TARGETED JULIA CREEK DUNNART SURVEYS

Vecco Critical Minerals Project

PREPARED FOR AARC ENVIRONMENTAL SOLUTIONS PTY LTD
August 2023

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Prepared for AARC Environmental Solutions

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1.0 INTRODUCTION

EcoSmart Ecology was commissioned by AARC Environmental Solutions (AARC) to undertake a targeted Julia Creek Dunnart (*Sminthopsis douglasi*) survey of the Vecco Critical Minerals Project. This report documents the survey methods, results and provides recommendations that can be considered to avoid or reduce impacts. An assessment of the project against significant impact assessment guidelines is also provided.

Scope of Works

This work aims to:

- Undertake suitable trapping/sampling methods across areas of high habitat amenity in an attempt to confirm the presence of the species,
- Describe and/or evaluate habitat amenity,
- Map areas of suitable habitat (if present) and, if possible, indicate which areas/habitats might have higher amenity than others, and
- Provide an assessment of significance against the Environment Protection and Biodiversity Conservation Act (EPBC) significant impact guidelines 1.1 (2013) and Nature Conservation (NCA) significant residual impact assessment guidelines (2014).

Study Team and Qualifications

Consistent with Eyre *et al*. (2014), Table 1.1 below outlines the study team, their qualifications, and respective tasks.

Table 1.1. Study team and qualifications

Personnel	Qualifications	Experience	Tasks
Mark Sanders	BSc (Hons)	20+ years	Field monitoring, report preparation, data analysis, project management
Jarrad Barnes	BSc	6 years	Field monitoring, report preparation, data analysis

2.0 BACKGROUND

2.1 Project Location

The Project is located on Bow Park Station and is approximately 70 km north of Julia Creek township and approximately 515 km west of Townsville in Northwest Queensland. The townships of Cloncurry and Richmond are located approximately 125 km west and 145 km east of the Project respectively.

The Project area will be defined by two Mining Lease Applications (MLA) located within Exploration Permits for Minerals (EPM) 25254 and 26846. The combined approximate area of the MLAs is 3,536 ha.

The land within and surrounding the Vecco Project area is designated as 'Rural' zone under the McKinlay Shire Planning Scheme 2019. Existing land use of the Vecco Project area is low intensity cattle grazing.

2.2 Development Overview

Vecco Industrial Pty Ltd (Vecco) is seeking to develop the Vecoo Critical Minerals Project which will target vanadium pentoxide (V2O5) and High Purity Alumina (HPA), along with minor quantities of rare earth elements (REE). The life of mine (LOM) is expected to be approximately 36 years, including construction, operation, and rehabilitation.

The Project is a proposed greenfield operation that will consist of a shallow, open-cut mine to an approximate depth of up to 35 m. Processing will occur following on site crushing and screening of the ore. Mineral products will be packed in containers and transported by truck to Townsville, for secondary processing into battery electrolyte or export from the Port of Townsville to international markets.

Key components of the Project include:

- Open cut mining of up to 1.9 Mtpa ROM ore over a period of approximately 26 years, with all waste progressively backfilled behind the mining pit. All mined land will be returned to natural topography (or above) resulting in no final void. Rehabilitation of mined land will occur progressively over the LOM,
- Mine infrastructure including, administration buildings, bathhouse, crib rooms, storage warehouse, workshop, fuel storage, refuelling facilities, wash bay, laydown area, and a helipad,
- Development of out-of-pit waste rock emplacements,
- Construction and operation of a Mineral Processing Plant (MPP) and ore handling facilities,
- Construction of an access road from Punchbowl Road,
- Construction of an airstrip to provide access for the Royal Flying Doctors Service,
- Construction of a 10 MW solar farm and associated energy storage system,
- Installation of a raw water supply pumping system and pipeline to connect the mine to the Saxby River for water harvesting,

- Construction of an on-site workers village and associated facilities, including an adjacent sewage treatment plant (STP),
- Other associated minor infrastructure, plant, equipment and activities,
- Progressive establishment of soil stockpiles, laydown area and borrow pits (for road base and civil works). Material will be sourced from local quarries where required,
- Mine operations using conventional surface mining equipment (excavators, front end loaders, rear dump trucks, dozers),
- Strategic disposal of neutralised process rejects within the backfilled mining void,
- Continued exploration and resource definition drilling on the MLAs,
- Progressive development of internal roads and haul roads including a causeway over the Saxby River to enable access and product haulage, and
- Development of water storage dams and sediment dams, and the installation of pumps, pipelines, and other water management equipment and structures including temporary levees, diversions and drains.

The proposed mine layout is illustrated in Figure 2.1.

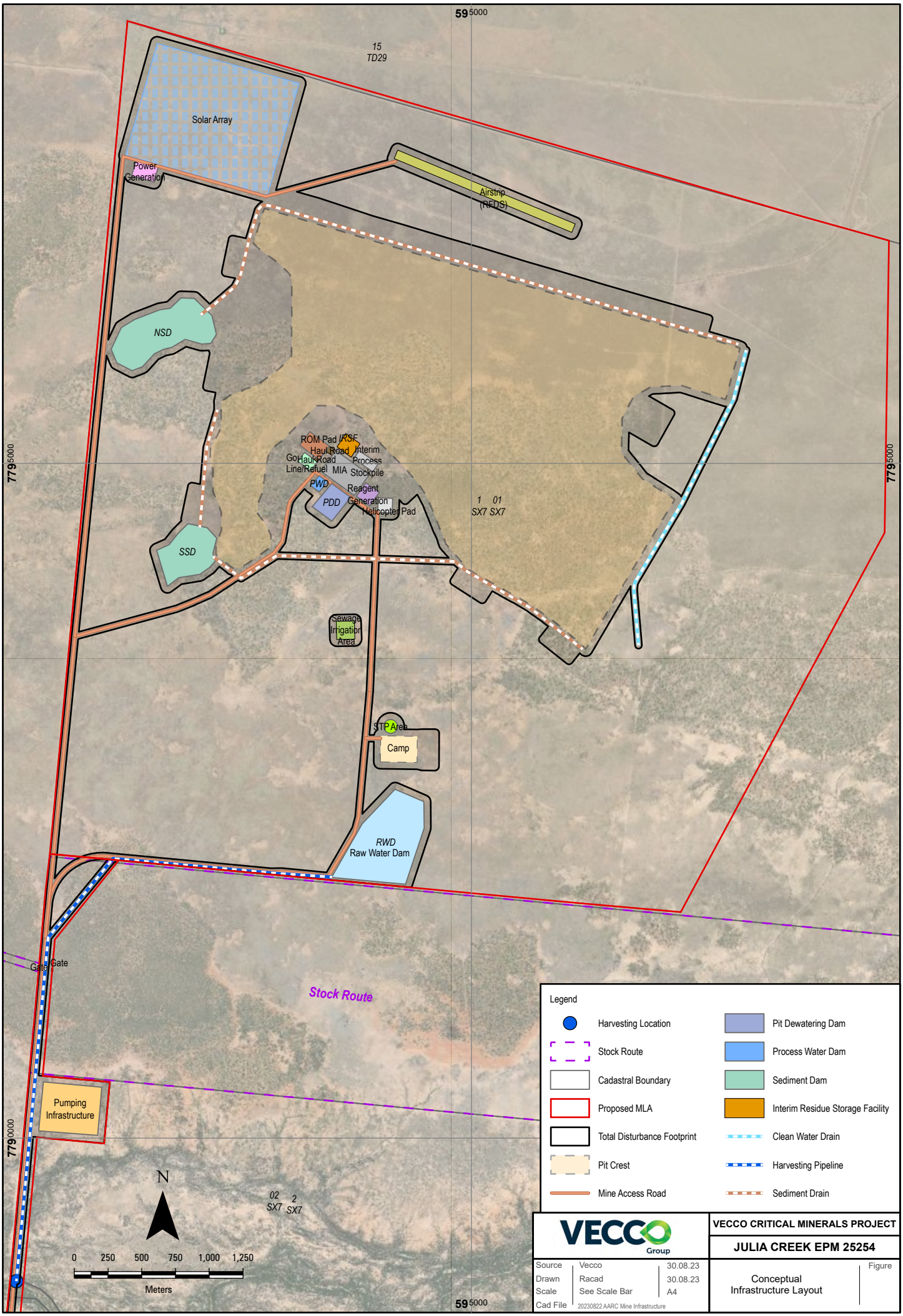
2.3 Vegetation

Botanical surveys (Kier and Lopez 2023) of the Vecco MLA have identified eight Regional Ecosystems (REs) as present (Table 2.1). These include three grassland RE's, 2.4.2b, 2.5.35 and 2.3.69a/b. Only the former two occurred in the Julia Creek Dunnart survey area and methods focused on these two REs.

Table 2.1. Regional Ecosystems (REs) identified at Vecco

RE	Description	Extent (ha)
2.3.17a	*Eucalyptus microtheca* +/- *Excoecaria parvifolia, Lysiphyllum cunninghamii, Atalaya hemiglauca* woodland fringing channels in fine-textured alluvial systems	2.08
2.3.69a/b	*Dichanthium spp., Iseilema spp., Aristida spp.* and *Brachyachne convergens* in mixed tussock grasslands on active Quaternary alluvial deposits derived from coarse-grained parent material in the west	39.56
2.3.7a	*Acacia cambagei* +/- *Eucalyptus microtheca* low woodland on fine-textured Quaternary alluvial plains	24.74
2.4.2b	*Astrebla spp., Iseilema spp.* +/- *Aristida latifolia, Eulalia aurea* tussock grassland on Tertiary clay deposits	2,905.83
2.5.12a	*Eucalyptus pruinosa subsp. pruinosa* low woodland on plains and low rises on red and yellow earths	878.57
2.5.1a	*Lysiphyllum cunninghamii, Atalaya hemiglauca* and *Grevillea striata* low woodland on plains on earths and sandy soils	74.46
2.5.33b	*Melaleuca spp.* +/- *Eucalyptus pruinosa, Asteromyrtus symphyocarpa, Terminalia canescens* low open woodland on sand sheets in the west	64.07
2.5.35	*Aristida latifolia* +/- *Enneapogon polyphyllus, Brachyachne convergens, Sporobolus* spp. tussock grassland on thin, residual sand deposits overlying Tertiary clay plains	19.35

Figure 2.1. Proposed mine layout


595000
779000
15
TD29
Solar Array
Power Generation
Airstrip (RFDS)
NSD
SSD
ROM Pad
RSF
Haul Road
Interim Process Stockpile
Go Line/Refuel
Haul Road
MIA
PWD
PDD
Reagent Generation
Helicopter Pad
1 SX7
01 SX7
Sewage Irrigation Area
STP Area
Camp
RWD
Raw Water Dam
Gate
Gate
Stock Route
Pumping Infrastructure
02 SX7
2 SX7
N
0 250 500 750 1,000 1,250
Meters
Legend
Harvesting Location
Stock Route
Cadastral Boundary
Proposed MLA
Total Disturbance Footprint
Pit Crest
Mine Access Road
Pit Dewatering Dam
Process Water Dam
Sediment Dam
Interim Residue Storage Facility
Clean Water Drain
Harvesting Pipeline
Sediment Drain
VECCO Group
VECCO CRITICAL MINERALS PROJECT
JULIA CREEK EPM 25254
Source Vecco 30.08.23
Drawn Racad 30.08.23
Scale See Scale Bar A4
Cad File 20230822 AARC Mine Infrastructure
Conceptual Infrastructure Layout
Figure

Our surveys noted variation within the areas mapped as RE 2.4.2b; while the majority was dominated by *Eulalia aurea* and *Aristida latifolia*, some areas were dominated by *Astrebla squarrosa* and *Astrebla lappacea*. These later areas (i.e., grasslands dominated by *Astrebla* spp) were not extensive and mostly restricted to (i) a small area in the near centre of the MLA and (ii) a larger area the south-west corner (Figure 2.2) where the two subtypes may have occurred in a 50% mix. Areas dominated by *Astrebla* grasses typically coincided with Mitchell soils without a sandy surface (see Section 2.4).

2.4 Soils

A habitat suitability model developed by Smith *et al.* (2007) identified soil type, and in particular its ability to form large deep cracks, as important in predicting Julia Creek Dunnart habitat amenity. This section provides an overview of soils identified within the Vecco MLA, with more details available in Tang and Thwaites (2023).

Three Soil Management Units (SMUs) have been identified within the MLA. The extent of these units is provided in Table 2.2 and their spatial distribution is provided in Figure 2.3 (mapped at a scale of 1:35,000).

Table 2.2. Soil Management Units and their extent within the MLA

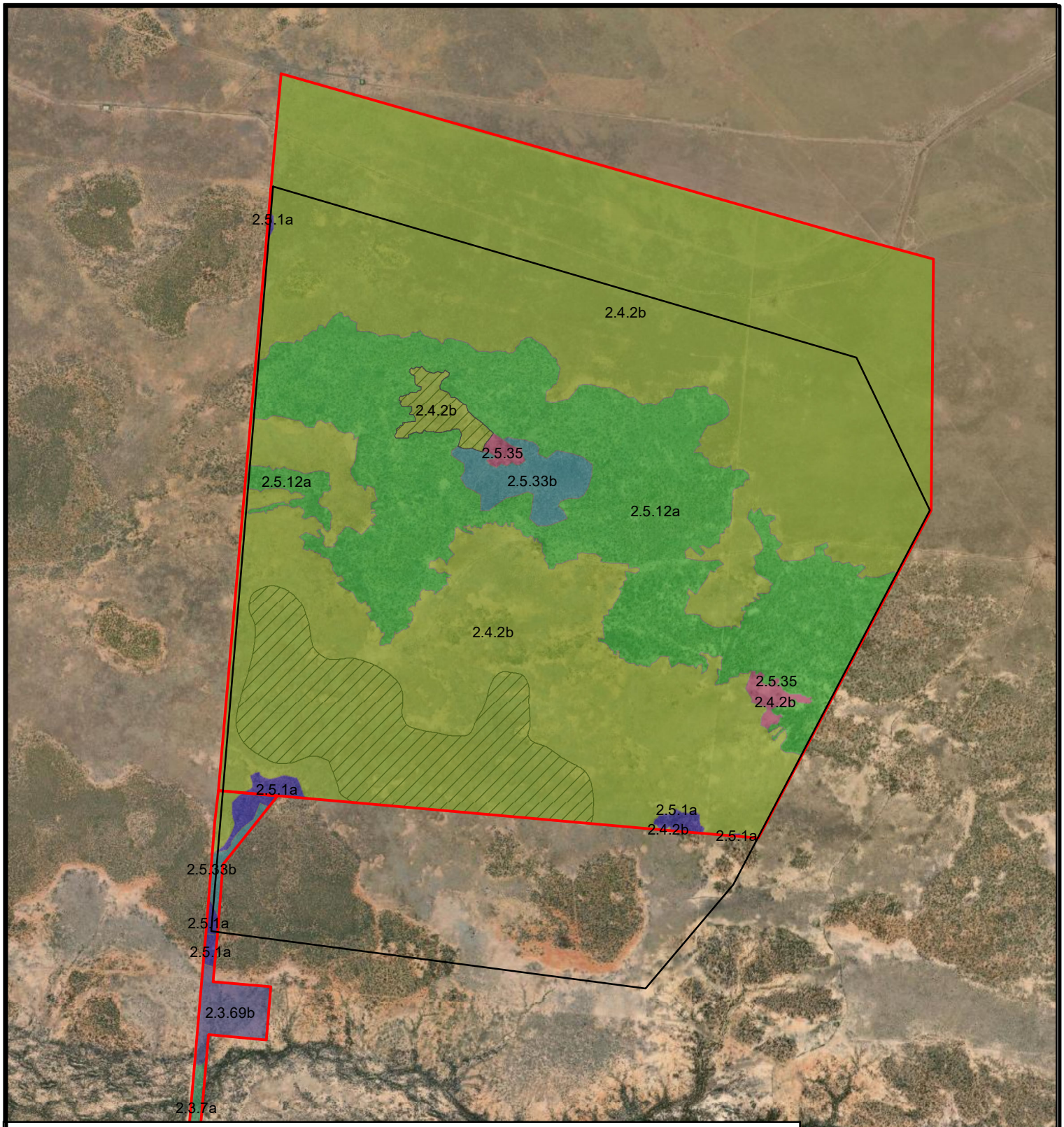
Soil management unit	Surface area (ha)	Proportion of MLA (%)
Mitchell	2301	73
Soapberry	41	1.5
Gum	801	25.5
Total area	*3143*	*100*

Mitchel SMU

Grey Dermosols (minor Grey Vertosols) occurring on gently inclined or near-level landforms, distributed throughout the majority of the MLA. The soil profile consists of a sandy surface of variable shallow depths on a blocky structured clay soil. Clay content increases with depth. The topsoil, or A horizon (0 – 0.2 m), is a sandy loam with laboratory data indicating less than 35% clay. The sandier A horizon would inherently reduce the shrink-swell capacity of the topsoil and may fill in cracks if they form. As such this SMU has fine – medium cracks (up to 10 mm). It is typically dominated by *Aristida latifolia, Iseilama* spp. and *Eulalia aurea* tussock grasslands.

A variant of this soil is where the sandy surface is absent (either eroded or non-existent in patches). Soil cracks in these areas can be more abundance and pronounced though, on balance, most are less than 40 mm. Mitchell dominated grasslands (*Astrebla*) are more common on these soils.

The provided soil mapping does not spatially separate these two subunits although, based on our investigations, the latter soils are largely confined to the south-west corner of the MLA and a central area mapped as RE 2.4.2b.



Legend

- Julia Ck Dunnart survey area
- Vecco proposed MLA
- 2.3.17a
- 2.3.69a
- 2.3.69b
- 2.3.7a
- 2.4.2b
- 2.5.12a
- 2.5.1a
- 2.5.33b
- 2.5.35
- Astrebla community areas

aphics, and the GIS User Community

Figure 2.2
Regional Ecosystem (RE) map for the Vecco MLA

Scale:
1:48,742

0 0.275 0.55 1.1 1.65 2.2
Kilometers

ecosmart ECOLOGY

Client: AARC | **Project:** Vecco Julia Creek Dunnart Survey

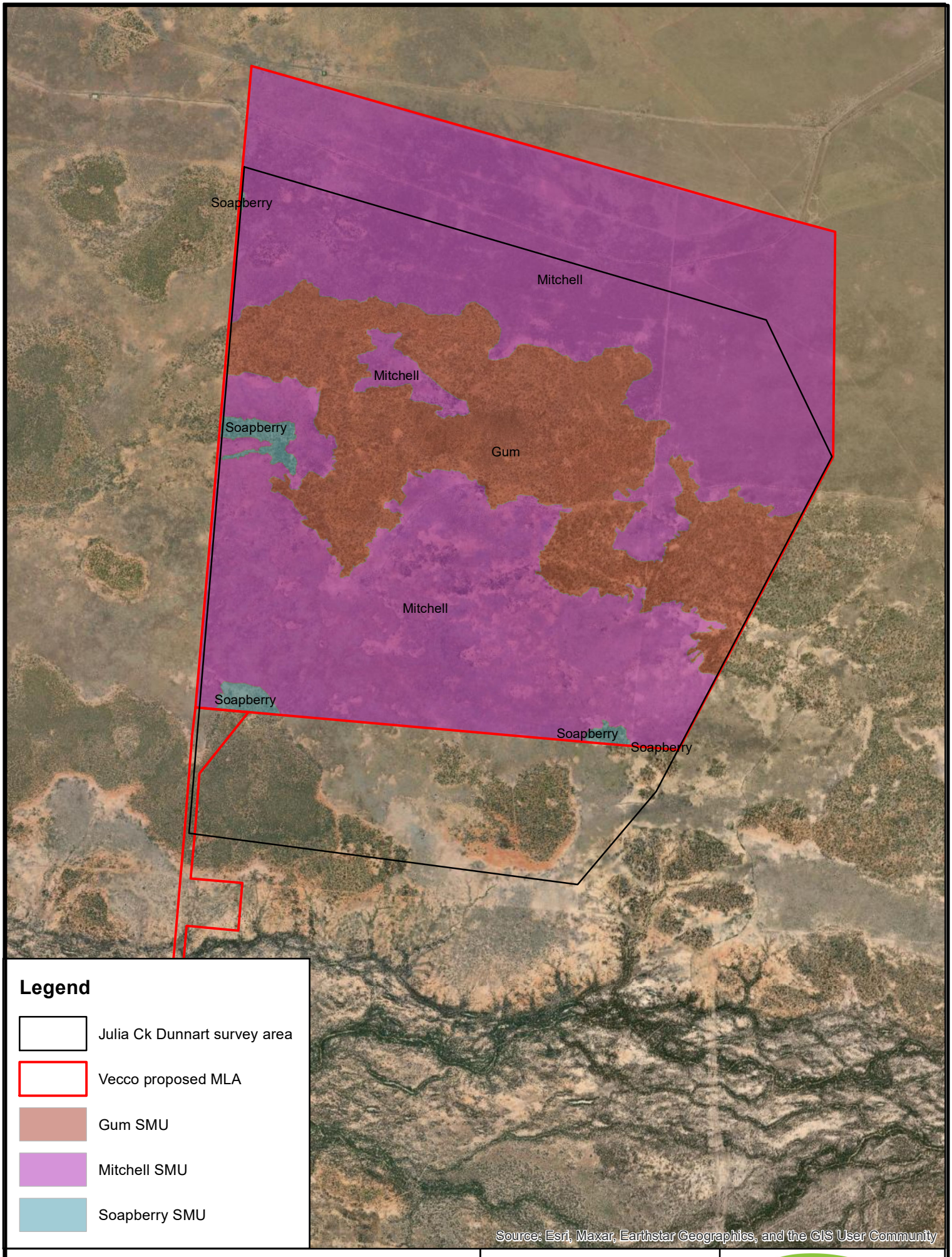


Figure 2.3
Spatial distribution of Soil Management Units (SMU) identified at the Vecco Project

Scale:
1:48,742
0 0.275 0.55 1.1 1.65 2.2
Kilometers

ecosmart ECOLOGY

Client: AARC | **Project:** Vecco Julia Creek Dunnart Survey

Soapberry SMU

Reddish brown, deep, sandy soil in the southern region of the MLA, on gently inclined or near-level landforms. The profile generally exhibits minimal A horizon material and therefore comprises largely a B horizon with sand texture throughout. Vegetation associated with this unit includes open woodland of *Atalaya hemiglauca* and *Melaleuca citrolens*.

Surface conditions vary, with some sites displaying firm and hard setting surfaces, and others with soft and loose surfaces. The A horizon is described with sand texture, with laboratory data suggesting 90% sand composition (refer Table 9). No cracking was observed within this SMU.

Gum SMU

Reddish brown clay loam sandy soil unit stretching across the central region of the study area, on gently inclined or level plains. The profile usually consists of a weakly formed A horizon with sandy clay loam to medium clay texture for the subsoil (B horizon). Vegetation associated with this unit includes *Corymbia* spp., *Atalaya hemiglauca* and *Grevillea striata* open woodland.

Surface conditions are firm with surface crusting. The profile consists of mainly a reddish B horizon of sandy loam to clay loam sandy texture beneath a sandy A horizon up to 0.2 m deep. Little to no surface soil cracking is present within this SMU.

3.0 METHODS

Two targeted surveys for Julia Creek Dunnart were conducted at the Vecco Project site. The first survey was conducted from 12/09/2021 – 17/09/2021 ("September survey"). The second survey was conducted from 06/04/2022 – 11/04/2022 ("April survey"). Following the completion of these surveys the Mining Lease Application (MLA) was shifted to the north and, consequently, some grassland in the north has not been surveyed (refer Figure 2.2). Conversely survey effort was undertaken in the south which is now outside the MLA. Grasslands not surveyed have similar structure and characteristics to the surveyed grasslands and this adjustment is not expected to affect the Julia Creek Dunnart assessment.

3.1 Habitat suitability

Habitat data was collected using various methods across the September and April Surveys with the key aims of characterising on-site habitat and determining areas of highest habitat amenity for Julia Creek Dunnart. The location of habitat transect sites are shown in Figure 3.1.

September 2021

Habitat data was collected at nine grassland sites at Vecco and four grassland sites immediately adjacent to the Julia Creek Airport to compare habitat suitability between the Vecco site and known high-amenity habitat. Land surrounding Julia Creek Airport was selected as the high-amenity comparison due to the capture of a Julia Creek Dunnart in 2005 and being considered largely undisturbed and intact as recently as 2009 (DERM 2009). This location was also the site for a Julia Creek Dunnart reintroduction program undertaken in 2007 based on the 2005 record and high habitat amenity (DERM 2009).

Data in September was collected along 50m transects with the total number of intercepts recorded for grass tussocks by species, soil cracks 2-4cm wide, and soil cracks >4cm wide.

April 2022

Habitat data in April was collected at 21 grassland sites within the MLA along 50m transects. At each site, the total length of soil cracks 2-4cm wide, soil cracks >4cm wide, and the total number of grass tussocks was counted within 1m either side of the transect. Ground cover data was recorded using ten 1x1m quadrats spaced 5m apart on alternating sides along the transect. Percentage grass cover and the number of tussocks >10cm diameter per quadrat were recorded for each site. The two or three most dominant grass species were recorded at each site. Soil colour along the transect was recorded as either "dark" (i.e., clays with no surface sandy surface), "grey" (clays with a sandy surface), or "mixed" (transects with facets of both).

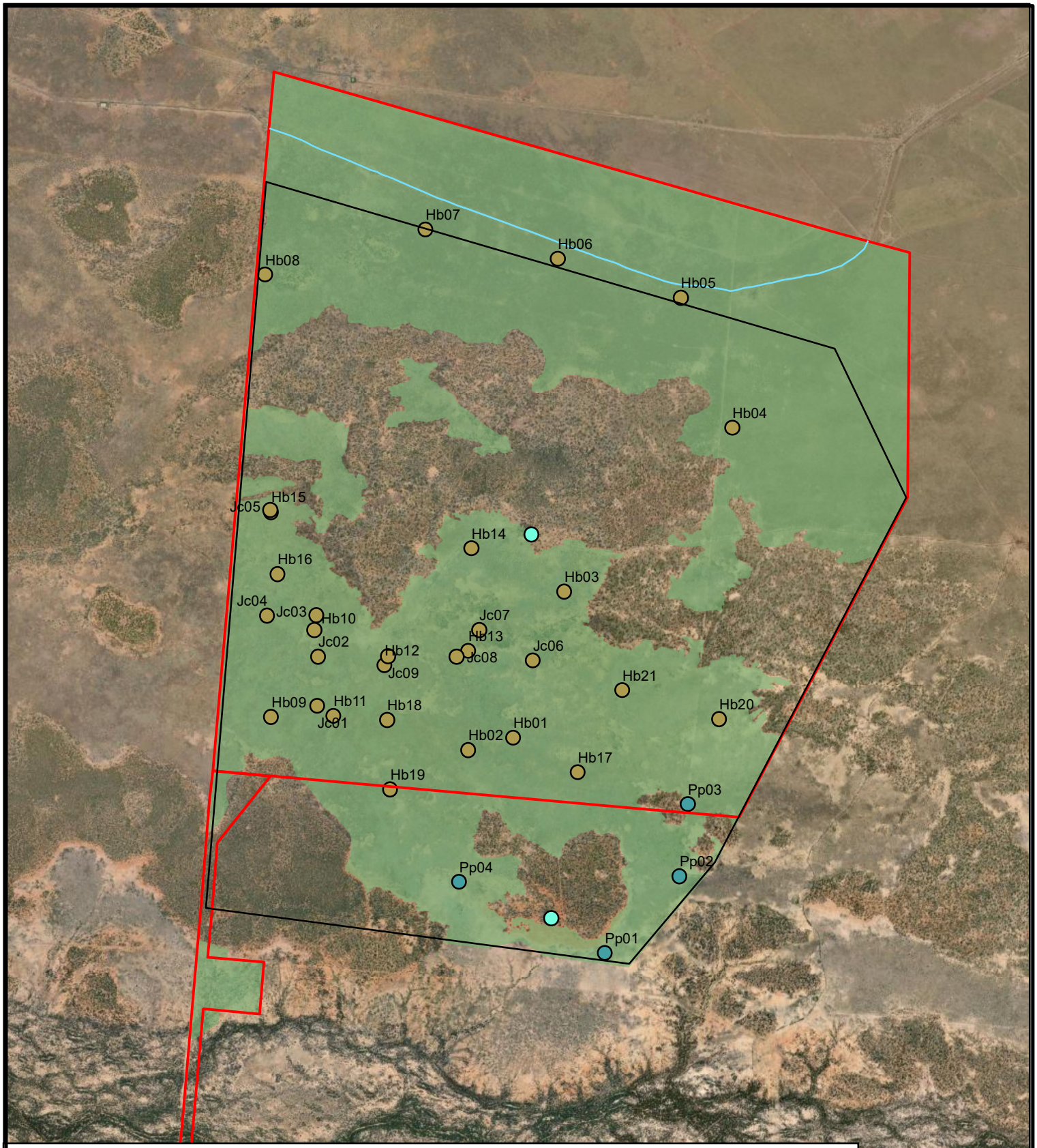


Figure 3.1
Soil and ground cover transect locations

Scale:
1:48,742

0 0.275 0.55 1.1 1.65 2.2
Kilometers

ecosmart ECOLOGY

Client: AARC

Project: Vecco Julia Creek Dunnart Survey

Statistical Analysis

Previous research has shown suitable sites for Julia Creek Dunnart have at least 40% grass cover (Kutt 2003). Grass cover along each transect was compared by calculating 95% confidence intervals on mean grass cover across all 10 quadrats and visually assessing if these confidence intervals intercepted 40% cover. A site was considered as having suitable ground cover if the 95% confidence interval included 40% cover. Equivalent data were not compared for quadrat tussock counts as tussock quality was not accounted for i.e. whether or not the tussock had been grazed upon.

Data for whole transects was compared using the non-parametric Kruskal-Wallis test due to non-normality and small sample size. Variable pairs for comparison were determined post-hoc. The below variable pairs were tested, where the syntax "x ~ y" indicates testing if y has an effect on x:

- Total crack length (2-4cm) ~ Soil colour
- Total crack length (>4cm) ~ Soil colour
- No. tussocks ~ Soil colour
- Mean grass cover % ~ Soil colour
- Total crack length (2-4cm)~ Mean grass cover %
- Total crack length (>4cm) ~ Mean grass cover %

Tests that were statistically significant (<0.05) were compared using Wilcoxon pairwise tests with a conservative Bonferroni p-adjustment to determine the source of statistical significance.

3.2 Julia Creek Dunnart targeted survey methods

Julia Creek Dunnarts were targeted using a combination of ScoutGuard SG562-C motion-sensing trail cameras ("camera traps") and Elliott Type A traps deployed in suitable grassland habitat. Targeted survey locations and the methods are shown in Figure 3.2.

September 2021

Four terrestrial vertebrate baseline survey sites were established in September though only two were located within grassland (Fs02 and Fs03). Suitable capture methods at each site for Julia Creek Dunnart included a single camera trap and a trapping array of 20 Elliott traps.

Camera traps

The two camera traps, one at each trap site, were baited with a peanut butter smeared in front of the camera and operational for four nights. Cameras were set to high sensitivity, three photos per trigger, with a 0s delay between photos within a trigger, and the default 30s delay between consecutive triggers.

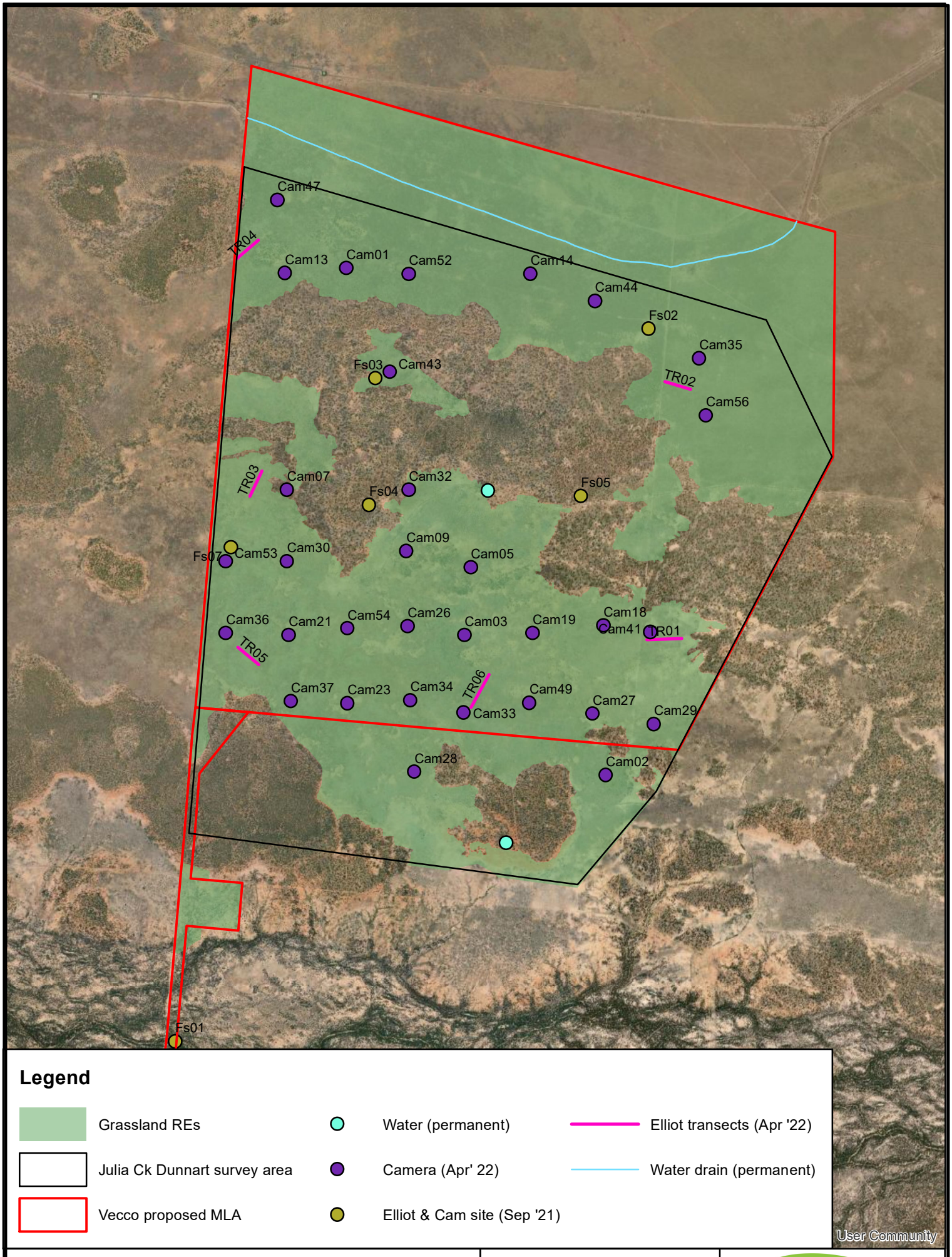


Figure 3.2
Soil and ground cover transect locations

Scale:
1:48,742
0 0.275 0.55 1.1 1.65 2.2
Kilometers

Client: AARC

Project: Vecco Julia Creek Dunnart Survey

ecosmart ECOLOGY

Elliott traps

Forty Elliott traps, twenty at each trap site, were baited with a standard peanut butter and oat mammal bait mix and were operational for four nights. Traps were set each afternoon, checked each morning, and closed during the day due to high temperatures.

April 2022

The April survey included targeted Elliot trapping and camera trapping.

Camera traps

A total of 32 camera traps were deployed throughout remnant grassland habitat on-site in a grid pattern with an average inter-camera distance of ~600 m (±~90 m SD). Cameras were mounted in a vertical orientation (i.e. pointed at the ground) on an aluminium fence dropper at ~1 m above the ground (Photo 1). Cameras were baited with a peanut butter smear in front of the camera and were operational for seven nights. Cameras were set to high sensitivity, three photos per trigger, with a 0s delay between photos within a trigger, and the default 30s delay between consecutive triggers.

During this period an additional camera was also operational for four consecutive nights at a baseline fauna transect (FS07).

Elliott traps

Six Elliott trap-lines were deployed throughout remnant grassland habitat on-site. Areas of dark soil were targeted where possible. Each trap-line consisted of 20 Elliott traps, spaced approximately 10 m apart at right angles to vehicle tracks, and baited with a standard peanut butter and oat mixture mammal bait. Traps were operational for four nights.

An additional Elliot line, also consisting of 20 Elliot traps, was also operation for four consecutive nights at a baseline fauna transect (FS07).

3.3 Survey effort

Total survey effort for both camera trap and Elliott trap methods in grassland habitats is summarised in Table 3.1 below.

Table 3.1. Grassland survey effort by method

Survey	Camera traps			Elliott traps		
	N	Nights	Trap-nights	N	Nights	Trap-nights
Sep-21	2	4	8	40	4	160
Apr-22	32	7	224	120	4	480
Apr-22	1	4	4	20	4	80
Total			**236**			**720**

Photo 1. Camera set-up showing vertical orientation during the April survey

3.4 Survey timing, conditions and limitations

Survey Conditions

Climate data for the September and April Surveys were collected from the nearest Bureau of Meteorology weather station located at Julia Creek Airport (BoM station ID 029058) ~80 km SSW of the survey area.

Minimum overnight temperatures during the September survey were mild, ranging from 12.4 – 16.5°C. Maximum daytime temperatures were hot, ranging from 34.4 – 38.5°C. Minimum overnight temperatures during the April survey were mild to warm, ranging from 16.8 – 25.4°C, and maximum daytime temperatures were hot, ranging from 38.0 – 40.1°C.

No rainfall was recorded during either survey, nor within a week prior to the commencement of either survey. Total rainfall in the three months preceding the September survey was ~21% higher than average (Figure 3.3); however, all rain recorded in this period fell in June, resulting in two dry months leading up to September. Total rainfall in the three months preceding the April survey was ~58% below average (Figure 3.3).

Survey and Assessment Limitations

The following limitations are recognised:

- Vehicle tracks proved difficult to find while setting Elliott trap-lines in April. Trap-lines were located within proximity to known tracks despite potentially suitable habitat at a greater distance from tracks.
- Surveys have not inspected or assessed grasslands in the very northern portion of the MLA.
- Grasslands across the majority of the MLA are uniform though, in some areas, darker soils with larger cracks were noted. These areas also had a different mix of grass species (i.e., dominated by *Astrebla* spp). Neither the provided soil mapping, nor vegetation mapping, is of sufficient scale to isolate these areas.

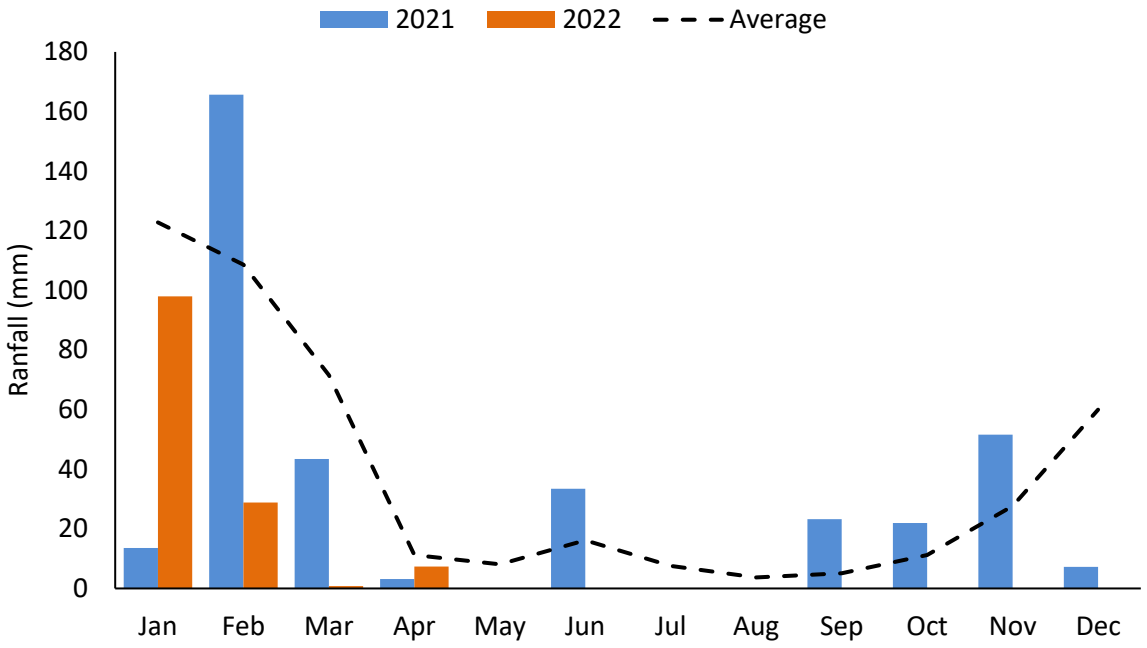


Figure 3.3. Monthly rainfall from January 2021 to April 2022 at Julia Creek Airport. Average monthly rainfall for all available years (n = 16) since 2001 is indicated by the dashed black line.

4.0 RESULTS

4.1 Julia Creek Dunnart habitat value

Traverses across the MLA during both surveys noted grasslands were typically dominated by 'grey' soils which, as discussed below, had limited surface cracks, were dominated by non-*Astrebla* grasses and had a sandy surface.

Smaller areas had 'dark' soils where the grassland was dominated by *Astrebla* species and there was no evidence of a sandy surface. While soil cracks were more abundant in these areas, large cracks were uncommon. These habitats were found at two locations. The first is a small area near the centre of the site, which is mapped as RE 2.4.2b, and the second is a larger area located in the south-wester corner of the MLA (refer to Figure 5.1 for locations). In this later area the darker soils formed what was estimated as a 1:1 mosaic with 'grey' soils. The *Astrebla* grassland on the darker soils in the south-west was variably affected by grassing pressure though cover gradually reduced in proximity to permanent water. As such, the better grasslands were located in the west.

4.1.1 September 2021

Habitat transects in Grasslands on the Vecco MLA identified limited narrow soil cracks (2-4cm) though large areas lacked soil cracks entirely. Just two sites, JC02 and JC04, had a single soil crack intercept of 4+cm wide. These sites were on the 'dark' soils of the Mitchel SMU.

Comparison transects near Julia Creek Airport had on average fewer intercepts with narrow soil cracks, but a greater frequency of intercepts with wide soil cracks (Figure 4.1). Sites at Julia Creek Airport with wide soil cracks were typically dominated by *Astrebla* spp., and the two sites within the Vecco MLA with wide soil cracks (JC02 and JC04) showed a higher frequency of intercepts with *Astrebla* spp. than all other sites (Figure 4.2).

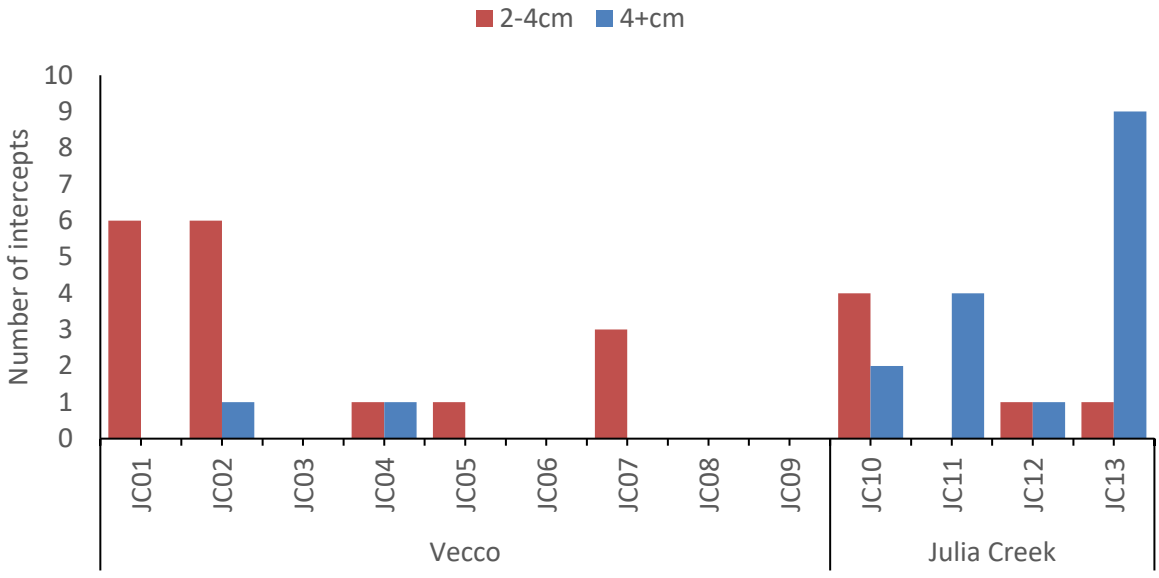


Figure 4.1. Number of intercepts of narrow (2-4cm, orange) and wide (4+cm, blue) soil cracks along a 50 m transect at nine habitat sites at Vecco and four comparison sites near Julia Creek Airport.

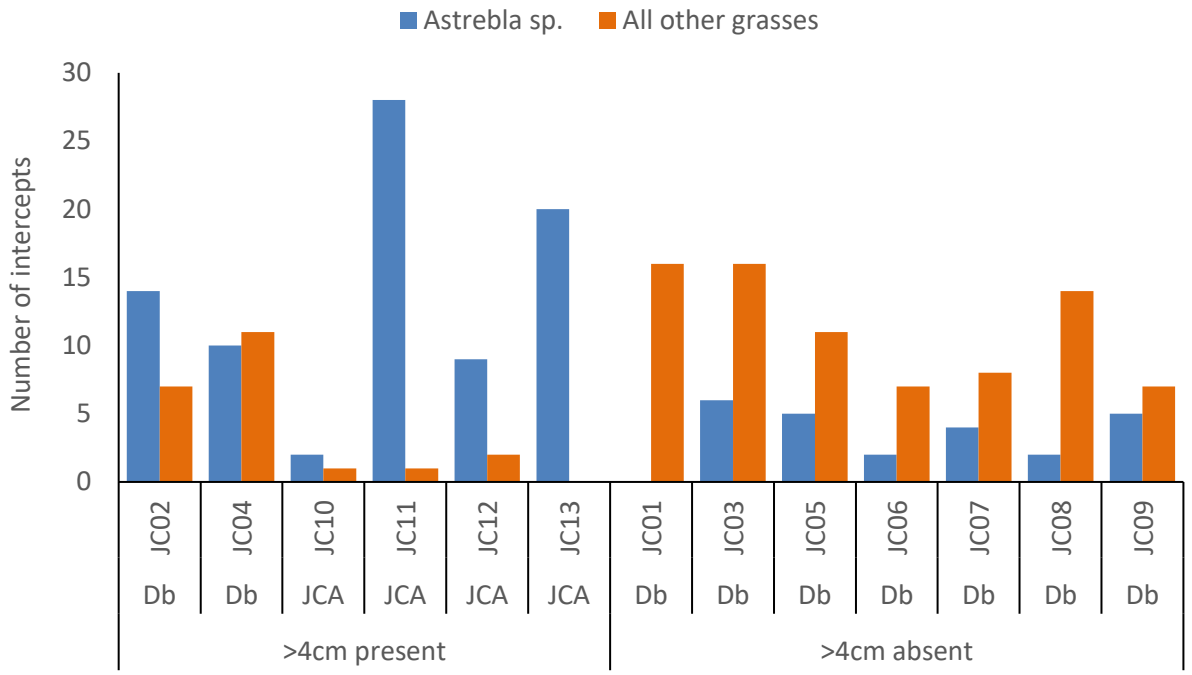


Figure 4.2. Number of *Astrebla* spp. and other grasses intercepts at nine habitat sites at Vecco (Db) and four comparison sites near Julia Creek Airport (JCA), categorised by presence or absence of wide (>4cm) soil cracks

4.1.2 April 2022

A total of five ground cover transects had average ground cover of above 40%, and a further five sites were not significantly lower than 40% average cover as judged by 95% confidence intervals (Figure 4.3).

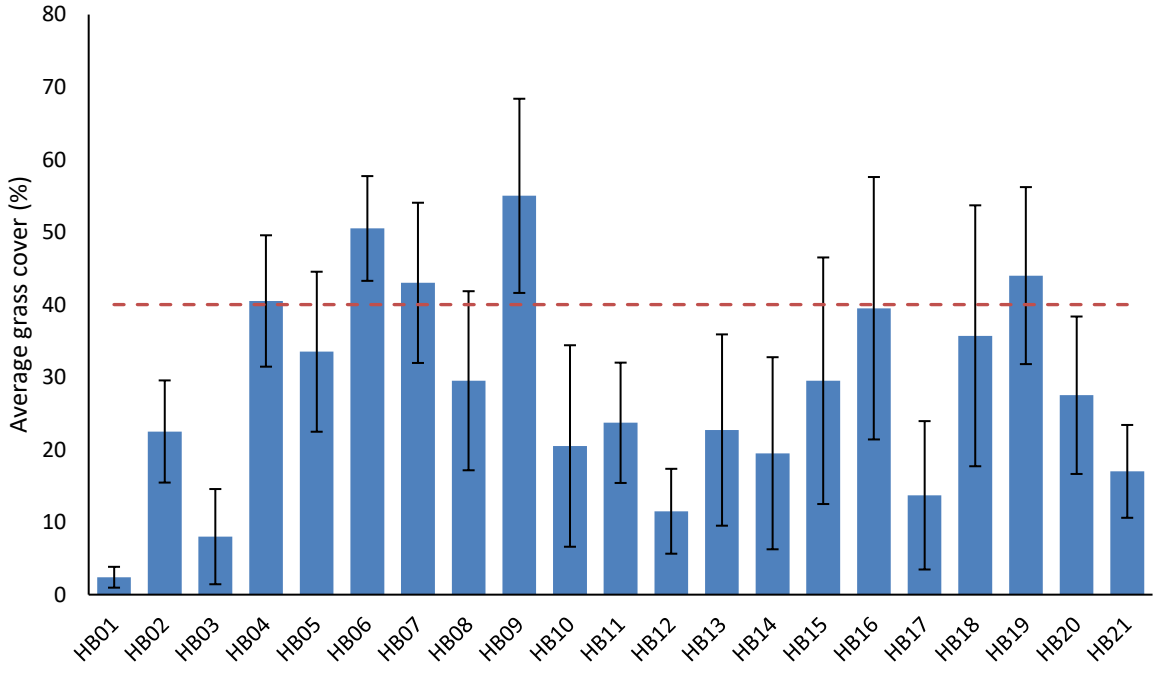


Figure 4.3. Average grass cover (±95% CI) along a 50m transect at 21 habitat assessment sites on the Vecco MLA. Average percentage of grass cover is calculated from 10 1x1 m quadrats per transect.

Comparison of crack length by soil colour shows a significant difference in total crack length of cracks 2-4cm in width between different soil colours (Table 4.1; Figure 4.4). A pairwise comparison of soil colours shows dark soils have a significantly greater length of cracks 2-4cm than grey soils (Wilcoxon pairwise, Bonferroni p-adjustment, p = 0.004). There was no difference in crack length of cracks 2-4cm between dark and mixed or between mixed and grey soils. There was no significant difference for any other parameters tested (Table 4.1).

Table 4.1. Results of Kruskal-Wallis tests comparing the effect of soil colour on total crack length, number of tussocks and mean grass cover, and of mean grass cover on total crack length at 21 habitat transects on the Vecco MLA.

Test	Chi-sq	DF	p
Total crack length (2-4cm) ~ Soil colour	10.888	2	0.004
Total crack length (>4cm) ~ Soil colour	4.4851	2	0.106
No. tussocks ~ Soil colour	1.8413	2	0.398
Mean grass cover % ~ Soil colour	3.288	2	0.199
Total crack length (2-4cm)~ Mean grass cover %	19.984	19	0.396
Total crack length (>4cm) ~ Mean grass cover %	19.872	19	0.402

Chi-sq is the test-statistics, DF is degrees of freedom, and p is the statistical significance of the test. P values <0.05 were considered statistically significant.

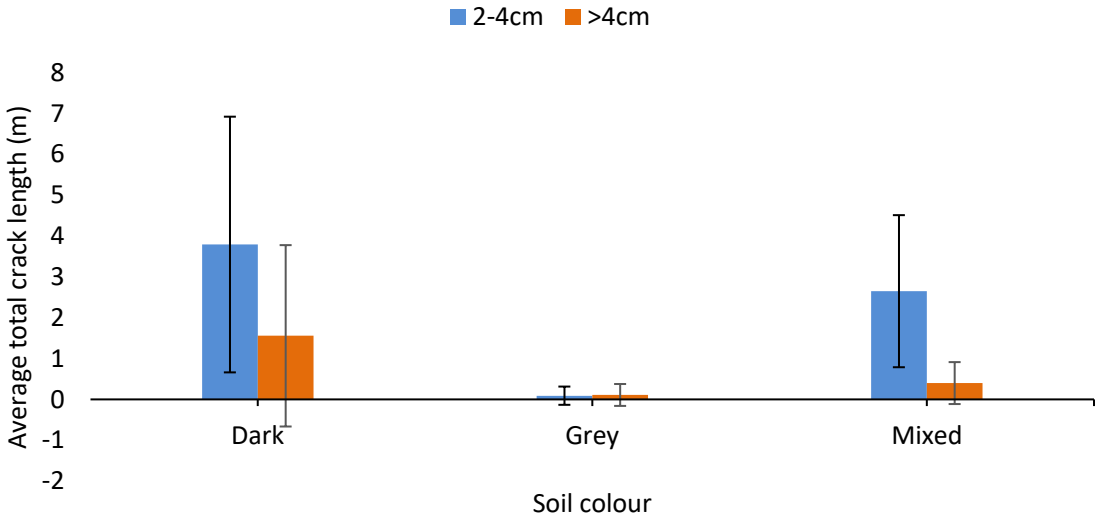


Figure 4.4. Average total crack length (±95% CI) of cracks 2-4cm in width and >4cm in width by dark (N = 7), grey (N = 11) and mixed (N = 3) soils along 21 transects at the Vecco MLA.

4.2 Julia Creek Dunnart Presence and Trap Results

No Julia Creek Dunnarts were recorded by any survey method during either survey. The only mammal detected during the surveys was Long-haired Rats (*Rattus villosissimus*).

Photo 2. HB08, one of the better representatives of 'dark' soils at Vecco (Mitchel SMU). This area, like most areas of dark soil, is small in extent with the grey-tone grasses in the distance indicating a soil change (to 'grey' Mitchell SMU). Based on ten quadrat samples, grass cover here was ~30%.

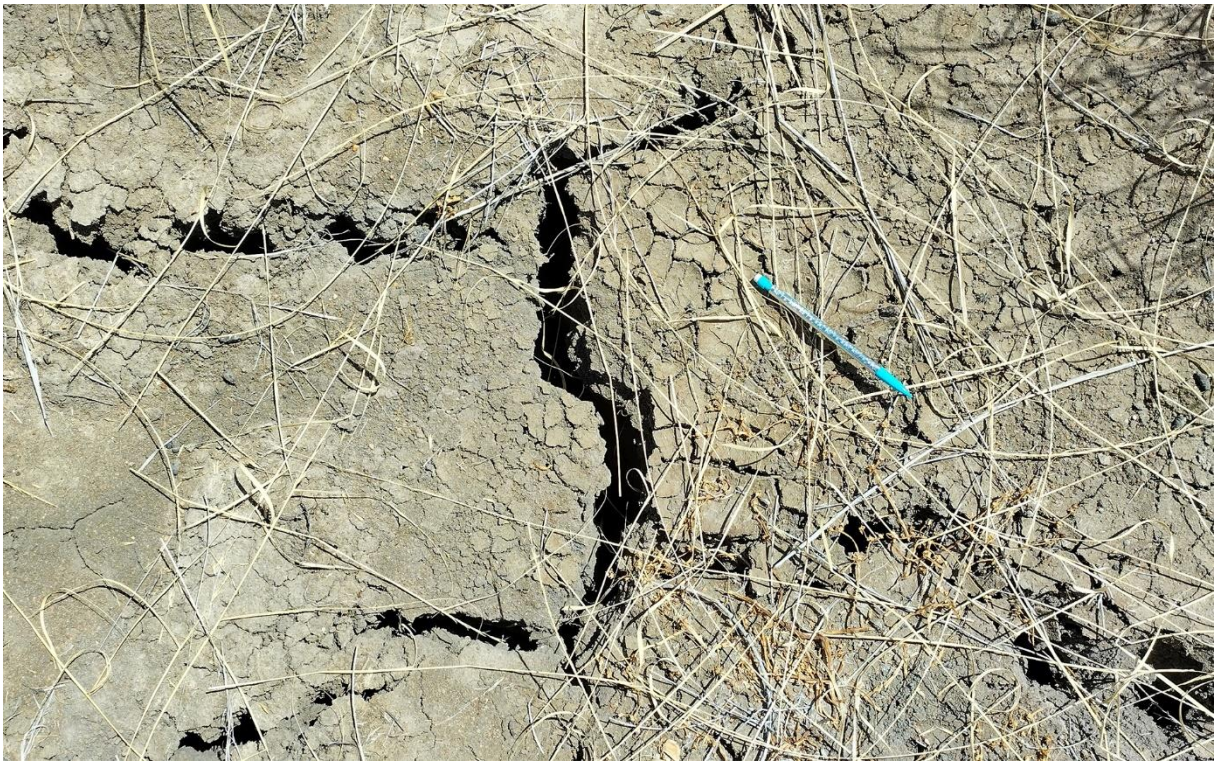


Photo 3. The cracks depicted here are some of the better cracks encountered during survey (HB08).

Photo 4. HB10, a typical representative of 'grey' soils at Vecco (Mitchell SMU). Not the different grass composition to HB08 lacking *Astrebla* tussocks. Based on ten quadrat samples, grass cover here was ~20%.

Photo 5. Cracks are rare on the 'grey' soils of the Mitchel SMU, such as those depicted here at HB10. Note the red surface sand which limits shrink-swell capacity.

5.0 DISCUSSION

5.1 Julia Creek Dunnart habitat

Julia Creek Dunnart habitat, if present, will be restricted to grassland communities (RE 2.4.2b, 2.5.35) within the Vecco MLA. Grassland communities show a strong correlation to soil type being restricted to the Mitchel SMU. Other soils, which lack clay content and therefore any capacity to shrink-swell, do not form cracks and have a canopy. None of these characteristics are consistent with Julia Creek Dunnart habitat.

A grassland habitat suitability model developed by Smith *et al.* (2007) determined the most sensitive predictor for Julia Creek Dunnart presence is ground cover, followed by grazing pressure (which directly influences ground cover), dominant soil type and the number of soil cracks per square metre (which is at least partly influenced by the dominant soil type). Distance from watering points and Prickly Acacia (*Vachellia nilotica*) density also affect habitat suitability (Smith *et al.* 2007). National parks, road reserves, stock routes and research stations are therefore areas considered areas of high habitat suitability, whereas working stations such as Bow Park Station are typically considered of low habitat value (Smith *et al.* 2007).

There is no research describing the size of soil cracks used by Julia Creek Dunnarts; however, limited photographic evidence of soil crack width at diurnal resting sites in Bladensburg National Park suggest soil cracks utilised by the species are ≥50 mm wide (Woolley 2017). In the eastern parts of its range, percent ground cover at dunnart-positive sites is reported at 40–65% with tussock heights of 0.4-0.5 m (Kutt 2003). Grass tussock height was not recorded during this survey, but most mature tussocks were at least 30 cm high. A range of grass species have been reported from Julia Creek Dunnart habitat (Kutt 2003), and the communities reported are typically more complex than those observed around the Vecco MLA, most of which consisted of only two or three dominant grass species.

Based on these habitat considerations, grassland areas within the Vecco MLA with highest amenity for Julia Creek Dunnart will have a high incidence of wide soil cracks and high percent grass cover (>40%). Wide soil cracks were recorded in four of six sites on dark soil, one on mixed soil, and one on grey soil. Dark soils also exhibited by far the highest density of narrow (2-4cm) soil cracks. This suggests darker soils are more likely to have some habitat amenity while grey soils, on balance, do not; however, large soil cracks were only present on four out of seven dark soil sites, and only in meaningful amounts on two out of seven sites. Therefore, not all areas of dark soil should be considered suitable, only a small subset.

While soil mapping at the resolution required to highlight areas of dark soils is not available, our in-field observations suggest the site is dominated by grey soils, possibly as much as 70-80% of the area[1]. By comparison dark soil areas are small in extent and at their most extensive near the south-west of the MLA where they may occur in a 50% mosaic with grey soils. Even in areas of high-density dark soil, sites on the MLA lacked the cryptogamic crust of sites at Julia Creek Aerodrome.

[1] Based on the original survey area; grey soils may be even more extensive now the MLA extent has been shifted north.

Mimosa (*Vachellia farnesiana*) was only noted in low density on the property, primarily on or near channels, so this is unlikely to significantly affect Julia Creek Dunnart presence on-site.

Several watering points and water-filled channels were noted within or near the MLA and these may have an effect on Julia Creek Dunnart presence. Smith *et al.* (2007) found a positive correlation on habitat suitability with increasing distance to water, with sites ≥5 km from water more likely to contain suitable habitat. This was significantly correlated with land tenure i.e. properties utilised for grazing tend to have a higher density of watering points. At the Vecco MLA, no single survey site or habitat transect site was more than 5 km from any known watering point (range 0.12–2.88 km), and as Bow Park is a working cattle station, this may indicate a lower likelihood of suitable habitat occurring on-site.

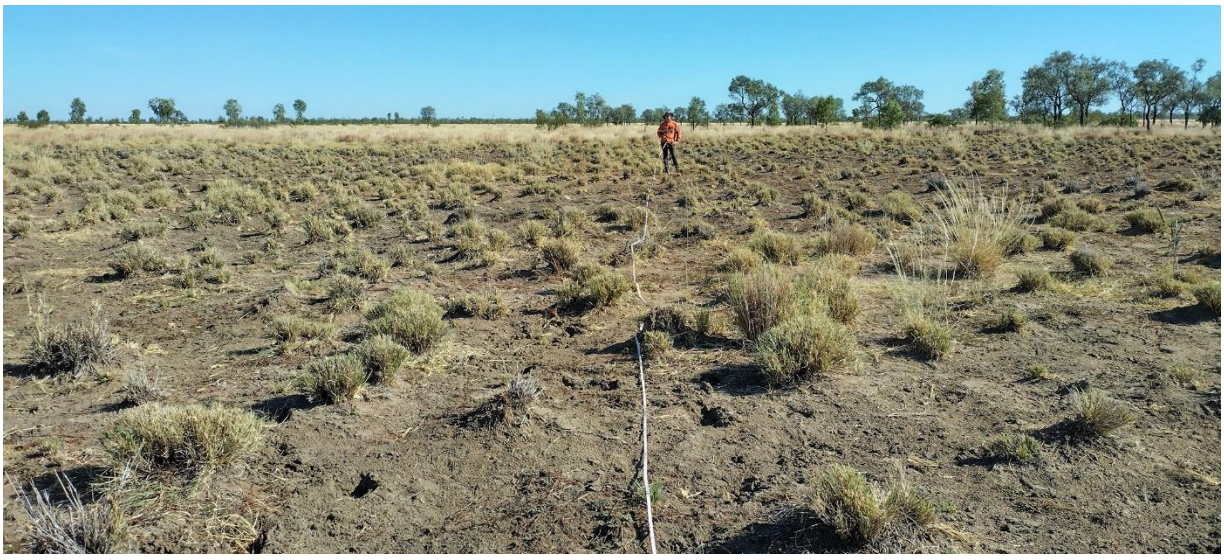


Photo 6. HB01, an example of grazing pressure on an *Astrebla* 'dark' soil grassland. HB01 is ~1.6 km from the nearest water source. Based on ten quadrat samples, grass cover here was <5%.

Based on the above, we anticipate that the majority of the land within the MLA will not be suitable for Julia Creek Dunnart due to the lack of wide soil cracks and grazing impacts affecting grass cover. Even in areas where larger soil cracks are present and grazing pressure is low, soil cracks are less abundant compared to areas of high habitat amenity at the Julia Creek Aerodrome. Even possible habitat within the study area seems to have low amenity. As such, while the presence of the species cannot be discounted based on micro-habitat features alone, it seems improbable.

5.2 Julia Creek Dunnart presence

Despite Elliott and camera trapping conducted during suitable conditions within the Vecco MLA no Julia Creek Dunnarts have been detected.

Furthermore, no other blacksoil vertebrate specialist which typically co-occur with Julia Creek Dunnart were noted. Rather, during surveys both the Downs Bearded Dragon (*Pogona henrylawsoni*) and the Speckled Brown Snake (*Pseudonaja guttata*) were noted offsite to the south of Flinders River. The area in which these species were recorded was visually dissimilar to sites at the Vecco MLA being dominated by a mixture of Mitchell Grass (*Astrebla* spp.) and Flinders Grass (*Iselema* sp.), having a greater abundance of deep, wide (>4cm) soil cracks,

and having a distinct cryptogamic crust. These habitats were, in comparison, more similar to those noted around the Julia Creek Aerodrome.

5.3 Disturbance and Impacts

Field investigations have found extensive areas of grassland are not suitable habitat for Julia Creek Dunnart due to the lack of soil cracks. Even where large soil cracks occur, they are limited in abundance. The species is therefore not expected to occur. Nevertheless, this section considers the extent of potential habitat loss, noting any such loss is of low amenity habitat unlikely to support the species.

Field investigations have found soil cracks, if present, are most likely to occur in areas which lack a sandy surface; these are typically associated with *Astrebla* grasses. Existing RE and soil mapping is of insufficient scale to highlight these areas though, based on our data, are restricted to a small area near the centre of the site and an area in the south-west. In the south west these 'dark' soils form what is estimated to be a 1:1 mosaic with less suitable 'grey' soils.

Figure 5.1 shows how the proposed activities are likely to affect these areas. The central area is lost and a small portion is affected in the south. Notably, this avoids areas of more extensive *Astrebla* in the west which is less impacted by cattle due to distance from water. The extent of this loss is provided in Table 5.1.

Table 5.1. Estimated loss of low amenity Julia Creek habitat.

RE	Approx Location	Approx % dark soil	Total loss (ha)	Loss of dark soil habitat (ha)
2.4.2b	Near centre of MLA	100	32.03	32.03
2.4.2b	SW corner of MLA	50	58.3	29.2*
			Approximate total	*61.23*

*Calculation based on an infield estimate of a 1:1 mosaic of dark/grey soils in the affected area of low amenity RE 2.4.2b.

5.4 Conclusion and Recommendations

While proving an absence is always difficult, it seems unlikely that Julia Creek Dunnart will occur at the study area due to:

1) The lack of capture/evidence despite sufficient sampling effort,
2) The dominance of grey soils across the site which have poor cracking potential. Areas of possible habitat, largely restricted to darker soils, is modest in extent,
3) Grazing pressure affecting grass cover, especially within 5 km of fixed water points,
4) Even where possible habitat occurs (i.e. dark soils lacking sandy surface and with lower grazing impacts) these have low amenity due to depleted wide soil cracks compared to high-value habitats (e.g. Julia Creek Aerodrome),
5) The absence of black-soil specialist vertebrate species which are often sympatric with Julia Creek Dunnart and therefore potential indicators of presence.

To increase confidence the species is not present, further surveys could be included as a condition of activity. These should occur on at least one additional occasion prior to construction and continue annually for three years. Surveys should focus on areas of dark soil with wide soil cracks and a high percentage of grass cover such as areas around HB08, HB09 and HB19. Ideally surveys should occur during the cooler months of the year, May-July.

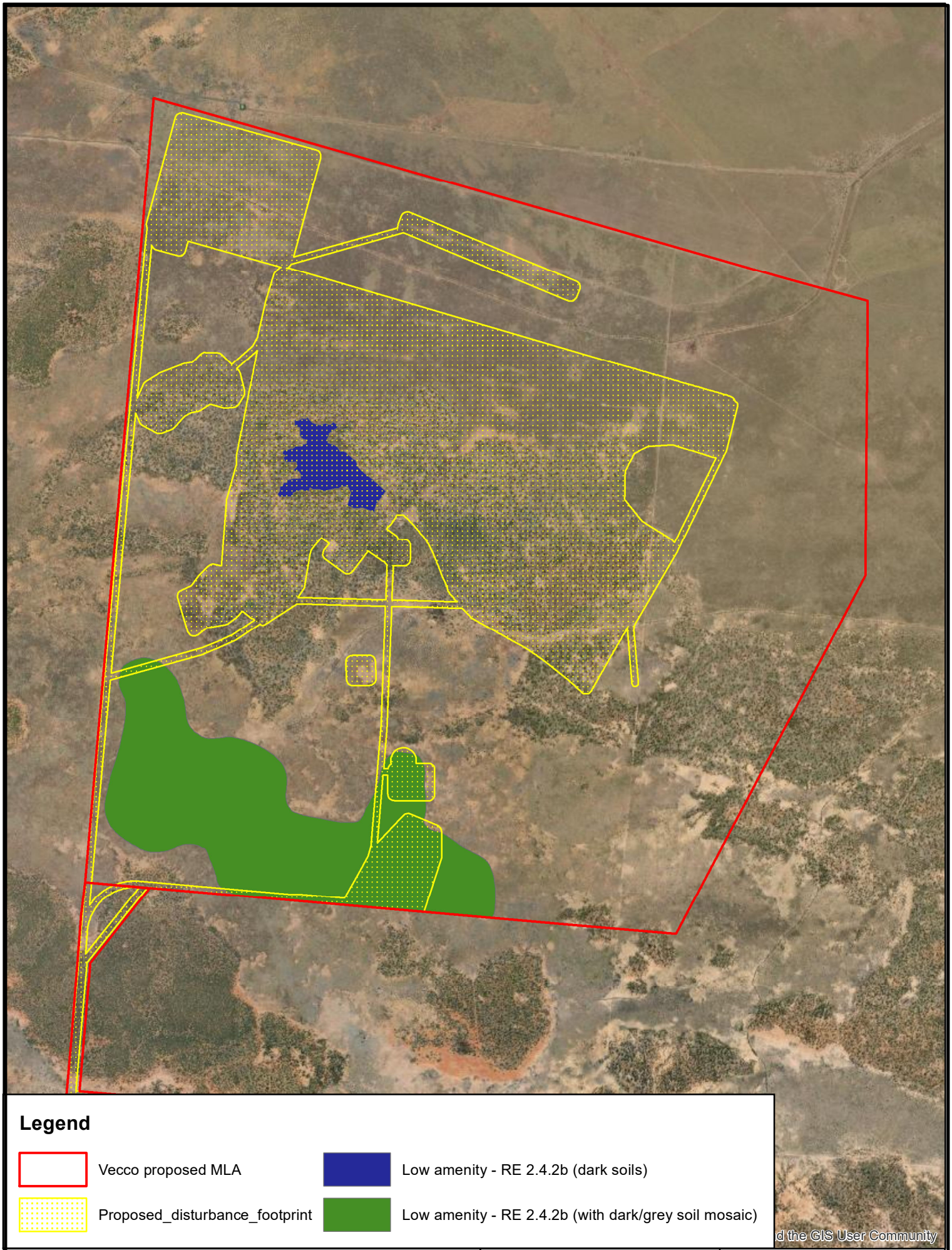


Figure 5.1
The potential loss of low amenity Julia Creek Dunnart habitat due to the Vecco project

Scale:
1:39,873

0 0.225 0.45 0.9 1.35 1.8
Kilometers

ecosmart ECOLOGY

Client: AARC | **Project:** Vecco Julia Creek Dunnart Survey

6.0 SIGNIFICANT IMPACT ASSESSMENT

The Julia Creek Dunnart is classified as Vulnerable under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and as Endangered under Queensland's *Nature Conservation Act 1992* (NC Act). The species is therefore assessed under both EPBC Act and NC Act guidelines.

Under the EPBC Act, an action is considered likely to have a significant impact on a Vulnerable species if it will:

- lead to a long-term decrease in the size of an important population of a species
- reduce the area of occupancy of an important population
- fragment an existing important population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of an important population
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
- introduce disease that may cause the species to decline, or
- interfere substantially with the recovery of the species.

Under the NC Act, an action is considered likely to have a significant impact on an Endangered or Vulnerable species if it will:

- lead to a long-term decrease in the size of a local population;
- reduce the extent of occurrence of the species; or
- fragment an existing population; or
- result in genetically distinct populations forming as a result of habitat isolation; or
- result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat; or
- introduce disease that may cause the population to decline; or
- interfere with the recovery of the species; or
- cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.

The following sections assess the likelihood of a significant impact on the evaluated species under the relevant impact assessment guidelines. These assessments are made under the assumption that all recommended mitigatory measures outlined in this report are incorporated into the final project.

6.1 Julia Creek Dunnart significant impact assessment

6.1.1 EPBC Act significant impact guidelines 1.1 (2013)

The Julia Creek Dunnart is classified as Vulnerable under the EPBC Act. The significant impact assessment for this species under EPBC Act guidelines is given in Table 6.1.

Table 6.1. EPBC significant impact assessment for Julia Creek Dunnart (*Sminthopsis douglasi*)

Guideline	Likelihood	Justification
Lead to a long-term decrease in the size of an important population of a species	No	Species not considered present on site. Areas with dark soil and large cracks are, in comparison to high amenity habitats offsite, low in value and largely outside the development footprint.
Reduce the area of occupancy of an important population	No	Not considered present on site, see above.
Fragment an existing important population into two or more populations	No	Not considered present on site.
Adversely affect habitat critical to the survival of a species	No	Habitat on-site is considered suboptimal at best due to a paucity of significant soil cracks and only moderate grass cover. Considerable grazing pressure and associated impacts (notably reduction in percentage grass cover, and proximity to watering points) indicates the MLA represents low suitability habitat under the habitat model of Smith *et al.* (2007)
Disrupt the breeding cycle of an important population	No	Not considered present on site.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	No individuals were recorded on-site, and the habitat on-site is considered suboptimal at best (as above).
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	No	The greatest threat from invasive species to Julia Creek Dunnarts comes from Feral Cats and Prickly Acacia. Feral Cats are likely already established in the environment. Prickly Acacia will be mapped and controlled as part of mine operations to ensure spread is limited or decreased.
Introduce disease that may cause the species to decline	No	No significant known diseases affecting Julia Creek Dunnarts.
Interfere substantially with the recovery of the species.	No	Key recovery actions for the species include securing protection of suitable habitat, reducing the impact of threatening processes, and verifying the species' distribution (DERM 2009). No individuals were recorded on-site, and the habitat on-site is considered suboptimal at best (as above). This study also provides additional data points for understanding the species' distribution.

6.1.2 NC Act significant residual impact assessment guidelines (2014)

The Julia Creek Dunnart is classified as Endangered under the NC Act. The significant impact assessment for this species under NC Act guidelines is given in Table 6.2.

Table 6.2. NC Act significant residual impact assessment for Julia Creek Dunnart (*Sminthopsis douglasi*)

Guideline	Likelihood	Justification
Lead to a long-term decrease in the size of a local population	No	Species not considered present on site. Areas with dark soil and large cracks are, in comparison to high amenity habitats offsite, low in value and largely outside the development footprint.
Reduce the extent of occurrence of the species	No	Not considered present on site, see above.
Fragment an existing population	No	Not considered present on site.
Result in genetically distinct populations forming as a result of habitat isolation	No	Not considered present on site.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	No	The greatest threat from invasive species to Julia Creek Dunnarts comes from Feral Cats and Prickly Acacia. Feral Cats are likely already established in the environment. Prickly Acacia will be mapped and controlled as part of mine operations to ensure spread is limited or decreased.
Introduce disease that may cause the population to decline	No	No significant known diseases affecting Julia Creek Dunnarts.
Interfere with the recovery of the species	No	Key recovery actions for the species include securing protection of suitable habitat, reducing the impact of threatening processes, and verifying the species' distribution (DERM 2009). No individuals were recorded on-site, and the habitat on-site is considered suboptimal at best (as above). This study also provides additional data points for understanding the species' distribution.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	No	Not considered present on site.

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