ECOLOGICAL MONITORING 2022

Lynwood Quarry, NSW

Prepared for:

Holcim (Australia) Pty Ltd
Level 8
Tower B
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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Holcim (Australia) Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.30045.00300-R01-v2.0	28 February 2023	F Iolini, J Beeton, J Drane	Jeremy Pepper	Jeremy Pepper
630.30045.00300-R01-v1.0	16 February 2023	F Iolini, J Beeton, J Drane	Jeremy Pepper	Jeremy Pepper

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1 Introduction

1.1 Background

SLR Consulting Australia Pty Ltd (SLR) was commissioned by Holcim (Australia) Pty Ltd ('Holcim') to undertake ecological and rehabilitation monitoring at the Lynwood Quarry in 2022. The Lynwood Quarry is a hard rock quarry approximately two kilometres west of Marulan, in the Southern Highland IBRA Region and Bungonia Sub-region of New South Wales (NSW) (see Figure 1).

Initial planning consent for the Lynwood Quarry was granted to Cemex (now Holcim) on 21 December 2005 for an approved five million tonnes per annum output. Since the original development approval, five modifications have been approved, with quarrying operations approved until 01 January 2038. Ecological and rehabilitation monitoring is a requirement of the project approval and associated ecology reports and management plans.

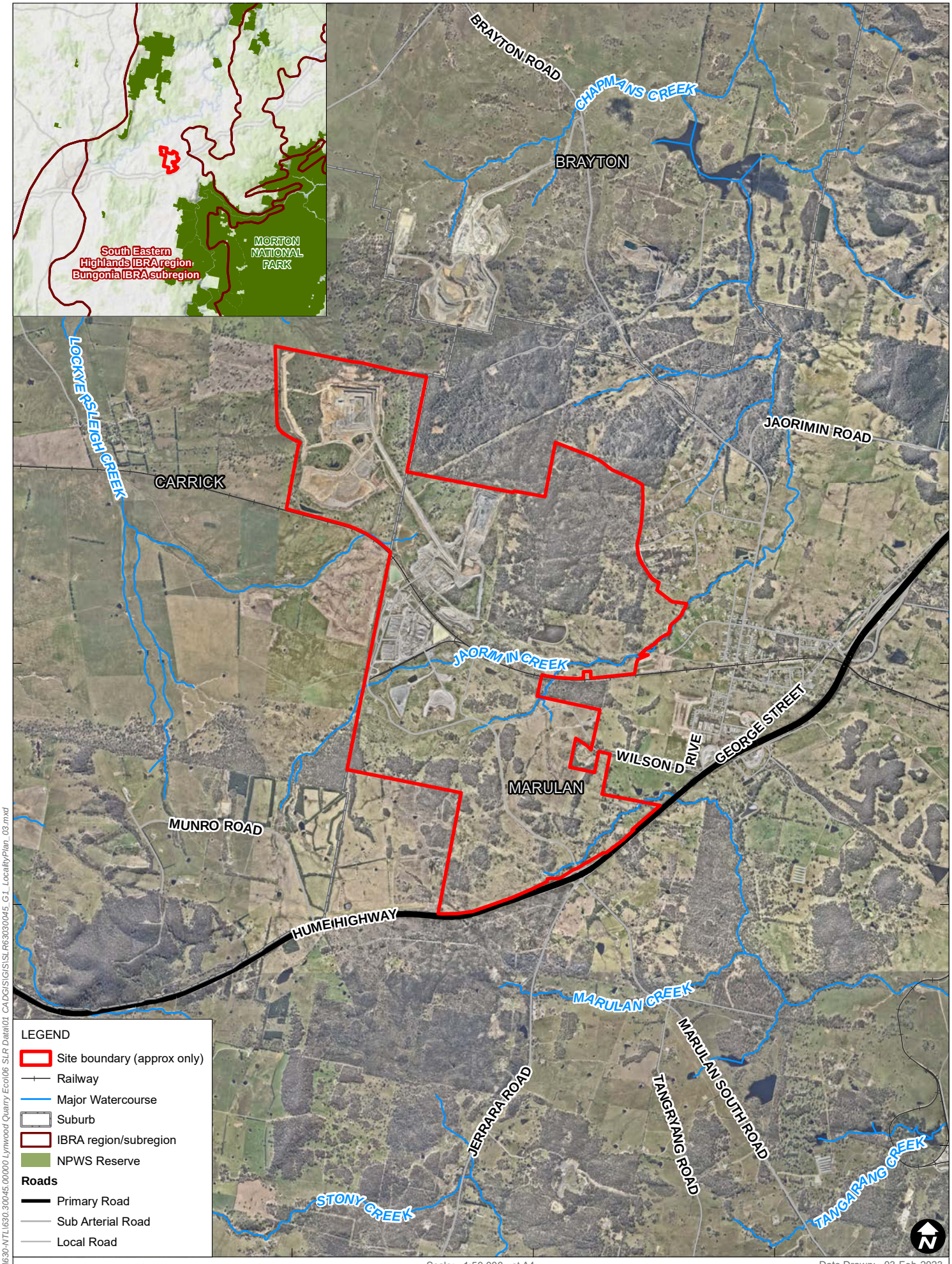
1.2 Previous Ecological Reports

Various documents were prepared during the approval phase of the quarry (Umwelt 2005, 2011, 2013, 2018a and 2018b) and these have been relied upon for background information in relation to the ecology, rehabilitation and management requirements of the site. A summary of previous ecological reports is provided below.

1.2.1 Ecological Assessment

Key findings of the Ecological Assessment (EA) (Umwelt 2005) are as follows:

- Four vegetation types occur across the site: Tableland Low Woodland, Western Tablelands Dry Forest, Tableland Grassy Box-Gum Woodland, Riparian Gum Box-Apple Woodland and Camden Woollybutt Low Open Forest.
- No threatened species of flora were recorded; however, potential habitat exists for Buttercup Doubletail Diuris aequalis, Pine Donkey Orchid Diuris tricolor, Cotoneaster Pomaderris cotoneaster, Tallong Midge Orchid Genoplesium plumosum and Cambage Kunzea Kunzea cambagei.
- Areas of retained vegetation across the site provide habitat for a suite of local fauna species as well as the following threatened species which are listed as 'vulnerable' under the Biodiversity Conservation Act 2016 (BC Act): Speckled Warbler, Squirrel Gilder, Eastern Coastal Free-tailed Bat (previously Eastern Freetail-bat), Eastern False Pipistrelle and Large Bent-winged Bat (previously known as Eastern Bentwing-bat).
- Potential habitat also exists for other BC Act listed threatened fauna species, including Giant Burrowing Frog, Rosenberg's Goanna, Striped Legless Lizard, Blue-billed Duck, Swift Parrot, Barking Owl, Masked Owl, Brown Treecreeper, Regent Honeyeater, Hooded Robin, Diamond Firetail, Spotted-tailed Quoll, Grey-headed Flying-fox and Large-eared Pied Bat.
- To mitigate the impacts of the development the EA proposed monitoring in retained vegetation on a three-yearly basis involving four monitoring locations to be established within a Habitat Management Area (HMA), Jaorimin Creek Management Area and Cultural Management Area (CMA). The proposed approach was a standard 20 m by 20 m flora quadrat to record species diversity and structural composition, as well as photo monitoring and fauna monitoring targeting threatened species. Nest boxes were also proposed to be installed and monitored on an annual basis for five years.



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Data Source: NSW SS, 2020, Basemap supplied by ESRI and other sources
Aerial imagery supplied by Nearmap (August, 2022)

SLR

SITE LOCATION

FIGURE 1

H:\Projects-SLR\660-SrvWOL\630-NTL\630.30045.00000 Lynwood Quarry Eco\06 SLR Data\01 CADG\S\GIS\SLR630300045_G1_LocalityPlan_03.mxd

1.2.2 Box Gum Woodland Management Plan

Key aspects of the Box Gum Woodland Management Plan (Umwelt 2013) are as follows:

- During construction the site was found to contain a large population of the threatened plant Hoary Sunray Leucochrysum albicans var. tricolor, which at the time was listed as 'vulnerable' under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, as well as areas of White Box - Yellow-Box - Blakely's Red Gum Woodland, which at the time was listed as a 'critically endangered ecological community' (CEEC) under the BC Act.
- To mitigate and offset the loss of these threatened entities, a Box Gum Woodland Management Plan was prepared which details management actions, regeneration, and revegetation strategies.
- A Biodiversity Offset Area (BOA) was set aside, which incorporates a 185 ha area in the southwest portion of the site and includes the Cultural Management Area. As such, three-yearly plot monitoring in the CMA (as previously proposed under the Rehabilitation Plan) was identified as suitable to capture the 'retained vegetation' monitoring requirements of the biodiversity offset area.
- The plan also commits to annual monitoring and reporting to determine success of rehabilitation and general condition including weed and pest animal presence, presence of Hoary Sunray and other matters of national environmental significance (MNES).

1.2.3 Rehabilitation and Landscape Management Plan

The relevant ecological and rehabilitation components of the Rehabilitation and Landscape Management Plan (Umwelt 2018a) can be summarised as follows:

- The rehabilitation efforts are to be focused on three areas over the first five years of operations; these are the haul road construction area, the western amenity bund and the southern edge of the overburden emplacement area.
- The key elements of the rehabilitation strategy include:
  - The early, timely and progressive rehabilitation of disturbed areas.
  - The surface of the southern overburden emplacement area and the Lynwood overburden emplacement area will be shaped in a generally irregular landform to resemble a natural surrounding landform wherever possible.
  - Stripped topsoil will be placed in stockpiles no greater in depth than 3 m and will be seeded with a cover crop if they are to remain in place for longer than six months.
  - Shaped areas will be covered with topsoil, seeded with a native species and cover crop mix with intent of achieving mixed grassland and woodland native vegetation communities.
  - Selected surface habitat features consisting of large rocks, logs and trees from clearing undertaken will also be placed across the rehabilitated area. These features will provide potential fauna habitat and will aid in achieving a stable landform.
- Weed control measures consist of a comprehensive weed survey of all areas of the quarry every 4 years, which will advise weed removal. Weed removal is to prioritise noxious species.
- Feral animal control programs are to be implemented as required and include inspections for the presence of significant populations of feral animals.

- The granite pit benches are to be seeded with a native tree species mix and a grass species mix also used on the safety bund.
- Overburden and emplacement areas south of the Main Southern Railway are expected to be seeded with species from the Tableland Low Woodland vegetation community while the overburden emplacement areas to the north of the Main Southern Railway are expected to be seeded with a mixture of Tableland Grassy Box-Gum Woodland and Western Tablelands Dry Forest vegetation communities.
- Rehabilitation of the southern overburden emplacement area and western amenity bund aim to establish PCT1330 Yellow Box - Blakely's Red gum grassy woodland on the tablelands, South Eastern Bioregion.
- Holcim is to establish and maintain the HMA and Jaorimin Creek corridor for the conservation of ecological values. Management includes fencing and signposting the boundary of the management areas and removal of dilapidated fences throughout. The HMA is approximately 130 ha of which 105 ha is presently vegetated and an area of 25 ha is proposed to be rehabilitated via assisted regeneration and plantings.
- Species established will represent the existing vegetation communities within the HMA, being Western Tablelands Dry Forest, Tableland Grassy Box-Gum Woodland and Tableland Low Woodland. The riparian species to be established along the creek line will also include Acacia mearnsii and A. dealbata.
- The remaining remnant woodland occurring within the project area that is outside the quarry footprint and specific management areas, will also be managed during the life of the project to maintain its ecological values. Strategies will include management of grazing impacts, weed and feral animal control, sediment and erosion control and encouragement of natural regeneration.
- Maintenance and replacement of arboreal habitat is to occur through the relocation of salvaged tree hollows or installation of nest boxes. Nest boxes are to be monitored annually for a period of five years, followed by condition inspections every four years.
- Ecological monitoring is to include:
  - Annual monitoring of vegetation screens for 4 years
  - 3-yearly monitoring of retained vegetation, moving to 10-yearly if positive for 3 consecutive years
  - 3-yearly fauna monitoring, moving to 10-yearly where positive for 3 consecutive years
  - Annual nest box monitoring for 5 years, then 4-yearly condition inspections
- Preliminary completion criteria are provided for the key rehabilitation works and HMA (see assessment at Section 4.2).

1.2.4 Riparian Area Management Plan Marulan Creek Catchment Area

The Riparian Area Management Plan for Marulan Creek (Umwelt 2011) provides details in relation to management of impacts to riparian areas of Marulan Creek during construction and operation of Lynwood Quarry. The main impacts in the vicinity of Marulan creek relate to the construction of the access road including the construction compound and the culvert at the location of creek crossing.

In relation to rehabilitation the plan states:

- Holcim propose to implement a program of rehabilitation works along existing drainage lines to reduce the current extent of bank and bed erosion and associated sediment transport, where possible.

- Rehabilitation works will initially include fencing of the third order section of Marulan Creek to prevent cattle access and allow for natural regeneration. This fenced area will be inspected annually for the first three years to assess the level of natural regeneration. If natural regeneration is not proceeding to an acceptable level by the third year of annual monitoring, then alternative regeneration measures including supplementary planting in accordance with measure in the RLMP will be considered.
- Lynwood Quarry's Environmental Officer will inspect Marulan Creek within the project area on a quarterly basis (and after severe storm events) to identify the condition of the vegetation and any significant erosion or creek stability issues.
- During the operational phase of the project monitoring of the management measures implemented will be undertaken in accordance with the Rehabilitation and Landscape Management Plan.

1.2.5 Riparian Area Management Plan Jaorimin Creek Catchment

The Riparian Area Management Plan for Jaorimin Creek (Umwelt 2018b) provides details in relation to management of impacts to riparian areas of Jaorimin Creek during construction and operation of Lynwood Quarry. The active quarry area and several dams are within the creek catchment and a raft of controls (such as use of sediment devices, seeding and revegetation of disturbed areas, monitoring, limiting work areas) are suggested to limit impacts caused during construction and operation of these features.

The plan includes the objectives in relation to rehabilitation:

- The riparian corridor has been fenced to exclude cattle where required.
- Revegetation works have occurred along Jaorimin Creek south of the Main Southern Railway.
- Nest boxes along Jaorimin Creek have been established, monitored and are being maintained.
- The site is managing significant weed or feral animal infestations with a demonstrable reduction pre-construction.
- Monitoring has indicated that natural regeneration is occurring.

1.3 Ecological and Rehabilitation Monitoring Requirements

Based on the review of previously approved documentation (Umwelt 2005, 2013 and 2018), SLR has devised the ecological and rehabilitation monitoring schedule for the next 10 years, as provided in Table 1.

The monitoring program will require updating as rehabilitation progresses, in particular to add areas of active quarry that become available for rehabilitation (overburden emplacement areas and pits, etc.).

Table 1 Overview of Monitoring Program to 2030

Monitoring Method	Year 2020-2030 (✓=survey required, ☑=survey completed, ☒ survey not completed)										
	20'	21'	22'	23'	24'	25'	26'	27'	28'	29'	30'
1. Nest box survey	☑	☑	☑	✓	✓						
2. Retained vegetation monitoring*	☑			✓			✓			✓	
3. Hoary Sunray Monitoring	☑			✓			✓			✓	
4. Rehabilitation Monitoring Amenity Bund#		☑	☑	✓							
5. Rehabilitation Monitoring of HMA+		☑	☑	✓	✓	✓					
6. Rehabilitation Monitoring of BOA		☑	☑	✓							
7. Rehabilitation Monitoring of BOA (revegetated)		☑	☑	✓	✓	✓	✓	✓	✓	✓	✓
8. Box-gum Woodland Monitoring (retained)		☑	☑	✓	✓	✓	✓	✓	✓	✓	✓
9. Rehabilitation monitoring of creek corridors^			☑	✓	✓	✓	✓	✓	✓	✓	✓

* After 2029 an assessment is required to determine whether the monitoring can move to 10-yearly intervals

Monitoring may cease after three years if vegetation meets completion criteria

\+ After 2025 an assessment is required to determine whether additional planting is required, if it is monitoring of HMA rehab should be extended

^ Monitor annually for 10 years from planting unless completion criteria are met sooner

The surveys of each monitoring method involve:

1. Usage and maintenance survey of 50 nest boxes is required to be undertaken annually for five (5) years
2. Vegetation and Fauna Monitoring of at four (4) locations within areas of retained vegetation, including BAM plots and a fauna survey (involving diurnal reptile, amphibian and bird surveys, spotlighting, and use of ultrasonic bat-call detection and infrared camera devices) at 3-yearly intervals until at least 2029.
3. Hoary Sunray population estimates including counting the number of Hoary Sunray plants within ten 2m^2 plots at locations at 3-yearly intervals in perpetuity.
4. Collection of BAM plot and LFA data at one location on the amenity bund annually for 3-years or until rehabilitation completion criteria are met.
5. Collection of BAM plot and LFA data at two locations within the northern Habitat Management Area, annually for five years.
6. Collection of BAM plot and LFA data at one location within the Biodiversity Offset Area annually for 3-years.
7. Collection of BAM plot data at one location within the regeneration portion of the Biodiversity Offset Area annually in perpetuity.
8. Collection of BAM plot data at two locations within the retained portion of the Box-gum Woodland annually in perpetuity.
9. Collection of BAM plot and LFA data at two locations within core riparian corridors, annually for ten years.

1.4 Monitoring Objectives

The purpose of the Lynwood ecological monitoring program is to monitor ecological values within rehabilitation and areas of retained vegetation within the site and demonstrate the achievement of objectives in accordance with the Ecological Assessment (Umwelt 2005), Box Gum Woodland Management Plan (Umwelt 2013) and Rehabilitation and Landscape Management Plan (Umwelt 2018).

The objectives of the 2022 ecological monitoring are to:

- Determine the current condition of rehabilitation and retained vegetation areas through comparison with benchmarks and landscape function maximum values.
- Detect any problems with management of natural areas through general opportunistic observations and make recommendations to address these issues, especially at the Biodiversity Offset Area.
- Establish baseline data for two new plots in riparian corridors of Jaorimin and Marulan Creek so that future monitoring can detect changes in vegetation condition and landscape function.
- Determine whether nest boxes are being utilised by native fauna and determine whether any nest box maintenance actions are required.

2 Methods

2.1 Staff Roles and Qualifications

The roles and qualifications of all staff responsible for preparation of this report are listed in Table 2.

Table 2 Staff Roles and Qualifications

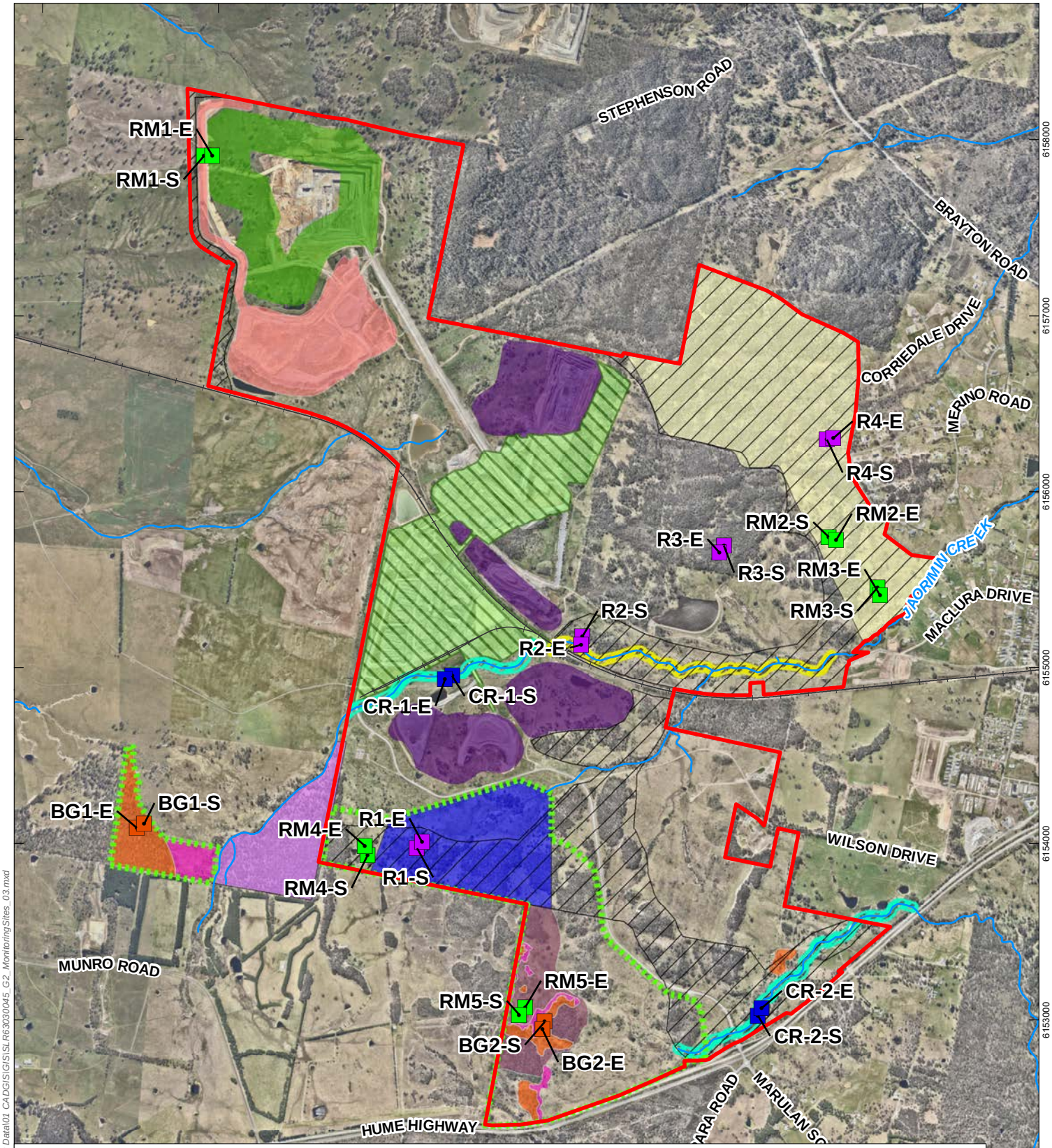
Staff Name & Title	Qualifications and Training	Role
Jeremy Pepper Technical Director	Bachelor of Science (Hons Class 1) University of NSW 1996 Cert II Bushland Regeneration, TAFE NSW Cert III Horticulture (Arboriculture), TAFE NSW BAM accredited assessor (#BAAS17104)	Project Director, report technical review
Fiona Iolini Associate Ecologist	Bachelor of Environmental Science and Management, University of Newcastle 2007 Certificate of Native Plant Identification, Sydney University 2008 Cert III Conservation and Land Management, TAFE NSW 2015 BAM accredited assessor (#BAAS19042)	Project Manager, report preparation
Joshua Drane Project Ecologist	Bachelor of Environmental Science, Australian Catholic University	Field surveys, data analysis and report preparation
Jarrid Beeton Project Ecologist	Bachelor of Environmental Science and Management, University of Newcastle 2018 Dip. Conservation and Land Management, TAFE NSW Cert III Horticulture, TAFE NSW Report writer, Spring field survey	Field surveys, data analysis and report preparation
Ashleigh Pritchard Senior GIS Analyst	Diploma of Spatial Information Services (GIS), TAFE NSW 2009 Esri Certified ArcGIS Desktop Associate 10.5, 2018	GIS data management and figure preparation

2.2 Rehabilitation Monitoring Methods

2.2.1 Monitoring Site Selection

Five permanent rehabilitation monitoring sites were established within areas of rehabilitation and an additional two permanent vegetation monitoring sites were established within areas of retained box gum woodland in 2021. In 2022 these sites were re-surveyed and an additional two permanent rehabilitation monitoring sites were established within core riparian corridors of Jaorimin and Marulan Creeks. Flora (BAM plot) and Landscape Function Analysis (LFA) monitoring data was collected at each of these locations in 2022.

Location and details of the monitoring sites, vegetation communities (DPE 2022) and management areas are included in Figure 2, Figure 3 and Table 3.



Scale: 1:30,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 03-Feb-2023
Project Number: 630.30045.00000

Data Source: NSW SS, 2020, Basemap supplied by ESRI and other sources
Aerial imagery supplied by Nearmap (August, 2022)
Conservation and Management Areas digitised from (Umwelt, 2018)

MONITORING SITES

FIGURE 2

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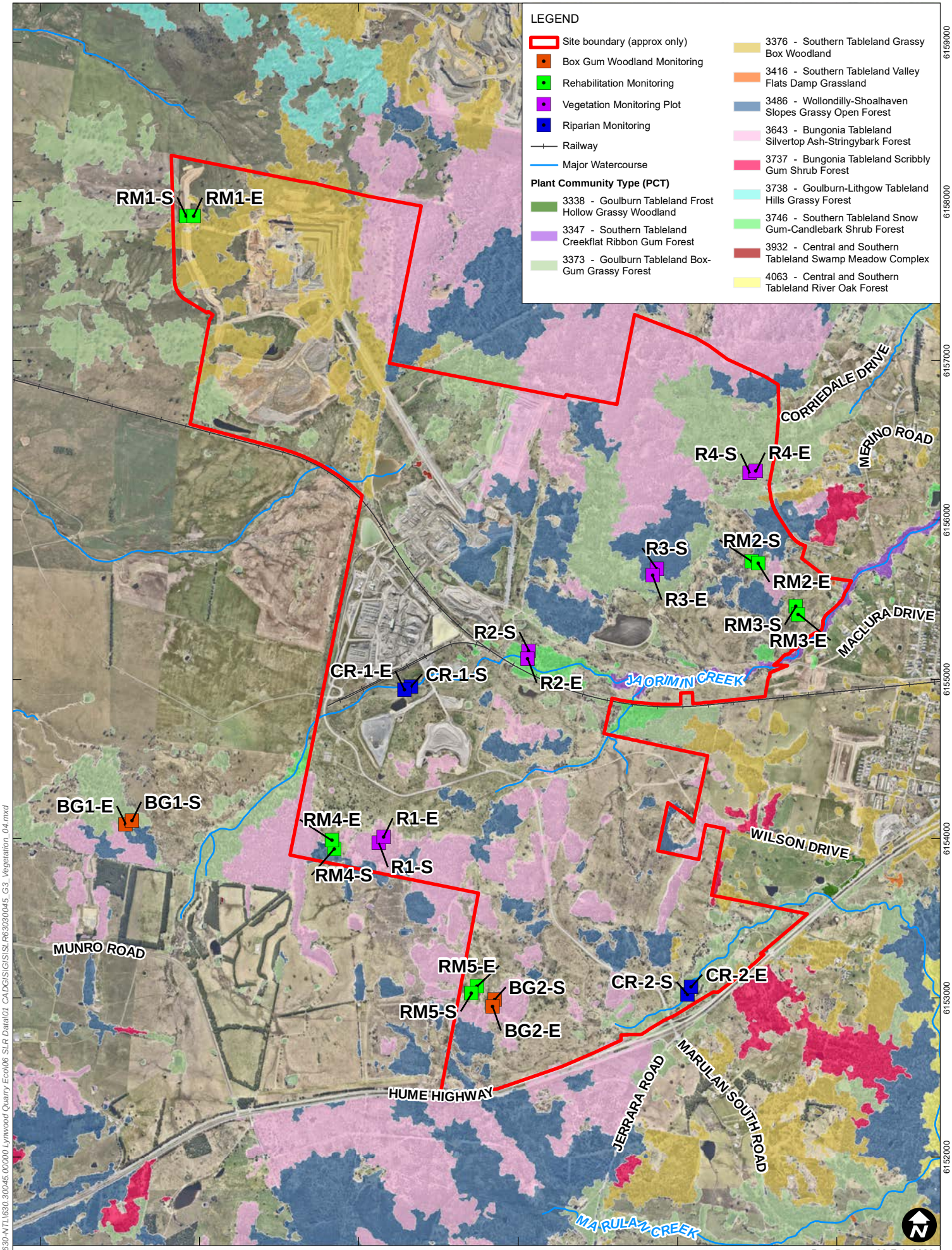

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Data Source: NSW SS, 2020, Aerial imagery supplied by Nearmap (August, 2022) State Vegetation Type Map (SVTM). © State Government of NSW and Department of Planning and Environment 2022 ('Not classified' not shown)

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PLANT COMMUNITY TYPE

FIGURE 3

Table 3 Monitoring Site Location and Details

Management/ Rehabilitation Area	Monitoring Site	Transect Start		Transect End		State Vegetation Map (DPE 2022)
		Easting (MGA)	Northing (MGA)	Easting (MGA)	Northing (MGA)	
Amenity Bund Rehabilitation Area	RM1	769915.4	6157908	769962.9	6157910	PCT 3376 Southern Tableland Grassy Box Woodland (prior to recent quarry development)
Habitat Management Area (Rehabilitation portion)	RM2	773464.8	6155743	773506.3	6155726	n/a
	RM3	773741.8	6155457	773757.6	6155409	n/a
Biodiversity Offset Area - Regeneration Area portion	RM4	770845.1	6153936	770830.3	6153989	n/a
Biodiversity Offset Area - Box Gum Woodland CEEC Regeneration Area	RM5	771706.9	6153029	771739.9	6153072	n/a
Retained Box Gum Woodland (non-revegetated area)	BG1	769577.1	6154113	769535.1	6154090	PCT 3373 Goulburn Tableland Box-Gum Grassy Forest
	BG2	771851.8	6152990	771838.8	6152946	PCT 3643 Bungonia Tableland Silvertop Ash -Stringybark Forest
Riparian	CR1	771326.2	6154954	771285.1	6154935	n/a
	CR2	773062.9	6153023	773084.5	6153068	PCT 3373 Goulburn Tableland Box-Gum Grassy Forest

Note - Co-ordinates provided in GDA94 zone 55

The sites were selected randomly whilst in the field, aiming to monitor each of the following areas:

- Amenity bund rehabilitation area - this is an approximate 8-hectare revegetation area in the northwest of the quarry which is one of the areas directly impacted by the proposed quarry operations and which requires prioritised rehabilitation efforts according to the Rehabilitation and Landscape Management Plan (Umwelt 2018). One permanent rehabilitation monitoring plot was established in this area.
- Habitat Management Area - this is a 130-hectare area in the northeast of the site, of which 25 hectares requires rehabilitation via assisted regeneration and planting according to the Rehabilitation and Landscape Management Plan (Umwelt 2018). Annual monitoring of this area is to occur for 5-years to determine whether planting is required. Two permanent rehabilitation monitoring plots were established in this area.
- Biodiversity Offset Area - this is a 185-hectare area in the south of the site, of which 5.5 hectares is to be regenerated (via direct seeding and tube-stock planting) according to the Rehabilitation and Landscape Management Plan (Umwelt 2018). One permanent rehabilitation monitoring plot was established in this area.

- Box Gum Woodland CEEC Regeneration - in relation to the 185-hectare Biodiversity Offset Area in the south of the site, an additional 22-hecatres of this area is to be regenerated according to the Box-Gum Woodland Management Plan (Umwelt 2013). One permanent rehabilitation monitoring plot was established in this area.
- Retained Box Gum Woodland (non-revegetated area) - three additional areas in the south of the Lynwood Quarry site are to be monitored in accordance with the Box Gum Woodland Management Plan (Umwelt 2013). Two permanent rehabilitation monitoring plots were established in this area.
- Core Riparian Corridors - the core riparian corridors of Jaorimin and Marulan Creeks extend as a narrow band through the north and south of the site respectively. These areas are to be rehabilitated including cattle exclusion and passive and active regeneration as required. Two permanent rehabilitation monitoring plots were established within these areas.

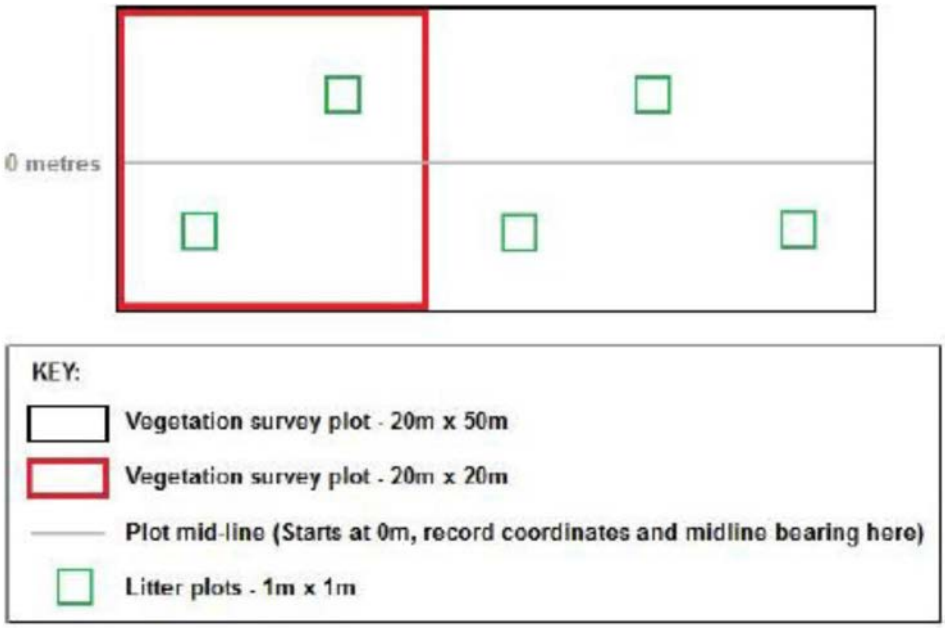
Plots were positioned to ensure appropriate representation of the different vegetation types present across the site. Monitoring sites have been pegged using metal star-pickets fitted with a yellow cap and marked with the site reference. Two star-pickets were positioned at each site, one at the start and one at the end of the midline (or 50 m transect) of each BAM plot.

2.2.2 Vegetation Survey Technique

Flora monitoring was completed during the spring survey period at each of the nine permanent monitoring sites described above, following survey methods prescribed in the NSW Biodiversity Assessment Method (BAM) (DPIE 2020).

This involved a 20 m by 20 m floristic plot to assess species composition and structure, and a 20 m by 50 m plot to assess vegetation function. The function attributes collected under the BAM include tree stem size, hollow-bearing tree counts, and ground cover (leaf litter, bare ground, cryptogram, and rock). The ground cover attributes are collected via five 1 m by 1 m plots along the midline, see Figure 4.

Figure 4 BAM Plot Layout



The BAM provides a repeatable assessment tool to compare vegetation and structural changes over time and to provide comparison for the areas of retained vegetation. All PCTs listed in the NSW BioNet Vegetation Classification database provide 'benchmark' scores for these attributes to which comparison with the relevant plot data can be made. Due to the widespread use of this method in NSW, this method was chosen to provide a consistent and replicable method of assessing the health of the retained vegetation.

To categorise the vegetation at each BAM plot into a PCT (where relevant), previous vegetation mapping and floristic data (Umwelt 2005), as well as current floristic composition data was compared to PCT's within the BioNet Vegetation Classification database. The PCT database was filtered using the Southern Highland IBRA Region and Bungonia Sub-region, followed by a close examination of floristics to match the vegetation at each plot.

The following vegetation characteristics were recorded within each BAM plot, as required by the Rehabilitation and Landscape Management Plan (Umwelt 2018):

- 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, feral animals, vehicles or humans.
- Evidence of site management (eg fencing and weed control actions).

2.2.3 Landscape Function Analysis

The Landscape Function Analysis (LFA) technique by Tongway et al. (2004) uses rapidly assessed, simple visual indicators, to determine how well a landscape functions as a biophysical system. LFA assesses the fate of vital resources such as water, topsoil and organic matter, and identifies both potential accelerated losses and processes that retain those resources.

The LFA results describe the functionality of the landscape as a biophysical system by providing an assessment of the landscape organisation (through the landscape organisation index and patch area index) and of the soil surface condition (through the soil surface condition indices; soil stability, infiltration of water and the cycling of nutrients).

Overall, a soil landscape that is on a trajectory to sustainability in the context of vegetative cover and soil stability would have high landscape organisation index and patch area index values (i.e. close to one indicating good vegetation cover - while lower values indicate higher occurrence of bare ground) and high soil surface condition indices scores (out of 100). This assessment aims to track an improvement in the landscape function of the rehabilitation towards these values over time by comparing the results at the rehabilitation sites annually.

Details of the LFA methods used are included in Appendix A. Each of the gradsects was positioned along the BAM transect which was set up down the slope in accordance with the LFA technique. The location of each gradsect was marked using metal star pickets at the top and bottom of the slope and coordinates for the pegs are included in Section 2.2.1.

2.3 Biodiversity Offset Area Survey

A general inspection of the biodiversity offset area was also undertaken opportunistically whilst traversing across the site between monitoring plot locations. The survey involved searches for evidence of erosion, collecting notes on weeds and pests, evidence of planting, natural regeneration and general management.

2.4 Nest Box Monitoring Methods

A total of 50 nest boxes were inspected as part of the winter survey in 2022. The locations of nest boxes are shown in Figure 5. This was completed by two qualified SLR ecologists, using a non-invasive remote camera inspection method to record the following details:

- Native fauna occupancy.
- Presence of nests, eggs, or young.
- Indirect signs of usage (eg scats, fur, feathers, egg fragments).
- Evidence of pest species (eg bees, exotic birds, such as Indian Myna).
- Nest box condition and maintenance requirements.

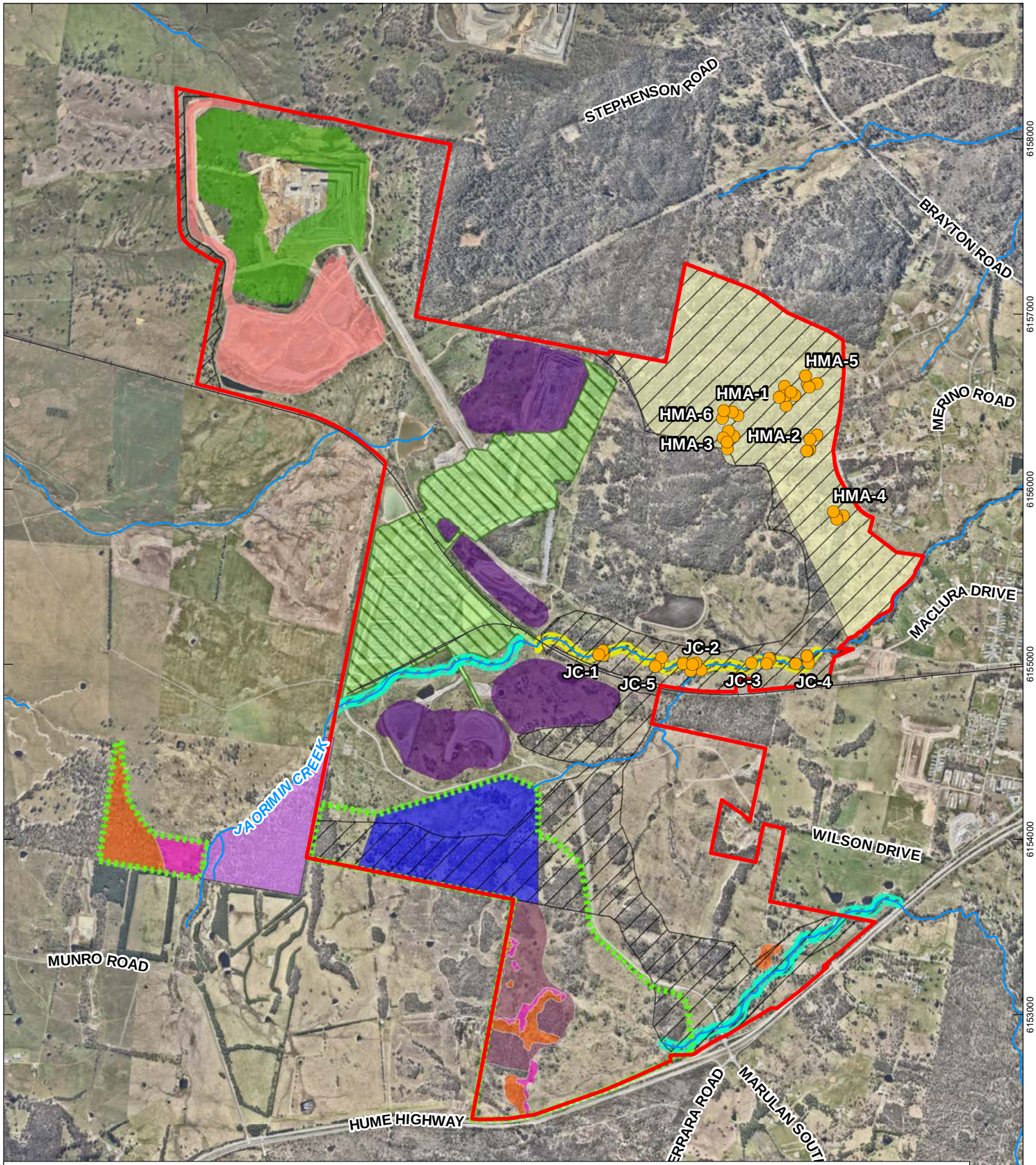
2.5 Survey Details

The current 2022 ecological and rehabilitation monitoring involved winter and spring surveys as detailed in Table 4.

Table 4 Details of the 2022 Ecological and Rehabilitation Monitoring

Date (2022)	Survey Technique	Weather Conditions*
23 August	Nest box inspections	Temp 4°C (min) 13°C (max). Rain 0.0 mm (rained while onsite). Wind NW 69km/hr 05:00 (max). Moon phase: Third quarter to new moon. Sunrise 6:25am. Sunset 5:30pm.
24 August	Nest box inspections	Temp -3°C (min) 12°C (max). Rain 6.4 mm (no rain while onsite). Wind WNW 46km/hr 15:54 (max). Moon phase: Third quarter to new moon. Sunrise 6:24am. Sunset 5:31pm.
21 November	Vegetation survey (BAM plots and LFA)	Temp 7.9°C (min) 14.4°C (max). Rain 3.0 mm. Wind W 83km/hr 15:03 (max). Moon phase: Third quarter to new moon. Sunrise 5:44am. Sunset 7:49pm.
22 November	Vegetation survey (BAM plots and LFA)	Temp 3.6°C (min) 14.8°C (max). Rain 1.0 mm. Wind W 70km/hr 13:35 (max). Moon phase: Third quarter to new moon. Sunrise 5:43am. Sunset 7:50pm.

* Weather data sourced from BOM (2022a) weather station Goulburn Airport 070330 (20 km SW of site) and www.timeanddate.com (Sydney 2021).



LEGEND

- Site boundary (approx only)
- Location of Nest Box
- Railway
- Major Watercourse
- Assisted Natural Regeneration
- Biodiversity Offset Area
- Box Gum Woodland (CEEC)
- Box Gum Woodland (CEEC) Regeneration
- Box Gum Woodland Derived Native Grassland (CEEC)
- Existing Approved Core Riparian Corridor
- Existing Approved Cultural Heritage Management Zone
- Existing Approved Habitat Management Area
- Habitat Management Area
- Joarmin Creek Management Area
- Rehabilitated Area – Biodiversity Values or Grazing
- Rehabilitated Area – Grazing
- Rehabilitated Areas – Biodiversity Values
- Rehabilitation Area – Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (PCT 1330)

0 0.5 1 km

Scale: 1:30,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 03-Feb-2023
Project Number: 630.30045.00000

Data Source: NSW SS, 2020, Basemap supplied by ESRI and other sources
Aerial imagery supplied by Nearmap (August, 2022)
Conservation and Management Areas digitised from (Umwelt, 2018)

SLR

NEST BOX LOCATIONS

FIGURE 5

H:\Projects-SLR\660-SrWOL\630-NT\630.30045.00000 Lynwood Quarry Eco\06 SLR Data\01 CADG\S\G\S\SLR630300045_G4_NestBoxes_03.mxd

2.5.1 Survey Limitations

Survey efficacy is influenced by a range of factors. For this type of survey, such limitations are generally due to a single, short duration survey that does not account for seasonal variation. Given the short period of time spent on site, the detection of certain species may be affected by:

- Seasonal migration (particularly migratory birds).
- Seasonal flowering periods (some species are cryptic and are unlikely to be detected outside of the known flowering period).
- Seasonal availability of food, such as blossoms for some fauna.
- Weather conditions during the survey period (some species may go through cycles of activity related to specific weather conditions, for example some reptiles and frogs can be inactive during cold weather).
- Species lifecycle (cycles of activity related to breeding).

The survey was undertaken during periods of moderate to heavy rainfall which limited the general inspection of the BOA and weeds across the site to paths travelled to reach the monitoring sites.

2.5.2 SLR Permits and Licenses

The SLR ecology team operates under a Scientific Licence (licence number SL100176, issued under the BC Act), which authorises field staff to trap, capture, harm, hold and release plants and animals protected under the BC Act and National Parks and Wildlife Act 1974, as well as an Animal Research Authority (issued by the Secretary of the NSW Animal Care and Ethics Committee of DPIE), which allows trapping of animals in NSW for the purposes of animal research.

3 Results

3.1 Vegetation Monitoring

An examination of the existing PCT floristics (see Table 5) shows that each site matches generally with PCT 1330 Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (DPIE 2021), which is a sub-unit of the threatened ecological community White Box Yellow Box Blakely's Red Gum Woodland (TSC 2022). This PCT is in the process of being revised to PCT 3373 Goulburn Tableland Box-Gum Grassy Forest and PCT 3376 Southern Tableland Grassy Box Woodland under the new Revised State Vegetation Type (SVT) mapping (DPE 2022).

As RM1 is newly established rehabilitation (an amenity bund requiring revegetation), and CR1 has not yet begun rehabilitation, there is currently no existing native vegetation; however, the target PCT identified in the Rehabilitation and Landscape Management Plan (Umwelt 2018) is PCT 1330. As such all rehabilitation and retained vegetation sites are currently compared to the benchmark values for PCT 1330.

The BioNet Vegetation Classification profile and benchmark values are included in Appendix B.

Table 5 Identification of Plant Community Types at Monitoring Sites

Site/Source	Key flora species in BAM plot/ Key flora species of community
RM1	n/a
RM2	Cassinia sifton, Haloragis aspera, Euchiton involucratus, Austrostipa pubescens, Microtis unifolia, Aristida vagans, Microlaena stipoides, Rytidosperma fulvum, Goodenia hederacea, Hypericum gramineum, Cheilanthes sieberi, Chrysocephalum apiculatum
RM3	Microlaena stipoides, Cassinia sifton, Schoenus apogon, Euchiton sphaericus, Austrostipa densiflora
RM4	Eucalyptus agglomerata, Acacia decurrens, Austrostipa densiflora, A. scabra, Microlaena stipoides, Euchiton sphaericus, Rytidosperma racemosum
RM5	Cassinia sifton, Microlaena stipoides, Schoenus apogon, Euchiton involucratus, E. sphaericus, Austrostipa scabra, Cheilanthes sieberi, Microtis unifolia
BG1	Eucalyptus blakelyi, E. melliodora, E. bridgesiana, Cassinia sifton, Lissanthe strigosa, Austrostipa densiflora, A. scabra, Microlaena stipoides, Wahlenbergia communis, Schoenus apogon, Cheilanthes sieberi, Euchiton sphaericus, Goodenia hederacea, Lomandra multiflora, Plantago gaudichaudii
BG2	Eucalyptus blakelyi, E. dives, Cassinia sifton, Ozothamnus diosmifolius, Austrostipa densiflora, Microlaena stipoides, Austrostipa scabra, Gonocarpus tetragynus, Euchiton sphaericus, Lomandra multiflora, Goodenia hederacea, Microtis unifolia, Schoenus apogon, Veronica plebeia
CR1	n/a
CR2	Eucalyptus blakelyi, Acacia decurrens, Cassinia sifton, C. aculeata, Ozothamnus diosmifolius, Olearia phlogopappa, O. viscidula, Austrostipa scabra, Microlaena stipoides, Carex appressa, Geranium solanderi, Hydrocotyle sibthorpioides
PCT 1330 Floristics (DPIE 2021)	Eucalyptus melliodora, E. bridgesiana, E. blakelyi, E. dives, E. macrorhyncha, E. rubida, E. pauciflora, E. mannifera, E. viminalis, Lissanthe strigosa, Melichrus urceolatus, Bothriochloa macra, Gonocarpus tetragynus, Goodenia hederacea, Hydrocotyle laxiflora, Lomandra filiformis subsp. coriacea, Microlaena stipoides, Themeda triandra

Site/Source	Key flora species in BAM plot/ Key flora species of community
PCT 3373 Floristics (DPE 2022)	Eucalyptus melliodora, E. macrorhyncha, E. blakelyi , E. dives , E. mannifera , E. bridgesiana , Acacia decurrens , E. rubida , E. rossii , Acacia dealbata , A. melanoxylon , E. cinerea , E. pauciflora , Allocasuarina littoralis , E. amplifolia , A. parramattensis , Allocasuarina luehmannii , E. tereticornis , E. eugenioides , E. goniocalyx , E. polyanthemos, E. radiata , E. sclerophylla , E. viminalis, Lissanthe strigosa, Pimelea curviflora, Melichrus urceolatus, Hibbertia obtusifolia, Themeda triandra, Microlaena stipoides, Poa sieberiana, Elymus scaber, Aristida ramosa, Rytidosperma leave, Lomandra filiformis, L. multiflora, Goodenia hederacea, Hydrocotyle laxiflora, Oxalis perennans, Chrysocephalum apiculatum, Tricoryne elatior, Gonocarpus tetragynus and Hypericum gramineum.
PCT 3376 Floristics (DPE 2022)	Eucalyptus melliodora, E. bridgesiana, E. blakelyi, E. rossii, Acacia dealbata, E. mannifera, E. macrorhyncha, Allocasuarina verticillata, E. dives, E. rubida, Brachychiton populneus, E. nortonii, E. pauciflora, E. polyanthemos, A. decurrens, A. parramattensis, Allocasuarina littoralis, E. amplifolia, E. tereticornis, Callitris endlicheri, E. albens, E. camaldulensis, E. cinerea, E. dalrympleana, E. sieberi, E. viminalis, Melichrus urceolatus, Lissanthe strigosa, Hydrocotyle laxiflora, Austrostipa scabra, Lomandra filiformis, Microlaena stipoides and Elymus scaber.
WBYBBRW Floristics – Relevant Species (TSC 2022)	A. densiflora, A. scabra, Cheilanthes sieberi, Chrysocephalum apiculatum, Arthropodium fimbriatum, Eremophila debilis, Einadia nutans, Eucalyptus blakelyi, E. bridgesiana, E. melliodora, Euchiton sphaericus, E. involucratum, Gonocarpus tetragynus, Goodenia hederacea, Hypericum gramineum, Lissanthe strigosa, Lomandra multiflora, Microlaena stipoides, Microtis unifolia, Plantago gaudichaudii, Rytidosperma racemosum, Schoenus apogon, Wahlenbergia communis, Veronica plebeia

A total of 59 native flora species was recorded during the 2022 flora surveys, including seven trees, seven shrubs, 28 forbs, 15 grasses (or grass-like species), two ferns and zero 'other' species. A total of 48 exotic flora species was recorded, six of which (Nassella trichotoma, Rubus anglocandicans, Senecio madagascariensis, Bromus diandrus, Hypericum perforatum and Paspalum dilatatum) are defined as High Threat Exotic (HTE) species under the BAM.

Complete BAM plot data for each site, including notes on plot disturbance and management factors, is included in Appendix C to Appendix K.

A summary of the 2022 BAM plot data and comparison to PCT benchmarks is provided in Table 6 and graphed for each site in Appendix C to Appendix K.

Table 6 BAM Plot Data Comparisons to PCT Benchmark Data[#]

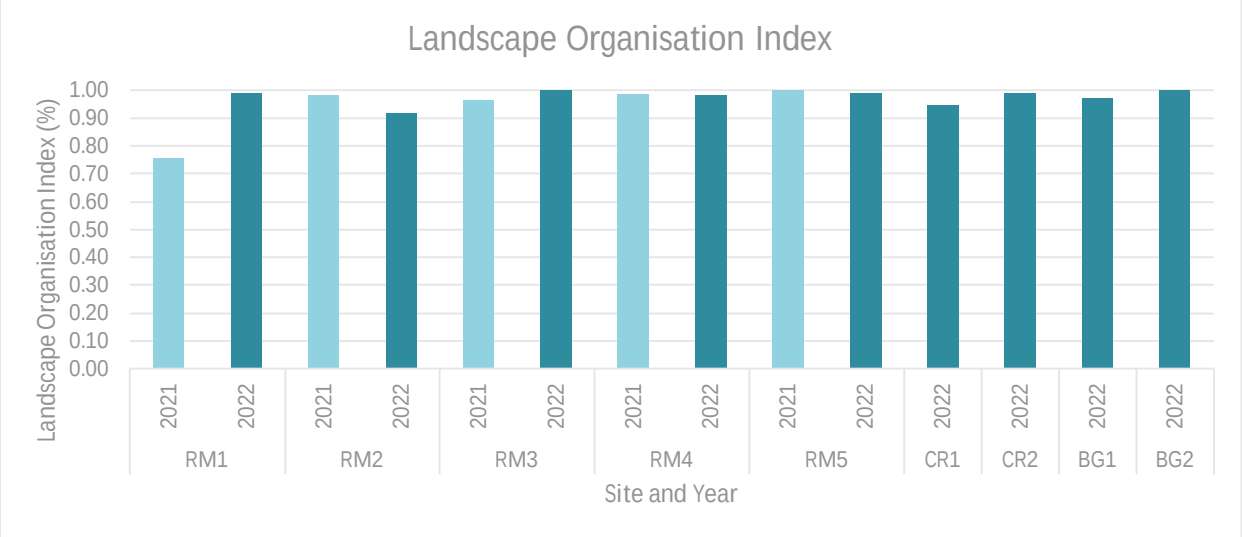
	RM1	RM2	RM3	RM4	RM5	BG1	BG2	CR1	CR2	PCT 1330
Tree count	0	1	0	2	0	2	4	1	3	4
Shrub count	0	2	1	2	1	2	3	2	4	7
Grass count	0	3	5	4	4	7	6	2	4	9
Forb count	1	8	3	4	8	11	9	2	5	16
Fern count	0	1	0	1	0	0	1	0	0	1
Other count	0	0	0	0	0	0	0	0	0	2
Tree cover	0	0.5	0	30	0	10	15.2	10	26.5	25
Shrub cover	0	22	1	31	20	20.5	66	0.2	22.6	5
Grass cover	0	6	36.2	50.1	38.5	23.2	4	3.5	20.7	37
Forb cover	2	11.7	0.7	0.4	3.8	12.1	5	0.6	2.7	9
Fern cover	0	0.5	0	0.1	0	0	0.1	0	0	0
Other cover	0	0	0	0	0	0	0	0	0	0
Length of logs	0	0	0	20	0	25	3	8	7	50
Litter cover	1.8	5	6	4.4	4.2	10	17	3.4	5	45
No. large trees	0	0	0	0	0	0	0	0	0	3

Shaded values are at or above PCT benchmark values

3.2 Landscape Function Analysis Results

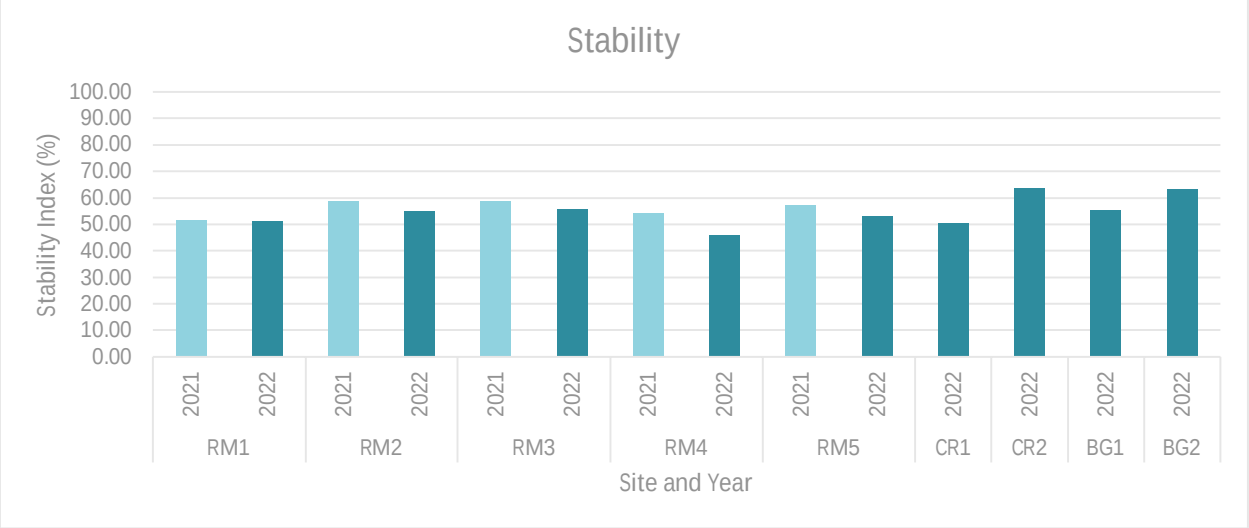
The landscape organisation index results for 2021 and 2022 are presented in Figure 6. With respect to Landscape Organisation, all rehabilitation sites are performing well in 2022 with RM3 and BG2 recording the highest at 1.0 and RM2 recording the lowest at 0.92, this is an increase from 2021 with the lowest of 0.76.

Figure 6 Landscape Function Analysis: Landscape Organisation Index



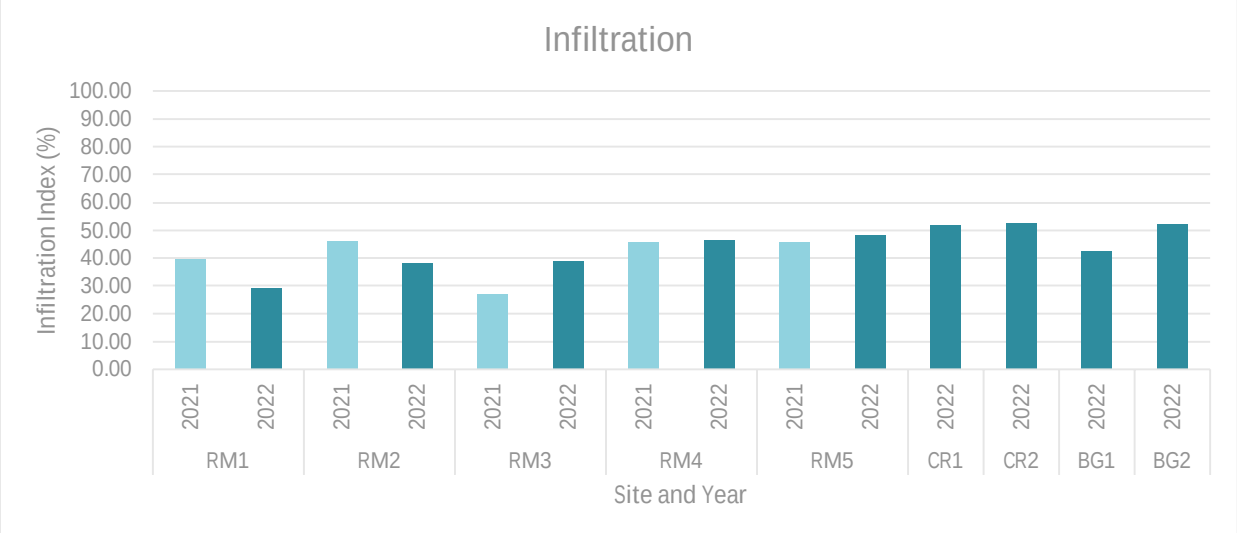
The stability index results for 2021 and 2022 are presented in Figure 7. With respect to the stability index the overall performance is average, CR2 is currently performing the best at 64 %, whilst RM4 is performing the worst at 46 % with a decrease of 9 % from 2021.

Figure 7 Landscape Function Analysis: Stability Index



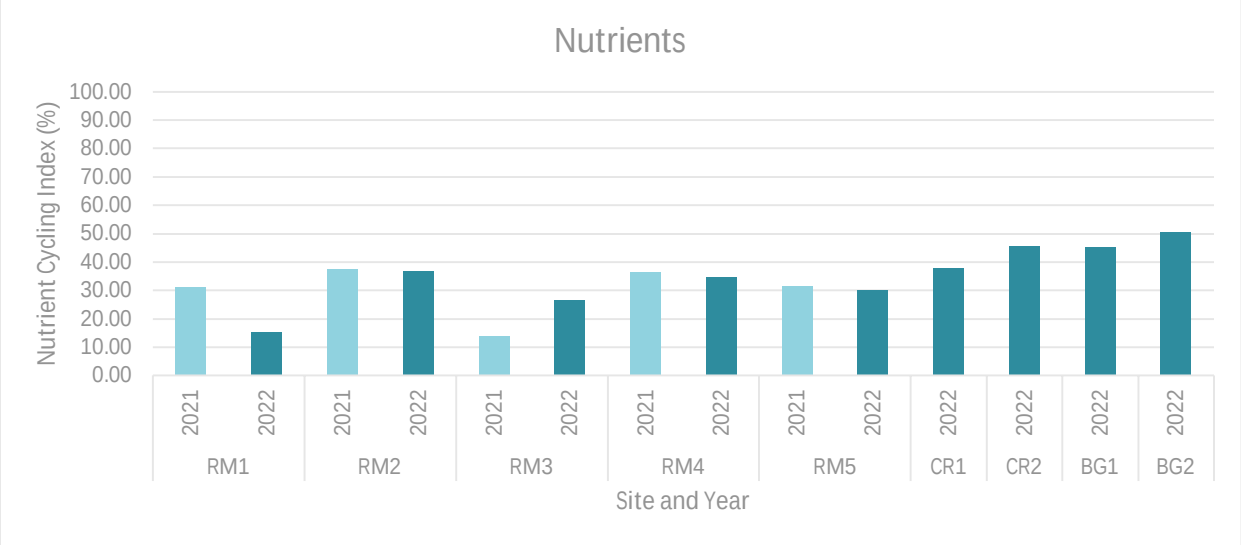
The infiltration index results for 2021 and 2022 are presented in Figure 8. With respect to the infiltration index the overall results are poor to average. CR2 is currently performing the best with the highest infiltration index of 53 %, while RM1 is performing the poorest with an infiltration index of 29 %. RM1 and RM2 have shown a decrease since last year while RM3, RM4 and RM5 have shown an increase, with RM3 showing the largest increase of 12 %.

Figure 8 Landscape Function Analysis: Infiltration Index



The nutrient cycling index results for 2021 and 2022 are presented in Figure 9. Nutrient cycling is poor for all monitoring sites, with BG2 is currently performing the best with an index of 51 %, whilst RM1 is performing the poorest with 15 %. Nutrient cycling at RM1 has decreased by 16 % since 2021 but has increased at RM3 by 12 %.

Figure 9 Landscape Function Analysis: Nutrient Cycling Index



The complete LFA data for all monitoring sites in 2022 is provided in Appendix C to Appendix K.

3.3 Biodiversity Offset Area

The areas of retained box gum woodland vegetation within the Biodiversity Offset Area (BOA) (ie 'Box Gum Woodland (CEEC)' and 'Box Gum Woodland derived Native Grassland (CEEC)' – see Figure 2) are generally in moderate to good condition and no immediate actions are necessary, other than minor spot control of high threat exotics, such as Serrated Tussock Nassella trichotoma and St John's Wort Hypericum perforatum. Open areas in the west of the BOA that appear to have been historically cleared (previously identified as derived native grassland) are naturally regenerating with Eucalyptus spp. and Cassinia sifton (see Photo 1).

Other parts of the BOA were also generally in moderate to good condition, although control of high threat exotics Serrated Tussock Nassella trichotoma and St John's Wort Hypericum perforatum and control of priority weed Blackberry Rubus anglocandicans is required as patches of these species occur particularly in the southeast portion of the BOA. Some evidence of successful Blackberry control was observed; however, some new growth was also seen (see Photo 2). No areas of erosion were seen and there were no other management issues noted.

Photo 1 Natural Regeneration in Box Gum Woodland derived Native Grassland (CEEC)

Photo 2 Blackberry in Southeast of BOA

3.4 Nest Boxes

A total of 50 nest boxes were inspected during the winter monitoring event (See Appendix L for complete nest box inventory). Key results are summarised as follows:

- 10 nest boxes were occupied by native fauna, including: six boxes occupied by either Sugar Gliders or Squirrel Gliders Petaurus spp. (two boxes had young), two boxes occupied by Brushtail Possum Trichosurus vulpecula, Australian Wood Duck Chenonetta jubata with eggs and one unidentifiable fauna species
- One nest box contained a feather nest with fresh eggs
- 40 of the 50 nest boxes contained nesting material, identified as being a mix of glider nests (leaf material), wood duck nest (bark and leaves with fragments of eggs) and bird nests (sticks and feathers)
- Two nest boxes were recorded as having pests (inactive wasp nests)
- Five nest boxes require maintenance including:
  - Two requiring the removal of an inactive wasp nest
  - One box needs tightening or replace attachment on the tree
  - One box needs to be reinstalled on to a new tree because of a snapped tree trunk

4 DISCUSSION

4.1 General

Comparison of vegetation data collected from monitoring plots to PCT benchmarks indicates that most attributes are below benchmark, apart from the following, which are at or above benchmark:

- RM1 - cover of 'fern' and 'other'
- RM2 - diversity of 'fern' and cover of 'shrub' 'forb', 'fern' and 'other'
- RM3 - cover of 'fern' and 'other'
- RM4 - diversity of 'fern', and cover of 'tree', 'shrub', 'grass and grass-like', 'fern' and 'other'
- RM5 - cover of 'shrub', 'grass and grass-like', 'fern' and 'other'
- BG1 - cover of 'shrub', 'forb', 'fern' and 'other'
- BG2 - diversity of 'tree' and 'fern' and cover of 'shrub', 'fern' and 'other'
- CR1 - cover of 'fern' and 'other'
- CR2 - cover of 'tree', 'shrub', 'fern' and 'other'

This suggests that most rehabilitation sites would benefit from planting local native species, chosen from PCT 1330; however, it would not be realistic to try and achieve benchmark status at rehabilitation sites. Results should be used as a guide for replanting efforts and to track rehabilitation progress over time.

With respect to landscape function analysis, overall the rehabilitation performance is average. With a maximum potential score of 1.0, the landscape organisation index is good for all sites (scoring 0.92-1), with the amenity bund RM1 increasing to 0.99 from previous year 0.76. The following indices are overall poor to average:

- Stability is average at all sites (46-64 %)
- Infiltration is average for all sites (38-53 %), except RM1, which is performing poorly (29 %)
- Nutrient cycling is poor at all remediation sites (15-37%) and average at the creek and box gum sites (38-51%)

The landscape function is expected to improve over time with the following actions:

- Planting of native ground covers, shrubs and trees
- Introduction of habitat features such as mulch, rock and logs

The following general management notes were made:

- Most sites showed evidence of moderate to severe historic clearing, with RM1 noted as recently cleared to facilitate the quarry operations
- Minor evidence of pasture improvement was noted at RM2, RM3 and RM5
- Light active erosion was found to be occurring at RM1 and moderate to severe active erosion was recorded at CR1 and CR2
- The unnamed creek line near the site entrance and adjacent to CR2 shows severe active bank erosion; extensive stream rehabilitation will be required to remediate the streamline

- Minor removal of course woody debris was noted at most sites, but was considered to be more severe at RM1 and RM2, where it is likely that fuel load management is undertaken as part of quarry operations
- Light to moderate grazing by wildlife (mainly Kangaroos) was noted at most sites
- There was no evidence of fire damage
- Minor to moderate storm damage was noted at BG1 and BG2 with some broken branches and limb drop observed
- Most sites recorded low to moderate cover of weeds, with severe weediness occurring at RM1 and CR1
- Minor impacts by animal tracks were noted at CR2
- Fencing was noted at RM2, RM3, RM5 and BG1
- General health of vegetation is good at RM2, BG1, BG2, moderate at RM4, RM5, CR2 and poor at RM1, RM3 and CR1
- RM3, RM5 and CR1 were noted as requiring weed control and planting, whilst RM1, RM2, RM4 and CR2 require weed control
- Natural regeneration was recorded at most sites (except for RM1) however regeneration was often patchy; RM3 and CR1 in particular requires planting of trees and shrubs
- Recent plantings have occurred on the western side of the amenity bund (near RM1 - see Photo 3) and it is recommended that ongoing watering and weed maintenance is undertaken for upkeep of these plantings; in particular Rye Grass (presumably non-sterile) appears to be smothering the plantings

Photo 3 Native Plantings at Western slope of Amenity Bund

Most nest boxes show evidence of usage (40 of 50), with 10 occupied during the survey. In regard to target species usage: the Squirrel Glider boxes are generally occupied by Sugar Gliders or their nesting materials; the Brushtail Possum boxes show evidence of possum usage but are also being used by birds; the Ringtail Possum boxes are used by bird species; the bat boxes show no evidence of usage; the Owlet Nightjar boxes appear to be used by gliders; and one Rosella box shows evidence of glider usage. In relation to maintenance, two boxes require pest removal, one requires repositioning or new attachment and one requires transfer to a new tree.

4.2 Completion Criteria

An assessment of completion criteria from the Rehabilitation and Landscape Management Plan is provided in Appendix M. The assessment determined the following:

- None of the amenity bund completion criteria have been met, including with respect to vegetation establishment, groundcover protection, weed and feral pest control, achievement of a sustainable ecosystem with trees, presence of habitat features, recruitment of natives or fencing
- With respect to the HMA:
  - three completion criteria were unable to be assessed, being the completion criteria in relation to fencing of the HMA, cattle exclusion and weed and feral pest control
  - one is on track for completion (nest box usage)
  - one is not met (natural regeneration not occurring in some areas of HMA)
- With the establishment of the creek corridors monitoring sites CR1 and CR2 the core riparian corridors criteria were able to be assessed in 2022:
  - two completion criteria are not met due to a lack revegetation and natural regeneration at CR1
  - one is partially not met (weed and feral animal) as further feral animal monitoring will be required, however weed cover is not met
  - one is on track for completion (nest box usage)
  - one could not be assessed (cattle exclusion)

5 CONCLUSION and RECOMMENDATIONS

The 2022 ecological monitoring of the Holcim Lynwood quarry involved the collection of data with respect to:

- Progress of rehabilitation
- Condition of vegetation in areas of retained box gum woodland vegetation
- Usage and condition of nest boxes
- General site notes with respect to management of natural areas and weeds

The areas of retained box gum woodland vegetation within the Biodiversity Offset Area (BOA) are generally in moderate to good condition and no immediate actions are necessary, other than control of isolated occurrences of high threat weeds (such as Serrated Tussock Nassella trichotoma and St John's Wort Hypericum perforatum).

Other parts of the BOA were also generally in moderate to good condition, although control of high threat weeds (such as Serrated Tussock Nassella trichotoma and St John's Wort Hypericum perforatum) and exotic perennial grass (Sweet Vernal Grass Anthoxanthum odoratum) and control of priority weed (Blackberry Rubus anglocandicans) is required as patches of these species occur particularly in the southeast portion of the BOA and along the access road to the quarry.

The rehabilitation areas require weed control, maintenance of plantings and additional planting. Portions of the creek lines across the site (in the vicinity of CR1 and CR2) also require erosion control and bank stabilisation. The amenity bund requires additional work to stabilise erosion as well as additional planting of native trees, shrubs and groundcover plants of PCT 1330 in accordance with the Rehabilitation and Landscape Management Plan (Umwelt 2018).

Overall, the site requires targeted weed control of Serrated Tussock and Blackberry, including spot spray techniques using herbicides or hand/mechanical removal with limited soil disturbance wherever practicable to reduce impacts to surrounding native vegetation and waterways.

Nest box monitoring indicates a high rate of usage by native fauna and general good condition of most nest boxes. Removal of pests and ongoing monitoring of the boxes, particularly along Jaorimin Creek, is recommended to prevent further impacts on the native fauna using the boxes. It is also recommended that one of the boxes is repositioned and one is relocated to a new tree.

Any fencing of the management areas should be surveyed to enable assessment of completion criteria for fencing. Future weed mapping should incorporate an overall vegetation condition mapping exercise in accordance with the National Trust Method (or similar).

Ecological monitoring should continue in accordance with the summary in Section 1.3. The next monitoring event would therefore be required in 2023 and will include full suite of monitoring, including nest box monitoring, rehabilitation monitoring, box gum woodland monitoring, retained vegetation monitoring and Hoary Sunray monitoring.

LFA monitoring is currently part of the monitoring method applied at Lynwood Quarry. However, we note that LFA is being replaced by BAM plot monitoring in accordance with the recent changes to NSW Resources Regulator (2021) guidelines. Accordingly, it is recommended that LFA monitoring is not undertaken or is undertaken at an interval of once every 3 years.

With respect to RM1, recent planting efforts were focussed on the outer face of the amenity bund. Recent documentation from Lynwood Quarry indicates that up to September 2022, 8,000 m^2 of hydro seed and 570 tube stock were planted at the amenity bund. If planting will not be undertaken along the inner face of the amenity bund (where the RM1 plot is located) the plot should be moved to the outer face in order to monitor the rehabilitation.

Future monitoring events should compare to updated PCT benchmarks of PCT 3373 and PCT 3376. These are currently very similar to the benchmarks for PCT 1330.

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Appendix A:
LFA Methods

A 1 LFA SOIL SURFACE ASSESSMENT

A 1.1 Rainsplash protection

The objective is to assess the degree to which physical surface cover and projected plant cover ameliorate the effect of raindrops impacting on the soil surface. Assess the projected percentage cover of perennial vegetation to a height of 0.5 m, plus rocks > 2 cm and woody material > 1 cm in diameter or other long-lived, immoveable objects. These objects intercept and break up raindrops, making them less erosive and less liable to form soil physical crusts. This indicator relates to the Stability Index.

Table A1 Rainsplash protection

Projected cover	Class	Interpretation
1% or less	1	No rainsplash protection
1 to 15%	2	Low rainsplash protection
15 to 30%	3	Moderate rainsplash protection
30 to 50%	4	High rainsplash protection
More than 50%	5	Very high rainsplash protection

A 1.2 Perennial grass basal, tree/shrub canopy cover

The objective is to estimate the "basal cover" of perennial grass and/or the density of canopy cover of trees and shrubs. This indicator assesses the contribution of the below-ground biomass of perennial vegetation in contributing to nutrient cycling and infiltration processes (example). Grass cover is assessed by summing the butt lengths (example) of perennial grass plants in the query zone. Tree and shrub cover is defined from the cover and density of the canopy overhanging the query zone. (McDonald et al, p 66-71 has photo-references). The contribution of annual plants is included under litter.

Table A2 Perennial grass basal tree/shrub canopy cover

Basal and canopy cover	Class	Interpretation
1% or less	1	No below ground contribution
1 to 10%	2	Low below ground contribution
10 to 20%	3	Moderate below ground contribution
More than 20%	4	High below ground contribution

A 1.3 Litter cover, origin & incorporation

The objective is to assess the amount, origin and degree of decomposition of plant litter. "Litter" refers to annual grasses and ephemeral herbage (both standing and detached) as well as detached leaves, stems, twigs, fruit, dung, etc. The position of litter in the overall landscape also assists in defining fertile patches. Plant litter accumulation is strongly related to the carbon, nitrogen and other elements stored in the surface soil layers and acquired by decomposition processes. Note: recent fire usually eliminates litter, temporally disadvantaging the nutrient cycling index as it relies strongly on the litter indicator. Unless the effect of the fire itself is being assessed a period of at least one growing season should elapse before assessing burnt sites. There are three properties of litter that need to be assessed in the following order: the cover; the origin of the litter; and the decomposition.

Table A3 Litter cover

% Cover of plant litter*	Class
<10	1
10-25	2
25-50	3
50-75	4
75-100	5
100 up to 20 mm thick	6
100, 21-70 mm thick	7
100, 70-120 mm thick	8
100, 120-170 mm thick	9
100, > 170 mm thick	10

*When litter is more than 100% cover, the depth is assessed by compressing it with the flat of your hand to remove "air-gaps"

Table A4 Litter transport

Interpretation	Example
Local (l)	derived from plants growing in very close proximity to the query zone and showing no signs of transport/deposition by wind or water flows and transported
Transported (t)	litter has clear signs of being washed or blown to the current location.

Table A5 Litter decomposition

Interpretation	Example
Nil decomposition (n)	the litter is loosely spread on the surface with few signs of decomposition and incorporation.
Slight decomposition (s)	litter is broken down into small fragments and intimately in contact with soil; some fragments may be partially buried.
Moderate decomposition (m)	litter is in several distinct layers; some fungal attack is visible; the layer next to the soil is somewhat humified; some darkening of the soil to a depth of less than 10 mm
Extensive decomposition (e)	litter has at least 3 layers or stages in decomposition ranging from fresh material on top to 20 mm or more of comprehensively humified (very dark, with no identifiable fragments) at the soil-litter interface; mineral soil may have significant organic darkening in excess of 10 mm.

A 1.4 Soil biological crust cover

The objective is to assess the cover of cryptogams visible on the soil surface. "Cryptogam" is a generic term that includes algae, fungi, lichens, mosses and liverworts. Fruiting bodies of mycorrhizas would be included. When these are present, they indicate soil surface stability and elevated levels of available nutrients in the surface layers of soil. They are known to exchange minerals and water with vascular plants in return for carbohydrates.

Typically, they colonise soils with pre-existing stable physical crusts, though not exclusively. They tend to impart flexibility to the physical crust, due to the ramification of hyphae through the surface few mm. Cryptogams may be early colonisers of recovering soil surfaces but may decline as vascular plant cover increases. Typically, they need high light levels to persist and are seldom found under dense, particularly woody, litter. They have been observed under light grassy litter. Open, crusted soils are their typical habitat.

The soil surface may need close inspection to assess the presence of cryptogams. Adding a little water and observing the "greening" of cryptogams over a period of 10 –20 seconds can be very useful. Some cryptogams are "detached" from the soil surface after long periods of desiccation, but cover is assessed normally.

Table A6 Cryptogram cover

Cryptogram cover	Class	Interpretation
Not applicable	0	No stable crust present
1% or less	1	No contribution
1 to 10%	2	Slight contribution
10 to 50%	3	Moderate contribution
More than 50%	4	Extensive contribution

A 1.5 Crust brokenness

The objective is to assess to what extent the surface crust is broken, leaving loosely attached soil material available for erosion. A crust is defined as a physical surface layer that overlies sub-crust material. Soils with physical crusts in good condition are crusts that are smooth and conforms to the gentle undulations in the soil surface. These good condition crusts yield little soil material in a runoff event.

However, crusts can become unstable, brittle and easily disturbed by grazing animals, the materials becoming available for wind or water erosion. Polygonal cracking of the crust without curled edges is not considered broken and scores 4, the maximum value. Typically, sections of crust are lost, forming a micro-crater (example) that may be filled with loose alluvium. Both the area of and severity of broken crust needs to be assessed.

Table A7 Crust brokenness

Crust brokenness	Class
No crust present	0
Crust present but extensively broken	1
Crust present but moderately broken	2
Crust present but slightly broken	3
Crust present but intact, smooth	4

A 1.6 Erosion type & severity

The objective is to assess the type and severity of recent/current soil erosion ie soil loss from the query zone. Erosion in this context refers to accelerated erosion caused by the interaction of management and climatic events, rather than the background levels of geologic erosion.

There are five distinct types of soil erosion that are caused by water and/or wind action. It is useful to note which type or types are active and how serious is the soil loss. This involves both the aerial extent and the severity. The conventions of McDonald et al 1990 p 92-96 are used. A number of images are presented to assist accurate classification. Sometimes the erosion occurred at some time in the past and spontaneous restoration has since taken place. For example; rill edges may be rounded or terracettes may have cryptogam colonisation. In these cases, reduce the severity by one class.

Table A8 Erosion

Class	Severity
1	Severe
2	Moderate
3	Slight
4	Insignificant

A 1.7 Deposited materials

The objective is to assess the nature and amount of alluvium transported to and deposited on the query zone. The presence of soil and litter materials on the query zone indicates the availability for transport of resources from upslope sources in the landscape and implies some instability. Silts, sands and gravels usually comprise the alluvium. Absence does not necessarily imply a lack of deposition, as erosion may sweep all these materials out of the system. Alluvial fans can become quite stable and productive, depending on the stress and disturbance impacting on the surface. An alluvial fan may become a productive patch within a short time if the right seasonal conditions occur. The amount or volume of deposited material is more important than the simple cover.

Hummocking is an indication of the movement large quantities of materials by wind. It is not to be confused with pedestalling which is the eroding away of material around plants and other objects. It is most often associated with adjacent scalding. Hummocking is confined to soils with sandy-textured surface layers and is the result of re-sorting of sand by wind, which accumulates around obstructions, often to depths of many centimetres, or even metres. The soil in the hummock is unconsolidated, and if sectioned reveals layers of accumulated soil (inter-bedding) and/or organic matter. The soil in pedestals is coherent and has no sign of layering. A consequence of hummocking is that fine-grained materials and litter maybe widely dispersed during windy phases and are lost to the system. It is rare in the tropical grasslands.

Table A9 Deposited material

Deposited material	Class
Extensive amount available Greater than 50% cover several cm deep	1
Moderate amount of material available 20 to 50% cover	2
Slight amount of material available 5% to 20% cover	3
None or small amount of material available 0-5% cover	4

A 1.8 Soil surface roughness

The objective is to assess the surface roughness for its capacity to capture and retain mobile resources such as water, propagules, topsoil and organic matter. Surface roughness may be due to soil surface microtopography which retain flowing resources (depressions, gilgais etc) or to high grass plant density such that water flows are highly convoluted at the 5-cm horizontal scale. High surface roughness slows outflow rates, permitting a longer time for infiltration and may comprise a safe site for the lodgement of propagules and litter. Soil surface relief that does not facilitate resource retention attracts low scores. The spatial expression of roughness off the strict line transect may provide context and assist in the assessment. On mine sites with bank and trough formations, the depth of the trough is the relevant depth to record (look at the integrity of the trough; if bank broken within 10 metres downgrade class value, according to loss of water holding ability (often this is class 4 or 5).

Table A10 Surface roughness

Surface roughness	Class
<3 mm relief in soil surface smooth	1
Shallow depressions 3-8 mm relief; low retention	2
Deeper depressions 8-25 mm, dense tussock grasslands; moderate retention	3
Deep depressions that have a visible base; large retention	4
Very deep depressions or cracks >100mm; extensive retention	5

A 1.9 Surface resistance to disturbance

The objective is to assess the ease with which the soil can be mechanically disturbed to yield material suitable for erosion by wind or water. This assessment should only be done on dry soil, as all moist soils are soft. All the criteria below assume dry soil. A very hard soil surface implies high mechanical strength, but very low infiltration, due to low porosity and massive crusting or hard setting. This is considered in the Excel template, which weights the indicator appropriately. Crust flexibility and coherence are assessed as per the table. Note that classification here is not necessarily intuitive: barren scald surfaces receive a 4.

Table A11 Surface resistance to disturbance

Surface nature	Class	Interpretation
Non -brittle	5	Shows some “springiness” when pressed with finger, typically with A0 layer; or Surface is a self-mulching clay; or Surface has no physical crust and is under a dense perennial grass sward (ie not just an isolated plant).
Crust is very hard and brittle	4	Needs a metal implement to break the surface, forming amorphous fragments or powder. The sub-crust is also very hard, coherent and brittle.
Moderately hard	3	Surface has a physical crust and moderately hard, needing a plastic tool (eg pen-top) to pierce, breaking into amorphous fragments or powder; the sub-crust is coherent.
Easily broken	2	Surface is easily penetrated with finger pressure (to about first knuckle joint). Surface may have a weak physical crust and sub-crust is non-coherent eg sandy.
Loose sandy surface	1	Surface is not crusted, easily penetrated by finger pressure to about second knuckle joint. Sub-surface is non-coherent.

A 1.10 Slake test

The objective of this test is to assess the stability of natural soil fragments to rapid wetting. The test needs to be done on each landscape stratum type identified. Stable soil fragments maintain their cohesion when wet, implying low water erosion potential.

The test is performed by gently immersing air-dry soil fragments of about 1-cm cube size in rainwater and observing the response over a period of a minute or so. Water quality is important. Saline water is unsuitable. The soil crust must remain uppermost after immersion. The fragment can be obtained with a chisel or knife blade, breaking the fragment with the fingers to the appropriate size. Some soils with high organic matter levels may float in the water. Usually, these are stable (Class 4). Soils that do not permit coherent fragments to be picked up and tested (eg loose sands) should be scored as “not applicable” (a zero in the spreadsheet).

Table A12 Slake test

Observed behaviour	Class	Interpretation
Not Applicable	0	No coherent fragments available eg sand
Very unstable	1	Fragment collapses in less than 5 seconds
Unstable	2	Fragment substantially collapses 5-10 seconds; a thin surface crust remains. >50% of the sub-crust material slumps
Moderately stable	3	Surface crust remains intact with some slumping of the sub-crust but less than 50%
Very stable	4	Whole fragment remains intact with no swelling

A 1.11 Texture

The objectives of this test are to classify the texture of the surface soil and relate this to permeability. This procedure is an initial measurement at the establishment of the site and does not require being repeated at each monitoring event. It is done with a pedologists' moist bolus test, and a simplified 4 point scale.

The field technique is described by McDonald et al 1990. Take a sample of soil from a depth of 0-5 cm that will comfortably fit into the palm of the hand. Moisten the soil with water, a little at a time, and knead until the ball of soil, so formed, just fails to stick to the fingers. Add more soil or water to attain this condition, known as the sticky point, which approximates field capacity for that soil. Continue kneading and moistening until there is no apparent change in the soil ball, usually 1-2 minutes. The behaviour of the soil ball, or bolus, and the ribbon it produces by pressing out between the thumb and forefinger characterizes the field texture. The flow-chart in figure 33 enables soil texture to be quickly determined.

Table A13 Texture

Texture	Class
Silty clay to heavy clay (very slow infiltration rate)	1
Sandy clay loam to sandy clay (slow infiltration rate)	2
Sandy loam to silt loam (moderate infiltration rate)	3
Sandy to clayey sand (high infiltration rate)	4

Appendix B:

BioNet Vegetation Classification Profile and Benchmark Data

BioNet Vegetation Classification - Community Profile Report

Plant Community Type ID (PCT ID): 1330

PCT Name: Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion
Classification Confidence Level: 5-Very Low
Vegetation Description: Other Diagnostics Features: Woodland with a sparse shrub layer and dense grassy groundcover.; LandscapePosition: Occurs on loamy soils on undulating terrain between 500 and 900m on the tablelands.
Variation and Natural Disturbance:
Vegetation Formation: Grassy Woodlands;
Vegetation Class: Southern Tableland Grassy Woodlands;
IBRA Bioregion(s): NSW South Western Slopes; South East Corner; South Eastern Highlands; Sydney Basin;
IBRA Sub-region(s): Inland Slopes; South East Coastal Ranges; Murrumbateman; Bungonia; Kanangra; Crookwell; Oberon; Bathurst; Orange; Hill End; Bondo; Kybeyan-Gourock; Monaro; Wollemi; Burragorang; Capertee Valley; Capertee Uplands;
LGA: Not Assessed
Lithology: Not Assessed
Landform Pattern: Not Assessed
Landform Element: Not Assessed
Emergent species: None
Upper Stratum Species: Eucalyptus melliodora; Eucalyptus bridgesiana; Eucalyptus blakelyi; Eucalyptus dives; Eucalyptus macrorhyncha; Eucalyptus rubida subsp. rubida; Eucalyptus pauciflora; Eucalyptus mannifera; Eucalyptus viminalis;
Mid Stratum Species: Lissanthe strigosa; Melichrus urceolatus;
Ground Stratum Species: Bothriochloa macra; Gonocarpus tetragynus; Goodenia hederacea; Hydrocotyle laxiflora; Lomandra filiformis subsp. coriacea; Microlaena stipoides var. stipoides; Themeda australis;
Diagnostic Species: Not Assessed
Fire Regime:
TEC Assessed: Has associated TEC
TEC List: Listed BC Act,CE: White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (Equivalent); Listed EPBC Act,CE: White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (Equivalent);
Associated TEC Comments:
PCT Percent Cleared: 94.00
PCT Definition Status: Approved

Community Condition Benchmarks

Vegetation Class	Southern Tableland Grassy Woodlands	Southern Tableland Grassy Woodlands	Southern Tableland Grassy Woodlands	Southern Tableland Grassy Woodlands
IBRA	South Eastern Highlands	South East Corner	NSW South Western Slopes	Sydney Basin
Benchmark Calculation Level	Class/IBRA	Class/IBRA	Class/IBRA	Class/IBRA
Tree Richness	4	4	4	5
Shrub Richness	7	8	6	10
Grass and Grass Like Richness	9	9	8	10
Forb Richness	16	14	10	16
Fern Richness	1	1	1	1
Other Richness	2	3	1	3
Tree Cover	25.0	22.0	41.0	39.0
Shrub Cover	5.0	13.0	2.0	12.0
Grass and Grass Like Cover	37.0	33.0	27.0	32.0
Forb Cover	9.0	8.0	8.0	9.0
Fern Cover	0.0	0.0	0.0	0.0
Other Cover	0.0	1.0	0.0	1.0
Total length of fallen logs	50	50	50	50
Litter Cover	45	45	45	45
Number of Large Trees	3.0	3.0	3.0	3.0
Large Tree Threshold Size	50	50	50	50

Table B1 Profile for PCT 3373

PCT ID	3373
VCA Type ID	0
PCT Name	Goulburn Tableland Box-Gum Grassy Forest
PCT Scientific Name	
Authority	Eastern NSW PCT Classification
Classification Type	Quantitative
Classification Confidence Level	High
Vegetation Formation	Grassy Woodlands
Vegetation Class	Southern Tableland Grassy Woodlands
Vegetation Description	A mid-high to tall dry sclerophyll grassy open forest to woodland of northern parts of the southern tablelands, occurring from Canberra and Queanbeyan north to Pejar and east to Durran Durra and Canyonleigh, with a northern outlier at Golspie. It is found in landscape positions with moderately deep soil profiles, particularly footslopes of gently undulating low hills, on a wide range of substrates including sedimentary (sandstone, arenite, greywacke, shale), acid volcanic (ignimbrite, rhyolite) and granitic rocks. This PCT is found at elevations of 600-850 metres asl with mean annual rainfall of 650-800 mm. Remnants of this community often have a long history of disturbance and the tree canopy may be sparse to very sparse, commonly including Eucalyptus melliodora and occasionally with Eucalyptus macrorhyncha, Eucalyptus blakelyi or Eucalyptus dives. A very sparse shrub stratum commonly includes scattered Lissanthe strigosa, Pimelea curviflora, Melichrus urceolatus or Hibbertia obtusifolia, while the ground layer is predominantly grassy and commonly includes Themeda triandra, Microlaena stipoides, Poa sieberiana, Elymus scaber and Aristida ramosa, with occasional high cover of Rytidosperma laeve. Common forbs include Lomandra filiformis, Lomandra multiflora subsp. multiflora, Goodenia hederacea, Hydrocotyle laxiflora, Oxalis perennans, Chrysocephalum apiculatum, Tricoryne elatior, Gonocarpus tetragynus and Hypericum gramineum. In lower landscape positions subject to cold air drainage this community may be replaced by PCT 3338, while on stony dry hills it commonly grades into PCT 3747.
Other Diagnostic Features	
IBRA Bioregion(s)	South Eastern Highlands;
IBRA Comments	
IBRA Sub-region(s)	Bungonia; Crookwell; Monaro; Murrumbateman;
NSW Landscape(s)	
LGA(s)	GOULBURN MULWAREE; QUEANBEYAN-PALERANG REGIONAL; UPPER LACHLAN; YASS VALLEY;
Elevation Min(m)	615.2
Elevation Median(m)	697.3
Elevation Max(m)	839.5
Annual Rainfall Min(mm)	648
Annual Rainfall Median(mm)	698
Annual Rainfall Max(mm)	776
Annual Mean Temperature Min (deg.C)	11.28
Annual Mean Temperature Median(deg.C)	12.38

PCT ID	3373
Annual Mean Temperature Max(deg.C)	13.18
Upper Stratum Species	
Mid Stratum Species	
Ground Stratum Species	
Diagnostic Species	
Emergent Species	
Tree Growth Form Group Species	Eucalyptus melliodora , Eucalyptus macrorhyncha , Eucalyptus blakelyi , Eucalyptus dives , Eucalyptus mannifera , Eucalyptus bridgesiana , Acacia decurrens , Eucalyptus rubida , Eucalyptus rossii , Acacia dealbata , Acacia melanoxylon , Eucalyptus cinerea , Eucalyptus pauciflora , Allocasuarina littoralis , Eucalyptus amplifolia , Acacia parramattensis , Allocasuarina luehmannii , Eucalyptus tereticornis , Eucalyptus eugenioides , Eucalyptus goniocalyx , Eucalyptus polyanthemos , Eucalyptus radiata , Eucalyptus sclerophylla , Eucalyptus viminalis
Shrub Growth Form Group Species	Melichrus urceolatus , Lissanthe strigosa , Pimelea curviflora , Hibbertia obtusifolia , Bossiaea buxifolia , Dillwynia sericea , Brachyloma daphnoides , Astroloma humifusum , Acacia genistifolia , Daviesia latifolia , Cassinia aculeata , Daviesia genistifolia , Acacia mearnsii , Acrotriche serrulata , Indigofera australis , Pultenaea microphylla , Acacia deanei , Daviesia mimosoides , Dillwynia phylicoides , Pultenaea procumbens , Acacia gunnii , Cryptandra amara , Daviesia leptophylla , Exocarpos strictus , Gompholobium huegelii , Leucopogon virgatus , Pultenaea subspicata , Acacia ulicifolia , Cassinia longifolia , Daviesia ulicifolia , Exocarpos cupressiformis , Hibbertia riparia , Leucopogon fraseri , Persoonia linearis , Rubus parvifolius , Acacia brownii , Acacia cognata , Acacia falciformis , Acacia implexa , Acacia paradoxa , Acacia rubida , Acacia terminalis , Calytrix tetragona , Cassinia laevis , Cassinia uncata , Grevillea lanigera , Kunzea parvifolia , Leptospermum continentale , Leptospermum myrtifolium , Leucopogon attenuatus , Leucopogon fletcheri , Leucopogon juniperinus , Olearia viscidula , Pimelea linifolia , Pomaderris andromedifolia , Rhytidosporum procumbens
Grass & Grass-like Growth Form Group Species	Lomandra filiformis , Themeda triandra , Microlaena stipoides , Lomandra multiflora subsp. multiflora , Poa sieberiana , Aristida ramosa , Elymus scaber , Rytidosperma laeve , Austrostipa scabra , Dichelachne micrantha , Rytidosperma pallidum , Poa meionectes , Rytidosperma racemosum , Austrostipa densiflora , Echinopogon ovatus , Panicum effusum , Rytidosperma monticola , Rytidosperma tenuius , Luzula densiflora , Luzula flaccida , Schoenus apogon , Aristida jerichoensis , Carex inversa , Juncus subsecundus , Lepidosperma laterale , Rytidosperma pilosum , Austrostipa mollis , Aristida vagans , Echinopogon caespitosus , Juncus filicaulis , Lomandra longifolia , Poa labillardierei var. labillardierei , Rytidosperma auriculatum , Eragrostis benthamii , Lepidosperma gunnii , Austrostipa rudis , Chloris truncata , Dichelachne inaequiglumis , Eragrostis leptostachya , Juncus usitatus , Panicum simile , Rytidosperma caespitosum , Rytidosperma penicillatum , Rytidosperma setaceum , Austrostipa pubinodis , Austrostipa semibarbata , Bothriochloa macra , Carex breviculmis , Cynodon dactylon , Dichelachne sieberiana , Lomandra micrantha subsp. tuberculata , Lomandra obliqua , Rytidosperma carphoides , Rytidosperma erianthum , Rytidosperma nudiflorum

PCT ID	3373
Forb Growth Form Group Species	Goodenia hederacea , Gonocarpus tetragynus , Hydrocotyle laxiflora , Hypericum gramineum , Chrysocephalum apiculatum , Tricoryne elatior , Oxalis perennans , Dianella revoluta , Bossiaea prostrata , Opercularia aspera , Cymbonotus lawsonianus , Einadia nutans , Hovea linearis , Wahlenbergia stricta , Solenogyne dominii , Acaena echinata , Galium gaudichaudii , Coronidium scorpioides , Daucus glochidiatus , Stylidium graminifolium , Acaena ovina , Asperula conferta , Crassula sieberiana , Geranium solanderi , Laxmannia gracilis , Microseris lanceolata , Plantago gaudichaudii , Calocephalus citreus , Leptorhynchos squamatus , Opercularia hispida , Plantago varia , Scleranthus biflorus , Ajuga australis , Bulbine bulbosa , Dichondra repens , Rumex brownii , Veronica plebeia , Wahlenbergia luteola , Acaena novae-zelandiae , Chrysocephalum semipapposum , Euchiton sphaericus , Opercularia diphylla , Plantago debilis , Leucochrysum albicans , Stackhousia monogyna , Wahlenbergia communis , Wahlenbergia gracilis , Dichopogon fimbriatus , Eryngium ovinum , Hackelia suaveolens , Oxalis exilis , Vittadinia muelleri , Wahlenbergia graniticola , Wurmbea dioica subsp. dioica , Asperula scoparia , Brachyscome ciliaris , Dianella longifolia , Drosera peltata , Euchiton involucratus , Euchiton japonicus , Senecio prenanthoides , Senecio quadridentatus , Viola betonicifolia , Vittadinia cuneata , Brachyscome rigidula , Caladenia carnea , Craspedia variabilis , Eriochilus cucullatus , Goodenia pinnatifida , Lagenophora stipitata , Oreomyrrhis eriopoda , Podolepis jaceoides , Poranthera microphylla , Pterostylis reflexa , Sebaea ovata , Swainsona sericea , Thysanotus tuberosus , Velleia paradoxa , Veronica calycina , Arthropodium minus , Asperula ambleia , Burchardia umbellata , Caesia parviflora , Calotis anthemoides , Cynoglossum australe , Dianella caerulea , Dichopogon strictus , Diuris sulphurea , Dysphania pumilio , Einadia hastata , Galium ciliare , Geranium retrorsum , Haloragis heterophylla , Hydrocotyle sibthorpioides , Isoetopsis graminifolia , Lagenophora gracilis , Microtis unifolia , Mitrasacme serpyllifolia , Oxalis chnoodes , Oxalis radicosa , Pterostylis nana , Pterostylis truncata , Ranunculus lappaceus , Scleranthus diander , Senecio diaschides , Senecio tenuiflorus , Stypandra glauca , Thelymitra circumsepta , Trachymene incisa subsp. incisa , Triptilodiscus pygmaeus , Wahlenbergia littoricola , Xerochrysum viscosum
Fern Growth Form Group Species	Cheilanthes sieberi subsp. sieberi , Cheilanthes austrotenuifolia
Other Growth Form Group Species	Hardenbergia violacea , Glycine clandestina , Desmodium varians , Thysanotus patersonii , Glycine tabacina , Billardiera scandens , Convolvulus erubescens , Amyema miquelii , Cassytha pubescens , Muellerina eucalyptoides
Median Native Species Richness per plot	36
Height Class (Walker & Hopkins 1990)	
Variation And Natural Disturbance	
Fire Regime	
Landscape Position	
Lithology	
Landform Pattern	
Landform Element	
Is PCT Derived?	
PCT derived from these communities	
PCT derived community comments	
Pre-European Extent	45446
Pre-European Extent Accuracy	
Pre-European Comments	Calculated from State Vegetation Type Map (SVTM) pre-clearing PCT map C1.1.M1 and Inland Multinomial Modelling. Values rounded to nearest hectare.
Current Extent	3589

PCT ID	3373
Current Extent Accuracy	
Current Extent Comments	Calculated from State Vegetation Type Map (SVTM) extant PCT map C1.1.M1 and Inland Multinomial Modelling. Values rounded to nearest hectare.
PCT Percent Cleared	92.1
% accuracy (of PCT % cleared estimate)	
PCT associated with TEC	Has associated TEC
TEC List	Listed BC Act,CE: White Box - Yellow Box - Blakelyâ€™s Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (Part) ; Listed EPBC Act,CE: White Box-Yellow Box-Blakelyâ€™s Red Gum Grassy Woodland and Derived Native Grassland (Part) ;
TEC Comments	(Comment TEC1) Relates to the NSW White Box Yellow Box Blakelyâ€™s Red Gum Woodland TEC. (Comment TEC2) May relate to the Commonwealth White Box Yellow Box Blakelyâ€™s Red Gum Woodland TEC where it meets condition criteria as per section 4 of the Listing Advice.
Adequacy of plot sampling	None
Total Number of Replicates	80
Number of Primary Replicates	54
Number of Secondary Replicates	26
Pre-European Mapped Or Modelled	
Current Extent Mapped Or Modelled	
Classification source	Eastern NSW PCT Classification
Citations	Connolly, D. et al., in prep.
Full Reference Details	Connolly, D., Binns, D., Turner, K., Hager, T., Lyons, M., Magarey, E. (in prep.) A revised classification of Plant Community Types for eastern New South Wales. NSW DPIE, Parramatta;
Profile Source	R4.145;
PCT Definition Status	Approved

Table B2 Benchmarks for PCT 3373

PCT ID	3373
Classification Confidence Level	High
PCT Name	Goulburn Tableland Box-Gum Grassy Forest
PCT Scientific Name	
Vegetation Class	Southern Tableland Grassy Woodlands
Vegetation Formation	Grassy Woodlands
IBRA Bioregion Code	SEH
IBRA Bioregion(s)	South Eastern Highlands

PCT ID	3373
Benchmark Calculation Level	Class/IBRA
PCT Benchmark Variation	monthly average, following AVERAGE RAINFALL year
Rainfall Threshold	560 - 846
Default Benchmark Condition	Yes
Tree richness	4
Tree cover	26
Shrub richness	7
Shrub cover	5
Grass & grass - like richness	9
Grass & grass - like cover	35
Forb richness	16
Forb cover	9
Fern richness	1
Fern cover	0
Other richness	2
Other cover	0
Total length of fallen logs	50
Litter cover	45
No.of large trees(per 0.1ha)	3
Large Tree Threshold Size	50
PCT Benchmarks Comments	Composition-Structure Benchmark : Class/IBRA | Function: Logs-Class; Litter-Class; Large Trees-Formation
PCT Benchmarks Reference Site	
Benchmark source	Multiple methods
Benchmark Confidence	Composition: High | Structure: Moderate | Function: Logs-Moderate; Litter-Moderate; Large Trees-Moderate
PCT Benchmark Status	Approved
PCT Definition Status	Approved

Table B3 Profile for PCT 3376

PCT ID	3376
VCA Type ID	0
PCT Name	Southern Tableland Grassy Box Woodland
PCT Scientific Name	
Authority	Eastern NSW PCT Classification

PCT ID	3376
Classification Type	Quantitative
Classification Confidence Level	Medium
Vegetation Formation	Grassy Woodlands;
Vegetation Class	Southern Tableland Grassy Woodlands;
Vegetation Description	A tall sclerophyll woodland with a dry shrub layer that is patchy to absent and a mid dense, grassy groundcover, widespread in the low hills of the drier parts of the Southern Tablelands between Bredbo and Rylstone. The canopy almost always includes box eucalypts (Eucalyptus melliodora or Eucalyptus bridgesiana), occasionally associated with Eucalyptus blakelyi which may be locally prominent in lower parts of the landscape. The shrub layer is sparse to absent with occasional, scattered Melichrus urceolatus, Lissanthe strigosa or various Acacia species. The mid-dense ground layer typically includes grasses, forbs, graminoids and some twiners, very frequently including Hydrocotyle laxiflora, Austrostipa scabra, Lomandra filiformis, Microlaena stipoides and Elymus scaber. The PCT primarily occurs in the Bredbo, Canberra, Goulburn and Boorowa areas, with more scattered occurrences extending north to Bathurst, Orange and Rylstone. It occurs on granite, volcanic and sedimentary substrates in cold, dry environments with a mean annual rainfall typically below 760 mm. While widespread, this PCT primarily occurs in small, often disturbed patches with a long history of grazing. It is not closely related floristically to nearby PCTs, however it grades into PCT 3373 which has a more diverse shrub layer and some subtle differences in canopy species. Eucalyptus macrorhyncha, Eucalyptus dives, Bossiaea buxifolia, Dillwynia sericea and Brachyloma daphnoides are only occasional in PCT 3373 however collectively represent a suite of species that are rare in this PCT. In the Boorowa area, PCT 3376 grades into PCT 3400 which are both grassy woodlands featuring Eucalyptus melliodora and Eucalyptus blakelyi. This represents the transition from the colder environment of the tablelands (PCT 3376) to the woodlands of the lower elevation, warmer climate of the South West Slopes (PCT 3400).
Other Diagnostic Features	
IBRA Bioregion(s)	NSW South Western Slopes; South East Corner; South Eastern Highlands; Sydney Basin;
IBRA Comments	
IBRA Sub-region(s)	Capertee Valley; Inland Slopes; South East Coastal Ranges; Bathurst; Bondo; Bungonia; Crookwell; Hill End; Monaro; Murrumbateman; Oberon; Orange; Wollemi;
NSW Landscape(s)	
LGA(s)	BATHURST REGIONAL; BLAYNEY; CABONNE; GOULBURN MULWAREE; HILLTOPS; LITHGOW; MID-WESTERN REGIONAL; QUEANBEYAN-PALERANG REGIONAL; SNOWY MONARO REGIONAL; SNOWY VALLEYS; UPPER LACHLAN; YASS VALLEY;
Elevation Min(m)	311.9
Elevation Median(m)	681.8
Elevation Max(m)	1028.1
Annual Rainfall Min(mm)	574
Annual Rainfall Median(mm)	682
Annual Rainfall Max(mm)	918
Annual Mean Temperature Min (deg.C)	10.55
Annual Mean Temperature Median(deg.C)	12.45

PCT ID	3376
Annual Mean Temperature Max(deg.C)	14.06
Upper Stratum Species	
Mid Stratum Species	
Ground Stratum Species	
Diagnostic Species	
Emergent Species	
Tree Growth Form Group Species	Eucalyptus melliodora , Eucalyptus blakelyi , Eucalyptus bridgesiana , Eucalyptus rossii , Acacia dealbata , Eucalyptus mannifera , Eucalyptus macrorhyncha , Allocasuarina verticillata , Eucalyptus dives , Eucalyptus rubida , Brachychiton populneus , Eucalyptus nortonii , Eucalyptus pauciflora , Eucalyptus polyanthemos , Acacia decurrens , Acacia parramattensis , Allocasuarina littoralis , Eucalyptus amplifolia , Eucalyptus tereticornis , Callitris endlicheri , Eucalyptus albens , Eucalyptus camaldulensis , Eucalyptus cinerea , Eucalyptus dalrympleana , Eucalyptus sieberi , Eucalyptus viminalis
Shrub Growth Form Group Species	Melichrus urceolatus , Lissanthe strigosa , Pimelea curviflora , Hibbertia obtusifolia , Bossiaea buxifolia , Astroloma humifusum , Cryptandra amara , Dillwynia sericea , Acacia implexa , Acrotriche serrulata , Cassinia longifolia , Pultenaea microphylla , Acacia genistifolia , Cassinia quinquefaria , Daviesia genistifolia , Daviesia ulicifolia , Dodonaea viscosa , Exocarpos cupressiformis , Kunzea ericoides , Acacia deanei , Acacia mearnsii , Acacia rubida , Brachyloma daphnoides , Bursaria spinosa , Pultenaea procumbens , Rubus parvifolius , Acacia falciformis , Cassinia aculeata , Cassinia laevis , Daviesia leptophylla , Hibbertia riparia , Indigofera australis , Leucopogon fletcheri , Styphelia triflora , Acacia cardiophylla , Acacia dawsonii , Acacia paradoxa , Acacia ulicifolia , Acacia vestita , Calytrix tetragona , Cheiranthera linearis , Daviesia acicularis , Daviesia latifolia , Daviesia mimosoides , Dillwynia phylicoides , Hibbertia cistoidea , Hibbertia monogyna , Indigofera adesmiifolia , Leucopogon neoanglicus , Monotoca scoparia , Pultenaea ferruginea , Pultenaea subspicata , Pultenaea villosa , Rhytidosporum procumbens , Solanum linearifolium
Grass & Grass-like Growth Form Group Species	Austrostipa scabra , Lomandra filiformis , Microlaena stipoides , Elymus scaber , Themeda triandra , Bothriochloa macra , Panicum effusum , Poa sieberiana , Rytidosperma racemosum , Carex inversa , Aristida ramosa , Lomandra multiflora subsp. multiflora , Schoenus apogon , Juncus filicaulis , Rytidosperma carphoides , Austrostipa bigeniculata , Austrostipa densiflora , Rytidosperma auriculatum , Dichelachne micrantha , Luzula densiflora , Rytidosperma pilosum , Chloris truncata , Rytidosperma laeve , Poa labillardierei var. labillardierei , Rytidosperma pallidum , Carex breviculmis , Rytidosperma erianthum , Rytidosperma caespitosum , Enneapogon nigricans , Eragrostis benthamii , Juncus subsecundus , Aristida jerichoensis , Lepidosperma laterale , Rytidosperma monticola , Carex appressa , Cymbopogon refractus , Cynodon dactylon , Lomandra bracteata , Lomandra longifolia , Poa meionectes , Rytidosperma setaceum , Sorghum leiocladum , Austrostipa rudis , Eragrostis brownii , Eragrostis leptostachya , Rytidosperma penicillatum , Rytidosperma tenuius , Sporobolus creber , Aristida vagans , Austrostipa mollis , Bothriochloa decipiens var. decipiens , Dichanthium sericeum , Dichelachne crinita , Dichelachne rara , Dichelachne sieberiana , Digitaria brownii , Echinopogon ovatus , Eragrostis parviflora , Juncus homalocaulis , Lachnagrostis filiformis , Luzula flaccida , Rytidosperma bipartitum , Rytidosperma fulvum , Aristida behriana , Austrostipa gibbosa , Austrostipa setacea , Carex tereticaulis , Cyperus gracilis , Deyeuxia quadriseta , Dichanthium tenue , Dichelachne hirtella , Dichelachne inaequiglumis , Dichelachne parva , Eragrostis elongata , Eragrostis trachycarpa , Isolepis cernua , Juncus gregiflorus , Juncus usitatus , Luzula meridionalis , Luzula ovata , Sporobolus elongatus , Tricostularia pauciflora , Typha domingensis

PCT ID	3376
Forb Growth Form Group Species	Hydrocotyle laxiflora , Oxalis perennans , Chrysocephalum apiculatum , Gonocarpus tetragynus , Acaena ovina , Rumex brownii , Tricoryne elatior , Solenogyne dominii , Cymbonotus lawsonianus , Hypericum gramineum , Crassula sieberiana , Geranium solanderi , Einadia nutans , Asperula conferta , Plantago varia , Triptilodiscus pygmaeus , Goodenia hederacea , Wahlenbergia communis , Wurmbea dioica subsp. dioica , Euchiton involucratus , Vittadinia muelleri , Bulbine bulbosa , Dichondra repens , Daucus glochidiatus , Leptorhynchos squamatus , Vittadinia cuneata , Wahlenbergia stricta , Eryngium ovinum , Plantago gaudichaudii , Senecio quadridentatus , Acaena echinata , Arthropodium minus , Wahlenbergia gracilis , Bossiaea prostrata , Dichopogon fimbriatus , Euchiton sphaericus , Chrysocephalum semipapposum , Cotula australis , Calocephalus citreus , Galium gaudichaudii , Goodenia pinnatifida , Microtis unifolia , Oxalis radicosa , Hackelia suaveolens , Scleranthus biflorus , Dianella longifolia , Dianella revoluta , Xerochrysum viscosum , Chamaesyce drummondii , Drosera peltata , Haloragis heterophylla , Leucochrysum albicans , Stackhousia monogyna , Veronica plebeia , Veronica calycina , Opercularia aspera , Opercularia diphylla , Oxalis exilis , Wahlenbergia luteola , Ajuga australis , Euchiton japonicus , Laxmannia gracilis , Lythrum hyssopifolia , Microseris lanceolata , Sebaea ovata , Aphanes australiana , Burchardia umbellata , Chamaesyce dallachyana , Dysphania pumilio , Epilobium billardierianum , Geranium retrorsum , Oreomyrrhis eriopoda , Scleranthus diander , Thelymitra circumsepta , Wahlenbergia graniticola , Calotis lappulacea , Cynoglossum australe , Ranunculus lappaceus , Solenogyne gunnii , Stuartina muelleri , Swainsona sericea , Vittadinia gracilis , Acaena novae-zelandiae , Alternanthera nana , Brachyscome rigidula , Desmodium brachypodum , Erodium crinitum , Hypoxis hygrometrica , Isoetopsis graminifolia , Plantago hispida , Thysanotus tuberosus , Ammobium craspedioides , Arthropodium milleflorum , Calotis anthemoides , Craspedia variabilis , Einadia hastata , Hovea linearis , Lagenophora gracilis , Microtis parviflora , Opercularia hispida , Plantago debilis , Podolepis jaceoides , Pterostylis mutica , Pterostylis nana , Stellaria pungens , Thelymitra pauciflora , Viola betonicifolia , Zornia dyctiocarpa var. dyctiocarpa , Alternanthera sp. A , Brachyscome angustifolia , Brachyscome ciliaris , Brachyscome multifida , Brachyscome ptychocarpa , Caesia parviflora , Caladenia tentaculata , Calotis scabiosifolia , Centipeda cunninghamii , Coronidium scorpioides , Cymbonotus preissianus , Desmodium rhytidophyllum , Dichopogon strictus , Diuris sulphurea , Einadia trigonos , Galium ciliare , Galium leiocarpum , Gnaphalium indutum , Hydrocotyle algida , Hydrocotyle foveolata , Isotoma axillaris , Lepidium pseudohyssopifolium , Mentha diemenica , Myriophyllum crispatum , Polygala japonica , Poranthera microphylla , Portulaca oleracea , Ranunculus pumilio , Rumex dumosus , Rutidosis leptorrhynchoides , Scutellaria humilis , Senecio diaschides , Senecio prenanthoides , Senecio tenuiflorus , Solanum pungetium , Swainsona monticola , Urtica incisa , Velleia paradoxa , Vittadinia triloba , Wahlenbergia gracilenta , Wahlenbergia multicaulis , Xerochrysum bracteatum
Fern Growth Form Group Species	Cheilanthes sieberi subsp. sieberi , Cheilanthes austrotenuifolia , Ophioglossum lusitanicum , Asplenium flabellifolium
Other Growth Form Group Species	Desmodium varians , Convolvulus erubescens , Glycine tabacina , Glycine clandestina , Clematis microphylla , Kennedia prostrata , Amyema pendula , Amyema miquelii , Thysanotus patersonii , Hardenbergia violacea , Glycine microphylla , Xanthorrhoea concava
Median Native Species Richness per plot	34
Height Class (Walker & Hopkins 1990)	
Variation And Natural Disturbance	
Fire Regime	
Landscape Position	
Lithology	
Landform Pattern	
Landform Element	
Is PCT Derived?	
PCT derived from these communities	

PCT ID	3376
PCT derived community comments	
Pre-European Extent	452899
Pre-European Extent Accuracy	
Pre-European Comments	Calculated from State Vegetation Type Map (SVTM) pre-clearing PCT map C1.1.M1 and Inland Multinomial Modelling. Values rounded to nearest hectare.
Current Extent	31900
Current Extent Accuracy	
Current Extent Comments	Calculated from State Vegetation Type Map (SVTM) extant PCT map C1.1.M1 and Inland Multinomial Modelling. Values rounded to nearest hectare.
PCT Percent Cleared	92.96
% accuracy (of PCT % cleared estimate)	
PCT associated with TEC	Has associated TEC
TEC List	Listed BC Act,CE: White Box - Yellow Box - Blakelyâ€™s Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (Part) ; Listed EPBC Act,CE: White Box-Yellow Box-Blakelyâ€™s Red Gum Grassy Woodland and Derived Native Grassland (Part) ;
TEC Comments	(Comment TEC1) Relates to the NSW White Box Yellow Box Blakelyâ€™s Red Gum Woodland TEC. (Comment TEC2) May relate to the Commonwealth White Box Yellow Box Blakelyâ€™s Red Gum Woodland TEC where it meets condition criteria as per section 4 of the Listing Advice.
Adequacy of plot sampling	None
Total Number of Replicates	194
Number of Primary Replicates	108
Number of Secondary Replicates	86
Pre-European Mapped Or Modelled	
Current Extent Mapped Or Modelled	
Classification source	Eastern NSW PCT Classification
Citations	Connolly, D. et al., in prep.
Full Reference Details	Connolly, D., Binns, D., Turner, K., Hager, T., Lyons, M., Magarey, E. (in prep.) A revised classification of Plant Community Types for eastern New South Wales. NSW DPIE, Parramatta;
Profile Source	R6.97;
PCT Definition Status	Approved

Table B4 Benchmarks for PCT 3376

PCT ID	3376
Classification Confidence Level	Medium
PCT Name	Southern Tableland Grassy Box Woodland
PCT Scientific Name	
Vegetation Class	Southern Tableland Grassy Woodlands
Vegetation Formation	Grassy Woodlands
IBRA Bioregion Code	SYB
IBRA Bioregion(s)	Sydney Basin
Benchmark Calculation Level	Class/IBRA
PCT Benchmark Variation	monthly average, following AVERAGE RAINFALL year
Rainfall Threshold	669 - 1035
Default Benchmark Condition	Yes
Tree richness	5
Tree cover	40
Shrub richness	10
Shrub cover	12
Grass & grass - like richness	10
Grass & grass - like cover	32
Forb richness	15
Forb cover	9
Fern richness	1
Fern cover	0
Other richness	3
Other cover	1
Total length of fallen logs	50
Litter cover	45
No.of large trees(per 0.1ha)	3
Large Tree Threshold Size	50
PCT Benchmarks Comments	Composition-Structure Benchmark : Class/IBRA | Function: Logs-Class; Litter-Class; Large Trees-Formation
PCT Benchmarks Reference Site	
Benchmark source	Multiple methods
Benchmark Confidence	Composition: High | Structure: Moderate | Function: Logs-Moderate; Litter-Moderate; Large Trees-Moderate
PCT Benchmark Status	Approved
PCT Definition Status	Approved

Appendix C:
Data and Graphs for RM1

Table C1 Plot Photographs at RM1 in 2022

Start of Transect	End of Transect
	

Table C2 BAM Plot Composition Attributes at RM1 in 2022 - Floristics (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Scientific Name	Cover	Abundance
Non-HTE	Anthoxanthum odoratum	0.5	20
HTE	Bromus diandrus	5	100
Non-HTE	Bromus molliformis	0.1	10
Non-HTE	Cirsium vulgare	2	20
Non-HTE	Echium plantagineum	1	10
Non-HTE	Erodium cicutarium	25	100
Non-HTE	Gamochaeta calviceps	0.5	50
Forb	Geranium solanderi	2	4
Non-HTE	Hirschfeldia incana	25	50
Non-HTE	Holcus lanatus	0.5	10
Non-HTE	Lolium perenne	5	50
Non-HTE	Modiola caroliniana	0.1	2
Non-HTE	Onopordum acanthium	0.5	2
Non-HTE	Phalaris aquatica	1	30
Non-HTE	Plantago lanceolata	1	50
Non-HTE	Polygonum aviculare	30	1000
HTE	Rubus anglocandicans (in Rubus fruticosus L. complex)	3	7
Non-HTE	Rumex acetosella	1	20
Non-HTE	Silybum marianum	3	100
Non-HTE	Solanum nigrum	0.5	5
Non-HTE	Sonchus asper	10	30
Non-HTE	Trifolium campestre	2	50
Non-HTE	Trifolium subterraneum	2	50
Non-HTE	Vulpia bromoides	2	50

Table C3 BAM Plot Structure Attributes at RM1 in 2022 - Species Richness and Cover (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Count of Species Richness	Sum of Cover of vascular plants
Native Tree	0	0
Native Shrub	0	0
Native Grass & grasslike	0	0
Native Forb	1	2
Native Fern	0	0
Native Other	0	0
High Threat Exotic	2	8
Non-HTE	21	112.7
Total Weeds	23	120.7

Table C4 BAM Plot Function Attributes at RM1 in 2022 - Tree Stems and Hollows (1000m^2 plot)

DBH (cm)	Number of tree stems	Number of tree stems with hollows
>80	0	0
50 to 79	0	0
30 to 49	0	0
20 to 29	0	0
10 to 19	0	0
5 to 9	0	0
<5	0	0

Table C5 BAM Plot Function Attributes at RM1 in 2022 - Length of Logs (1000m^2 plot)

Attribute	2022
Total Length of Logs (m)	0

Table C6 BAM Plot Function Attributes at RM1 in 2022 - Ground Cover Other (1m^2 plots)

Distance (m)	Litter	Bare ground	Cryptogram	Rock
5	1	0	0	0
15	5	1	0	0
25	1	0	0	0
35	1	1	0	0
45	1	0	0	0
Average	1.8	0.4	0	0

Table C7 BAM Plot Disturbance and Management Notes at RM1 in 2022 (1000m^2 plot)

Factor	Severity Code	Age Code	Observation
Clearing (inc logging)	3	R	Artificial bund - land clearing for quarry
Cultivation (inc pasture)	0	-	None
Soil erosion	2	R	Light rill erosion at plot
Firewood/CWD removal	3	-	Active quarry - wood debris probably managed
Grazing (native/stock)	0	R	None
Fire damage	0	-	None
Storm damage	0	-	None
Weediness	3	R	Very high weed cover
Other (stock, feral animals, vehicle, human)	0	-	None
Site management (fencing, weed control)	0	-	None
General Heath	1	-	Poor, requires weed control esp. around plantings
Regeneration	0	R	No natural regeneration occurring

KEY: Severity: 0 = no evidence, 1=light/low, 2=moderate, 3=severe/good Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

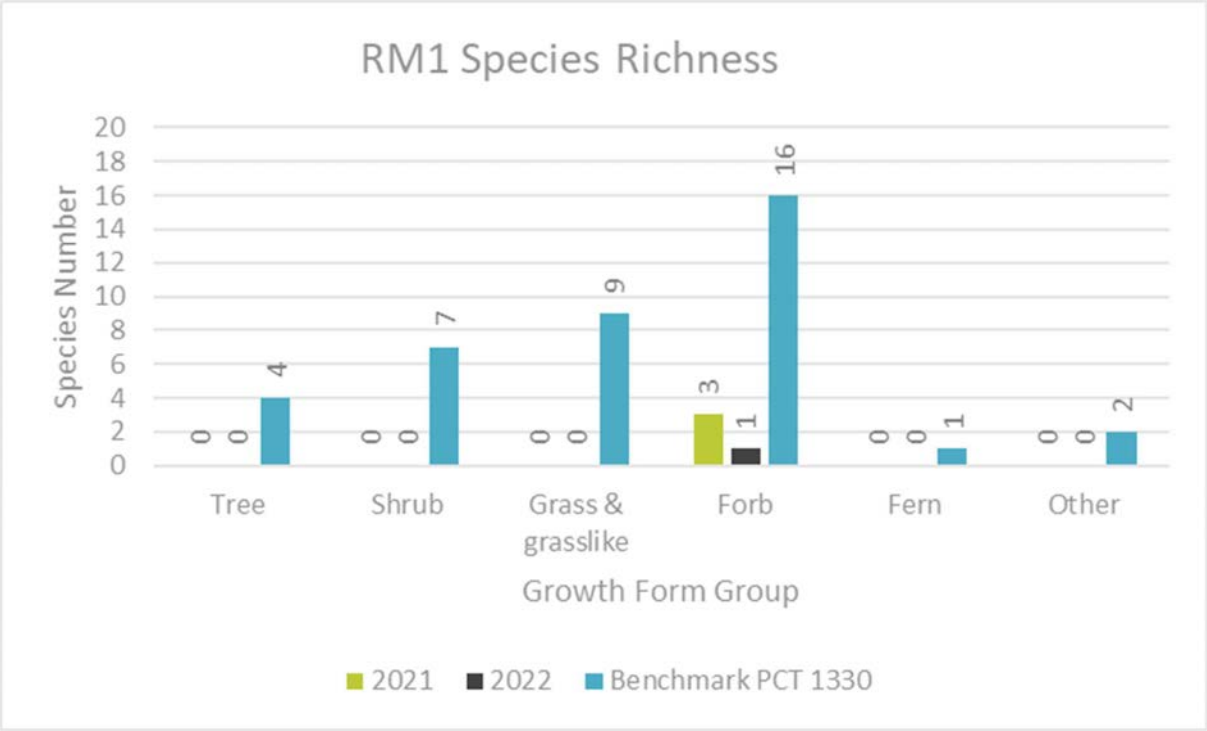
Table C8 LFA Landscape Organisation Data for RM1 in 2022

Start Distance (m)	End Distance (m)	Patch Width (cm)	Patch / interpatch	Identity	Notes
0	29.1	1000	Patch	Herb	Mostly weeds
29.10	29.70	60	Interpatch	Concrete	Concrete paver
29.70	50.00	1000	Patch	Grass	

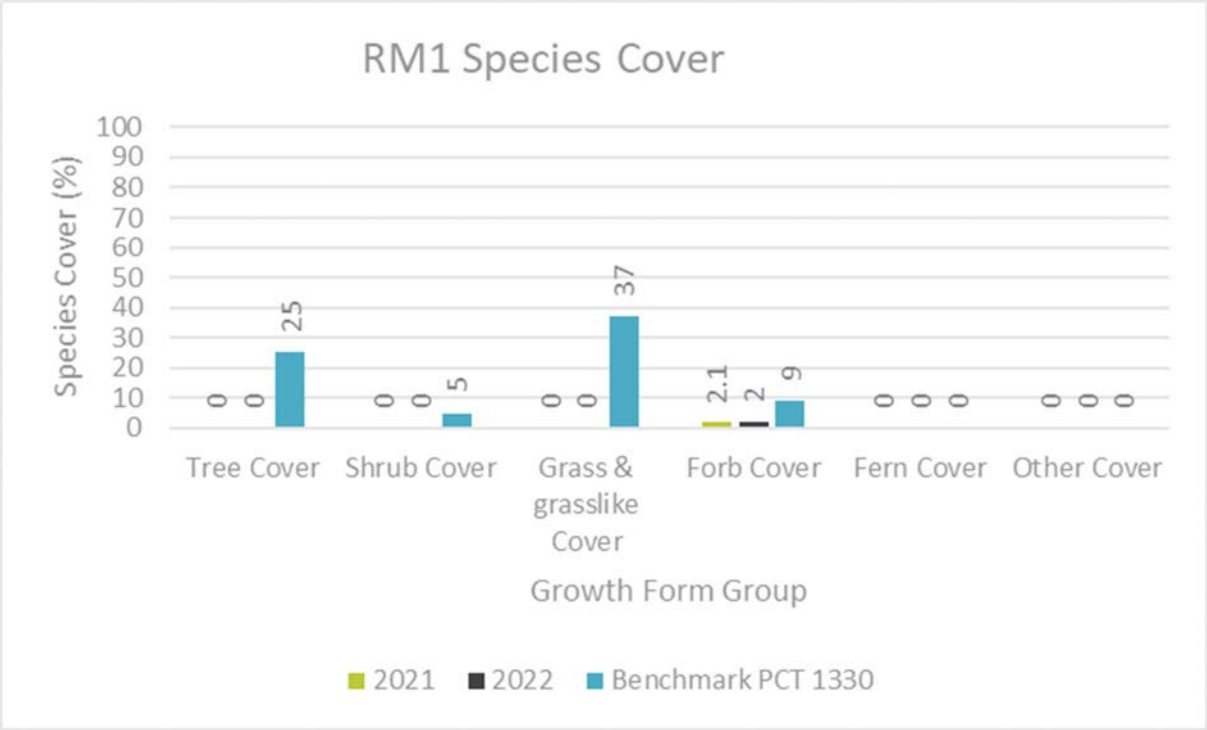
Table C9 LFA Soil Surface Assessment Data at RM1 in 2022

Start Distance (m)	11	50
Patch Identity	Herb	Grass
Rainsplash Protection (1-5)	5	5
t/s canopy cover (1-4)	2	2
Litter (1-10)	1	1
Soil Biological crust (0, 1-4)	0	0
Crust broken-ness (0, 1-4)	0	0
Erosion & Severity (1-4)	4	4
Deposited materials (1-4)	4	4
Surface Roughness (1-5)	3	3
Resistance to disturbance	2	1
Slake test (0, 1-4)	1	1
Texture (1-4)	1	3

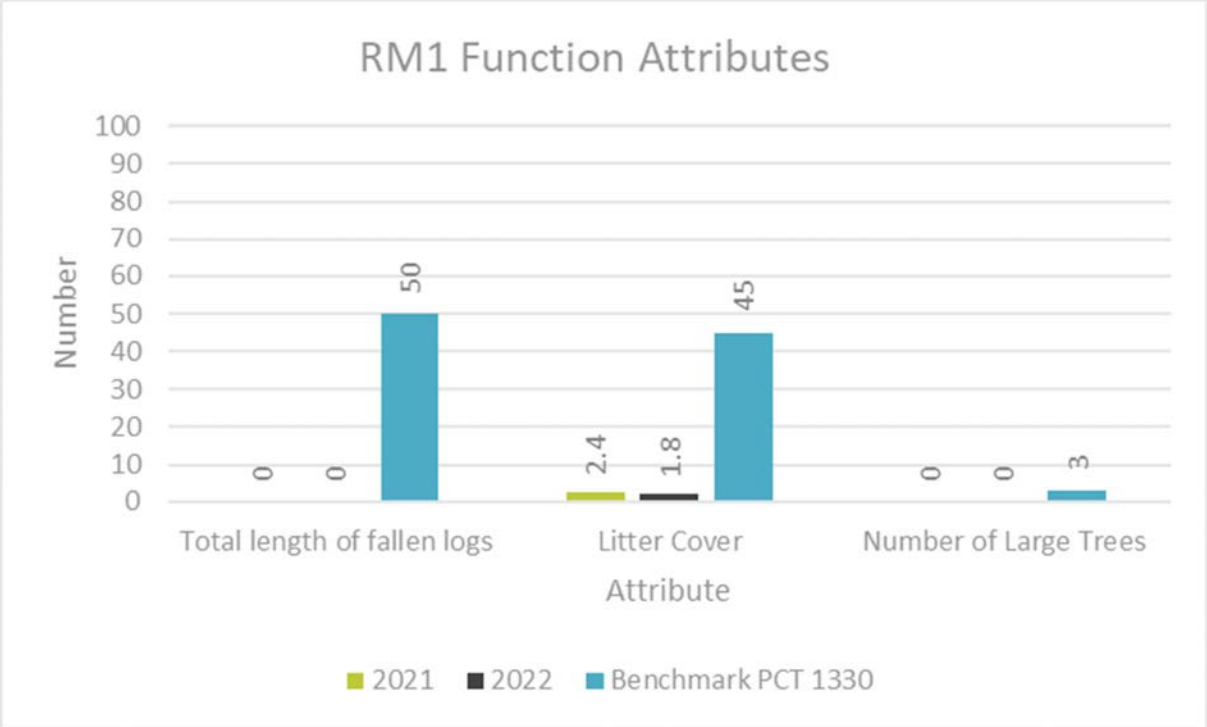
Graph C1 Species Richness at RM1



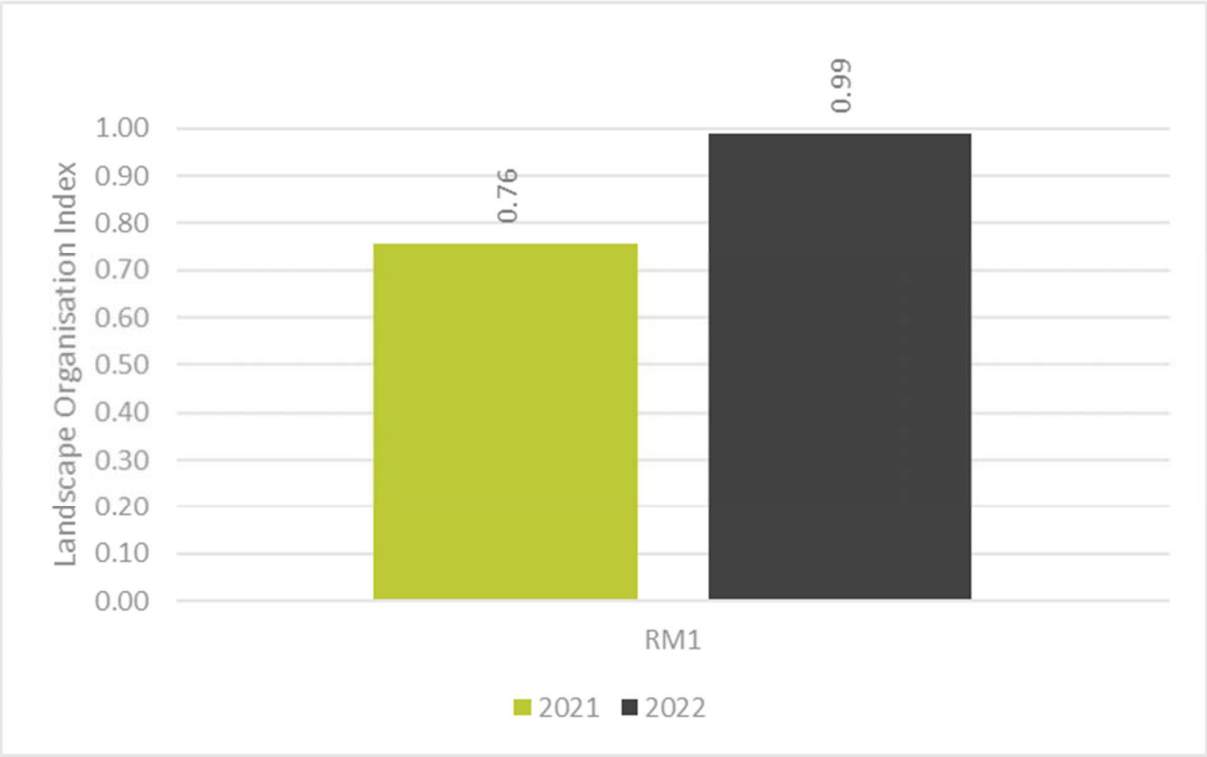
Graph C2 Species Cover at RM1



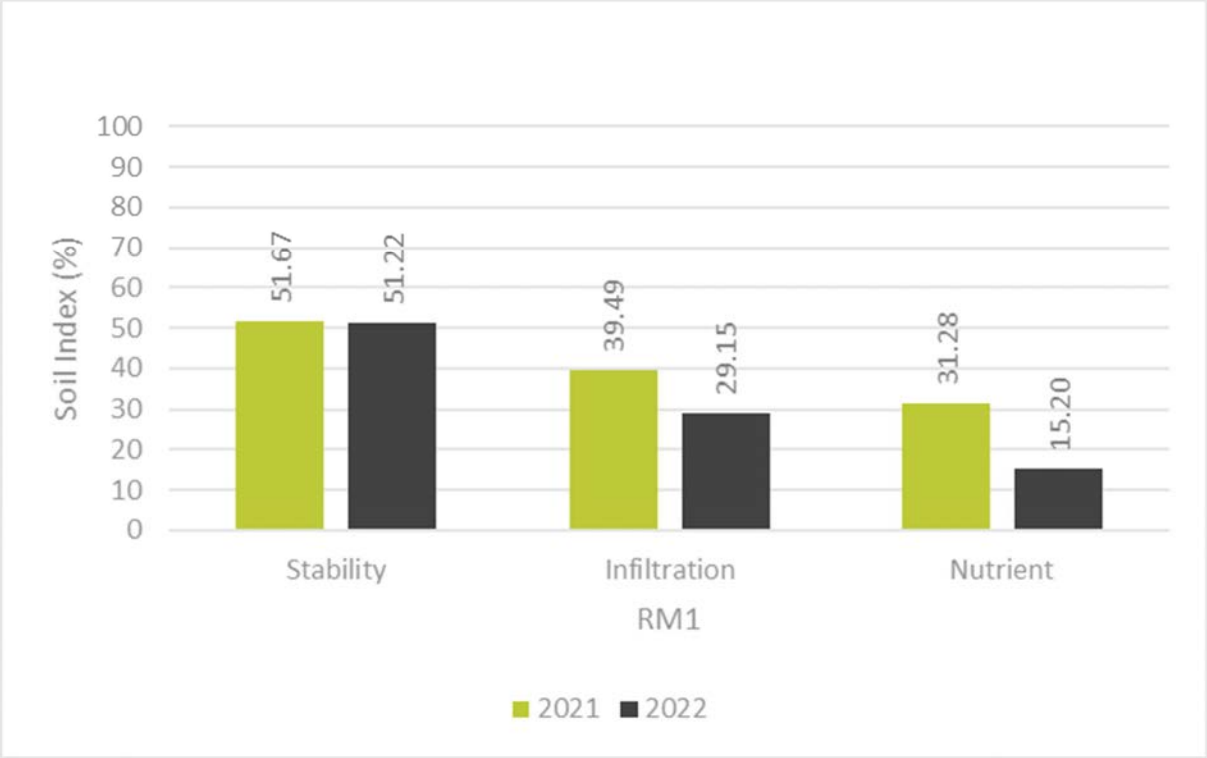
Graph C3 Function Attributes at RM1



Graph C4 LFA Landscape Organisation at RM1



Graph C5 LFA Soil Indices at RM1



Appendix D:
Data and Graphs for RM2

Table D1 Plot Photographs at RM2 in 2022

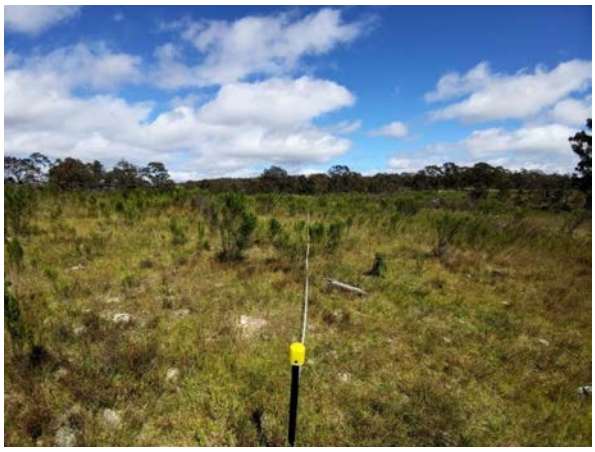
Start of Transect	End of Transect
	

Table D2 BAM Plot Composition Attributes at RM2 in 2022 - Floristics (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Scientific Name	Cover	Abundance
Non-HTE	Aira caryophyllea	20	200
Grass & grasslike	Aristida vagans	0.5	10
Grass & grasslike	Austrostipa pubescens	5	100
Non-HTE	Briza minor	0.1	20
Shrub	Cassinia sifton	20	50
Non-HTE	Centaurium erythraea	1	50
Fern	Cheilanthes sieberi	0.5	10
Forb	Chrysocephalum apiculatum	0.5	10
Non-HTE	Conyza bonariensis	0.1	2
Tree	Eucalyptus melliodora	0.5	1
Forb	Euchiton involucratus	5	100
Non-HTE	Gamochaeta purpurea	1	15
Forb	Goodenia hederacea	2	50
Forb	Gonocarpus tetragynus	0.1	10
Non-HTE	Holcus lanatus	0.1	1
Forb	Hypericum gramineum	1	50
Non-HTE	Hypochaeris radicata	0.5	5
Grass & grasslike	Microlaena stipoides	0	0
Forb	Microtis unifolia	2	40
HTE	Nassella trichotoma	20	100
Shrub	Ozothamnus diosmifolius	2	4
HTE	Rubus anglocandicans (in Rubus fruticosus L. complex)	0.1	1
Non-HTE	Rumex acetosella	0.1	2
Grass & grasslike	Rytidosperma fulvum	0.5	20
HTE	Senecio madagascariensis	0.1	1
Non-HTE	Trifolium campestre	0.1	1
Forb	Triptilodiscus pygmaeus	1	20
Forb	Wahlenbergia gracilis	0.1	2

Table D3 BAM Plot Structure Attributes at RM2 in 2022 - Species Richness and Cover (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Count of Species Richness	Sum of Cover of vascular plants
Native Tree	1	0.5
Native Shrub	2	22
Native Grass & grasslike	3	6
Native Forb	8	11.7
Native Fern	1	0.5
Native Other	0	0
High Threat Exotic	3	20.2
Non-HTE	9	23
Total Weeds	12	43.2

Table D4 BAM Plot Function Attributes at RM2 in 2022 - Tree Stems and Hollows (1000m^2 plot)

DBH (cm)	Number of tree stems	Number of tree stems with hollows
>80	0	0
50 to 79	0	0
30 to 49	0	0
20 to 29	0	0
10 to 19	0	0
5 to 9	0	0
<5	≥1	0

Table D5 BAM Plot Function Attributes at RM2 in 2022 - Length of Logs (1000m^2 plot)

Attribute	2022
Total Length of Logs (m)	0

Table D6 BAM Plot Function Attributes at RM2 in 2022 - Ground Cover Other (1m^2 plots)

Distance (m)	Litter	Bare ground	Cryptogram	Rock
5	5	10	5	0
15	5	1	5	0
25	5	5	2	2
35	5	1	5	10
45	5	1	1	20
Average	5	3.6	3.6	6.4

Table D7 BAM Plot Disturbance and Management Notes at RM2 in 2022 (1000m^2 plot)

Factor	Severity Code	Age Code	Observation
Clearing (inc logging)	3	O	Cleared historically
Cultivation (inc pasture)	1	NR	Minor pasture improvement
Soil erosion	0	-	None
Firewood/CWD removal	3	NR	Likely previously managed
Grazing (native/stock)	2	R	Moderate grazing by wildlife likely
Fire damage	0	-	None
Storm damage	0	-	None
Weediness	2	R	Moderate weed cover
Other (stock, feral animals, vehicle, human)	0	-	None
Site management (fencing, weed control)	1	NR	Fencing is present
General Heath	3	-	Moderate, requires weed control
Regeneration	2	R	Occurring naturally in all layers

KEY: Severity: 0 = no evidence, 1=light/low, 2=moderate, 3=severe/good Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Table D8 LFA Landscape Organisation Data for RM2 in 2022

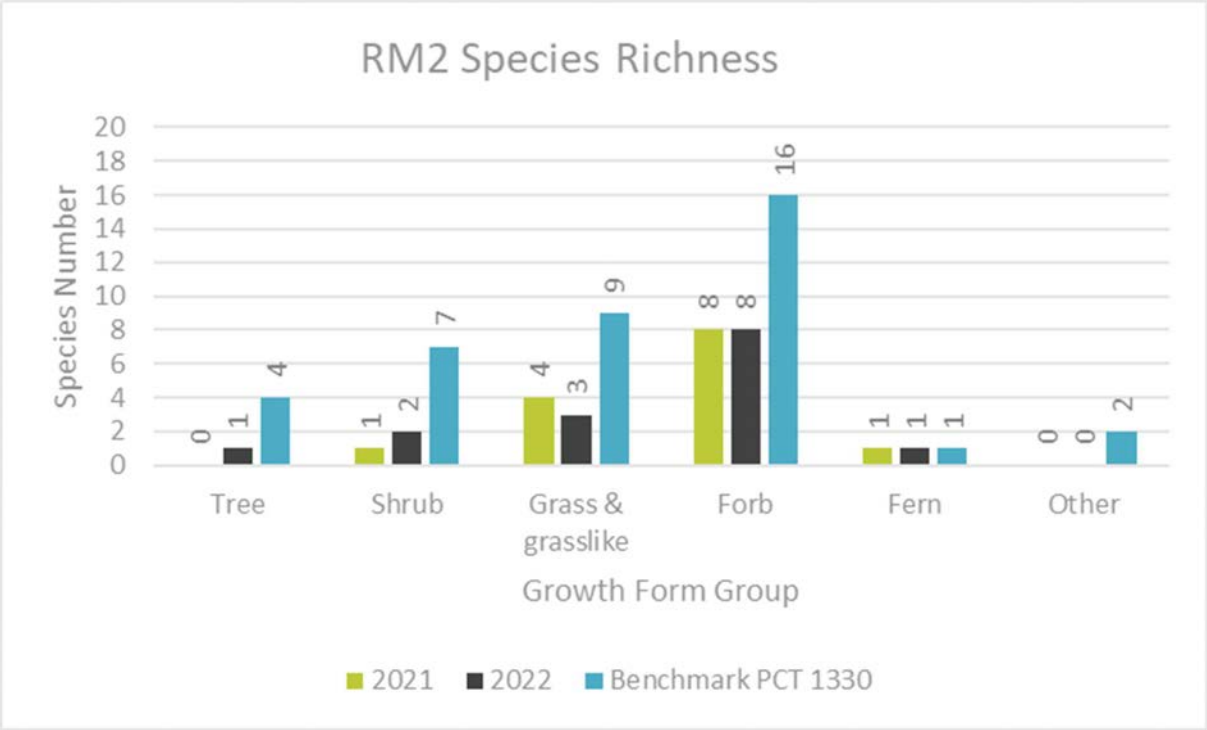
Start Distance (m)	End Distance (m)	Patch Width (cm)	Patch / interpatch	Identity	Notes
0.00	1.38	500	Patch	Shrub	n/a
1.38	1.79	40	Interpatch	Bare Ground	n/a
1.79	5.00	610	Patch	Shrub	n/a
5.00	8.85	720	Patch	Grass	n/a
8.85	9.50	50	Interpatch	Bare Ground	n/a
9.50	22.40	1000	Patch	Grass	n/a
22.40	24.95	520	Patch	Shrub	n/a
24.95	26.30	210	Patch	Grass	n/a
26.30	30.10	1000	Patch	Shrub	n/a
30.10	32.10	650	Patch	Grass	n/a
32.10	32.40	30	Interpatch	Rock	n/a
32.40	33.10	90	Interpatch	Bare Ground	n/a
33.10	33.90	510	Patch	Shrub	n/a
33.90	34.90	320	Patch	Grass	n/a
34.90	36.70	200	Patch	Shrub	n/a
36.70	36.90	10	Interpatch	Rock	n/a
36.90	39.70	560	Patch	Grass	n/a
39.70	40.40	30	Interpatch	Bare Ground	n/a
40.40	43.90	1000	Patch	Grass	n/a
43.90	45.60	400	Patch	Shrub	n/a
45.60	45.90	20	Interpatch	Rock	n/a
45.90	47.30	150	Patch	Shrub	n/a
47.30	48.10	1000	Patch	Grass	n/a
48.10	48.95	80	Interpatch	Rock	n/a
48.95	50.00	1000	Patch	Grass	n/a

Table D9 LFA Soil Surface Assessment Data at RM2 in 2022

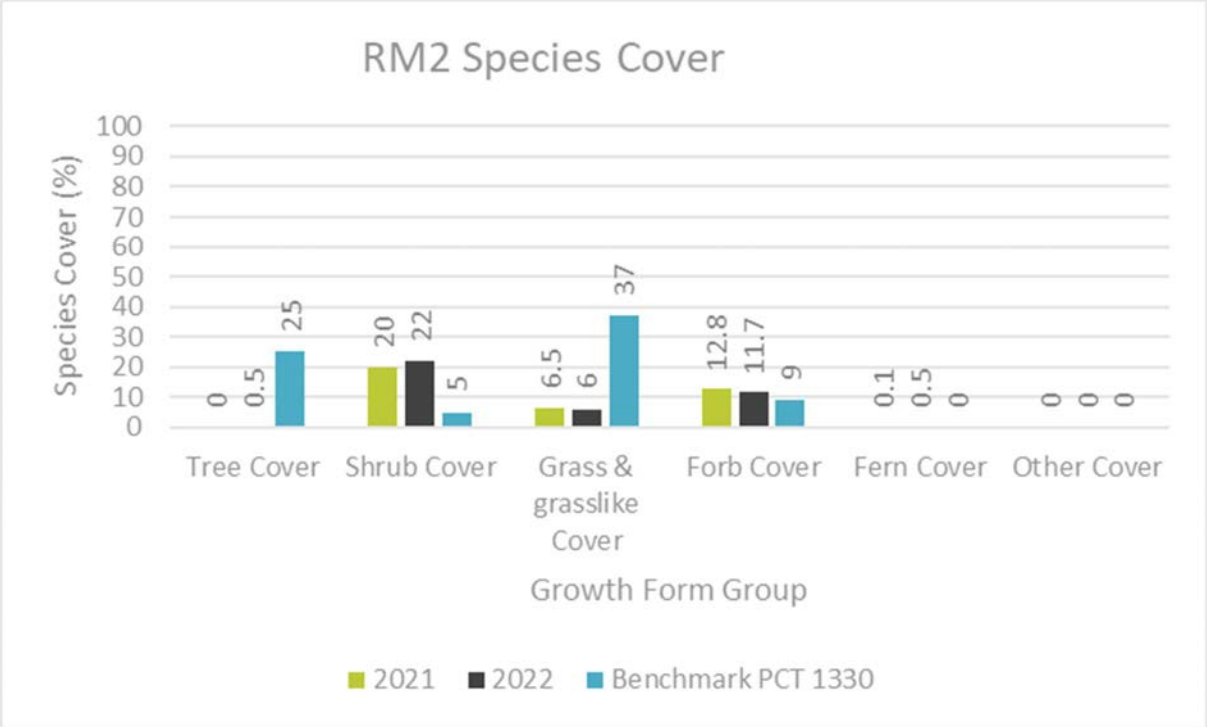
Start Distance (m)	0.8	1.6	3.9	7.5	9.2	19.5	23.5	36.5
Patch Identity	Shrub	Bare Ground	Shrub	Grass	Bare Ground	Grass	Shrub	Shrub
Rainsplash Protection (1-5)	3	2	4	4	1	4	4	4
t/s canopy cover (1-4)	3	1	3	2	1	2	3	3
Litter (1-10)	1	1	1	2	1	2	2	1
Soil Biological crust (0, 1-4)	2	3	2	2	3	2	2	2
Crust broken-ness (0, 1-4)	1	2	1	1	2	2	1	1
Erosion & Severity (1-4)	4	4	4	4	4	4	4	4
Deposited materials (1-4)	4	4	4	4	4	4	4	4
Surface Roughness (1-5)	2	2	2	2	2	2	2	2
Resistance to disturbance	3	3	3	3	3	3	3	3
Slake test (0, 1-4)	2	3	3	3	3	3	3	3
Texture (1-4)	3	3	2	2	2	2	2	2

BG = Bare ground, Sh = Shrub, H = Herb, G = Grass

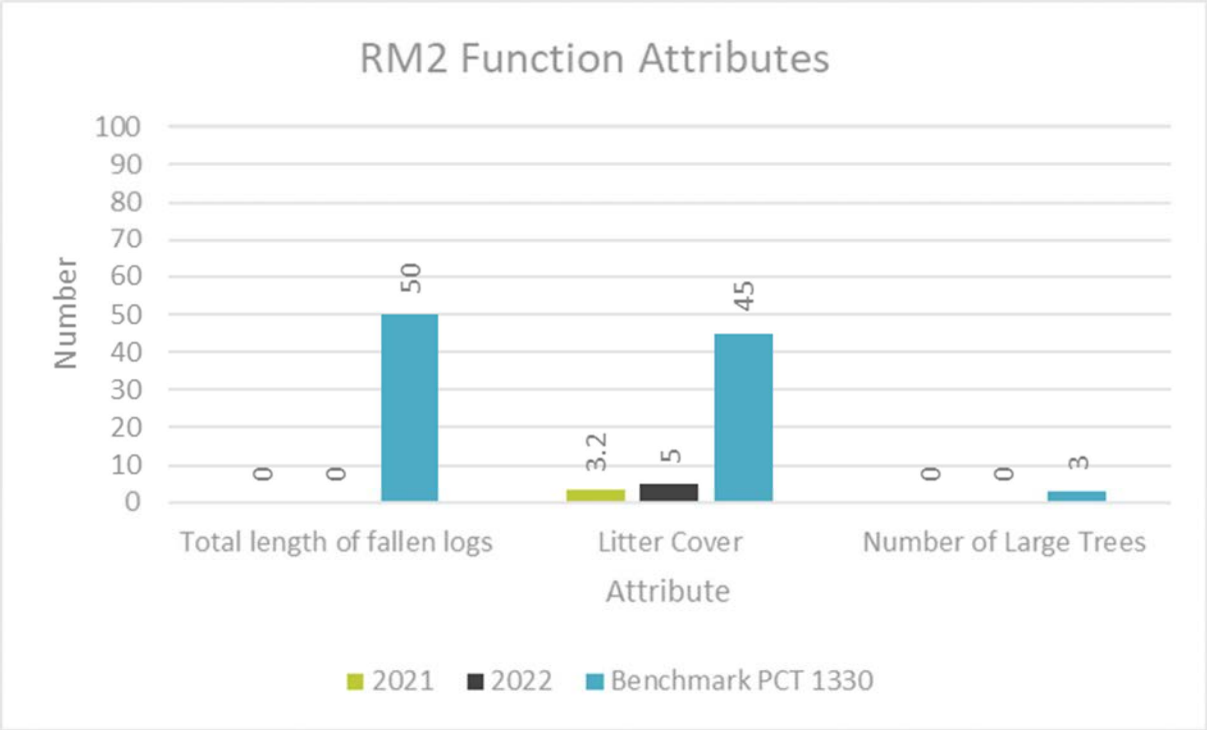
Graph D1 Species Richness at RM2



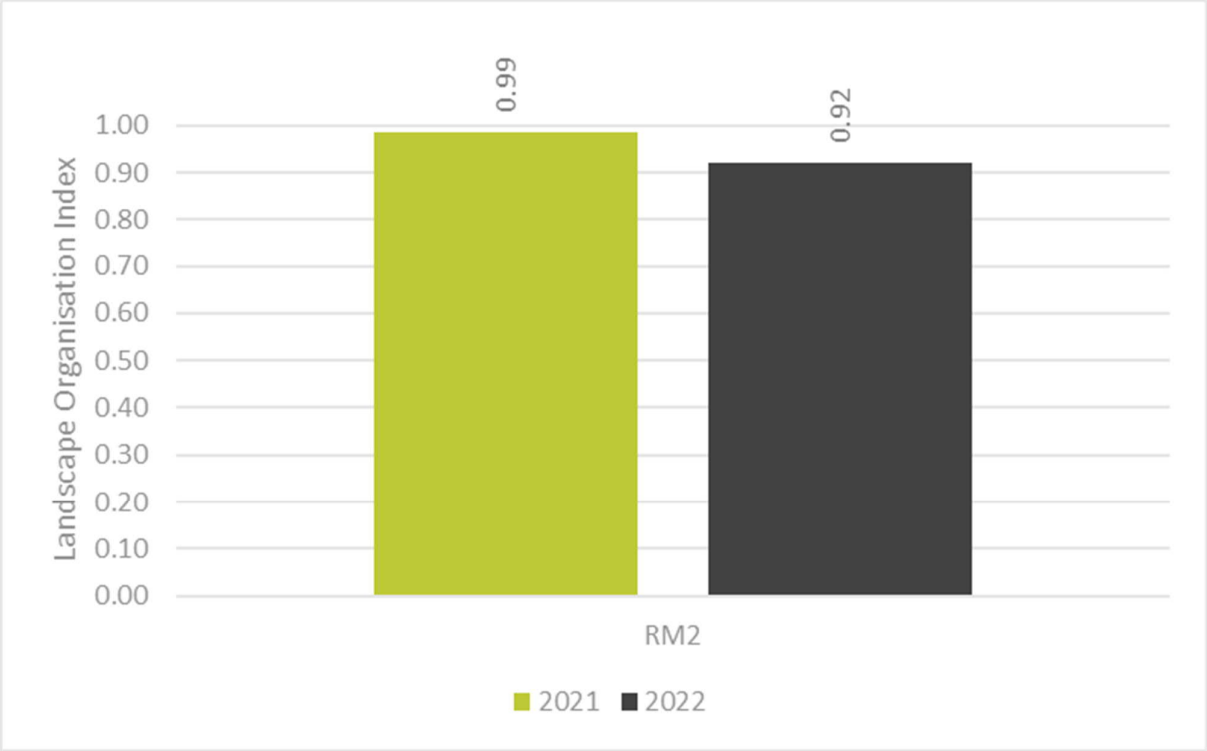
Graph D2 Species Cover at RM2



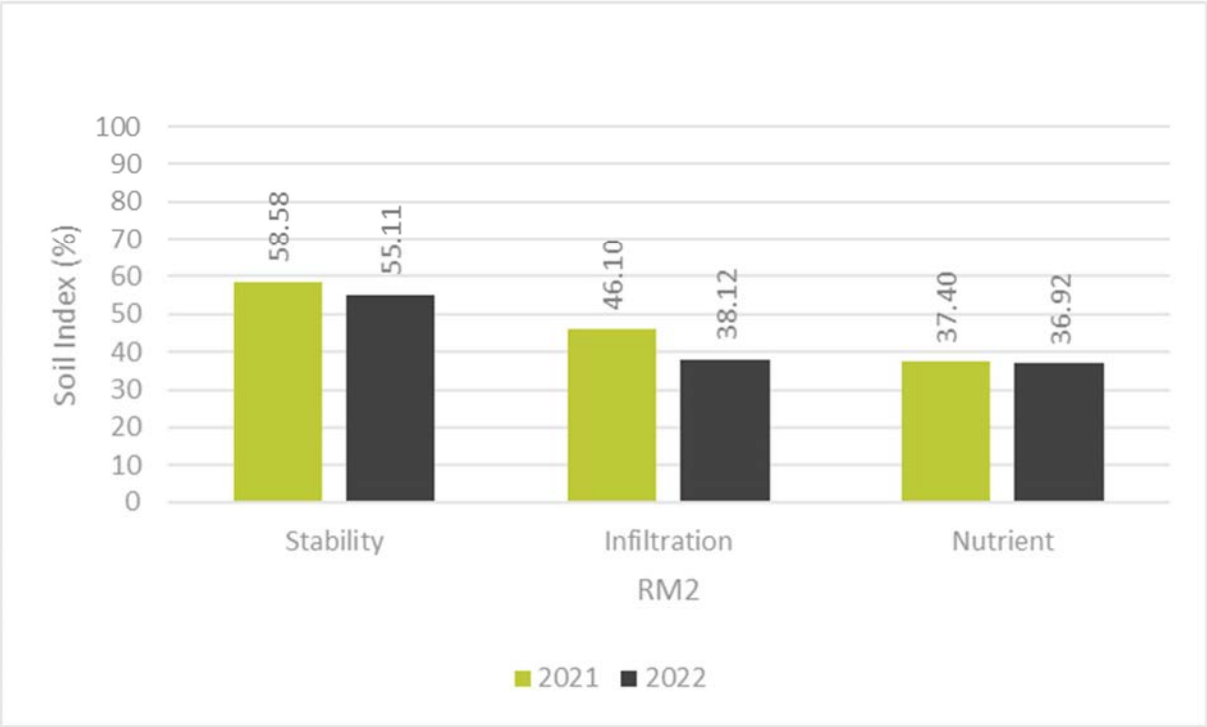
Graph D3 Function Attributes at RM2



Graph D4 LFA Landscape Organisation at RM2



Graph D5 LFA Soil Indices at RM2



Appendix E:
Data and Graphs for RM3

Table E1 Plot Photographs at RM3 in 2022

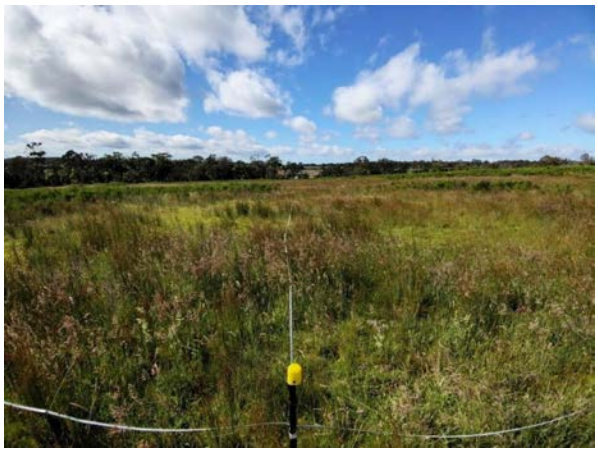
Start of Transect	End of Transect
	

Table E2 BAM Plot Composition Attributes at RM3 in 2022 - Floristics (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Scientific Name	Cover	Abundance
Non-HTE	Aira cupaniana	0.1	20
Grass & grasslike	Austrostipa densiflora	0.1	1
Non-HTE	Briza minor	0.1	20
Shrub	Cassinia sifton	1	7
Non-HTE	Centaurium erythraea	0.1	4
Non-HTE	Conyza bonariensis	0.1	2
Grass & grasslike	Eragrostis benthamii	0.1	5
Forb	Euchiton sphaericus	0.5	20
Non-HTE	Gamochaeta coarctata	0.1	2
Non-HTE	Holcus lanatus	25	100
HTE	Hypericum perforatum	0.1	1
Non-HTE	Hypochaeris radicata	0.5	10
Grass & grasslike	Juncus usitatus	15	100
Grass & grasslike	Microlaena stipoides	20	100
Forb	Oxalis radicosa	0.1	1
Non-HTE	Plantago lanceolata	0.1	2
Non-HTE	Rumex acetosella	1	50
Grass & grasslike	Schoenus apogon	1	100
Non-HTE	Trifolium campestre	0.1	2
Non-HTE	Trifolium subterraneum	0.1	1
Non-HTE	Vulpia bromoides	10	100
Forb	Wahlenbergia gracilis	0.1	2

Table E3 BAM Plot Structure Attributes at RM3 in 2022 - Species Richness and Cover (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Count of Species Richness	Sum of Cover of vascular plants
Native Tree	0	0
Native Shrub	1	1
Native Grass & grasslike	5	36.2
Native Forb	3	0.7
Native Fern	0	0
Native Other	0	0
High Threat Exotic	1	0.1
Non-HTE	12	37.3
Total Weeds	13	37.4

Table E4 BAM Plot Function Attributes at RM3 in 2022 - Tree Stems and Hollows (1000m^2 plot)

DBH (cm)	Number of tree stems	Number of tree stems with hollows
>80	0	0
50 to 79	0	0
30 to 49	0	0
20 to 29	0	0
10 to 19	0	0
5 to 9	0	0
<5	0	0

Table E5 BAM Plot Function Attributes at RM3 in 2022 - Length of Logs (1000m^2 plot)

Attribute	2022
Total Length of Logs (m)	0

Table E6 BAM Plot Function Attributes at RM3 in 2022 - Ground Cover Other (1m^2 plots)

Distance (m)	Litter	Bare ground	Cryptogram	Rock
5	5	0	0	0
15	5	0	0	0
25	5	0	0	0
35	10	0	0	0
45	5	0	0	0
Average	6	0	0	0

Table E7 BAM Plot Disturbance and Management Notes at RM3 in 2022 (1000m^2 plot)

Factor	Severity Code	Age Code	Observation
Clearing (inc logging)	3	O	Severely cleared historically
Cultivation (inc pasture)	1	NR	Minor pasture improvement
Soil erosion	0	-	None
Firewood/CWD removal	0	-	None
Grazing (native/stock)	2	R	Grazing by wildlife likely
Fire damage	0	-	None
Storm damage	0	-	None
Weediness	2	R	Moderate weed cover
Other (stock, feral animals, vehicle, human)	0	-	None
Site management (fencing, weed control)	1	NR	Fencing is present
General Heath	1	-	Moderate-poor, requires weed control & planting
Regeneration	1	R	Requires shrubs and trees

KEY: Severity: 0 = no evidence, 1=light/low, 2=moderate, 3=severe/good Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Table E8 LFA Landscape Organisation Data for RM3 in 2022

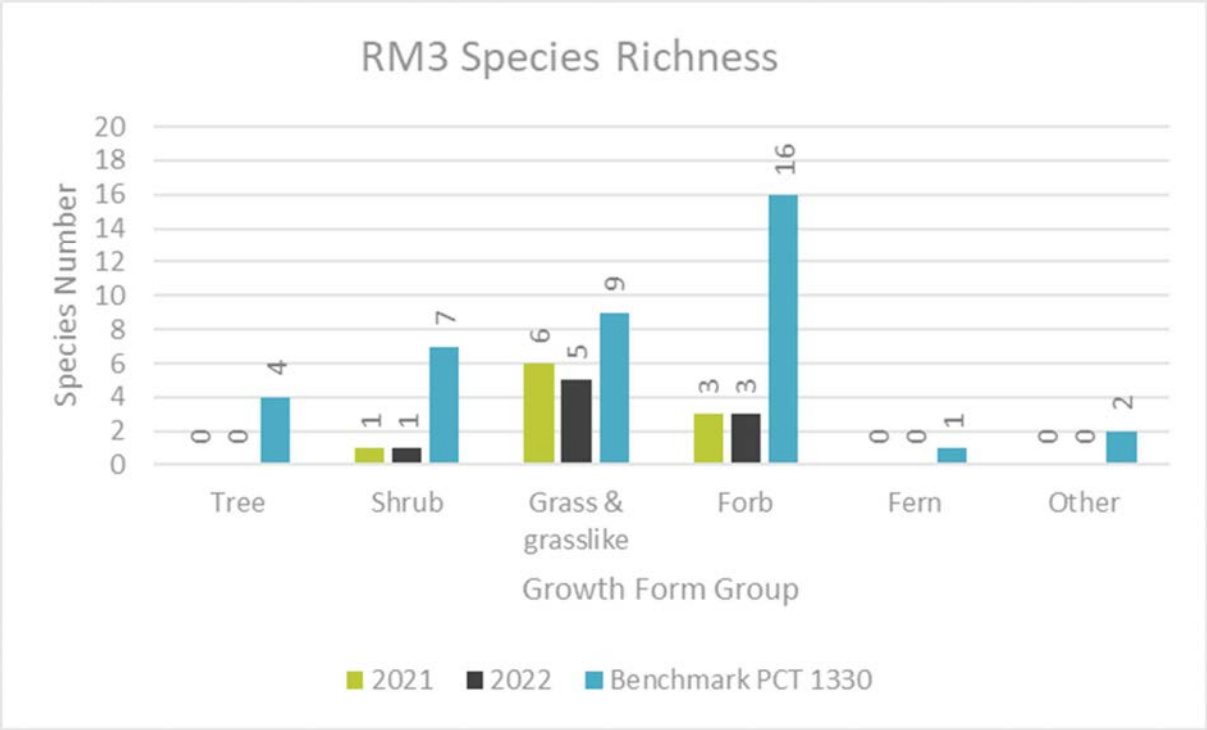
Start Distance (m)	End Distance (m)	Patch Width (cm)	Patch / interpatch	Identity	Notes
0.00	8.70	1000	Patch	Rush	Rush and Tall Grass
8.70	9.30	900	Patch	Grass	Short Grass
9.30	12.00	920	Patch	Rush	
12.00	13.00	640	Patch	Grass	
13.00	14.40	450	Patch	Rush	
14.40	21.65	950	Patch	Grass	
21.65	24.50	1000	Patch	Rush	
24.50	26.10	190	Patch	Grass	
26.10	29.40	230	Patch	Rush	
29.40	31.00	430	Patch	Grass	
31.00	33.50	510	Patch	Rush	
33.50	35.90	400	Patch	Grass	
35.90	36.30	700	Patch	Rush	
36.30	40.30	390	Patch	Grass	
40.30	50.00	1000	Patch	Rush	

Table E9 LFA Soil Surface Assessment Data at RM3 in 2022

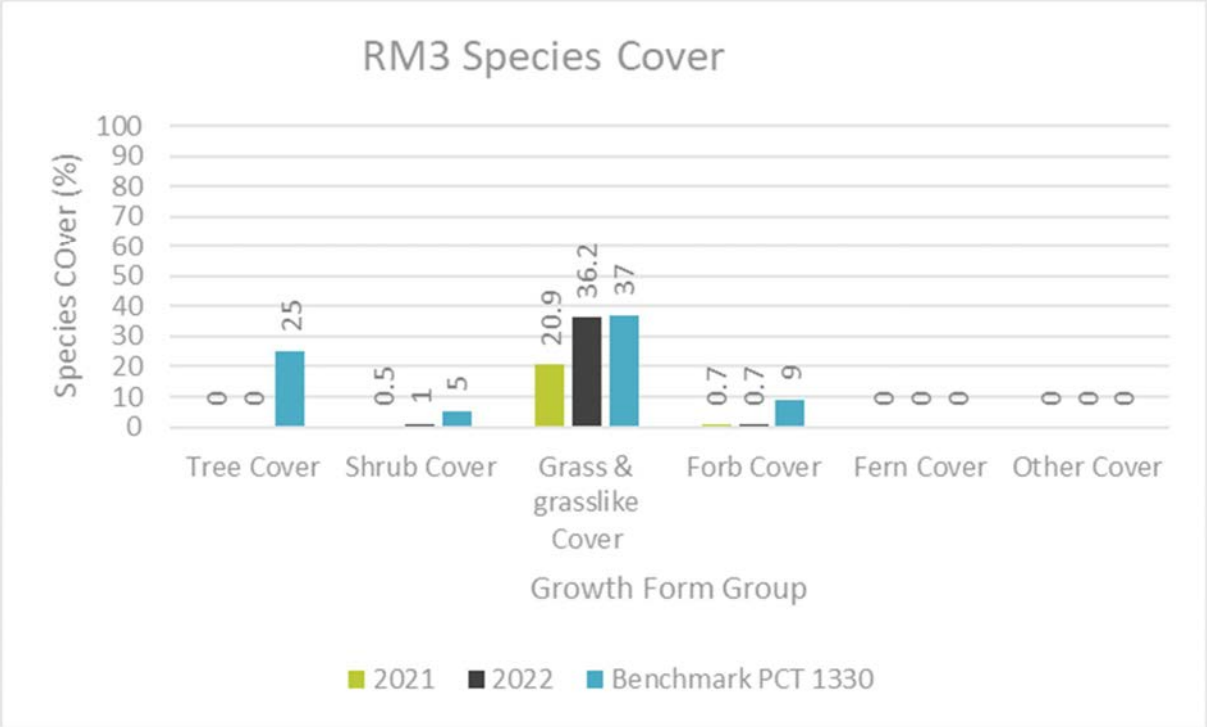
Start Distance (m)	2.4	8.9	10.8	18	22	34.7
Patch Identity	Rush	Grass	Rush	Grass	Rush	Grass
Rainsplash Protection (1-5)	5	5	5	5	5	5
t/s canopy cover (1-4)	2	2	2	2	2	2
Litter (1-10)	2	1	2	1	1	1
Soil Biological crust (0, 1-4)	1	2	1	3	2	2
Crust broken-ness (0, 1-4)	1	1	1	1	1	1
Erosion & Severity (1-4)	4	4	4	4	4	4
Deposited materials (1-4)	4	4	4	4	4	4
Surface Roughness (1-5)	2	2	2	2	2	2
Resistance to disturbance	2	2	2	3	3	3
Slake test (0, 1-4)	3	3	3	3	2	3
Texture (1-4)	2	2	2	2	2	2

BG = Bare ground, Sh = Shrub, H = Herb, G = Grass

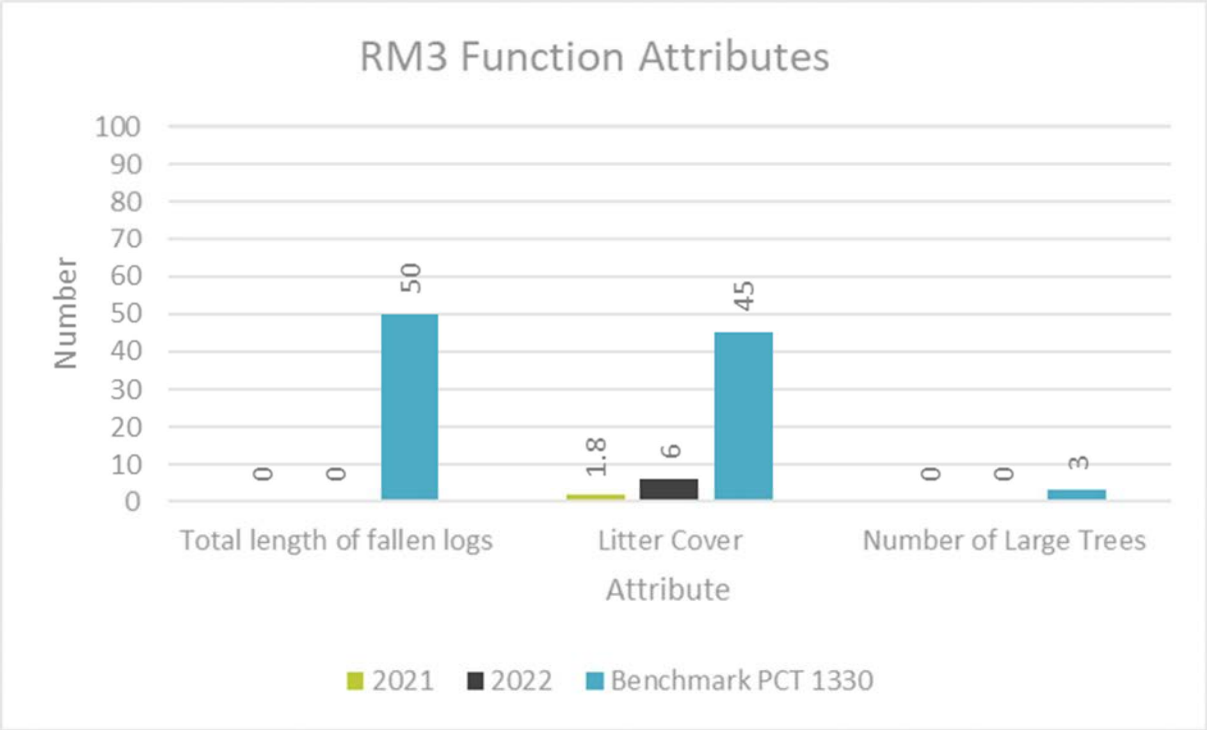
Graph E1 Species Richness at RM3



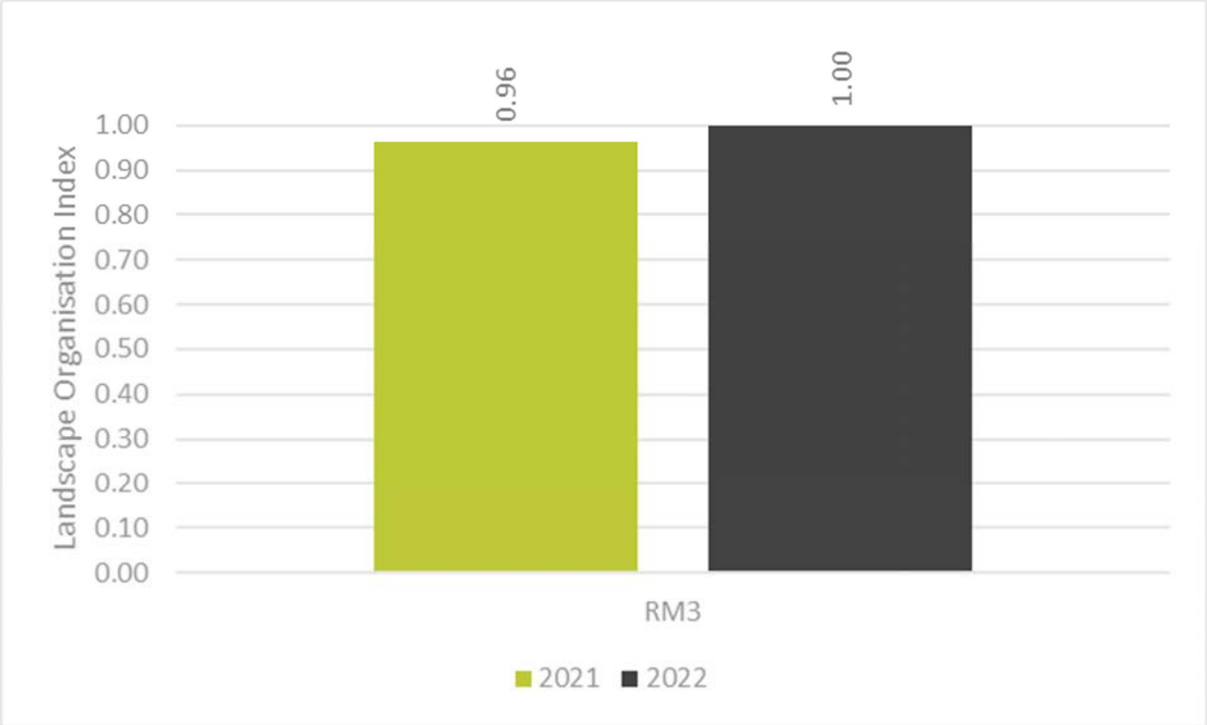
Graph E2 Species Cover at RM3



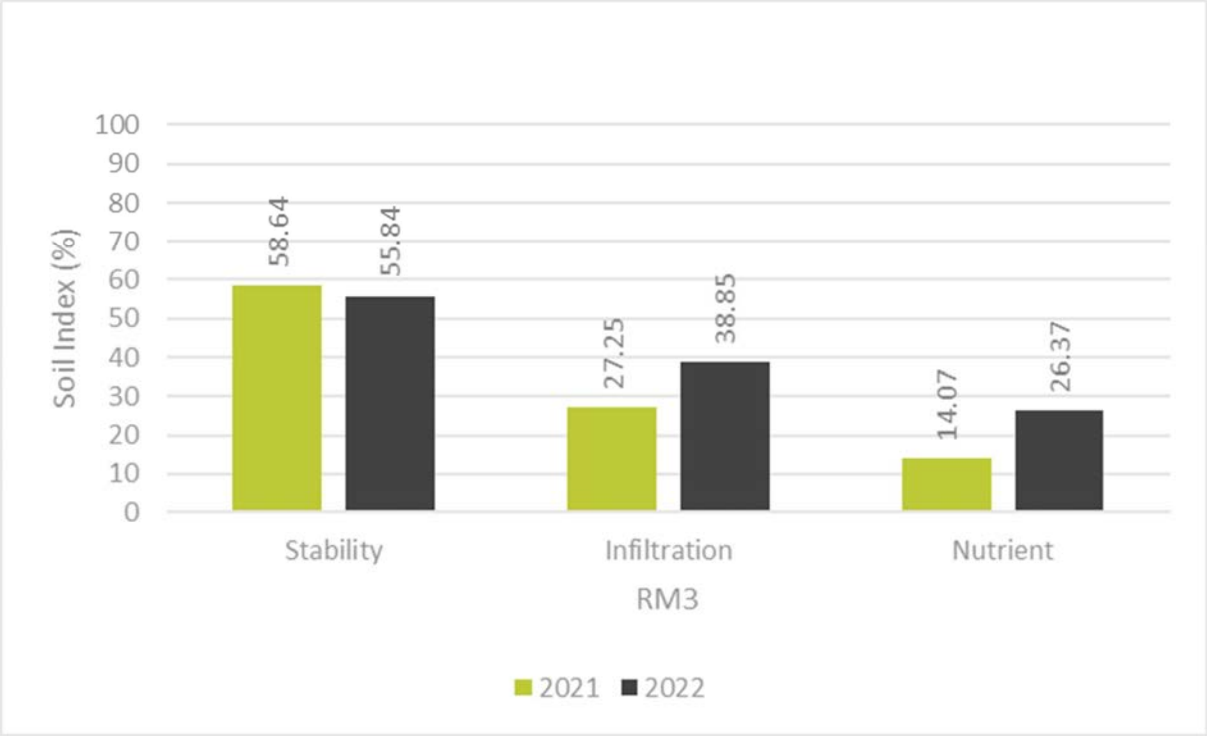
Graph E3 Function Attributes at RM3



Graph E4 LFA Landscape Organisation at RM3



Graph E5 LFA Soil Indices at RM3



Appendix F:
Data and Graphs for RM4

Table F1 Plot Photographs at RM4 in 2022

Start of Transect	End of Transect
	

Table F2 BAM Plot Composition Attributes at RM4 in 2022 - Floristics (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Scientific Name	Cover	Abundance
Tree	Acacia decurrens	10	1
Grass & grasslike	Austrostipa densiflora	20	100
Grass & grasslike	Austrostipa scabra subsp. falcata	20	100
Non-HTE	Briza minor	0.1	5
Non-HTE	Bromus molliformis	1	10
Shrub	Cassinia sifton	30	100
Fern	Cheilanthes sieberi	0.1	1
Non-HTE	Conyza bonariensis	0.5	10
Tree	Eucalyptus agglomerata	20	5
Forb	Euchiton sphaericus	0.1	10
Non-HTE	Facelis retusa	0.1	1
Non-HTE	Gamochaeta calviceps	0.1	10
Non-HTE	Gamochaeta coarctata	0.1	10
Non-HTE	Hypochaeris radicata	5	40
Forb	Laxmannia gracilis	0.1	1
Grass & grasslike	Microlaena stipoides	10	100
Non-HTE	Modiola caroliniana	2	10
HTE	Nassella trichotoma	5	50
Non-HTE	Onopordum acanthium	1	30
Shrub	Ozothamnus diosmifolius	1	3
Forb	Oxalis radicosa	0.1	1
Non-HTE	Paronychia brasiliana	1	20
Non-HTE	Plantago lanceolata	0.5	10
Non-HTE	Rumex acetosella	20	100
Grass & grasslike	Rytidosperma racemosum	0.1	5
Non-HTE	Solanum nigrum	0.5	5
Non-HTE	Trifolium repens	1	5
Forb	Wahlenbergia gracilis	0.1	4

Table F3 BAM Plot Structure Attributes at RM4 in 2022 - Species Richness and Cover (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Count of Species Richness	Sum of Cover of vascular plants
Native Tree	2	30
Native Shrub	2	31
Native Grass & grasslike	4	50.1
Native Forb	4	0.4
Native Fern	1	0.1
Native Other	0	0
High Threat Exotic	1	5
Non-HTE	14	32.9
Total Weeds	15	37.9

Table F4 BAM Plot Function Attributes at RM4 in 2022 - Tree Stems and Hollows (1000m^2 plot)

DBH (cm)	Number of tree stems	Number of tree stems with hollows
>80	0	0
50 to 79	0	0
30 to 49	0	0
20 to 29	0	0
10 to 19	4	0
5 to 9	2	0
<5	≥1	0

Table F5 BAM Plot Function Attributes at RM4 in 2022 - Length of Logs (1000m^2 plot)

Attribute	2022
Total Length of Logs (m)	20

Table F6 BAM Plot Function Attributes at RM4 in 2022 - Ground Cover Other (1m^2 plots)

Distance (m)	Litter	Bare ground	Cryptogram	Rock
5	5	0	0	0
15	5	5	0	0
25	5	0	0	0
35	5	0	0	0
45	2	30	0	0
Average	4.4	7	0	0

Table F7 BAM Plot Disturbance and Management Notes at RM4 in 2022 (1000m^2 plot)

Factor	Severity Code	Age Code	Observation
Clearing (inc logging)	2	O	Cleared historically, cut stumps
Cultivation (inc pasture)	0	-	None
Soil erosion	0	-	None
Firewood/CWD removal	1	O	Historical
Grazing (native/stock)	1	R	Light grazing by wildlife likely
Fire damage	0	-	None
Storm damage	0	-	None
Weediness	1	R	Moderate weed cover
Other (stock, feral animals, vehicle, human)	0	-	None
Site management (fencing, weed control)	1	R	Successful Blackberry control
General Heath	2	-	Moderate, requires weed control
Regeneration	2	R	Occurring naturally in all layers, but patchy

KEY: Severity: 0 = no evidence, 1=light/low, 2=moderate, 3=severe/good Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Table F8 LFA Landscape Organisation Data for RM4 in 2022

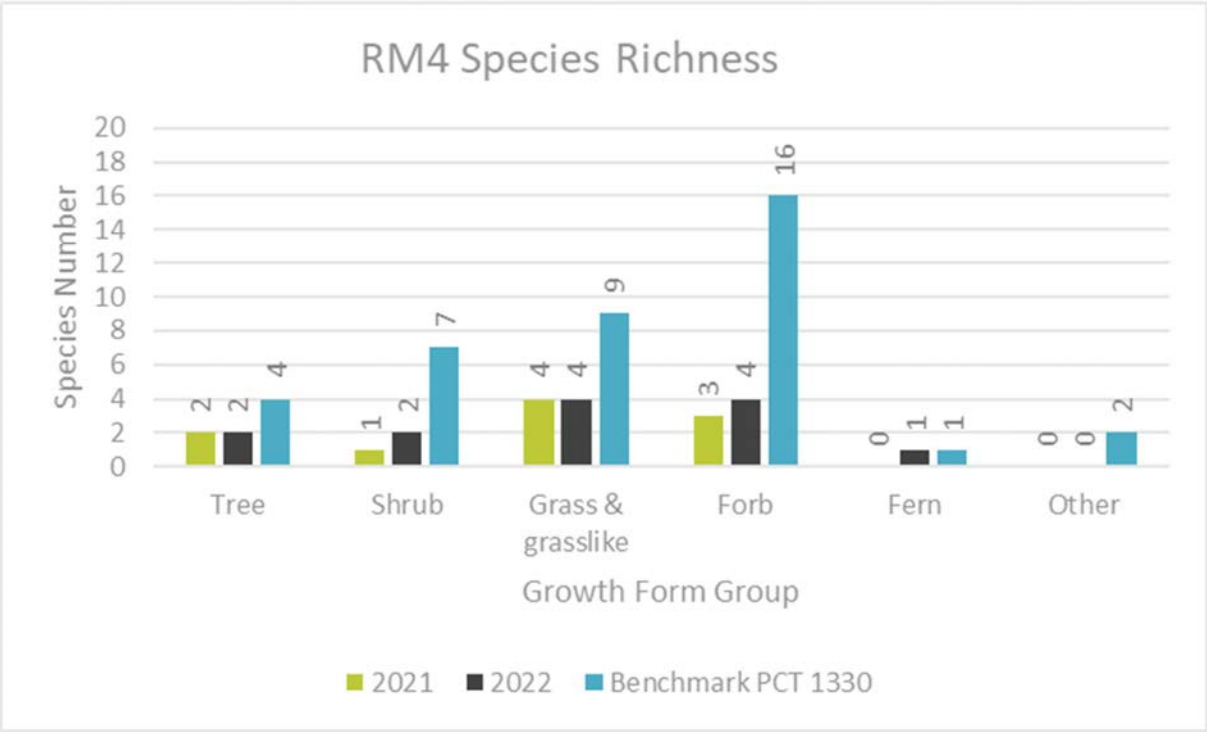
Start Distance (m)	End Distance (m)	Patch Width (cm)	Patch / interpatch	Identity	Notes
0.00	0.80	1000	Patch	Grass	n/a
0.80	1.80	420	Patch	Shrub	n/a
1.80	3.20	1000	Patch	Grass	n/a
3.20	8.10	270	Patch	Shrub	n/a
8.10	10.10	450	Patch	Grass Herbs	Short Grass and Herbs
10.10	14.10	1000	Patch	Grass	n/a
14.10	14.90	60	Patch	Shrub	n/a
14.90	27.10	1000	Patch	Grass	n/a
27.10	27.50	120	Interpatch	Log	n/a
27.50	28.70	1000	Patch	Grass	n/a
28.70	29.05	300	Interpatch	Log	n/a
29.05	35.40	1000	Patch	Grass	n/a
35.40	37.30	800	Patch	Shrub	n/a
37.30	38.30	850	Patch	Grass	n/a
38.30	38.80	90	Interpatch	Bare Ground	n/a
38.80	41.00	1000	Patch	Grass	n/a
41.00	42.90	1000	Patch	Soak	Wet Ground Drainage Ditch
42.90	43.70	850	Patch	Grass	n/a
43.70	44.20	1000	Interpatch	Bare Ground	n/a
44.20	48.10	450	Patch	Trees	n/a
48.10	50.00	430	Patch	Grass	n/a

Table F9 LFA Soil Surface Assessment Data at RM4 in 2022

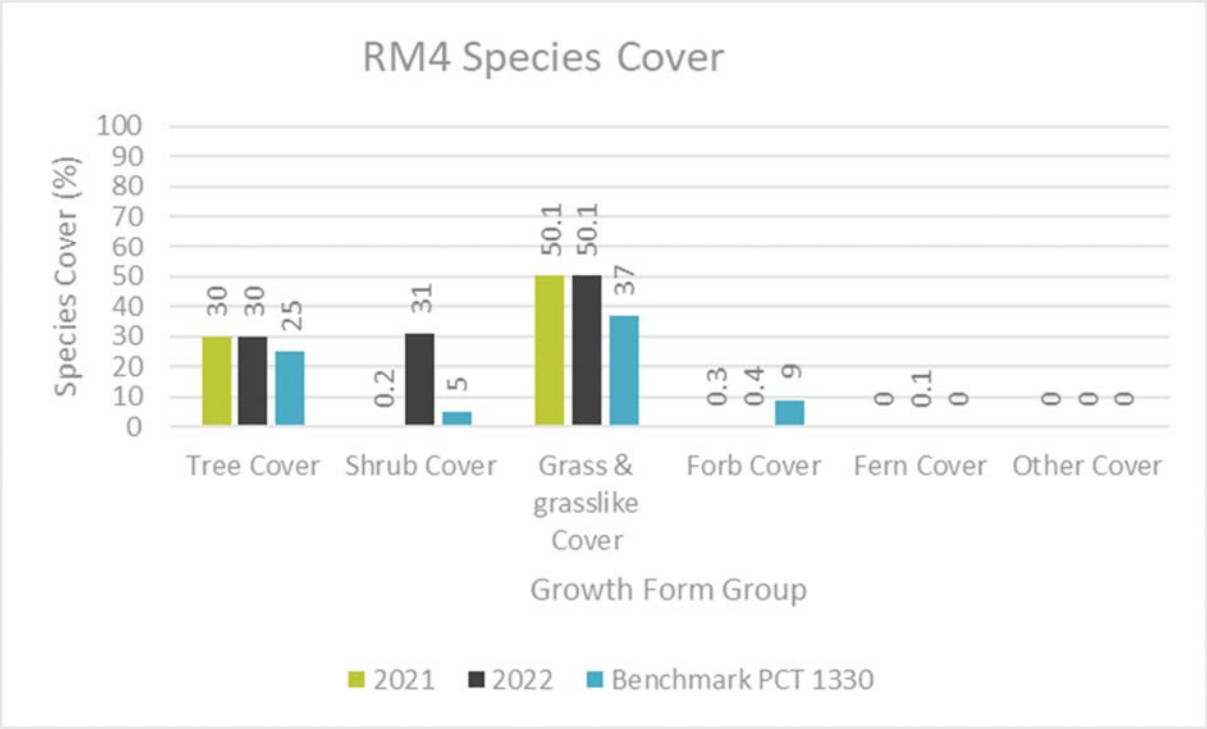
Start Distance (m)	0.5	1.1	2.4	3.7	19.7	37	38.7	42.9	44.3
Patch Identity	Grass	Shrub	Grass	Shrub	Grass	Shrub	Bare Ground	Soak	Bare Ground
Rainsplash Protection (1-5)	5	5	5	5	5	5	1	3	1
t/s canopy cover (1-4)	2	3	2	3	2	3	1	3	1
Litter (1-10)	2	2	2	2	2	2	1	0	1
Soil Biological crust (0, 1-4)	1	1	1	1	1	2	2	0	2
Crust broken-ness (0, 1-4)	1	1	1	1	1	1	2	0	2
Erosion & Severity (1-4)	4	4	4	4	4	4	4	3	4
Deposited materials (1-4)	4	4	4	4	4	4	4	3	4
Surface Roughness (1-5)	2	1	2	2	2	1	1	3	1
Resistance to disturbance	2	3	2	1	2	3	3	1	2
Slake test (0, 1-4)	2	2	2	2	2	3	3	1	3
Texture (1-4)	2	2	2	2	2	2	2	1	2

BG = Bare ground, Sh = Shrub, H = Herb, G = Grass

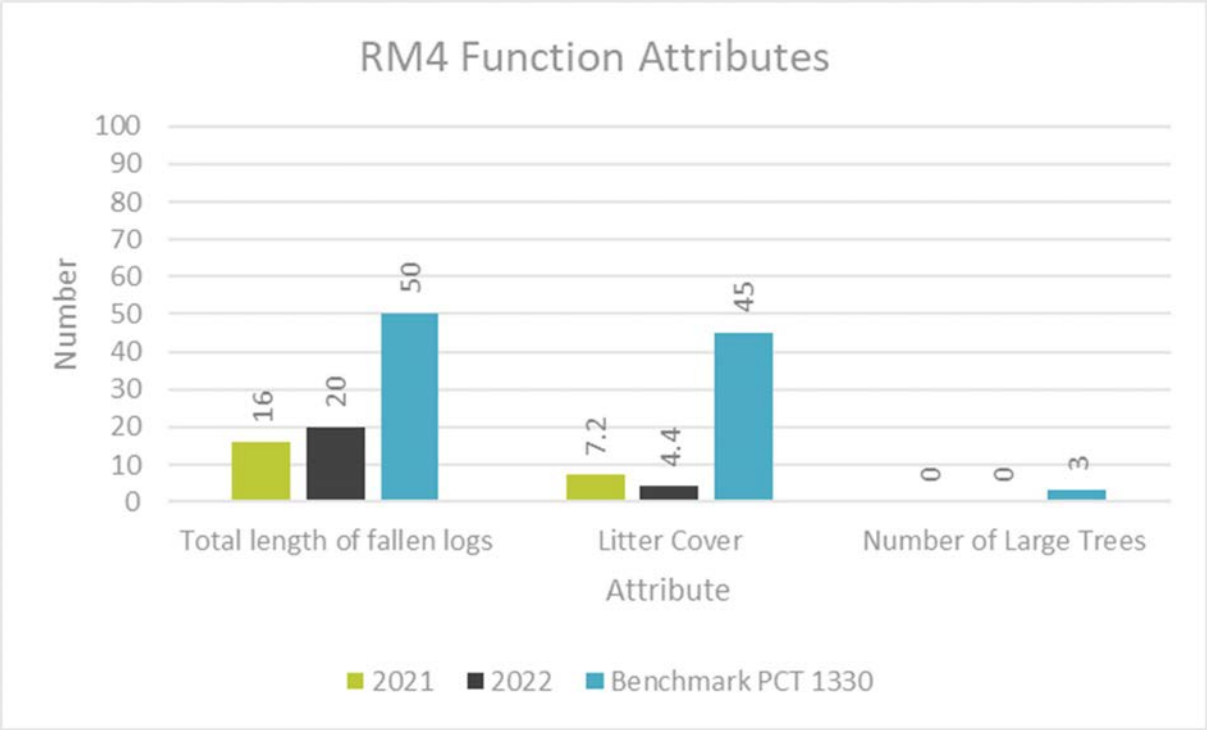
Graph F1 Species Richness at RM4



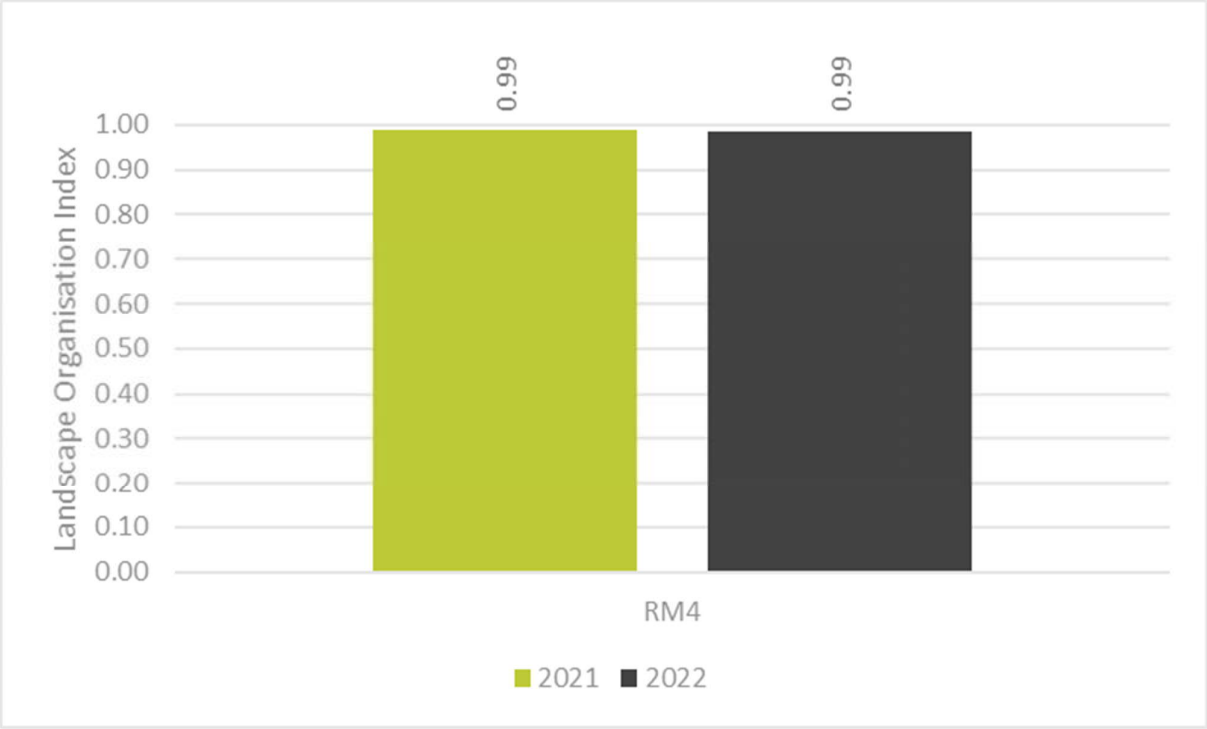
Graph F2 Species Cover at RM4



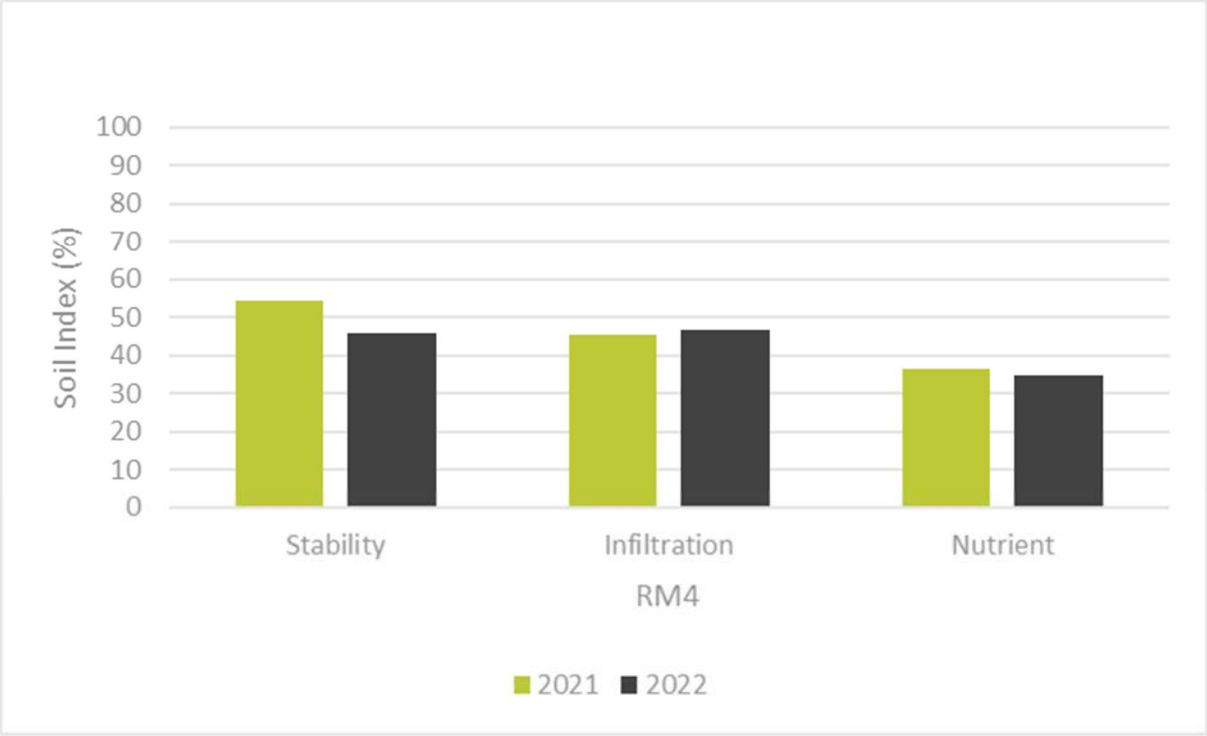
Graph F3 Function Attributes at RM4



Graph F4 LFA Landscape Organisation at RM4



Graph F5 LFA Soil Indices at RM4



Appendix G:
Data and Graphs for RM5

Table G1 Plot Photographs at RM5 in 2022

Start of Transect	End of Transect
	

Table G2 BAM Plot Composition Attributes at RM5 in 2022 - Floristics (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Scientific Name	Cover	Abundance
Non-HTE	Aira cupaniana	0.1	10
Non-HTE	Anthoxanthum odoratum	40	1000
Grass & grasslike	Austrostipa scabra subsp. falcata	3	50
Non-HTE	Briza minor	1	40
Shrub	Cassinia sifton	20	100
Non-HTE	Centaurium erythraea	1	20
Forb	Drosera peltata	0.1	2
Forb	Euchiton involucratus	0.5	20
Forb	Euchiton sphaericus	0.5	20
Non-HTE	Facelis retusa	0.1	5
Non-HTE	Gamochaeta coarctata	0.1	1
Forb	Hydrocotyle sibthorpioides	1	30
HTE	Hypericum perforatum	0.5	20
Forb	Isotoma fluviatilis	0.5	10
Grass & grasslike	Juncus holoschoenus	0.5	20
Grass & grasslike	Microlaena stipoides	30	500
Forb	Microtis unifolia	1	40
Non-HTE	Rumex acetosella	0.1	10
Grass & grasslike	Schoenus apogon	5	100
HTE	Senecio madagascariensis	0.5	10
Forb	Tricoryne elatior	0.1	3
Non-HTE	Trifolium campestre	0.1	1
Non-HTE	Trifolium repens	0.1	1
Forb	Wahlenbergia gracilis	0.1	2

Table G3 BAM Plot Structure Attributes at RM5 in 2022 - Species Richness and Cover (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Count of Species Richness	Sum of Cover of vascular plants
Native Tree	0	0
Native Shrub	1	20
Native Grass & grasslike	4	38.5
Native Forb	8	3.8
Native Fern	0	0
Native Other	0	0
High Threat Exotic	2	1
Non-HTE	9	42.6
Total Weeds	11	43.6

Table G4 BAM Plot Function Attributes at RM5 in 2022 - Tree Stems and Hollows (1000m^2 plot)

DBH (cm)	Number of tree stems	Number of tree stems with hollows
>80	0	0
50 to 79	0	0
30 to 49	0	0
20 to 29	0	0
10 to 19	0	0
5 to 9	0	0
<5	0	0

Table G5 BAM Plot Function Attributes at RM5 in 2022 - Length of Logs (1000m^2 plot)

Attribute	2022
Total Length of Logs (m)	0

Table G6 BAM Plot Function Attributes at RM5 in 2022 - Ground Cover Other (1m^2 plots)

Distance (m)	Litter	Bare ground	Cryptogram	Rock
5	5	0	0	0
15	5	0	0	0
25	5	0	0	2
35	1	0	0	5
45	5	0	0	2
Average	4.2	0	0	1.8

Table G7 BAM Plot Disturbance and Management Notes at RM5 in 2022 (1000m^2 plot)

Factor	Severity Code	Age Code	Observation
Clearing (inc logging)	3	O	Historical
Cultivation (inc pasture)	1	NR	Minor pasture
Soil erosion	0	-	None
Firewood/CWD removal	1	NR	Likely previously managed
Grazing (native/stock)	1	R	Light grazing by wildlife likely
Fire damage	0	-	None
Storm damage	0	-	None
Weediness	2	R	High cover of Anthoxanthum odoratum
Other (stock, feral animals, vehicle, human)	0	-	None
Site management (fencing, weed control)	1	R	Fencing is present
General Heath	2	-	Moderate-poor, requires weed control & planting
Regeneration	2	R	Occurring naturally in all layers, but patchy

KEY: Severity: 0 = no evidence, 1=light/low, 2=moderate, 3=severe/good Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Table G8 LFA Landscape Organisation Data for RM5 in 2022

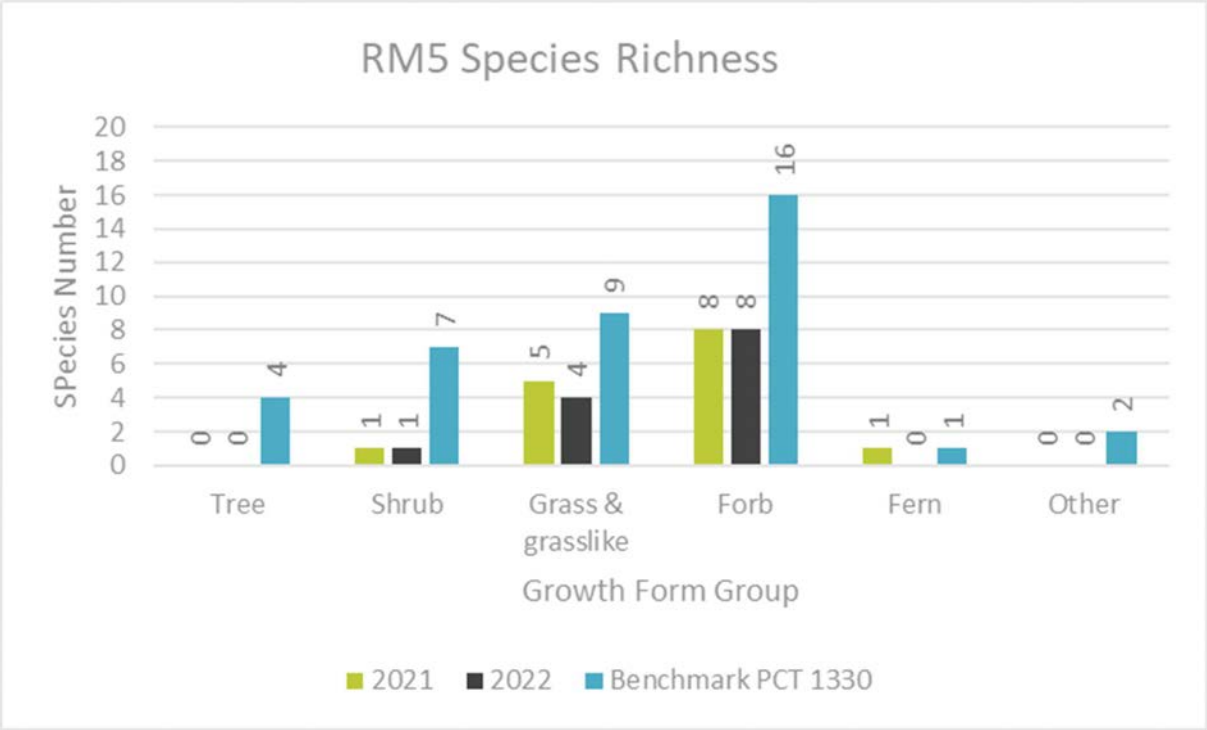
Start Distance (m)	End Distance (m)	Patch Width (cm)	Patch / interpatch	Identity	Notes
0.00	4.40	1000	Patch	Grass	n/a
4.40	14.40	1000	Patch	Shrub	n/a
14.40	21.90	1000	Patch	Grass	n/a
21.90	24.10	650	Patch	Shrub	n/a
24.10	24.50	10	Interpatch	Rock	n/a
24.50	25.70	550	Patch	Shrub	n/a
25.70	27.70	22	Patch	Grass	n/a
27.70	28.80	850	Patch	Shrub	n/a
28.80	31.70	1000	Patch	Grass	n/a
31.70	34.40	1000	Patch	Shrub	n/a
34.40	43.30	500	Patch	Grass	n/a
43.30	47.00	1000	Patch	Shrub	n/a
47.00	48.80	1000	Patch	Grass	n/a
48.80	49.40	370	Patch	Shrub	n/a
49.40	50.00	340	Patch	Grass	n/a

Table G9 LFA Soil Surface Assessment Data at RM5 in 2022

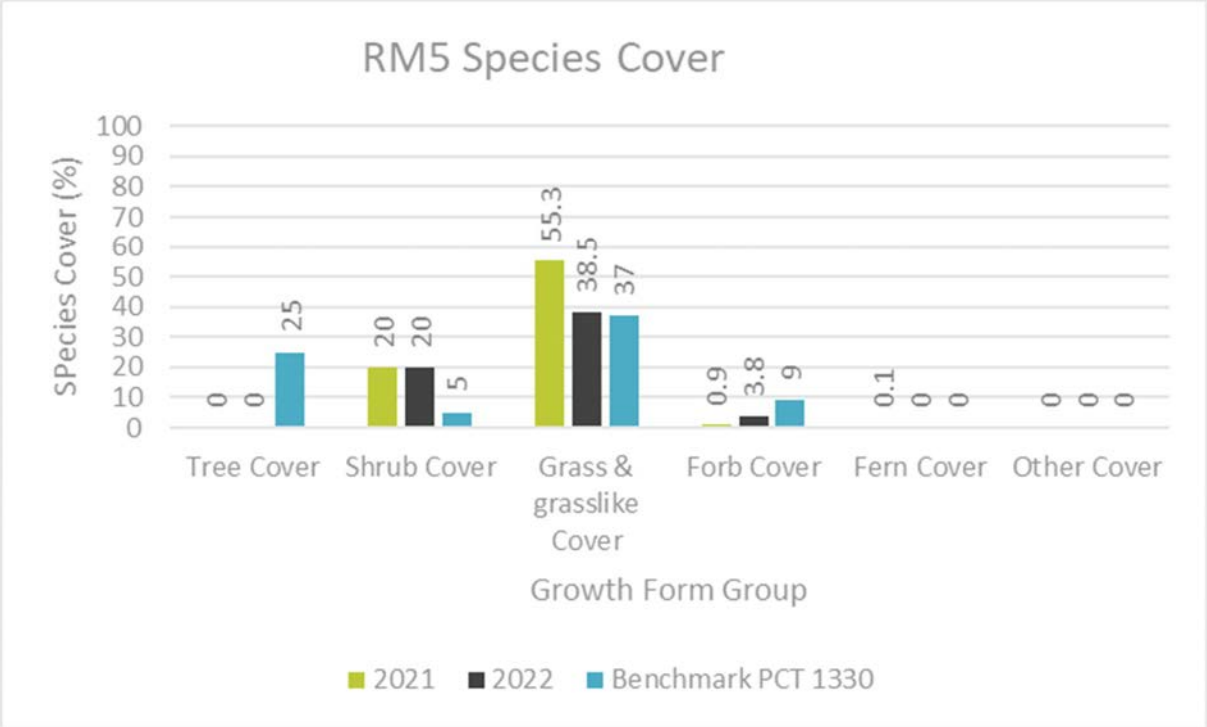
Start Distance (m)	4	9.6	14	23.5	33	37.7
Patch Identity	Grass	Shrub	Grass	Shrub	Shrub	Grass
Rainsplash Protection (1-5)	5	5	5	4	5	5
t/s canopy cover (1-4)	2	3	2	3	3	2
Litter (1-10)	2	1	2	1	1	2
Soil Biological crust (0, 1-4)	1	1	1	2	1	2
Crust broken-ness (0, 1-4)	1	1	1	2	1	2
Erosion & Severity (1-4)	4	4	4	4	4	4
Deposited materials (1-4)	4	4	4	4	4	4
Surface Roughness (1-5)	2	2	2	2	2	2
Resistance to disturbance	1	1	2	3	1	3
Slake test (0, 1-4)	3	2	3	2	2	2
Texture (1-4)	3	3	3	3	3	3

BG = Bare ground, Sh = Shrub, H = Herb, G = Grass

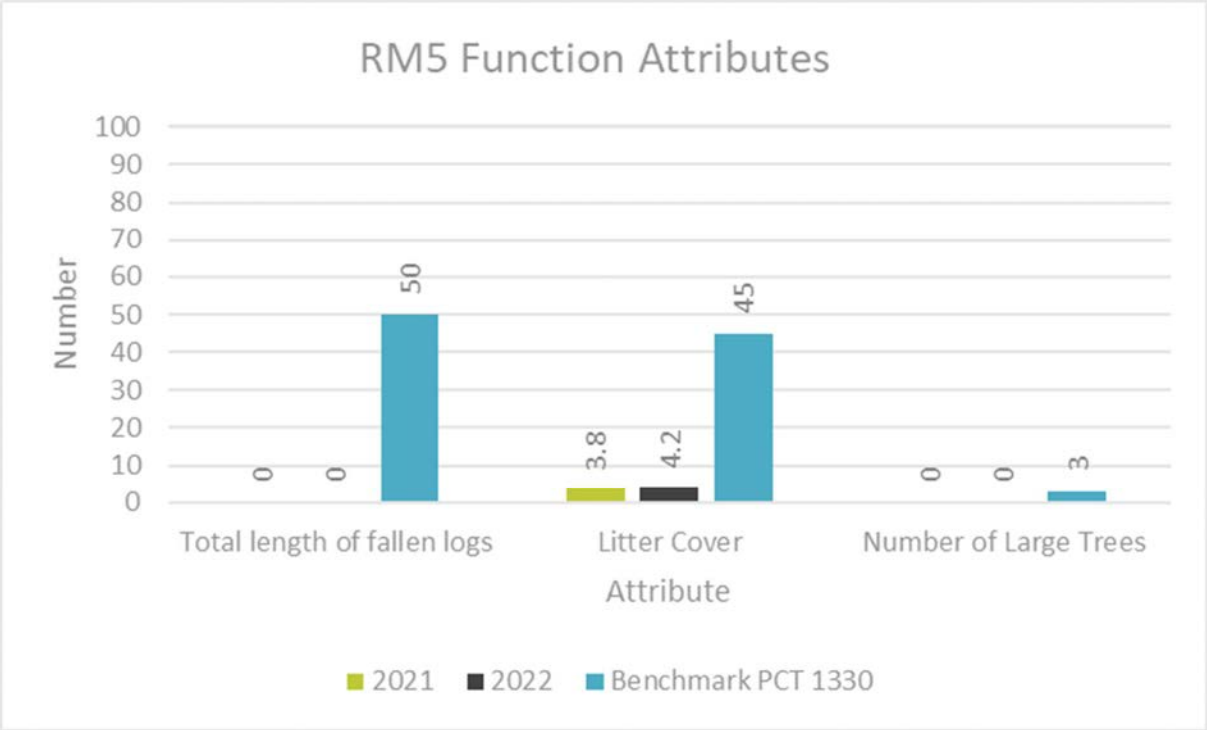
Graph G1 Species Richness at RM5



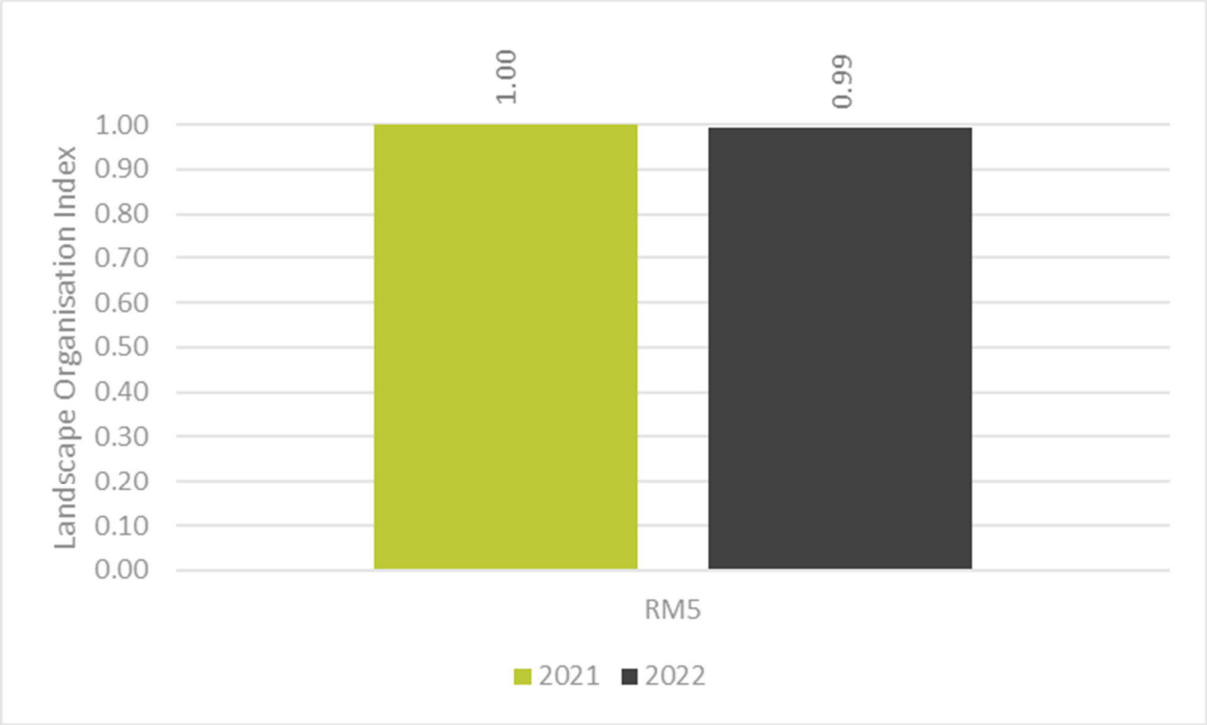
Graph G2 Species Cover at RM5



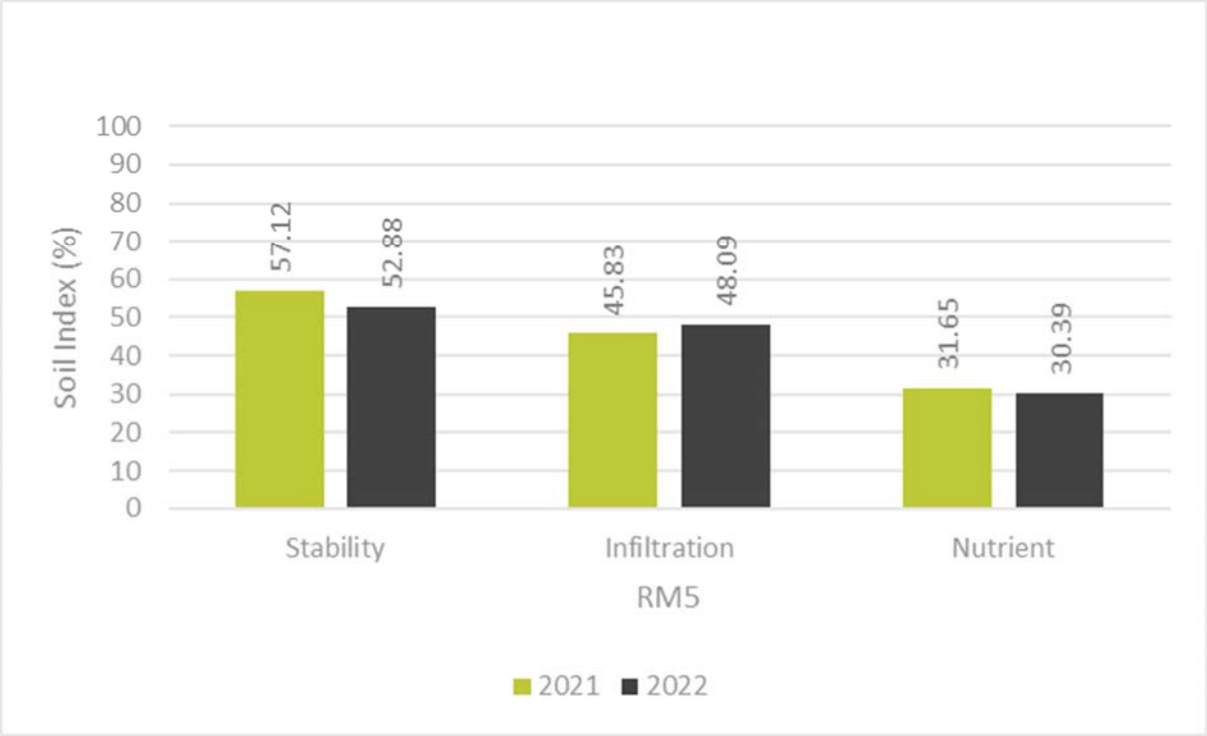
Graph G3 Function Attributes at RM5



Graph G4 LFA Landscape Organisation at RM5



Graph G5 LFA Soil Indices at RM5



Appendix H:
Data and Graphs for BG1

Table H1 Plot Photographs at BG1 in 2022

Start of Transect	End of Transect
	

Table H2 BAM Plot Composition Attributes at BG1 in 2022 - Floristics (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Scientific Name	Cover	Abundance
Forb	Acaena agnipila	0.1	1
Forb	Arthropodium fimbriatum	0.5	5
Grass & grasslike	Austrostipa densiflora	5	50
Grass & grasslike	Austrostipa scabra subsp. falcata	2	20
Non-HTE	Briza minor	0.1	5
Non-HTE	Bromus molliformis	0.5	30
Shrub	Cassinia sifton	20	50
Non-HTE	Centaurium erythraea	0.1	5
Non-HTE	Cirsium vulgare	1	5
Non-HTE	Cyperus congestus	1	20
Forb	Cyperus gracilis	0.1	1
Non-HTE	Dactylis glomerata	0.1	1
Tree	Eucalyptus blakelyi	5	1
Tree	Eucalyptus melliodora	5	1
Forb	Euchiton sphaericus	0.1	20
Non-HTE	Facelis retusa	0.1	3
Non-HTE	Gamochaeta purpurea	0.1	10
Forb	Gonocarpus tetragynus	0.1	1
Non-HTE	Holcus lanatus	0.1	1
Forb	Hydrocotyle sibthorpioides	5	100
Forb	Hypericum gramineum	0.1	1
HTE	Hypericum perforatum	0.1	1
Non-HTE	Hypochaeris radicata	2	100
Non-HTE	Juncus bufonius	1	50
Non-HTE	Lepidium africanum	0.1	2
Shrub	Lissanthe strigosa	0.5	10
Grass & grasslike	Lomandra multiflora	0.1	1
Grass & grasslike	Microlaena stipoides	15	100
Non-HTE	Modiola caroliniana	0.1	1
HTE	Nassella trichotoma	5	50
Forb	Opercularia diphylla	0.5	10
Forb	Oxalis radicosa	0.1	1
Non-HTE	Petrorhagia nanteuilii	0.1	5

Growth Form/ High Threat Exotic (HTE) status	Scientific Name	Cover	Abundance
Forb	Plantago gaudichaudii	0.5	50
Non-HTE	Rumex acetosella	5	100
Grass & grasslike	Rytidosperma fulvum	0.1	1
Grass & grasslike	Schoenus apogon	0.5	30
Non-HTE	Solanum chenopodioides	0.1	4
Grass & grasslike	Themeda triandra	0.5	10
Non-HTE	Trifolium campestre	0.1	2
Non-HTE	Vulpia bromoides	20	200
Forb	Wahlenbergia communis	5	50

Table H3 BAM Plot Structure Attributes at BG1 in 2022 - Species Richness and Cover (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Count of Species Richness	Sum of Cover of vascular plants
Native Tree	2	10
Native Shrub	2	20.5
Native Grass & grasslike	7	23.2
Native Forb	11	12.1
Native Fern	0	0
Native Other	0	0
High Threat Exotic	2	5.1
Non-HTE	18	31.6
Total Weeds	20	36.7

Table H4 BAM Plot Function Attributes at BG1 in 2022 - Tree Stems and Hollows (1000m^2 plot)

DBH (cm)	Number of tree stems	Number of tree stems with hollows
>80	0	0
50 to 79	1	0
30 to 49	3	0
20 to 29	0	0
10 to 19	0	0
5 to 9	0	0
<5	0	0

Table H5 BAM Plot Function Attributes at BG1 in 2022 - Length of Logs (1000m^2 plot)

Attribute	2022
Total Length of Logs (m)	25

Table H6 BAM Plot Function Attributes at BG1 in 2022 - Ground Cover Other (1m^2 plots)

Distance (m)	Litter	Bare ground	Cryptogram	Rock
5	10	0	0	0
15	20	0	0	0
25	10	1	0	0
35	5	0	0	0
45	5	2	0	0
Average	10	0.6	0	0

Table H7 BAM Plot Disturbance and Management Notes at BG1 in 2022 (1000m^2 plot)

Factor	Severity Code	Age Code	Observation
Clearing (inc logging)	0	-	None
Cultivation (inc pasture)	0	-	None
Soil erosion	0	-	None
Firewood/CWD removal	1	NR	Historical
Grazing (native/stock)	0	-	None
Fire damage	0	-	None
Storm damage	2	NR	Tree damage
Weediness	2	R	Moderate, area appears disturbed
Other (stock, feral animals, vehicle, human)	0	-	None
Site management (fencing, weed control)	1	NR	Fencing is present
General Heath	3	-	Good
Regeneration	2	R	Open areas naturally regenerating with tree & shrub

KEY: Severity: 0 = no evidence, 1=light/low, 2=moderate, 3=severe/good Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

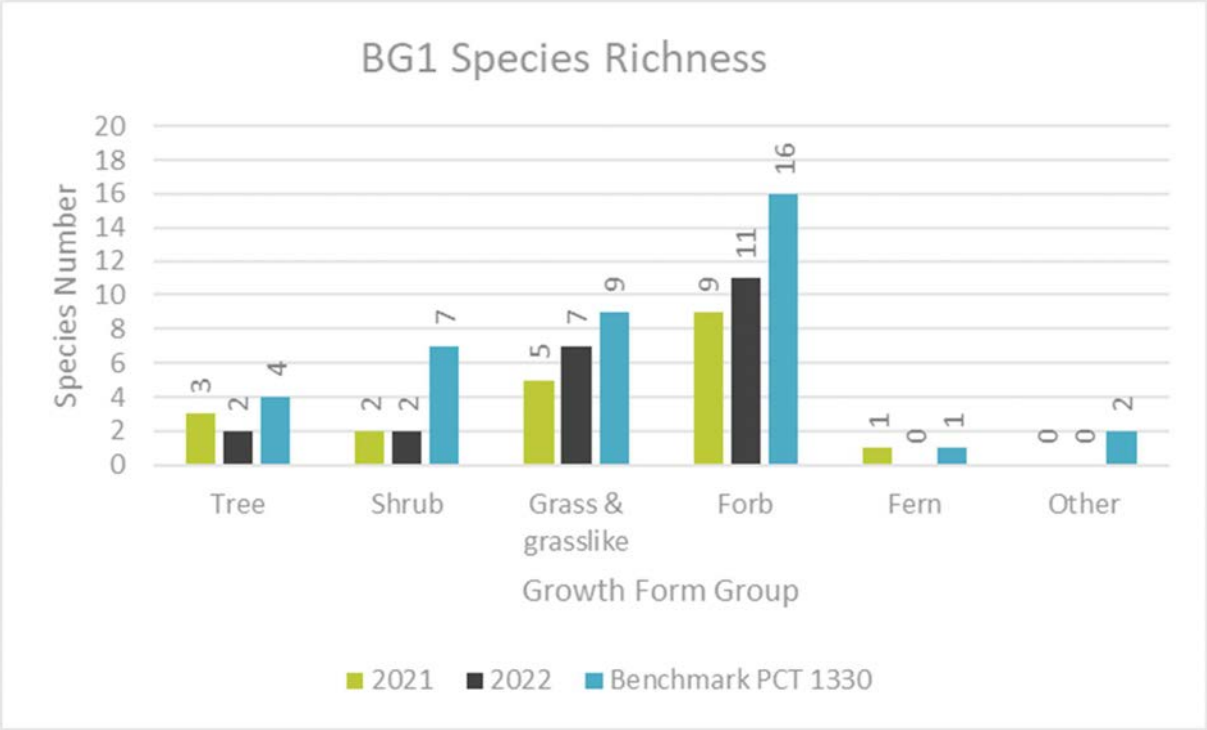
Table H8 LFA Landscape Organisation Data for BG1 in 2022

Start Distance (m)	End Distance (m)	Patch Width (cm)	Patch / interpatch	Identity	Notes
0.00	3.20	510	Patch	Grass	n/a
3.20	3.70	950	Interpatch	Log	n/a
3.70	4.50	160	Patch	Shrub	n/a
4.50	7.20	1000	Patch	Grass	n/a
7.20	8.60	600	Patch	Shrub	n/a
8.60	12.00	1000	Patch	Grass	n/a
12.00	13.30	1000	Patch	Shrub	n/a
13.30	17.30	1000	Patch	Grass	n/a
17.30	25.50	1000	Patch	Shrub	n/a
25.50	27.00	520	Patch	Grass	n/a
27.00	27.70	140	Patch	Herb	n/a
27.70	31.90	1000	Patch	Grass	n/a
31.90	32.20	350	Interpatch	Log	n/a
32.20	32.90	400	Patch	Sedge	n/a
32.90	37.50	1000	Patch	Grass	n/a
37.50	39.10	100	Interpatch	Bare Ground	n/a
39.10	40.50	1000	Patch	Grass	n/a
40.50	41.00	90	Interpatch	Bare Ground	n/a
41.00	43.00	100	Patch	Sedge	n/a
43.00	44.40	230	Patch	Grass	n/a
44.40	45.10	40	Interpatch	Bare Ground	n/a
45.10	45.25	30	Interpatch	Log	n/a
45.25	45.50	120	Patch	Grass	n/a
45.50	47.00	230	Interpatch	Bare Ground	n/a
47.00	47.34	750	Interpatch	Log	n/a
47.34	50.00	480	Patch	Grass	n/a

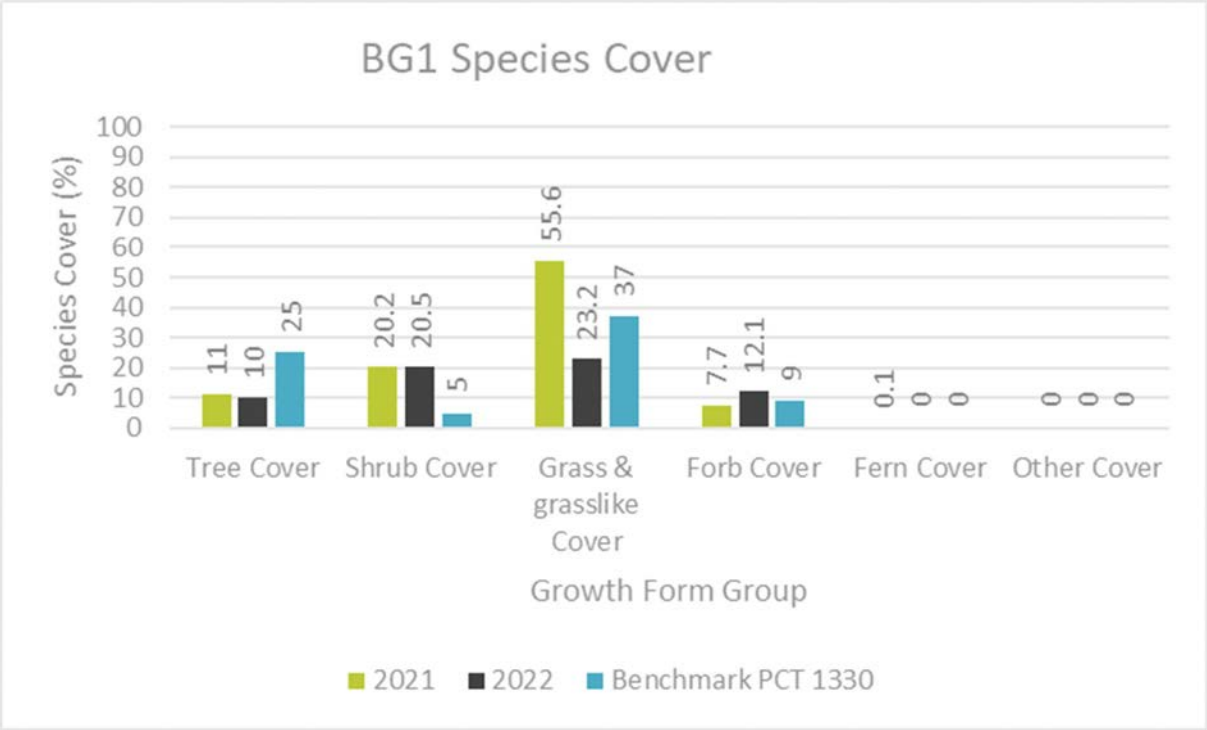
Table I9 LFA Soil Surface Assessment Data at BG1 in 2022

Start Distance (m)	1.7	8	10	12.8	16.4	20.4	27.5	38.8	48.8
Patch Identity	Grass	Shrub	Grass	Shrub	Grass	Shrub	Herb	Bare Ground	Bare Ground
Rainsplash Protection (1-5)	5	5	5	5	5	5	4	2	1
t/s canopy cover (1-4)	2	3	2	3	2	4	2	1	1
Litter (1-10)	2	2	2	2	2	3	2	3	2
Soil Biological crust (0, 1-4)	0	1	0	1	0	0	1	2	3
Crust broken-ness (0, 1-4)	0	0	0	0	0	0	1	1	3
Erosion & Severity (1-4)	4	4	4	4	4	4	4	4	4
Deposited materials (1-4)	4	4	4	4	4	4	4	4	4
Surface Roughness (1-5)	2	2	2	2	3	2	2	2	3
Resistance to disturbance	3	3	3	3	2	3	3	3	4
Slake test (0, 1-4)	2	2	1	2	2	2	2	2	4
Texture (1-4)	2	2	3	2	2	2	2	2	1

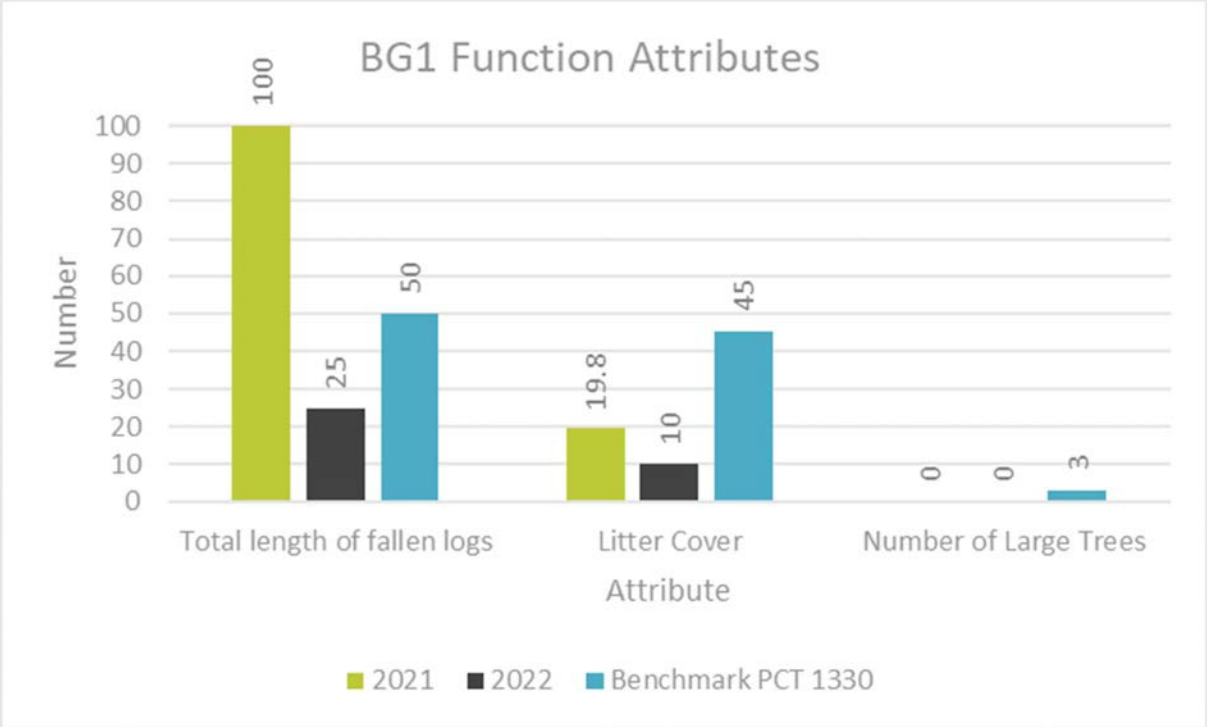
Graph H1 Species Richness at BG1



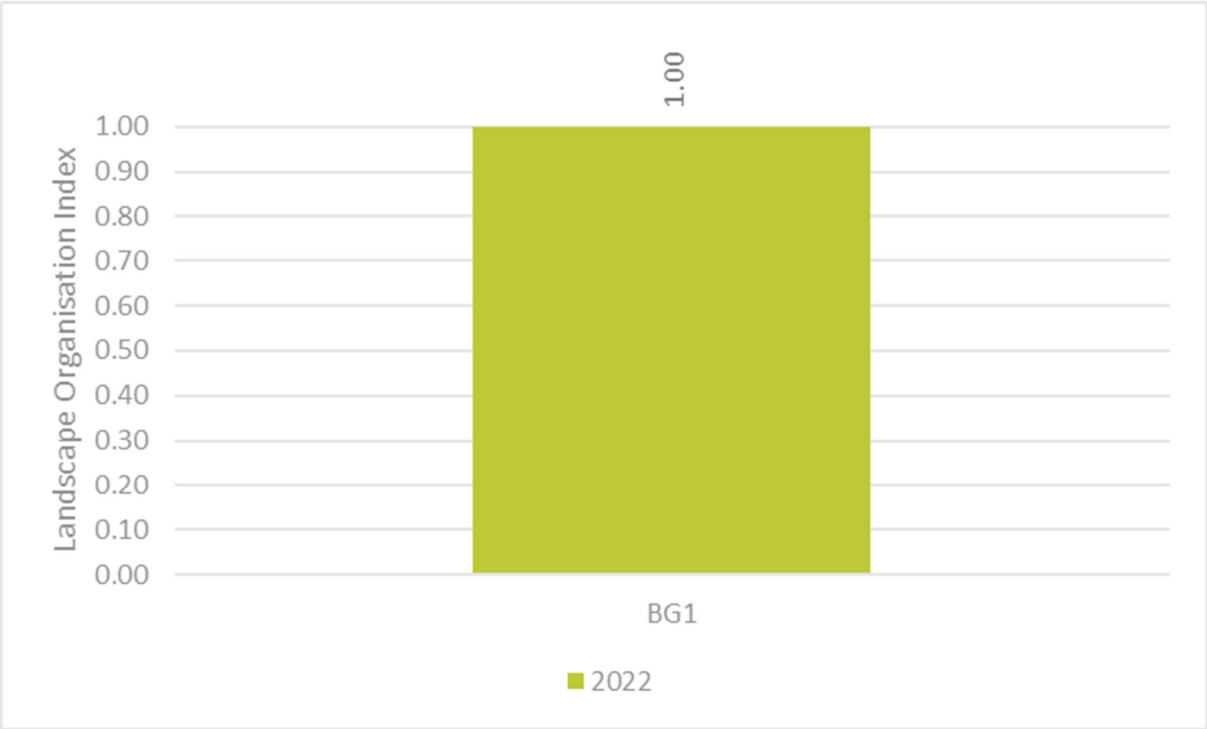
Graph H2 Species Cover at BG1



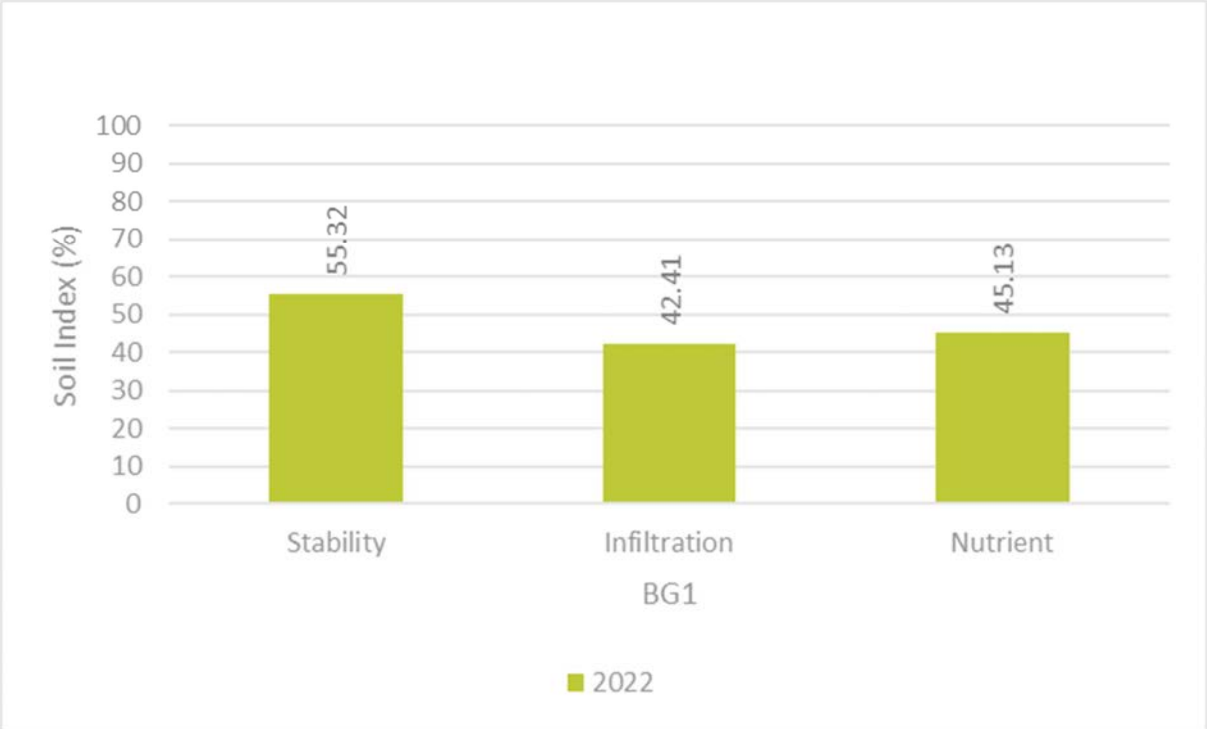
Graph H3 Function Attributes at BG1



Graph H4 LFA Landscape Organisation at BG1



Graph H5 LFA Soil Indices at BG1



Appendix I:
Data and Graphs for BG2

Table I1 Plot Photographs at BG2 in 2022

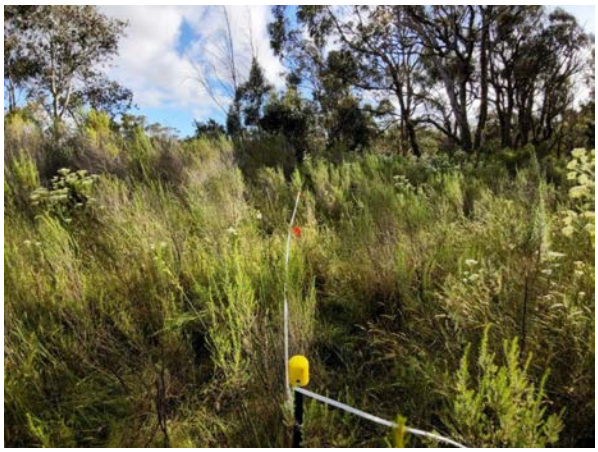
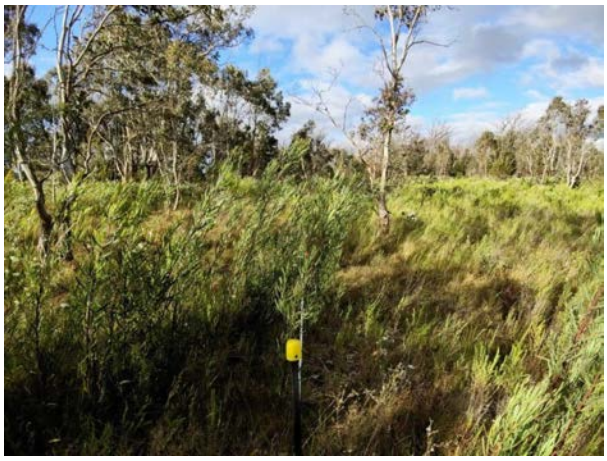
Start of Transect	End of Transect
	

Table I2 BAM Plot Composition Attributes at BG2 in 2022 - Floristics (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Scientific Name	Cover	Abundance
Tree	Acacia parramattensis	0.1	1
Non-HTE	Aira caryophyllea	0.2	100
Tree	Allocasuarina littoralis	0.1	2
Non-HTE	Anthoxanthum odoratum	2	100
Grass & grasslike	Austrostipa densiflora	0.5	30
Non-HTE	Briza minor	0.1	10
Shrub	Cassinia sifton	45	200
Non-HTE	Centaurium erythraea	0.1	10
Fern	Cheilanthes distans	0.1	1
Non-HTE	Conyza bonariensis	0.1	1
Forb	Cyperus gracilis	0.1	1
Forb	Drosera peltata	0.2	10
Tree	Eucalyptus blakelyi	5	1
Tree	Eucalyptus dives	10	5
Forb	Euchiton sphaericus	0.5	20
Forb	Gonocarpus tetragynus	2	100
Forb	Haloragis heterophylla	0.5	20
HTE	Hypericum perforatum	0.1	2
Non-HTE	Hypochaeris radicata	0.1	10
Grass & grasslike	Juncus usitatus	0.1	20
Grass & grasslike	Juncus vaginatus	0.1	10
Shrub	Leptospermum spp.	1	3
Forb	Leucochrysum albicans var. tricolor	0.1	1
Grass & grasslike	Lomandra multiflora	0.1	1
Forb	Microtis unifolia	0.1	2
Shrub	Ozothamnus diosmifolius	20	60
Non-HTE	Rumex acetosella	0.5	50
Grass & grasslike	Rytidosperma fulvum	3	50
Grass & grasslike	Schoenus apogon	0.2	50
HTE	Senecio madagascariensis	0.1	1
Forb	Stypandra glauca	1	20
Forb	Veronica plebeia	0.5	10
Non-HTE	Vulpia bromoides	1	100

Table I3 BAM Plot Structure Attributes at BG2 in 2022 - Species Richness and Cover (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Count of Species Richness	Sum of Cover of vascular plants
Native Tree	4	15.2
Native Shrub	3	66
Native Grass & grasslike	6	4
Native Forb	9	5
Native Fern	1	0.1
Native Other	0	0
High Threat Exotic	2	0.2
Non-HTE	8	4.1
Total Weeds	10	4.3

Table I4 BAM Plot Function Attributes at BG2 in 2022 - Tree Stems and Hollows (1000m^2 plot)

DBH (cm)	Number of tree stems	Number of tree stems with hollows
>80	0	0
50 to 79	1	0
30 to 49	1	0
20 to 29	0	0
10 to 19	5	0
5 to 9	13	0
<5	≥1	0

Table I5 BAM Plot Function Attributes at BG2 in 2022 - Length of Logs (1000m^2 plot)

Attribute	2022
Total Length of Logs (m)	3

Table I6 BAM Plot Function Attributes at BG2 in 2022 - Ground Cover Other (1m^2 plots)

Distance (m)	Litter	Bare ground	Cryptogram	Rock
5	5	0	5	0
15	10	0	0	0
25	40	1	0	0
35	15	0	0	0
45	15	50	5	0
Average	17	10.2	2	0

Table I7 BAM Plot Disturbance and Management Notes at BG2 in 2022 (1000m^2 plot)

Factor	Severity Code	Age Code	Observation
Clearing (inc logging)	2	NR	Historical
Cultivation (inc pasture)	0	-	None
Soil erosion	0	-	None
Firewood/CWD removal	1	NR	Historical
Grazing (native/stock)	0	-	None
Fire damage	0	-	None
Storm damage	0	-	None
Weediness	1	R	Light weed cover
Other (stock, feral animals, vehicle, human)	0	-	None
Site management (fencing, weed control)	0	-	None
General Heath	3	-	Good
Regeneration	2	R	Canopy rehabilitation occurring

KEY: Severity: 0 = no evidence, 1=light/low, 2=moderate, 3=severe/good Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

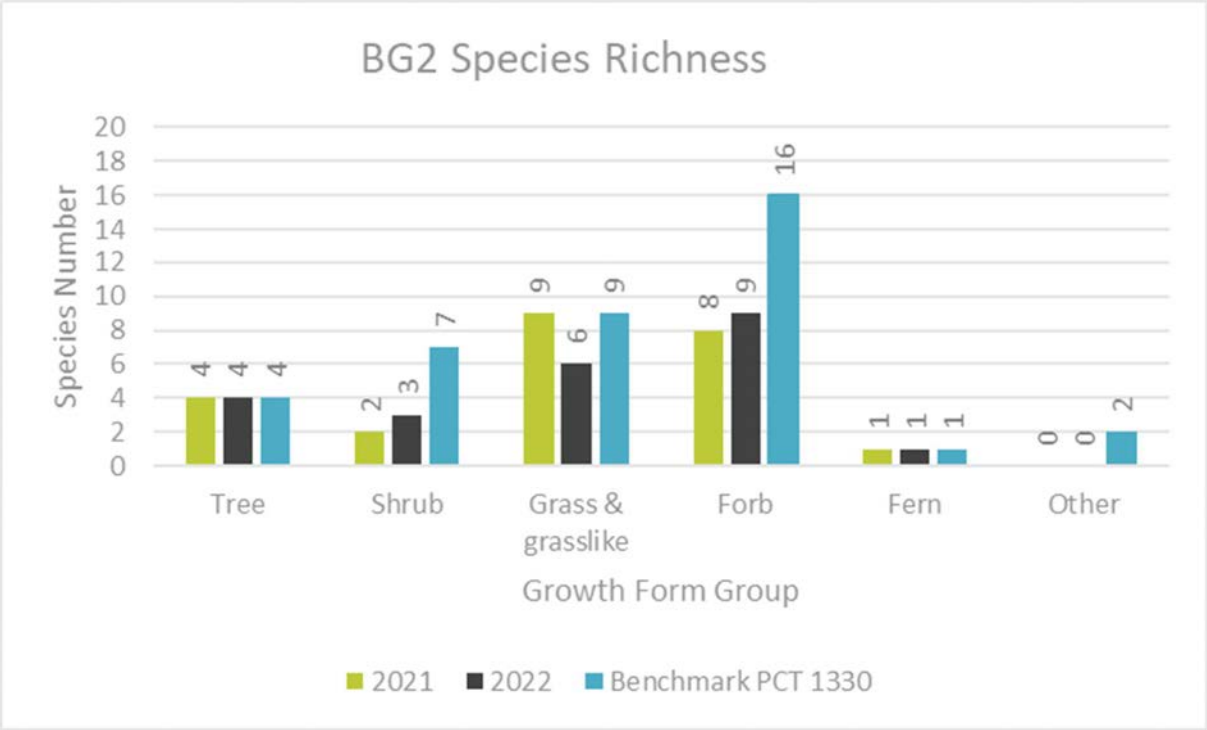
Table I8 LFA Landscape Organisation Data for BG2 in 2022

Start Distance (m)	End Distance (m)	Patch Width (cm)	Patch / interpatch	Identity	Notes
0.00	2.20	1000	Patch	Shrub	n/a
2.20	4.20	280	Patch	Grass	n/a
4.20	6.00	1000	Patch	Shrub	n/a
6.00	6.60	100	Patch	Grass	n/a
6.60	8.30	1000	Patch	Shrub	n/a
8.30	9.70	130	Patch	Grass	n/a
9.70	13.10	1000	Patch	Shrub	n/a
13.10	14.00	75	Interpatch	Leaf Litter	n/a
14.00	16.80	1000	Patch	Shrub Leaf Litter	n/a
16.80	18.30	150	Interpatch	Leaf Litter	n/a
18.30	24.40	1000	Patch	Shrub Leaf Litter	n/a
24.40	25.30	60	Interpatch	Leaf Litter	n/a
25.30	34.30	1000	Patch	Shrub Leaf Litter	n/a
34.30	43.40	1000	Patch	Shrub	n/a
43.40	43.80	50	Interpatch	Leaf Litter	n/a
43.80	46.90	1000	Patch	Shrub	n/a
46.90	47.40	80	Interpatch	Leaf Litter	n/a
47.40	50.00	850	Patch	Shrub	n/a

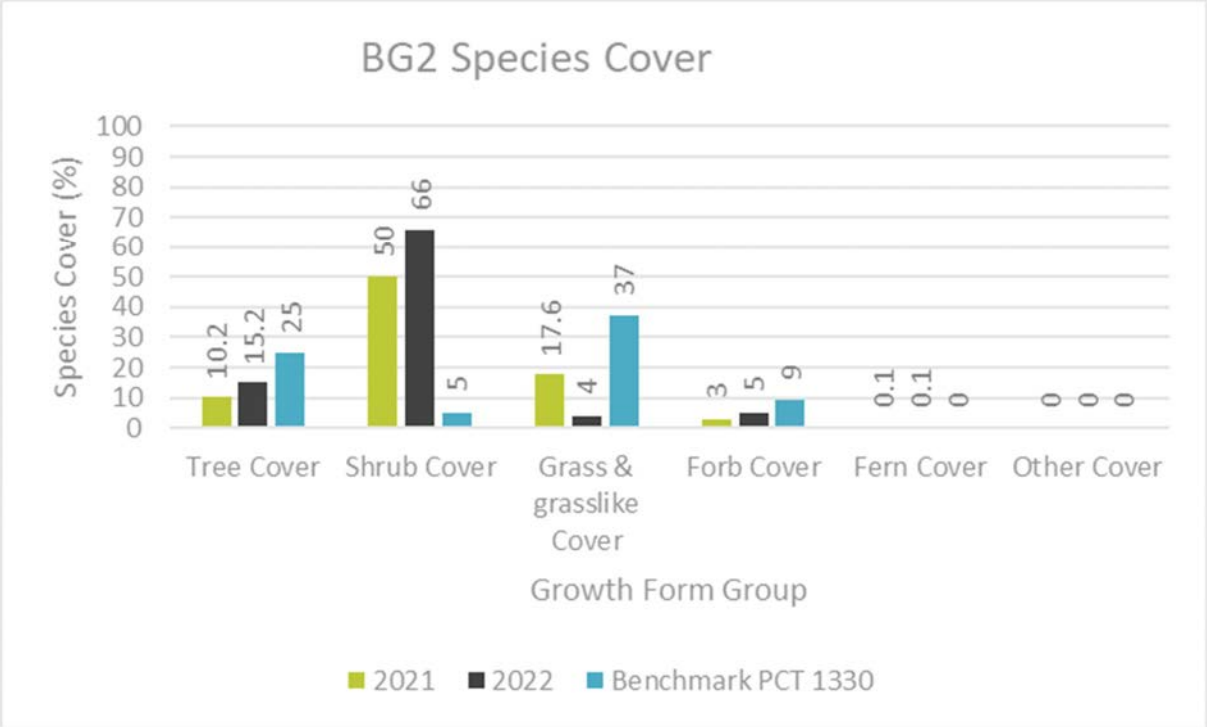
Table I9 LFA Soil Surface Assessment Data at BG2 in 2022

Start Distance (m)	1.3	3.2	5	6.2	9.2	11.2	13.6	14.7	17.7	20.8
Patch Identity	Shrub	Grass	Shrub	Grass	Grass	Shrub	Litter	Shrub Leaf	Litter	Shrub Leaf
Rainsplash Protection (1-5)	5	5	5	5	5	5	2	4	2	4
t/s canopy cover (1-4)	3	2	3	2	2	3	1	3	1	3
Litter (1-10)	2	2	2	2	2	2	4	4	4	4
Soil Biological crust (0, 1-4)	0	1	1	1	1	0	3	1	1	3
Crust broken-ness (0, 1-4)	0	0	0	0	0	0	4	0	0	0
Erosion & Severity (1-4)	4	4	4	4	4	4	4	4	4	4
Deposited materials (1-4)	4	4	4	4	4	4	4	4	4	4
Surface Roughness (1-5)	2	2	2	2	2	2	2	2	2	2
Resistance to disturbance	2	3	3	2	2	2	3	3	3	3
Slake test (0, 1-4)	3	3	3	3	3	3	3	3	3	2
Texture (1-4)	2	2	2	2	2	2	2	2	2	2

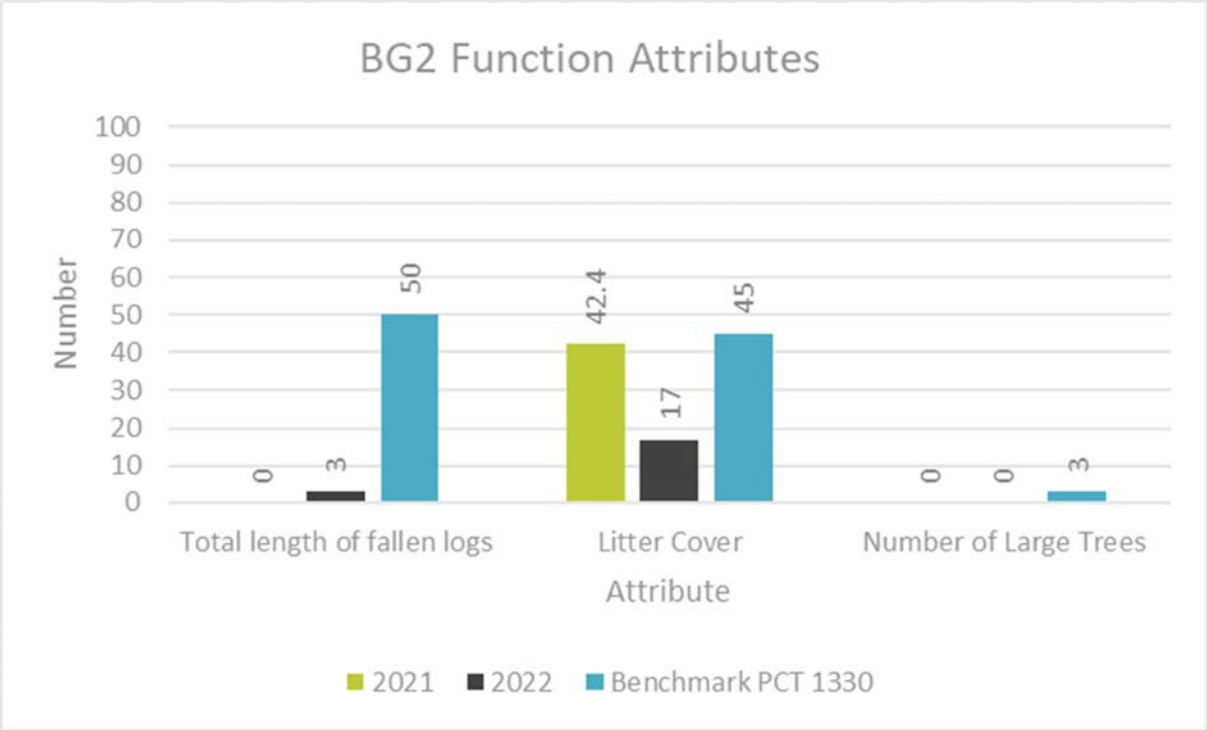
Graph I1 Species Richness at BG2



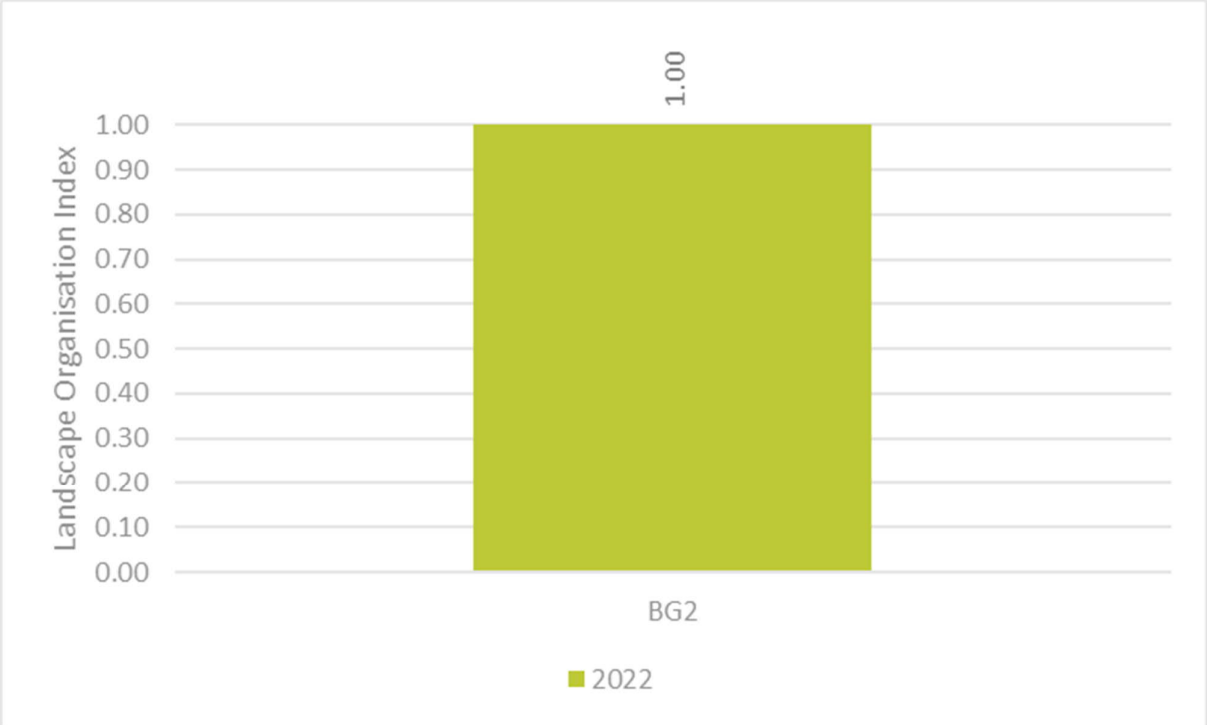
Graph I2 Species Cover at BG2



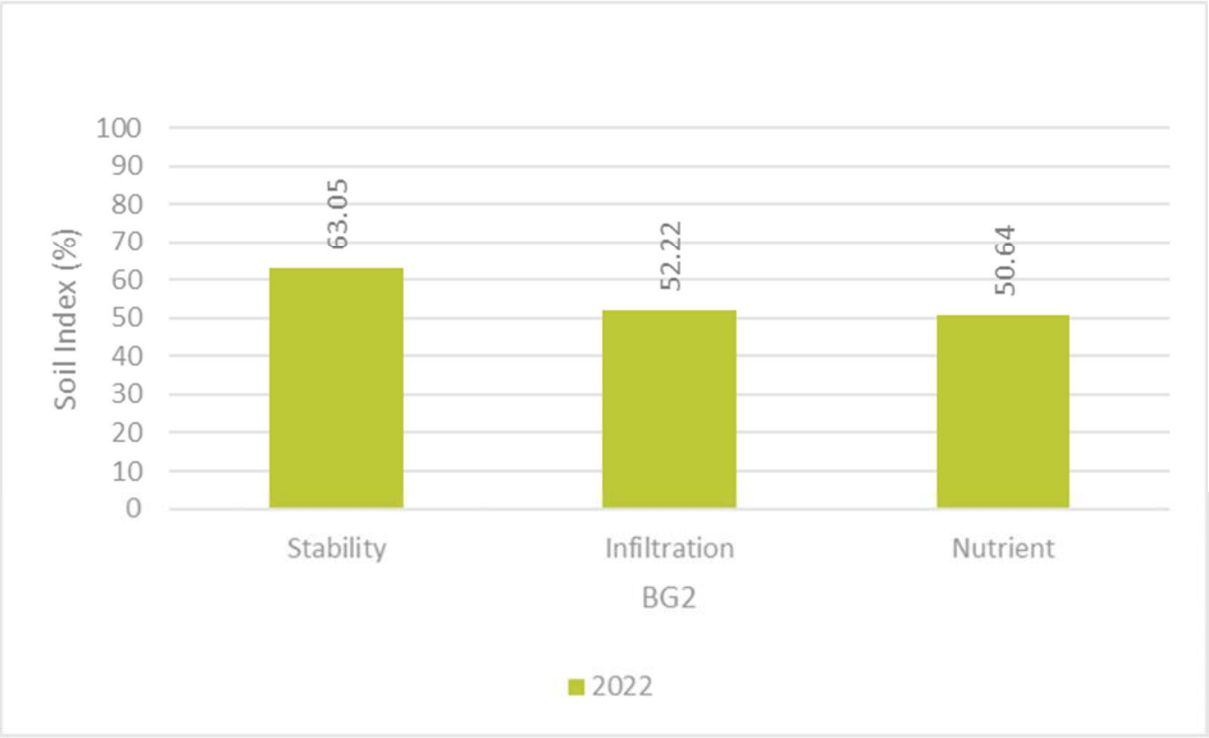
Graph I3 Function Attributes at BG2



Graph I4 LFA Landscape Organisation at BG2



Graph I5 LFA Soil Indices at BG2



Appendix J:
Data and Graphs for CR1

Table J1 Plot Photographs at CR1 in 2022

Start of Transect	End of Transect
	

Table J2 BAM Plot Composition Attributes at CR1 in 2022 - Floristics (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Scientific Name	Cover	Abundance
Tree	Acacia decurrens	10	7
Non-HTE	Avena fatua	2	50
Non-HTE	Bromus molliformis	10	100
Shrub	Cassinia sifton	0.1	3
Non-HTE	Conyza bonariensis	0.1	1
Non-HTE	Cyperus congestus	1	20
Non-HTE	Gamochaeta coarctata	0.1	2
Forb	Geranium solanderi	0.5	10
Forb	Haloragis heterophylla	0.1	1
Non-HTE	Holcus lanatus	50	1000
Non-HTE	Hypochaeris radicata	0.5	20
Grass & grasslike	Juncus usitatus	3	50
Shrub	Lissanthe strigosa	0.1	1
Grass & grasslike	Microlaena stipoides	0.5	20
HTE	Nassella trichotoma	0.5	3
HTE	Paspalum dilatatum	1	5
Non-HTE	Plantago lanceolata	1	20
HTE	Rubus anglocandicans (in Rubus fruticosus L. complex)	5	5
Non-HTE	Rumex acetosella	0.5	20
Non-HTE	Rumex crispus	0.5	10
Non-HTE	Trifolium campestre	0.1	1
Non-HTE	Trifolium subterraneum	0.5	10
Non-HTE	Vulpia bromoides	5	100

Table J3 BAM Plot Structure Attributes at CR1 in 2022 - Species Richness and Cover (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Count of Species Richness	Sum of Cover of vascular plants
Native Tree	1	10
Native Shrub	2	0.2
Native Grass & grasslike	2	3.5
Native Forb	2	0.6
Native Fern	0	0
Native Other	0	0
High Threat Exotic	3	6.5
Non-HTE	13	71.3
Total Weeds	16	77.8

Table J4 BAM Plot Function Attributes at CR1 in 2022 - Tree Stems and Hollows (1000m^2 plot)

DBH (cm)	Number of tree stems	Number of tree stems with hollows
>80	0	0
50 to 79	0	0
30 to 49	0	0
20 to 29	0	0
10 to 19	1	0
5 to 9	0	0
<5	≥1	0

Table J5 BAM Plot Function Attributes at CR1 in 2022 - Length of Logs (1000m^2 plot)

Attribute	2022
Total Length of Logs (m)	8

Table J6 BAM Plot Function Attributes at CR1 in 2022 - Ground Cover Other (1m^2 plots)

Distance (m)	Litter	Bare ground	Cryptogram	Rock
5	1	0	0	0
15	5	0	0	0
25	10	0	1	0
35	1	0	0	0
45	0	0	0	0
Average	3.4	0	0.2	0

Table J7 BAM Plot Disturbance and Management Notes at CR1 in 2022 (1000m^2 plot)

Factor	Severity Code	Age Code	Observation
Clearing (inc logging)	3	NR	Severely cleared historically
Cultivation (inc pasture)	0	-	None
Soil erosion	2	R	Moderate creek bank erosion
Firewood/CWD removal	2	NR	Historical
Grazing (native/stock)	0	-	None
Fire damage	0	-	None
Storm damage	0	-	None
Weediness	3	R	High weed cover
Other (stock, feral animals, vehicle, human)	0	-	None
Site management (fencing, weed control)	0	-	None
General Heath	1	-	Poor, requires weed control and planting
Regeneration	1	R	Yellow Box regeneration evident

KEY: Severity: 0 = no evidence, 1=light/low, 2=moderate, 3=severe/good Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

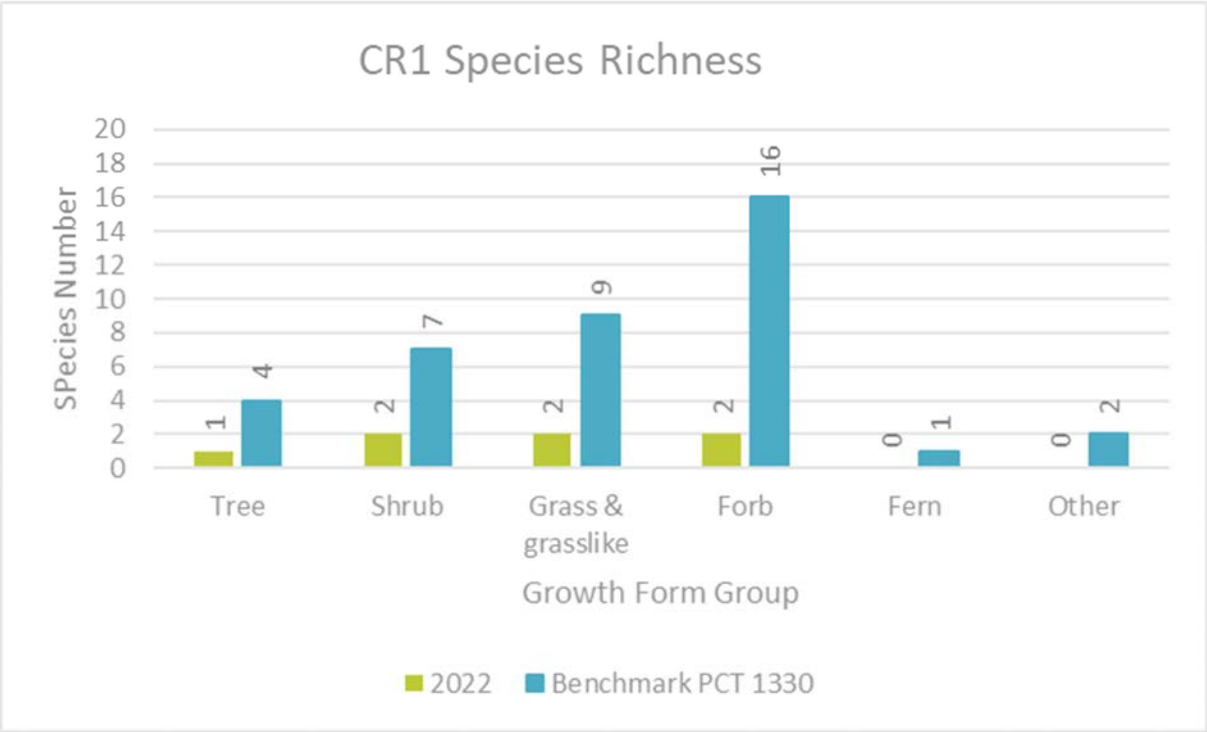
Table J8 LFA Landscape Organisation Data for CR1 in 2022

Start Distance (m)	End Distance (m)	Patch Width (cm)	Patch / interpatch	Identity	Notes
0.00	6.85	1000	Patch	Grass	n/a
6.85	7.10	20	Interpatch	Rock	n/a
7.10	15.20	1000	Patch	Grass	n/a
15.20	17.40	270	Patch	Shrub	Shrub Thicket Blackberry
17.40	18.70	130	Interpatch	Rock	Rocks under Blackberry
18.70	21.60	1000	Patch	Grass	n/a
21.60	22.80	70	Interpatch	Rock	n/a
22.80	24.80	1000	Patch	Grass	Shallow soil
24.80	28.70	520	Patch	Sedge	n/a
28.70	33.60	900	Patch	Grass	n/a
33.60	38.20	310	Interpatch	Bare Ground	Bare patchy ground shallow soil
38.20	43.00	400	Patch	Sedge	n/a
43.00	45.40	280	Interpatch	Bare Ground	Bare patchy ground shallow soil
45.40	50.00	1000	Patch	Grass	n/a

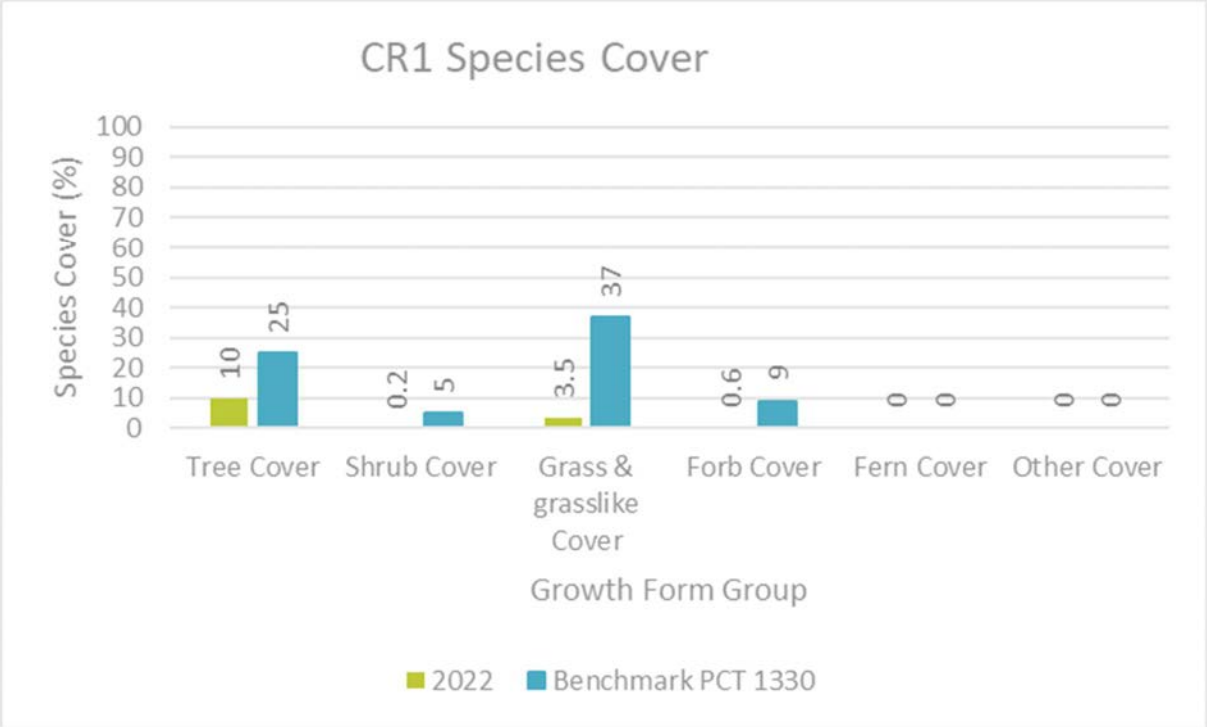
Table J9 LFA Soil Surface Assessment Data at CR1 in 2022

Start Distance (m)	2.7	9.5	18.8	24.8	32.7	41.4	44	38.8
Patch Identity	Grass	Grass	Shrub	Sedge	Sedge	Grass	Bare Ground	Bare Ground
Rainsplash Protection (1-5)	5	5	5	5	5	5	2	2
t/s canopy cover (1-4)	2	2	3	2	2	2	1	1
Litter (1-10)	2	2	2	1	1	2	1	1
Soil Biological crust (0, 1-4)	1	1	0	0	0	0	1	1
Crust broken-ness (0, 1-4)	0	0	0	0	0	0	0	0
Erosion & Severity (1-4)	4	4	4	4	4	4	3	3
Deposited materials (1-4)	4	4	4	4	4	4	4	4
Surface Roughness (1-5)	3	4	2	4	3	3	3	3
Resistance to disturbance	1	1	2	1	2	2	1	2
Slake test (0, 1-4)	2	2	2	0	0	0	0	0
Texture (1-4)	2	2	2	1	2	2	2	2

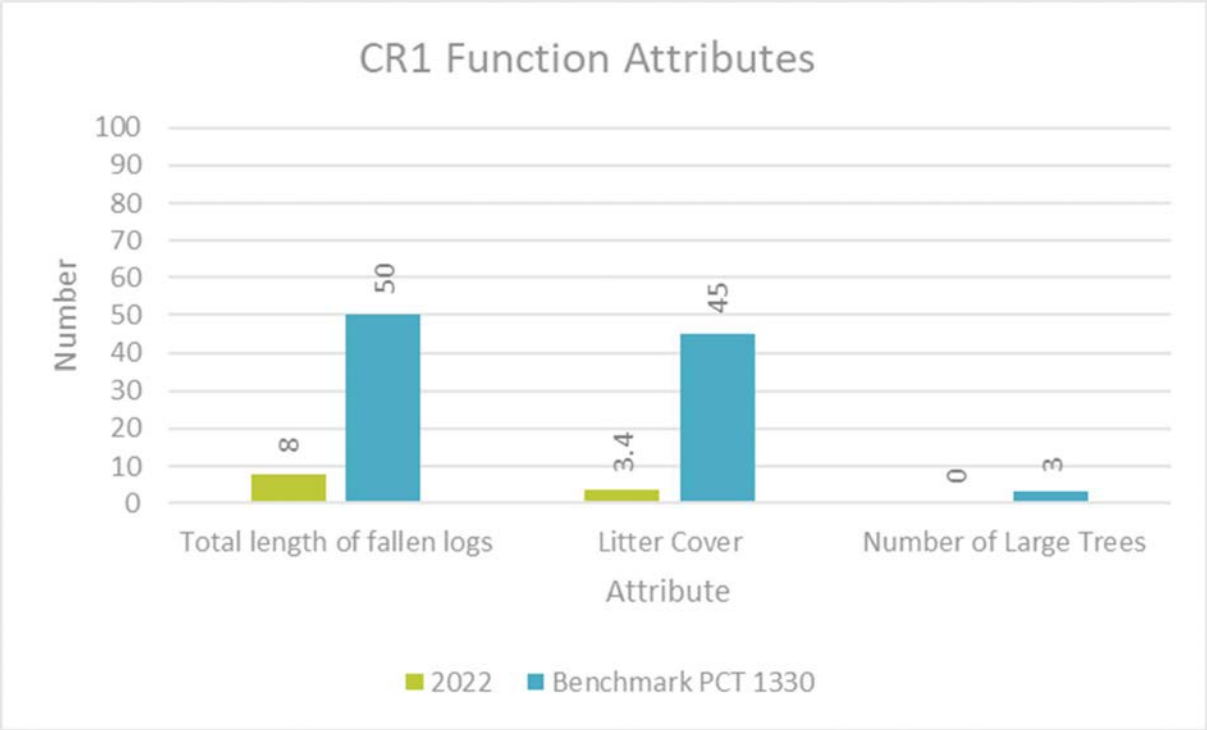
Graph J1 Species Richness at CR1



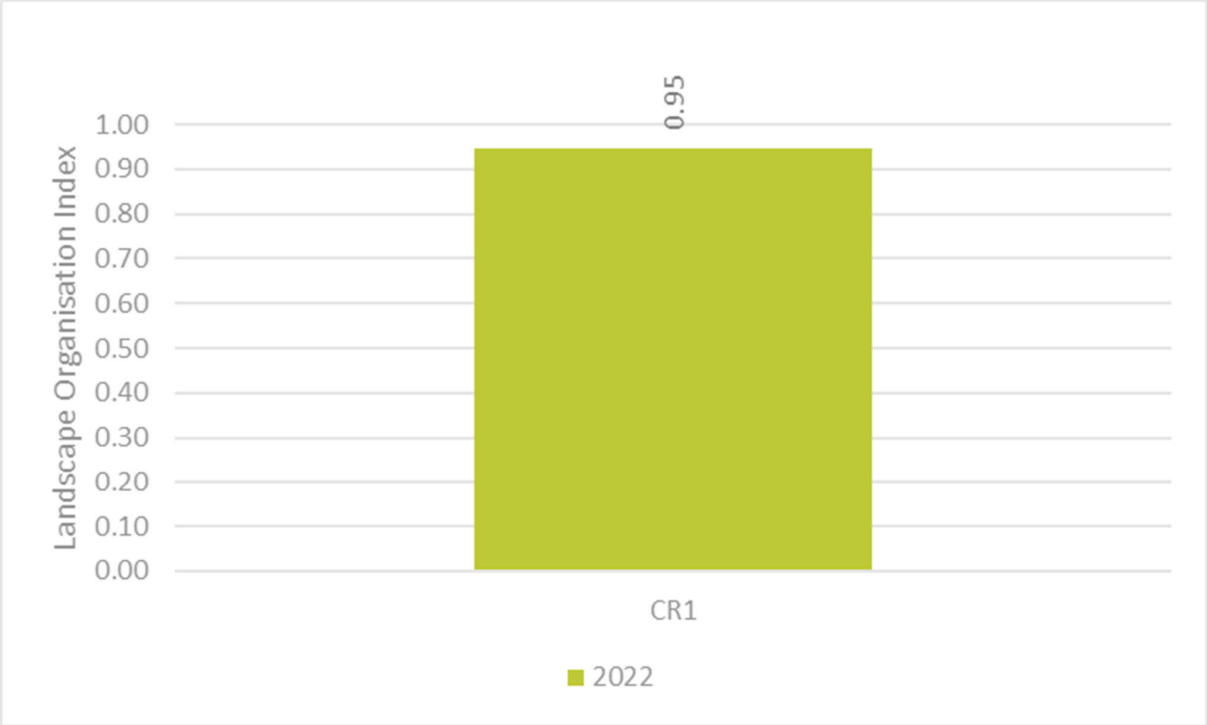
Graph J2 Species Cover at CR1



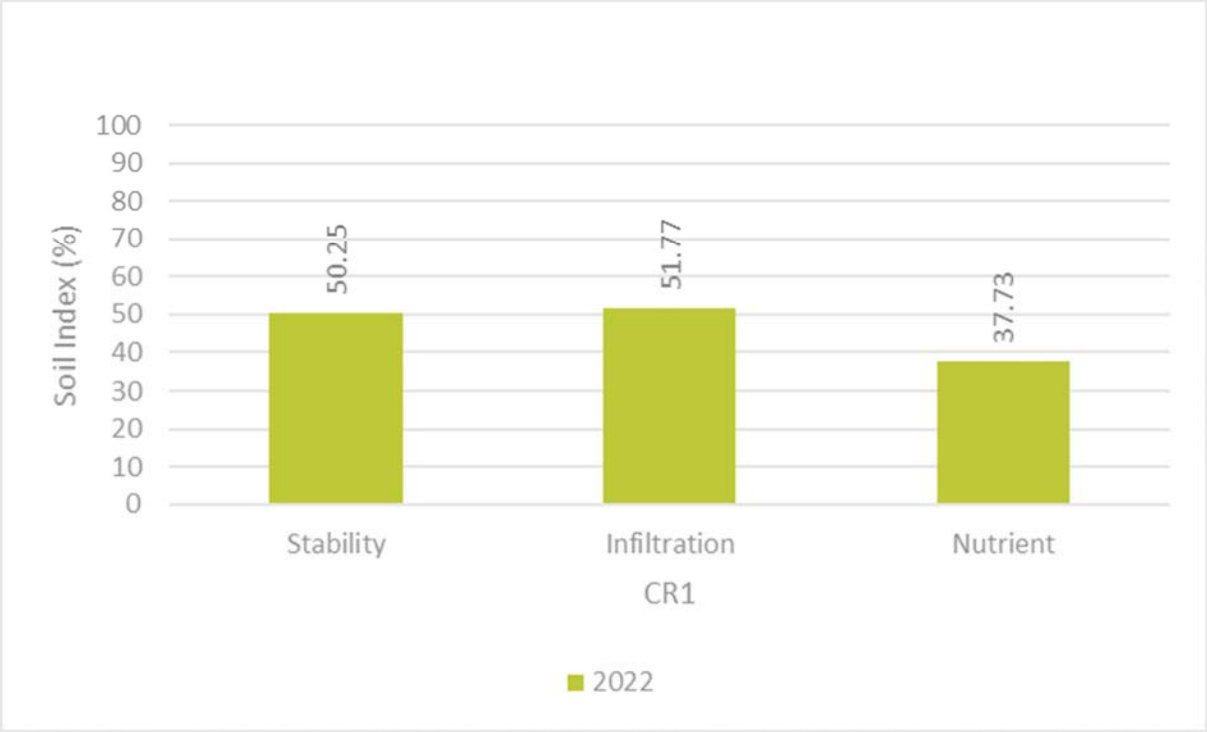
Graph J3 Function Attributes at CR1



Graph J4 LFA Landscape Organisation at CR1



Graph H5 LFA Soil Indices at CR1



Appendix K:
Data and Graphs for CR2

Table K1 Plot Photographs at CR2 in 2022

Start of Transect	End of Transect
	

Table K2 BAM Plot Composition Attributes at CR2 in 2022 - Floristics (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Scientific Name	Cover	Abundance
Tree	Acacia decurrens	1	3
Non-HTE	Aira cupaniana	0.1	10
Tree	Allocasuarina littoralis	0.5	2
Non-HTE	Anthoxanthum odoratum	1	100
Grass & grasslike	Austrostipa scabra subsp. falcata	0.1	1
Non-HTE	Avena fatua	0.1	3
Non-HTE	Briza maxima	0.1	1
Non-HTE	Bromus catharticus	2	100
Non-HTE	Bromus molliformis	0.1	5
Grass & grasslike	Carex appressa	0.5	2
Shrub	Cassinia aculeata	0.5	2
Shrub	Cassinia sifton	20	70
Non-HTE	Centaurium erythraea	0.1	1
Non-HTE	Cirsium vulgare	1	10
Non-HTE	Conyza bonariensis	0.1	5
Non-HTE	Cyperus congestus	0.5	10
Tree	Eucalyptus blakelyi	25	7
Non-HTE	Gallium aparine	0.2	10
Forb	Geranium solanderi	1	50
Non-HTE	Holcus lanatus	0.1	1
Forb	Hydrocotyle sibthorpioides	0.5	20
HTE	Hypericum perforatum	0.1	1
Non-HTE	Hypochaeris radicata	1	50
Grass & grasslike	Juncus usitatus	0.1	2
Grass & grasslike	Microlaena stipoides	20	200
HTE	Nassella trichotoma	5	30
Shrub	Olearia phlogopappa	2	5
Shrub	Olearia viscidula	0.1	1
Forb	Oxalis radicosa	0.1	1
Non-HTE	Plantago lanceolata	0.1	10
HTE	Rubus anglocandicans (in Rubus fruticosus L. complex)	2	4
Non-HTE	Rumex acetosella	2	100
Forb	Senecio quadridentatus	0.1	1

Growth Form/ High Threat Exotic (HTE) status	Scientific Name	Cover	Abundance
Forb	Senecio sp.	1	2
Non-HTE	Solanum chenopodioides	0.1	2
Non-HTE	Solanum nigrum	0.1	1
Non-HTE	Sonchus oleraceus	0.2	10
Non-HTE	Trifolium campestre	0.2	3
Non-HTE	Verbena bonariensis	0.1	2
Non-HTE	Vulpia bromoides	20	1000

Table K3 BAM Plot Structure Attributes at CR2 in 2022 - Species Richness and Cover (400m^2 plot)

Growth Form/ High Threat Exotic (HTE) status	Count of Species Richness	Sum of Cover of vascular plants
Native Tree	3	26.5
Native Shrub	4	22.6
Native Grass & grasslike	4	20.7
Native Forb	5	2.7
Native Fern	0	0
Native Other	0	0
High Threat Exotic	3	7.1
Non-HTE	21	29.2
Total Weeds	24	36.3

Table K4 BAM Plot Function Attributes at CR2 in 2022 - Tree Stems and Hollows (1000m^2 plot)

DBH (cm)	Number of tree stems	Number of tree stems with hollows
>80	0	0
50 to 79	0	0
30 to 49	12	0
20 to 29	6	0
10 to 19	1	0
5 to 9	1	0
<5	≥1	0

Table K5 BAM Plot Function Attributes at CR2 in 2022 - Length of Logs (1000m^2 plot)

Attribute	2022
Total Length of Logs (m)	7

Table K6 BAM Plot Function Attributes at CR2 in 2022 - Ground Cover Other (1m^2 plots)

Distance (m)	Litter	Bare ground	Cryptogram	Rock
5	5	0	0	0
15	5	0	0	0
25	5	0	0	0
35	5	0	0	0
45	5	0	0	0
Average	5	0	0	0

Table K7 BAM Plot Disturbance and Management Notes at CR2 in 2022 (1000m^2 plot)

Factor	Severity Code	Age Code	Observation
Clearing (inc logging)	2	NR	Evidence of historic clearing
Cultivation (inc pasture)	0	-	None
Soil erosion	3	R	High erosion on creek bank
Firewood/CWD removal	2	NR	Historical
Grazing (native/stock)	0	-	None
Fire damage	0	-	None
Storm damage	0	-	None
Weediness	2	R	Weedy understorey - minimal mid storey
Other (stock, feral animals, vehicle, human)	0	-	None
Site management (fencing, weed control)	0	-	None
General Heath	2	-	Moderate-good, requires weed control
Regeneration	2	R	Canopy rehabilitation occurring

KEY: Severity: 0 = no evidence, 1=light/low, 2=moderate, 3=severe/good Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

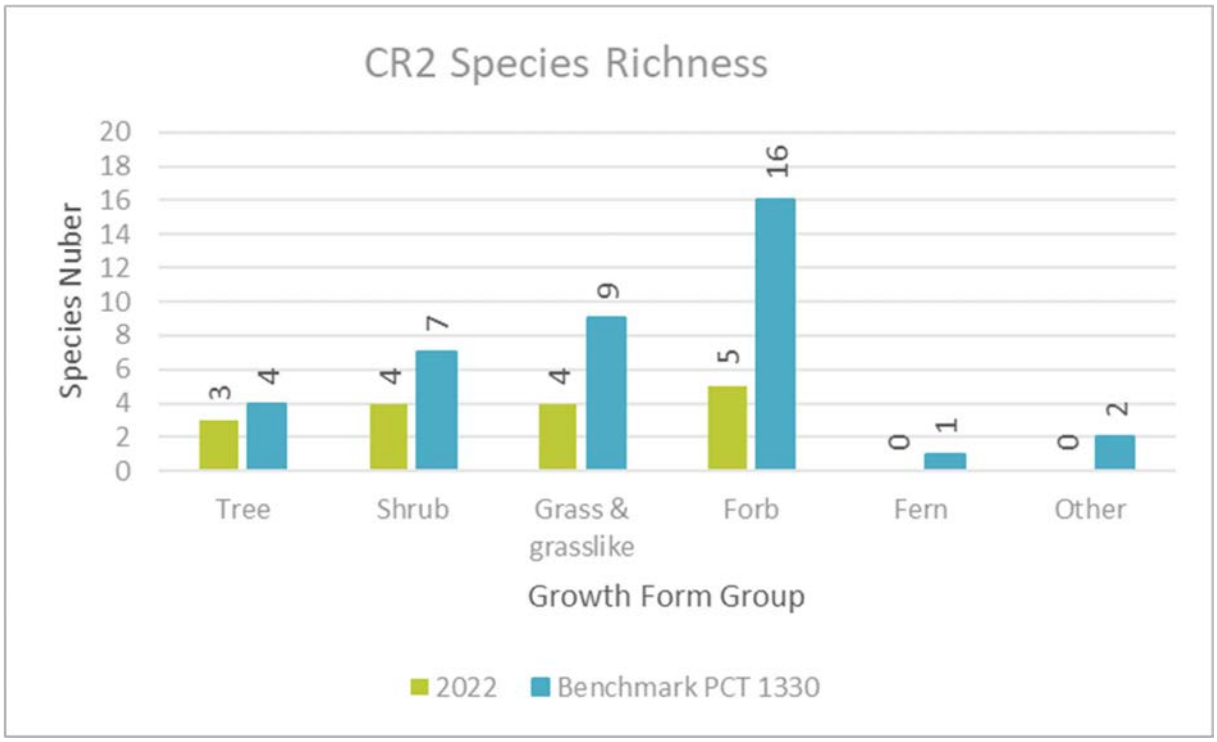
Table K8 LFA Landscape Organisation Data for CR2 in 2022

Start Distance (m)	End Distance (m)	Patch Width (cm)	Patch / interpatch	Identity	Notes
0.00	0.80	90	Interpatch	Leaf Litter	n/a
0.80	1.50	210	Patch	Herb	n/a
1.50	2.20	100	Patch	Grass	n/a
2.20	3.40	300	Patch	Herb	n/a
3.40	6.60	1000	Patch	Grass	n/a
6.60	10.80	1000	Patch	Shrub	n/a
10.80	14.90	1000	Patch	Grass	n/a
14.90	16.10	150	Patch	Shrub	n/a
16.10	21.10	1000	Patch	Grass	n/a
21.10	23.00	120	Patch	Shrub	n/a
23.00	27.80	1000	Patch	Grass	n/a
27.80	29.20	85	Patch	Herb	n/a
29.20	41.60	1000	Patch	Grass	n/a
41.60	42.20	90	Interpatch	Leaf Litter	n/a
42.20	44.20	1000	Patch	Grass	n/a
44.20	44.70	940	Interpatch	Log	n/a
44.70	50.00	1000	Patch	Grass	n/a

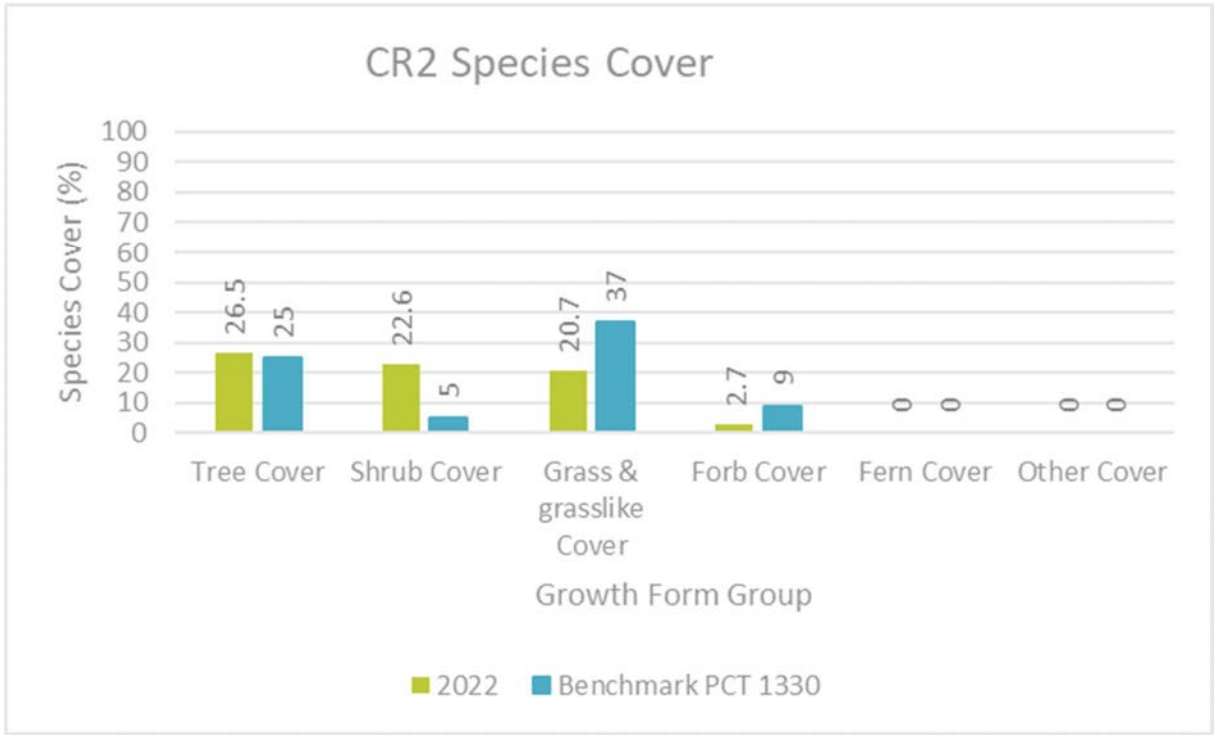
Table K9 LFA Soil Surface Assessment Data at CR2 in 2022

Start Distance (m)	0.4	1.2	1.8	3	7.7	15.3	18	22.4	27	42
Patch Identity	Leaf Litter	Herb	Grass	Herb	Shrub	Shrub	Grass	Shrub	Grass	Leaf Litter
Rainsplash Protection (1-5)	2	4	5	4	5	5	5	5	5	2
t/s canopy cover (1-4)	1	2	2	2	3	3	2	4	2	1
Litter (1-10)	5	3	3	3	2	2	2	2	2	5
Soil Biological crust (0, 1-4)	1	1	0	0	0	0	0	0	0	0
Crust broken-ness (0, 1-4)	0	0	0	0	0	0	0	0	0	0
Erosion & Severity (1-4)	4	4	4	4	4	4	4	4	4	4
Deposited materials (1-4)	4	4	4	4	4	4	4	4	4	4
Surface Roughness (1-5)	2	2	2	2	2	2	2	2	2	2
Resistance to disturbance	3	3	3	3	3	3	2	2	2	2
Slake test (0, 1-4)	3	3	3	3	3	3	3	3	3	3
Texture (1-4)	2	2	2	2	2	2	2	2	2	2

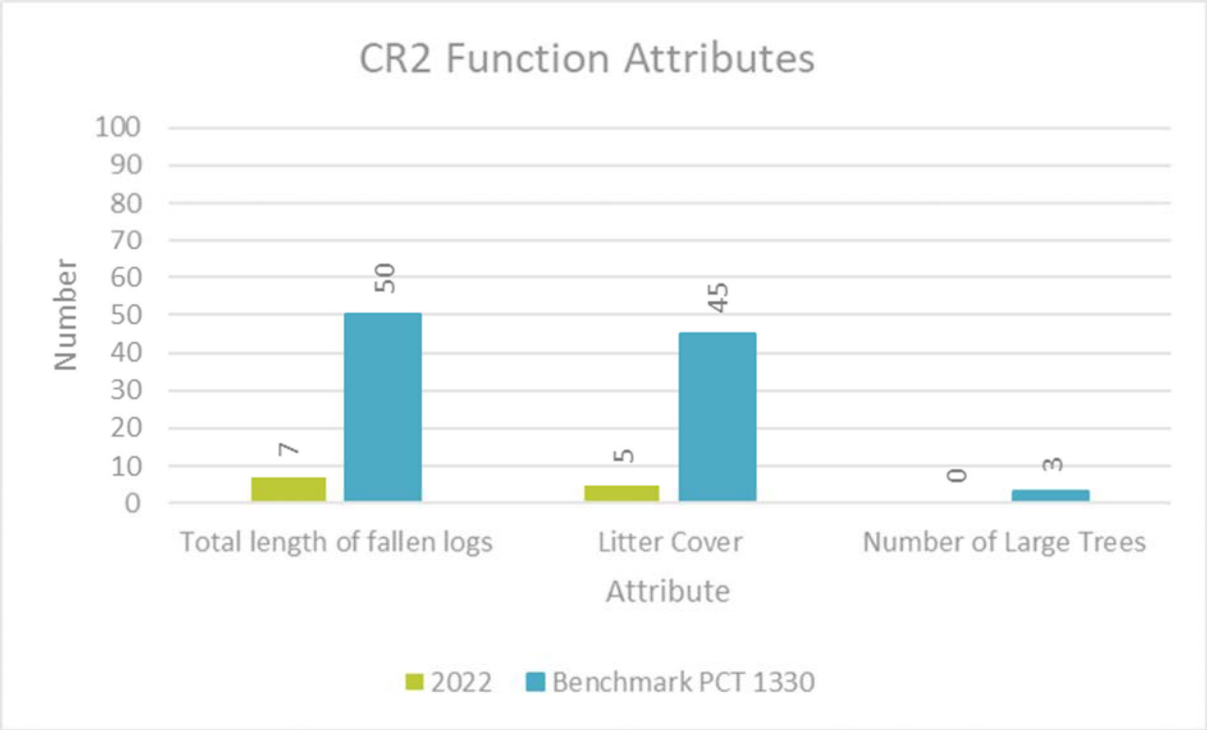
Graph K1 Species Richness at CR2



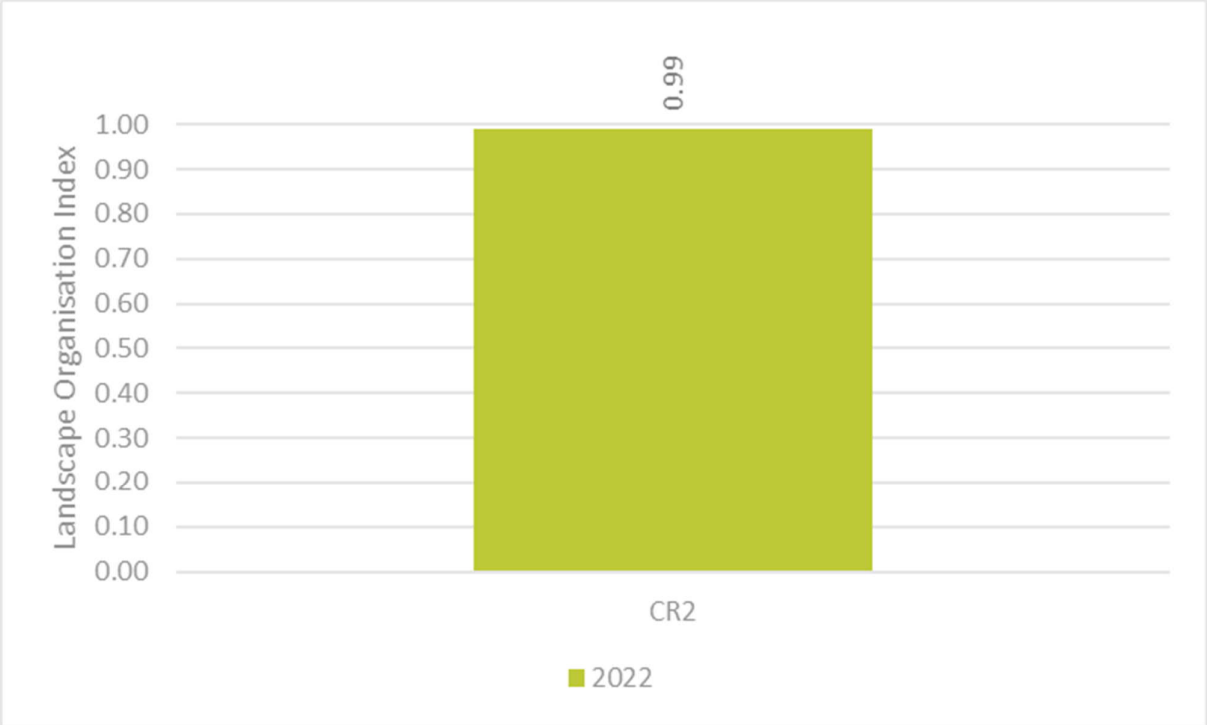
Graph K2 Species Cover at CR2



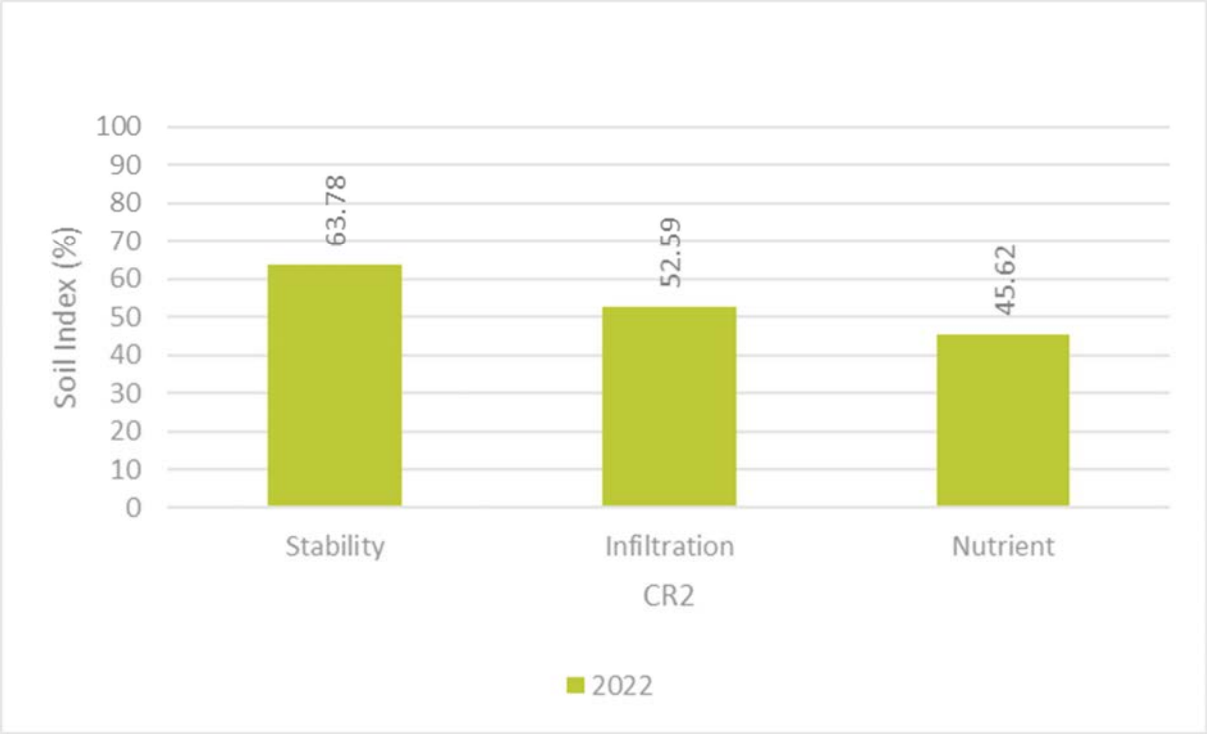
Graph K3 Function Attributes at CR2



Graph K4 LFA Landscape Organisation at CR2



Graph K5 LFA Soil Indices at CR2



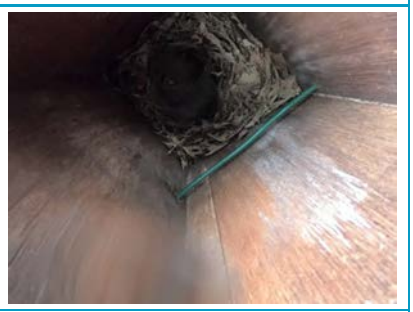
Appendix L:
Nest Box Inventory

Table L1 Results of Nest Box Inspection

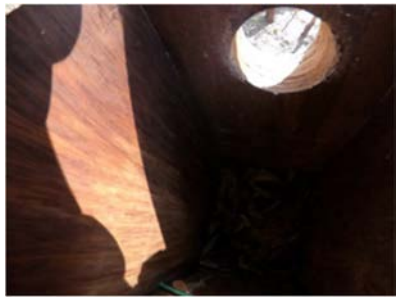
Box ID	Box Type	Native Fauna Occupancy (Y/N)				Pests (Y/N)	Repair (Y/N)	Comment (species present, signs of use, repair etc..)	Photo/ video number
		Fauna	Nest	Eggs	Young				
JC-1-1	Squirrel Glider	N	Y	N	N	N	N	Leaf nest	2:48
JC-1-2	Squirrel Glider	N	Y	N	N	N	N	Old nest with leaves and feathers	2:47
JC-1-3	Squirrel Glider	N	Y	N	N	N	N	Leaf nest	2:51
JC-1-4	Micro-Bat	N	N	N	N	N	N	Empty	2:49
JC-2-1	Brushtail Possum	N	Y	Y	Y	N	N	Nest with eggs, feathers and leaves	2:24
JC-2-2	Squirrel Glider	Y	Y	N	N	N	N	Leaf nest with unidentified fauna	2:28 & 9:12
JC-2-3	Squirrel Glider	Y	Y	N	Y	N	N	Glider with young in leaf nest	9:08
JC-2-4	Micro-Bat	N	N	N	N	N	Y	Needs relocation to new tree, host tree has broken and fallen onto the ground	
JC-2-5	Squirrel Glider	N	Y	N	N	N	N	Leaf nest	2:20
JC-3-1	Squirrel Glider	N	Y	N	N	N	N	Leaf nest	1:38
JC-3-2	Squirrel Glider	N	Y	N	N	N	N	Leaf nest	
JC-3-3	Squirrel Glider	N	Y	N	N	N	N	Leaf nest	
JC-3-4	Micro-Bat	N	N	N	N	Y	N	Inactive wasp nest	
JC-4-1	Squirrel Glider	N	Y	N	N	Y	N	Inactive wasp nest	1:38
JC-4-2	Squirrel Glider	N	Y	N	N	N	N	Leaf nest	1:34
JC-4-3	Brushtail Possum	N	Y	Y	N	N	N	Nest/ Feathers/ Cracked eggs	1:46
JC-4-4	Squirrel Glider	N	Y	N	N	N	N	Leaf nest	1:41
JC-4-5	Micro-Bat	N	N	N	N	N	N	Empty	1:32
JC-5-1	Squirrel Glider	N	N	N	N	N	N	Leaf nest	2:35
JC-5-2	Squirrel Glider	N	Y	N	N	N	N	Leaf nest	2:38
JC-5-3	Squirrel Glider	Y	Y	N	Y	N	N	Multiple gliders in leaf nest	2:33
HMA-1-1	Brushtail Possum	N	Y	N	N	N	N	Nest with feathers and eggshells	10:31
HMA-1-2	Squirrel Glider	Y	Y	N	Y	N	N	Multiple gliders in leaf nest with young	10:40
HMA-1-3	Squirrel Glider	Y	Y	N	Y	N	N	Multiple gliders in leaf nest with young	10:47
HMA-1-4	Ringtail Possum	N	Y	N	N	N	N	Nest with feathers and eggshells	10:35
HMA-1-5	Micro-Bat	N	N	N	N	N	N	Empty	10:33
HMA-1-6	Owlet Nightjar	N	Y	N	N	N	N	Leaf Nest	10:41
HMA-1-7	Owlet Nightjar	Y	Y	N	N	N	N	Glider	10:44
HMA-2-1	Squirrel Glider	N	Y	N	N	N	N	Leaf nest	11:16
HMA-2-2	Brushtail Possum	N	Y	N	N	N	N	Feather nest	11:20
HMA-2-3	Rosella	N	Y	N	N	N	N	Nest	11:17
HMA-2-4	Owlet Nightjar	N	Y	N	N	N	N	Nest	11:19
HMA-2-5	Micro-Bat	N	N	N	N	N	N	Empty	11:14
HMA-3-1	Ringtail Possum	Y	Y	N	N	N	N	Brushtail Possum	11:44
HMA-3-2	Brushtail Possum	Y	Y	N	N	N	N	Brushtail Possum	11:42
HMA-3-3	Brushtail Possum	N	Y	N	N	N	N	Nest	11:34
HMA-3-4	Owlet Nightjar	N	Y	N	N	N	N	Poor condition nest	11:39
HMA-3-5	Rosella	N	Y	N	N	N	N	Leaf Nest	11:36
HMA-4-1	Brushtail Possum	N	Y	N	N	N	N	Poor condition nest	11:36
HMA-4-2	Rosella	N	N	N	N	N	Y	Needs to be tighter on tree (replace attachment)	12:20

Box ID	Box Type	Native Fauna Occupancy (Y/N)				Pests (Y/N)	Repair (Y/N)	Comment (species present, signs of use, repair etc..)	Photo/ video number
		Fauna	Nest	Eggs	Young				
HMA-4-3	Squirrel Glider	Y	Y	N	Y	N	N	Multiple gliders seen leaving box before camera was inserted	12:28
HMA-4-4	Micro-Bat	N	N	N	N	N	N	Empty	12:41
HMA-5-1	Owlet Nightjar	N	Y	N	N	N	N	Leaf nest	10:51
HMA-5-2	Micro-Bat	N	N	N	N	N	N	Empty	10:55
HMA-5-3	Rosella	N	Y	N	N	N	N	Leaf nest	11:01
HMA-5-4	Squirrel Glider	N	Y	N	N	N	N	Leaf nest	10:53
HMA-6-1	Ringtail Possum	Y	Y	Y	N	N	N	Wood Duck with eggs	11:49
HMA-6-2	Brushtail Possum	N	Y	N	N	N	N	Poor condition nest	11:55
HMA-6-3	Ringtail Possum	N	Y	N	N	N	N	Poor condition nest	11:53
HMA-6-4	Brushtail Possum	N	Y	N	N	N	N	Poor condition nest	11:51

Table L2 Photograph Thumbnails of Nest Box Inspections

		
JC-1-1	JC-1-2	JC-1-3
		
JC-1-4	JC-2-1	JC-2-2
	NA – Box not operational	
JC-2-3	JC-2-4	JC-2-5

		
JC-3-1	JC-3-2	JC-3-3
		
JC-3-4	JC-4-1	JC-4-2
		
JC-4-3	JC-4-4	JC-4-5
		
JC-5-1	JC-5-2	JC-5-3
		
HMA-1-1	HMA-1-2	HMA-1-3

		
HMA-1-4	HMA-1-5	HMA-1-6
		
HMA-1-7	HMA-2-1	HMA-2-2
		
HMA-2-3	HMA-2-4	HMA-2-5
		
HMA-3-1	HMA-3-2	HMA-3-3
		
HMA-3-4	HMA-3-5	HMA-4-1

		
HMA-4-2	HMA-4-3	HMA-4-4
		
HMA-5-1	HMA-5-2	HMA-5-3
		
HMA-5-4	HMA-6-1	HMA-6-2
		
HMA-6-3	HMA-6-4	

Appendix M:
Assessment of Completion Criteria

Table M1 Assessment of Revegetated Areas Preliminary Completion Criteria (applies to the Amenity Bund ie RM1)

Area	Objective / Performance Indicator	Preliminary Completion Criteria	Timing	Assessment
Planting or direct seeding areas	Vegetation has been established at the revegetation area and there are no additional works required to be undertaken to assist to meet the requirements of the rehabilitation management plan or any other management plan.	Ground cover comparable to surrounding environment and the establishment of revegetation is such that it no longer requires attention to assure its successful development (>3 years of growth).	Monitor annually until condition criteria achieved.	Not met. Native vegetation was planted at the western side of Amenity Bund in 2022, although high weed cover (rye grass) around plantings. Maintenance of plantings is needed. Other revegetated areas not at rehabilitation stage.
Amenity Bund and emplacement areas	Rehabilitated areas are stable.	Areas of exposed soils are revegetated to achieve cohesive ground cover using a native plant species mix compatible with the surrounding environment and erosion has stabilised and resembles natural processes.	Monitor annually until condition criteria achieved.	Not met. Light erosion noted at RM1 plot and significant erosion noted in south of amenity bund. Other revegetated areas not at rehabilitation stage.
Natural areas	The site is managing significant weed or feral animal infestations	No increase in weed and feral pest populations and monitoring indicates the absence of or decline in weed species. Weeds comprise no more than 15%.	Annual weed monitoring. When monitoring indicates weeds comprise no more than 15% monitoring can be amended to every 3 years. Every 7 years feral animal monitoring is undertaken.	Not met. Evidence of weeds and rabbits in 2022 and wild pigs in 2021 were noted at the amenity bund. Ongoing weed control and feral animal management required.

Area	Objective / Performance Indicator	Preliminary Completion Criteria	Timing	Assessment
Planting or direct seeding areas	The rehabilitated community is representative of the targeted vegetation community being PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion.	Revegetation is progressing towards a sustainable ecosystem and only requires maintenance that is consistent with the intended final land use. More than 56% of established trees are healthy and growing and the rehabilitation is recognisable as PCT 1330.	When monitoring indicates revegetation has established on disturbed areas and stratum has reached more than 56% established, healthy trees (1.5 to 2m in height) or approximately 10 years from planting.	Not met. Native vegetation was planted at the western side of Amenity Bund in 2022, although high weed cover (rye grass) around plantings. Maintenance of plantings is needed.
Habitat areas devoid of habitat features and accessible for log and rock placement.	Use cleared trees and boulders to create habitat features in accessible habitat management areas	All logs and boulders available for relocation have been placed in habitat areas that are accessible by machinery.	Monitor every 2 years with the intent to achieve completion within 10 years of clearing activities.	Not met. No evidence of habitat feature placement noted. No evidence provided. Stockpile of logs noted in HMA.
Areas where assisted natural regeneration is primary activity	Monitoring has indicated that natural regeneration is occurring.	Signs of seeding occurring and signs of recruitment in all strata. Or evidence to demonstrate that the ecosystem will progress towards recruitment.	When monitoring indicates natural regeneration is establishing itself and weed coverage is <15% of the area to be regenerated.	Not met. Assisted natural regeneration areas found to require improvements to vegetation structure.
Fencing, exclusion and protection works	Rehabilitated areas signposted and fenced off from active quarry operations to prevent access.	All fences are in place, no barb wire exists in the internal fencing, signs are in place and gates are secured and operational. Internal fences that are no longer required are removed.	As completed and monitored annually for maintenance purposes.	Not met. No evidence of fencing of the amenity bund.

Table M2 Habitat Management Area Preliminary Completion Criteria (applies to the northern HMA ie RM2 and RM3)

Objective/Performance Indicator	Preliminary Completion Criteria	Timing	Assessment
The boundary of the HMA has been fenced and internal fencing has no barb wire.	HMA signposted and fenced off from active quarry operations to prevent access. Barb wire completely removed from internal fencing.	Within 5 years of implementing the Rehabilitation and Landscape Management Plan.	Not assessed. Fencing GIS data and photos required for HMA to allow comparison to management area boundaries. Evidence of fencing was noted at RM2 and RM3.

Objective/Performance Indicator	Preliminary Completion Criteria	Timing	Assessment
Cattle have been excluded from the area and appropriate signage erected.	Installation of fencing around the perimeter of the HMA to exclude cattle.	Within 6 months of implementing the Rehabilitation and Landscape Management Plan.	Not assessed. Fencing GIS data and photos required for HMA to allow comparison to management areas. No evidence of cattle noted in HMA during 2020, 2021 or 2022 monitoring.
Nest boxes have been established, monitored and are being maintained.	Nest boxes are being utilised or show signs of use by native species. Each nest box installed should be in good structural condition and functioning in the landscape.	Completed within 5 years of clearing activities	On track, third year of nest box monitoring completed and good evidence of usage. Minor maintenance recommended.
The site is managing significant weed or feral animal infestations with a demonstrable reduction pre-construction.	Weed and pest inspections show no increase in weed population and monitoring indicates the absence of or decline in weed species.	Annual weed monitoring. When monitoring indicates weeds comprise no more than 15% monitoring can be amended to every 3 years. Every 7 years feral animal monitoring is undertaken.	Not assessed. Targeted weed and pest inspection data required for HMA. Moderate evidence of weeds was recorded at RM2 and RM3 in 2022. There was no evidence of animal pests noted in the HMA in 2020, 2021 or 2022. Other signs of pests have been noted across the whole quarry including rabbit, fox, wild cat and wild pig.
Natural regeneration is occurring.	Signs of recruitment in all stratum or evidence to demonstrate that the ecosystem will progress towards recruitment. More than 56% of trees are healthy and growing and are recognisable as PCT 1330.	When monitoring indicates revegetation has established and no longer requires assistance.	Not met. Whilst natural regeneration was found to be occurring in all layers within parts of the HMA (eg around RM2), the lower more heavily grazed sections (eg around RM3, or the southeast end of the HMA) were found to require planting of trees and shrubs.

Table M3 Core Riparian Corridors Preliminary Completion Criteria (applies to the Core Riparian Corridors of Jaorimin Creek and Marulan Creek)

Objective / Performance Indicator	Preliminary Completion Criteria	Timing	Assessment
The required areas have been fenced to exclude cattle where required.	Installation of fencing around the perimeter of the corridor to exclude cattle	Within 6 months of implementing the Rehabilitation and Landscape Management Plan	Not assessed. Fencing GIS data and photos required for riparian corridor to allow comparison to management area boundaries. Evidence of fencing was noted at R2 in 2020 and CR2 in 2022.

Objective / Performance Indicator	Preliminary Completion Criteria	Timing	Assessment
Revegetation works have occurred along Jaorimin Creek south of the Main Southern Railway.	Signs of recruitment in all stratum or evidence to demonstrate that the ecosystem will progress towards recruitment. More than 56% of trees are healthy and growing.	When monitoring indicates revegetation has established on disturbed areas and stratum has reached more than 56% established, healthy trees (1.5m to 2m in height) or approximately 10 years from planting.	Not met. Rehabilitation monitoring commenced along Jaorimin Creek in 2022 with the establishment of CR1. No revegetation efforts were observed along the creek line.
Nest boxes along Jaorimin Creek have been established, monitored and are being maintained.	Nest boxes are being utilised or show signs of use by native species. Each nest box installed should be in good structural condition and functioning in the landscape	Completed within 5 years of clearing activities	On track, third year of nest box monitoring completed and good evidence of usage. Maintenance activities have been recommended.
The site is managing significant weed or feral animal infestations with a demonstrable reduction pre construction.	Weed and pest inspections show no increase in weed population and monitoring indicates the absence of or decline in weed species	Annual weed monitoring. When monitoring indicates weeds comprise no more than 15% monitoring can be amended to every 3 years. Every 7 years feral animal monitoring is undertaken.	Partially not met. Targeted weed and pest inspection data required for core riparian zones. Weed cover was high around CR1 (Joarimin Creek) and moderate around Marulan Creek in 2022. Evidence of rabbit was detected at R2 in 2020. Other signs of pests have been noted across the whole quarry including rabbit, fox, wild cat and wild pig.
Monitoring has indicated that natural regeneration is occurring.	Signs of recruitment in all stratum or evidence to demonstrate that the ecosystem will progress towards recruitment. More than 56% of trees are healthy and growing and are recognisable as PCT 1330.	When monitoring indicates any revegetation has established and stratum has reached more than 56% establishment or approximately 10 years from any revegetation works.	Not met. Rehabilitation monitoring was established in 2022 along Jaorimin Creek (CR1) and Marulan Creek (CR2). Natural regeneration of native trees and shrubs were observed at CR2 however CR1 contained very little revegetation and will require assistance to meet criteria through revegetation works.

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