ravensworth Complex, the potential for other sustainable and economically productive post-closure land uses will be investigated in light of the local and regional government land uses strategies that may have further evolved towards the end of the mine life. This process will be undertaken as part of the GCAA detailed mine closure process, in consultation with the relevant government and community stakeholders.

Management of rehabilitation at Ravensworth Complex will be under the guidance of DPIE and Resources Regulator through the implementation of the approved MOP. DPIE and Resources Regulator will continue to oversee Ravensworth Operations' management of rehabilitated areas under the approved MOP until the rehabilitation areas get to a point where the maturity and quality is sufficient to be managed as a biodiversity offset. Once this level is met, the rehabilitation areas will be managed by DPIE and Resources Regulator under the approved MOP.

7.11 Ecological and Rehabilitation Monitoring

Ravensworth Complex has an existing ecological monitoring program for its Operation which is implemented at the site, with the results reported externally in the Annual Review.

This program includes monitoring of fauna, remnant vegetation, rehabilitated areas and the use of nest boxes.

Additions to the existing monitoring program at Ravensworth Complex are discussed in the following sections and include the following:

- Monitoring of residual vegetation – to be undertaken annually;
- Long term rehabilitation and revegetation monitoring – to be undertaken annually;
- Annual rehabilitation inspections; and
- Fauna monitoring – to be undertaken at least once every three years.

7.11.1 Monitoring of Residual Vegetation (Analogue Sites)

The condition of residual vegetation within the Ravensworth Complex will be monitored to identify any deterioration or improvement in habitat quality during the life of the mine. It will also provide suitable data for comparison when assessing the performance of rehabilitation sites. Initially it is envisaged that this monitoring will be undertaken annually, however, where results are showing negligible change, the frequency of monitoring may be reduced (i.e. biennial) in consultation with regulatory authorities.

The monitoring approach will undertake systematic and repeatable surveys at permanent monitoring plots of quadrats, which will be sampled in order to record species diversity and structural composition. Plots will be sampled using systematic, semi-quantitative, repeatable techniques, such as the Modified Braun-Blanquet Cover-abundance method (Braun-Blanquet 1927, Poore 1955, Austin et al. 2000), to ensure data are comparable over time with as little observer bias as possible.

Photo monitoring points will also be established within each of the permanent monitoring plots, to enable a visual assessment of changes over time.

The monitoring surveys will typically assess and systematically record the following vegetation characteristics:

- Floristic composition (including cover and abundance of species) and structure;
- General health of vegetation;
- Evidence of natural regeneration;
- Occurrence and abundance of weed species;
- Presence of threatened or other significant species;
- Signs of disturbance, either by stock or humans;
- Evidence of feral animals; and
- Any observable impacts of the Ravensworth Complex activities, such as the effectiveness of fencing and weed control actions.

7.11.2 Annual Rehabilitation Inspection and Long Term Rehabilitation and Revegetation Monitoring Program

Rehabilitation inspections and monitoring will take place in accordance with the methods detailed in the approved MOP. The objective of this monitoring is to evaluate the progress of rehabilitation and regeneration works towards fulfilling the above rehabilitation objectives and the related long-term land use objectives. This monitoring program will be continued until it can be demonstrated to the relevant regulatory agencies that rehabilitation and regeneration has satisfied the approved MOP closure criteria. Information from this monitoring will also be used to refine closure criteria and modify rehabilitation and regeneration procedures as required.

Outcomes of rehabilitation inspections and monitoring will be recorded and any required reasonable and feasible management actions that are identified as part of the inspection, are to be implemented. Where necessary, rehabilitation and revegetation procedures will be amended accordingly with the aim of continually improving standards.

7.11.3 Fauna Monitoring

At each of the proposed rehabilitation monitoring points, a range of fauna survey techniques will be employed to assess ongoing fauna use of habitat, particularly focussing on the ongoing presence of threatened species. It is proposed that thorough monitoring of fauna at the Ravensworth Complex be undertaken at least once every three years, consistent with rehabilitation monitoring and the MOP. Typical surveys that will be conducted to undertake adequate monitoring of fauna may include spotlighting, herpetological surveys, diurnal bird surveys, Anabat echolocation call detection, and the use of hair funnels to detect terrestrial and arboreal mammals. As the rehabilitated communities mature, the range of fauna monitoring techniques will increase, as microhabitats and niches for a wider range of species become established.

Fauna surveys will specifically target threatened species previously recorded, or with reasonable potential to occur within the area (see **Section 4.8.3**). The results of the monitoring will be analysed and compared to previous survey results to determine general population trends. In the event that negative trends are identified, indicating the possible decline of particular threatened species, appropriate amelioration measures will be determined. If fauna monitoring identifies a decline of a threatened species, an investigation will be undertaken against analogue sites to determine if the decline is common in other areas in the region. If the decline is not common to analogue sites, reasonable and feasible corrective actions will be undertaken in accordance with management measures. In the event that further threatened species are identified at the Ravensworth Complex, the monitoring program will incorporate surveys to adequately assess and monitor these species.

7.12 Revegetation Care and Maintenance

Dependent upon the outcomes of the rehabilitation monitoring programs as outlined above, the scope of the rehabilitation care and maintenance phase may include the following:

- Weed and feral animal control of rehabilitation;
- Erosion control works;
- Re-seeding/planting of rehabilitation areas that may have failed;
- Maintenance fertilising; and
- Repair of fence lines, access tracks and other general related land management activities.

It is envisaged that this program will be continued as required until it can be demonstrated to the relevant regulatory agencies that the rehabilitation of the Ravensworth Complex has satisfied the closure criteria.

In regards to areas returned to sustainable grazing, it will be the intention to manage these areas in accordance with their intended use as soon as practical after rehabilitation has become established. As discussed above, it will be the intention to intermittently graze cattle to facilitate soil profile development, pasture species diversity and demonstrate sustainability of this intended final land use.

7.13 Monitoring Records

7.13.1 Active Mining Records

During active mining operations, Ravensworth Operations will maintain records relating to processes that may impact upon the rehabilitation of the site. This will provide the basis for interpretation of later rehabilitation monitoring outcomes. Typical records to be maintained include the following:

- Detailed rehabilitation procedures;
- Register of contaminated sites, including bioremediation areas;
- Records of production wastes and other waste streams and where they are located on site;
- Environmental monitoring records, including surface and groundwater quality;
- A register of topsoil, subsoil and or other soil substitute stockpiles (e.g. biosolids), which includes information such as the date in which they were formed and maintenance works undertaken (e.g. weed control, planting with native legumes to maintain microbes, etc.); and
- Environmental incident records.

7.13.2 Rehabilitation and Revegetation Methodology Records

Ravensworth Operations will record the details of each rehabilitation and revegetation campaign so that they are available for later interpretation of rehabilitation monitoring results.

This will allow the continual improvement of rehabilitation and revegetation standards on site.

Amongst the key monitoring parameters to be included in the program are the following:

- Landform design details;
- Drainage design details;
- Substrate characterisation;
- Site preparation techniques (e.g. topsoil and source, time of sowing, soil ameliorants used, etc.);
- Revegetation methodologies (e.g. rate and type of fertiliser, cover crop and rate, seed viability;
- Weather conditions;
- Photographic records; and
- Initial follow-up care and maintenance works.

7.14 Monitoring Rehabilitation Progress against Closure Criteria

The domain specific preliminary closure criteria were developed during the response to submissions process part of the EA (Umwelt, 2010). Refinement of closure criteria will be undertaken through the development of a future conceptual closure plan for Ravensworth Complex in accordance with the approved MOP.

8. Complaints, Incidents and Non-compliances

8.1 Complaints

Complaints in relation to Ravensworth Operations' activities are able to be made via the Community Contact Line (1800 620 553), which is maintained 24 hours per day, seven days a week. Complaints may also be made via letter, fax (02 6570 0747), email (*Ravensworth_eandc@glencore.com.au*) or in person. All complaints received will be recorded and investigated by the ECM, or their delegate.

Complaints will be handled in accordance with Community Complaints Protocol 10.05 (GCAA-625378177-10296). The complaints handling procedure generally involves the following:

- Recording details of the complaint received;
- Responding to the complainant as soon as practicable following receipt of the compliant;
- Investigation of the complaint and recording of details in an action tracking database;
- Follow-up correspondence with the complainant following investigation of the complaint; and
- Implementation of corrective actions and training (if required).

A summary of all complaints will be reported in the Ravensworth Operations Annual Review.

8.2 Incidents and Corrective Actions

In accordance with the GCAA-625378177-9992 GCAA *Incident Protocol*, all hazards, near misses and incidents are to be reported to the supervisor of the relevant work area immediately. Environmental incidents are to be reported to the Ravensworth Complex ECM or their delegate. All incidents, hazards and near misses are reported and recorded in the site's CMO system. The system maintains information including any corrective / preventative actions that are identified as being required as a result of the incident and the completion of these are then tracked at monthly HSEC meetings.

Emergency response protocols for environmental incidents are included in the Ravensworth Complex Emergency Response and Incident Management Plan and the Ravensworth Complex Pollution Incident Response Management Plan.

A review of the effectiveness of the corrective / preventative action(s) is to be conducted during Monthly HSEC Meetings.

The procedure for reporting of incidents is outlined in Section 9.3.

8.3 Compliance Auditing

Independent Environmental Audits will be undertaken in accordance with Condition 8 of Schedule 5 of the PA 09_0176 and Condition 6 and Schedule 3 of DA 104/96. The measures and actions described within this BOMP is within the scope for the Independent Environmental Audit and will be used to determine whether the Ravensworth Complex is complying with the relevant rehabilitation, biodiversity and offset management requirements.

If a non-compliance is identified (whether by an audit or other means), an investigation will be conducted to determine the cause of the non-compliance and recommend corrective actions. The Secretary of DPIE will be notified of non-compliances as soon as practicable, and provided with the outcomes of the investigation. The procedure for reporting of incidents is outlined in Section 9.3.

9. Reporting and Documentation Requirements and References

All internal and external reporting will be undertaken in accordance with the requirements of the GCAA Monitoring, Measurement, Reporting and Review Guideline. These documents outline the processes required for internal and external reporting and review requirements for internal and external reporting for all GCAA operations.

BOMP reporting requirements for the various management strategies, including reporting frequency and timing, are identified in ***Table 9-1*** below.

9.1 Internal Reporting

The ECM will report to the Operations Manager, the results of investigations of any complaints or any unauthorised clearing or other activities not in accordance with the approval conditions relating to this BOMP (refer to **Section 1.6**).

If a non-compliance relating to biodiversity management or clearing is identified, an internal report detailing the circumstances of the non-compliance and resulting actions, will be developed and submitted to GCAA in accordance with GCAA SD Measurement and Reporting and the GCAA Monitoring and Review Guideline. External reporting will be undertaken in accordance with **Section 9.2**.

9.2 External Reporting

An Annual Ecological Monitoring Report will be prepared and will document the monitoring methods and results from the winter monitoring period through to the autumn monitoring period. Ecological monitoring is conducted in accordance with the BBAM, which requires quantitative assessment of ten site attributes at each monitoring quadrat. The ten site attributes are used to calculate a Site Value Score. The Ecological Monitoring Reports will present both the Site Values Score and the ten attribute values for each quadrat.

Annual Ecological Monitoring Reports will include a comparison of that year's data with previous years' results to evaluate rehabilitation progress. These reports will also include management recommendations and ameliorative methods for ongoing biodiversity offset management of Ravensworth Complex. The annual Ecological Monitoring Report will be summarised as part of the Ravensworth Complex Annual Review, which will be submitted to DPIE and other relevant regulatory departments (including BCD). Annual Ecological Monitoring Reports and Annual Reviews will be made publicly available on the Ravensworth Operations website.

All other reporting will be undertaken in accordance with the requirements of the Ravensworth Complex EMS.

Report	Frequency	Requirements	Personnel
BOA inspection report/form	Minimum twice a year	Complete a BOA drive over and inspection, investigating aspects such as fence and gate condition, signage, access track condition, weeds, rubbish dumping, erosion and sedimentation, observations of stock and any other general observations	Competent site personnel

Report	Frequency	Requirements	Personnel
Weed management report	Upon completion of each control program	Contractor to report on information on areas worked, timing of works, techniques used, any issues encountered, recommendations and the control program for the subsequent year.	Weed management contractor
Vertebrate pest management report	Upon completion of each control program	Contractor to report on timing of works, techniques used, data on kills or bait update, any issues encountered, maps and data on the areas of impact and population estimates per species, recommendations and the control program for the subsequent year/s. In the report, monitoring results of area of impact and population size estimates should be compared to previous years of monitoring to identify any trends in vertebrate pest control performance.	Vertebrate pest management contractor
Annual biodiversity monitoring	Annually	Consultant to compile and analyse results of flora and fauna monitoring and to compare against performance criteria for this BOMP.	Prepared by consultant
EPBC 2010/5389 Compliance Report	Annually	Complete a report that reviews the compliance status of Ravensworth Operations against the conditions of EPBC 2010/5389 in the previous year. Report to be sent to DoAWE and published on the Ravensworth Operations website.	Prepared by consultant or competent site personnel
Ravensworth Complex Annual Review	Annually	Summarise operational and environmental activities for the previous year including annual review requirements, review of compliance with MOP, development approvals, EPBC Approval and other approvals and description of non-compliance/exceedances, rehabilitation progress, comprehensive monitoring results and complaints information.	Prepared by consultant or competent site personnel

Table 9-1 – Reporting Requirements

9.3 Non-compliance & Incident Reporting

In the event of any incident, the Secretary of DPIE (as well as any other relevant agencies) will be notified as soon as practicable after Ravensworth Complex becomes aware of the incident. Within seven days of identifying an incident relating to this BOMP, Ravensworth Operations will provide a written report to DPIE and other relevant regulatory agencies in accordance with Condition 6 of Schedule 5 of PA 09_0176.

Categories of environmental incidents are to be defined in accordance with GCAA-625378177-9992 GCAA *Incident Protocol.*

9.4 Contingency Plan

Ravensworth Operations undertakes an Environment and Community Broad Brush Risk Assessment (BBRA) on an annual basis to identify significant risks and the controls necessary to effectively manage them. A number of risks relating to biodiversity and rehabilitation management at Ravensworth Complex have been identified, as detailed in ***Table 9-2*** below.

Risk	Controls
Clearing Land – Clearing unauthorised areas (vegetation, threatened species).	Disturbance boundaries are clearly marked. GDPs are prepared and implemented for all vegetation clearing. A register of all threatened species and EECs is kept on site.
Mine Rehabilitation - Failure to comply with regulatory conditions (landform height, design, drainage, species).	LOM and annual rehabilitation planning and resource allocation. Annual rehabilitation monitoring. Internal and external audits. MOP approval.
Mine Rehabilitation - Failure to meet area rehabilitation targets or criteria.	LOM and annual rehabilitation planning and resource allocation. Annual rehabilitation monitoring. Internal and external audits. MOP approval.
BOAs – Failure to meet performance targets or completion criteria	BOA performance and completion criteria BOA land management and monitoring program (see ***Section 5***).
Other – Bushfire.	Bushfire Emergency Response Plan. Offset Area Bushfire Management Plan Site emergency response procedures.

Table 9-2 – Identified risks and controls relating to biodiversity and rehabilitation management at the Ravensworth Complex

9.5 Records

In accordance with the conditions of PA 09_0176, DA 104/96 and the Ravensworth Complex document control procedures, monitoring records will be maintained on site for at least four years.

10. Biodiversity Offset Management Plan Review

In accordance with Condition 4 of Schedule 5 of PA 09_0176 and Condition 3 of Schedule 4 of DA 104/96, this BOMP will be reviewed and revised (if necessary) within 3 months of any of the following:

- The submission of an Annual Review;
- The submission of an incident report;
- Submission of an Independent Environmental Audit; and
- Any modification of PA 09_0176 or DA 104/96.

The Ravensworth Complex ECM is responsible for reviewing and revising (if necessary) the BOMP.

Reviews of the BOMP will reflect any changes in the environmental procedures and requirements of the Ravensworth Complex, advances in current technology or best practice methods, operational procedures or mine planning. This review will also take into account any relevant new threatened species listings. All revisions will be approved by DPIE, prior to implementation.

The land management strategies (see **Section 5**) will be measured against the performance criteria set in the previous three years and revised, if required, for the next three year period if any issues or improvement opportunities are identified. Improved information gathered as a result of BOA monitoring or recent studies will also be used to review and refine land management strategies and performance criteria.

11. References

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Ravensworth Operations (2010) *Offset Area Management Programme*.

Umwelt (Australia) Pty Limited (2010a) *Ravensworth Operations Project – Environmental Assessment*. Report prepared for Ravensworth Operations.

Umwelt (Australia) Pty Limited (2010b) *Ravensworth Operations - Continued Operations Ecological Assessment*. Appendix 7 of the Environmental Assessment. Report prepared for Ravensworth Operations.

OEH (2008) *BioBanking Assessment Methodology*. Published by Office of Environment and Heritage

12. Accountabilities

Refer to **Section 1.7**.

13. Document Information

Property	Value
Approved by	Environment and Community Manager
Document Owner	Environment and Community Coordinator
Effective Date	13/07/2021
Keywords	Biodiversity, Offset, Management

Table 13-1 – Document Information

13.1 Related Documents and References

Refer to **Section 11ferror** for reference information.

13.2 Change Information

Full details of the document history are recorded in the document control register, by version. A summary of the current change is provided in ***Table 13.2*** below.

Version	Date reviewed	Change Details
1	17/11/2015	Update of previous document (Ravensworth E&C and DoPE review) New format
2	05/06/2018	Annual update of document including changes regarding Cultural and European heritage management at HOA (Ravensworth E&C review)
3	13/07/2021	Update to respond to external audit comments and general revision by Ravensworth Operations (Ravensworth E&C, BCD, Resources Regulator and DPIE review)
4	28/09/2022	Update following approval of Modification 10 – DA104/96

Table 13-2 – Change Information

14. Consultation

Date	Stakeholder	Summary of Consultation	Ravensworth Contact
19/05/2014	NSW Office of Water (NOW) Hemantha De Silva	Copy of draft Biodiversity Management Plan for consultation in accordance with Schedule 3 Condition 38 of PA 09_0176	Greg Newton (Ravensworth Open Cut)
19/05/2014	Singleton Council (SC) Alison Clarke	Copy of draft Biodiversity Management Plan for consultation in accordance with Schedule 3 Condition 38 of PA 09_0176	Greg Newton (Ravensworth Open Cut)
19/05/2014	Environment Protection Authority (EPA) Mitch Bennett	Copy of draft Biodiversity Management Plan for consultation in accordance with Schedule 3 Condition 38 of PA 09_0176	Greg Newton (Ravensworth Open Cut)
02/06/2014	NOW, SC and EPA	Reminder email regarding consultation for draft Biodiversity Management Plan	Greg Newton (Ravensworth Open Cut)
02/0462014	Cheryl Palmer (EPA)	Email to EPA with link to location of management plan	Greg Newton (Ravensworth Open Cut)
12/06/2014	Richard Bath Office of Environment and Heritage (OEH)	Letter received from EPA identifying OEH's comments	Greg Newton (Ravensworth Open Cut)
10/08/2020	Steven Cox (BCD)	Comments on the draft BOMP provided in BCD letter dated 10 August 2020	Klay Marchant (Ravensworth Complex)
14/08/2020	Peter Ainsworth (Resources Regulator)	Comments on the draft BOMP provided by Resources Regulator dated 14 August 2020	Klay Marchant (Ravensworth Complex)
14/04/2021	Lauren Evans (DPIE)	The draft BOMP was revised to address comments from BCD and Resources Regulator. DPIE provided comments on the revised draft BOMP in its letter dated 14 April 2021.	Klay Marchant (Ravensworth Complex)

Table 14-1 – Consultation

Appendix A - Species Composition for Target EECs

Target EEC	Species
Central Hunter Grey Box – Ironbark Woodland	*Acacia pendula* *Acacia bulgaensis* *Ajuga australis* *Allocasuarina luehmanii* *Angophora floribunda* *Aristida ramose* *Austrostipa scabra* *Bothriochloa decipiens* *Brachychiton populneus* subsp*. populneus* *Breynia oblongifolia* *Brunoniella australis* *Bursaria spinosa* subsp*. spinosa* *Calotis lappulacea* *Callitris endlicheri* *Cassinia quinquefaria* *Cheilanthes sieberi* subsp*. Seiberi* *Cheilanthes distans* *Chloris ventricose* *Chrysocephalum apiculatum* *Cymbopogon refractus* *Cyperus gracilis* *Desmodium varians* *Dichondra repens* *Dodonaea viscosa* *Einadia nutans* *Eragrostis leptostachya* *Eremophila debilis* *Eucalyptus crebra* *Eucalyptus moluccana* *Glycine tabacina* *Lomandra multiflora* subsp*. multiflora* *Microlaena stipoides* var*. stipoides* *Melichrus ureceolatus* *Notelaea microcarpa* var*. microcarpa* *Phyllanthus virgatus* *Solanum cinereum* *Sporobolis creber* *Vittadinia cuneata*
Central Hunter Ironbark – Spotted Gum – Grey Box Forest	*Acacia falcata* *Acacia parvipinnula* *Allocasuarina luehmanii* *Brachyscome multifida* *Breynia oblongifolia* *Brunoniella australis* *Bursaria spinosa* subsp*. Spinosa*

Target EEC	Species
	Calotis cuneifolia *Cheilanthes sieberi* subsp*. Seiberi* *Chrysocephalum apiculatum* *Corymbia maculate* *Cymbopogon refractus* *Daviesia ulicifolia* subsp*. Ulicifolia* *Desmodium varians* *Dianella revoluta var. revoluta* *Dichondra repens* *Echinopogon caespitosus* var*. caespitosus* *Entolasia stricta* *Eremophila debilis* *Eucalyptus crebra* *Eucalyptus fibrosa* *Eucalyptus glaucina* *Eucalyptus moluccana* *Eucalyptus tereticornis* *Glycine clandestine* *Glycine tabacina* *Hakea sericea* *Hypericum gramineum* *Laxmannia gracilis* *Lissanthe strigosa* *Lomandra multiflora* subsp*. Multiflora* *Microlaena stipoides* var*. stipoides* *Melichrus urceolatus* *Opercularia diphylla* *Paspalidium distans* *Pomax umbellate* *Pratia purpurascens* *Pultenaea spinosa* *Solanum prinophyllum* *Stackhousia viminea* *Themeda australis* *Vemonia cinerea* var*. cinereal* *Wahlenbergia communis* *Wahlenbergia gracilis*
River Flat Eucalypt Forest	*Acacia floribunda* *Acacia parramattensis* *Acmena smithii* *Adiantum aethiopicum* *Angophora floribunda* *Angophora subvelutina* *Austrostipa ramosissima* *Backhousia myrtifolia* *Breynia oblongifolia* *Bursaria spinosa* *Casuarina cunninghamiana* subsp*. cunninghamiana* *Casuarina glauca* *Cayratia clematidea* *Centella asiatica* *Cheilanthes sieberi* subsp*. sieberi* *Clematis aristate* *Clematis glycinoides*

Target EEC	Species
	Commelina cyanea *Cymbopogon refractus* *Desmodium varians* *Dichelachne micrantha* *Dichondra repens* *Digitaria parviflora* *Doodia aspera* *Echinopogon caespitosus* var. *caespitosus* *Echinopogon ovatus* *Einadia hastata* *Einadia trigonos* *Entolasia marginate* *Entolasia stricta* *Eragrostis leptostachya* *Eucalyptus amplifolia* *Eucalyptus baueriana* *Eucalyptus benthamii* *Eucalyptus botryoides* *Eucalyptus elata* *Eucalyptus grandis* *Eucalyptus longifolia* *Eucalyptus moluccana* *Eucalyptus ovata* *Eucalyptus saligna* *Eucalyptus tereticornis* *Eucalyptus viminalis* *Euchiton sphaericus* *Eustrephus latifolius* *Galium propinquum* *Geitonoplesium cymosum* *Geranium solanderi* *Glycine clandestine* *Glycine microphylla* *Glycine tabacina* *Hardenbergia violacea* *Hydrocotyle peduncularis* *Hymenanthera dentata* *Hypolepis muelleri* *Imperata cylindrica* var. *major* *Livistona australis* *Lomandra filiformis* *Lomandra longifolia* *Lomandra multiflora* subsp. *multiflora* *Melaleuca decora* *Melaleuca linariifolia* *Melaleuca styphelioides* *Melia azedarach* *Microlaena stipoides* var. *stipoides* *Opercularia diphylla* *Oplismenus aemulus* *Oxalis perennans* *Ozothamnus diosmifolius* *Pandorea pandorana* *Paspalidium distans*

Target EEC	Species
	Persicaria decipiens *Phyllanthus gunnii* *Plectranthus parviflorus* *Poranthera microphylla* *Pratia purpurascens* *Pteridium esculentum* *Rubus parvifolius* *Sigesbeckia orientalis* subsp*. orientalis* *Solanum prinophyllum* *Stephania japonica* var*. discolor* *Themeda australis* *Trema aspera* *Tristaniopsis laurina* *Vernonia cinereal* *Veronica plebeian* *Viola hederacea* *Wahlenbergia gracilis*
Hunter Floodplain Red Gum Woodland Complex	*Alternanthera denticulata* *Amaranthus macrocarpus var. macrocarpus* *Angophora floribunda* *Aristida ramosa* *Austrodanthonia fulva* *Austrostipa verticillata* *Brachychiton populneus subsp. populneus* *Calotis lappulacea* *Carex inversa* *Casuarina cunninghamiana subsp. cunninghamiana* *Cheilanthes austrotenuifolia* *Chrysochephalum apiculatum* *Commelina cyanea* *Cynodon dactylon* *Cynoglossum australe* *Cyperus fluvus* *Cyperus gracilis* *Dichondra repens* *Echinopogon caespitosus var. caespitosus* *Einadia hastata* *Eindadia trigonos subsp. trigonos* *Eucalyptus camaldulensis* *Eucalyptus melliodora* *Eucalyptus tereticornis* *Geranium solanderi var. solanderi* *Glycine tabacina* *Lepidium pseudohyssopifolium* *Marsilea drummondii* *Melia azedarach* *Microlaena stipoides var. stipoides* *Notelaea microcarpa var. microcarpa* *Oxalis exilis* *Plantago debilis* *Pratia concolor* *Pratia purpurascens* *Rumex brownii* *Urtica incisa*

Planning, Industry & Environment

Klay Marchant
Environment and Community Manager
Ravensworth Coal
Lemington Road
Ravensworth, NSW, 2330

13/07/2021

Dear Mr Marchant

Ravensworth Operations Project (MP09_0176)
Biodiversity Offset Management Plan – Conditional approval

I refer to the Biodiversity Offset Management Plan which was submitted in accordance with Condition 38 of Schedule 3 of the approval MP 09_0176 for the Ravensworth Operations Project.

The Department has carefully reviewed the document and is satisfied that it meets the requirements of the conditions of approval.

Accordingly, the Planning Secretary has approved the he revised version of the Biodiversity Offset Management Plan submitted to the Department on 14 May 2021. Please ensure that the approved plan is placed on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Daniel Martin at daniel.martin@dpie.nsw.gov.au

Yours sincerely

Director
Resource Assessments
as nominee of the Planning Secretary

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