



Offset Monitoring Program – Mount Emerald Wind Farm

RATCH Australia Corporation Limited



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Revision History

Version	Purpose	Issued by	Date	Reviewer	Date
1	Draft	Matthew Hemmings	01/06/2021	Mellissa Brown	27/07/2021

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4 Elements Consulting

PO Box 1059

Earlville, QLD 4870

www.4elementsconsulting.net.au

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1.0 Introduction

1.1 Background

The Mount Emerald Wind Farm (MEWF) Offset Site (study site) is located within land described as Lot 22 SP210202 and comprises approximately 434.9 ha (**Figure 1**). It is located immediately to the southeast of the MEWF site at Mutchilba, within the Mareeba Shire Council Area, with vehicle access through Lemontree Drive. The lot tenure is freehold and the primary land use is vacant. The area fringes the Baldy Mountain Forest Reserve and the Herberton Range National Park, via the Herberton Range (Queensland Government 2016).

On 26 November 2016, approval under the provisions of the *Environmental Protection and Biodiversity Conservation (EPBC) Act*, was granted to RATCH Australia Corporation Limited (RACL). As a requirement of the EPBC Act approval 2011/6228, as issued by the Federal Department of the Agriculture Water and the Environment (DAWE), a Biodiversity Offset Area was developed to compensate for the clearing of ~73 ha of habitat on the MEWF Project Site. The MEWF Offset site has been designated as a Nature Reserve under the *Nature Conservation Act 1992* by the Queensland Department of Environment and Science (DES).

The MEWF Offset site is located entirely within the Wet Tropics bioregion. It is mountainous with narrow ridges and rocky terrain that are steeply dissected along three dominant ridge lines. The offsets site lies adjacent to the MEWF project site. The majority of the site consists of remnant vegetation with ~192.89 ha consisting of Least Concern vegetation listed under the *Vegetation Management Act 1999* and the remaining ~242 ha listed as Of Concern vegetation.

4 Elements Consulting was commissioned by RACL to conduct biennial ecological monitoring surveys on the MEWF Offset Site. This current report details the results of the fourth fauna survey since 2017. This report has been prepared to comply with the requirements outlined in the Mount Emerald Wind Farm Offset Area Management Plan (RPS 2016), which details monitoring management actions. The data collected in 2016 provided baseline data for future monitoring to be compared against and enables targeted and adaptive management procedures to be implemented to ensure the biological integrity of the biodiversity area is maintained or improved and conserved into the future.

The actions required include:

- ▶ Targeted survey of threatened fauna species to determine changes to species diversity on site over time;
- ▶ Pest species presence/absence assessment;
- ▶ Photo-monitoring points to determine variation over time; and
- ▶ Targeted weed surveys.

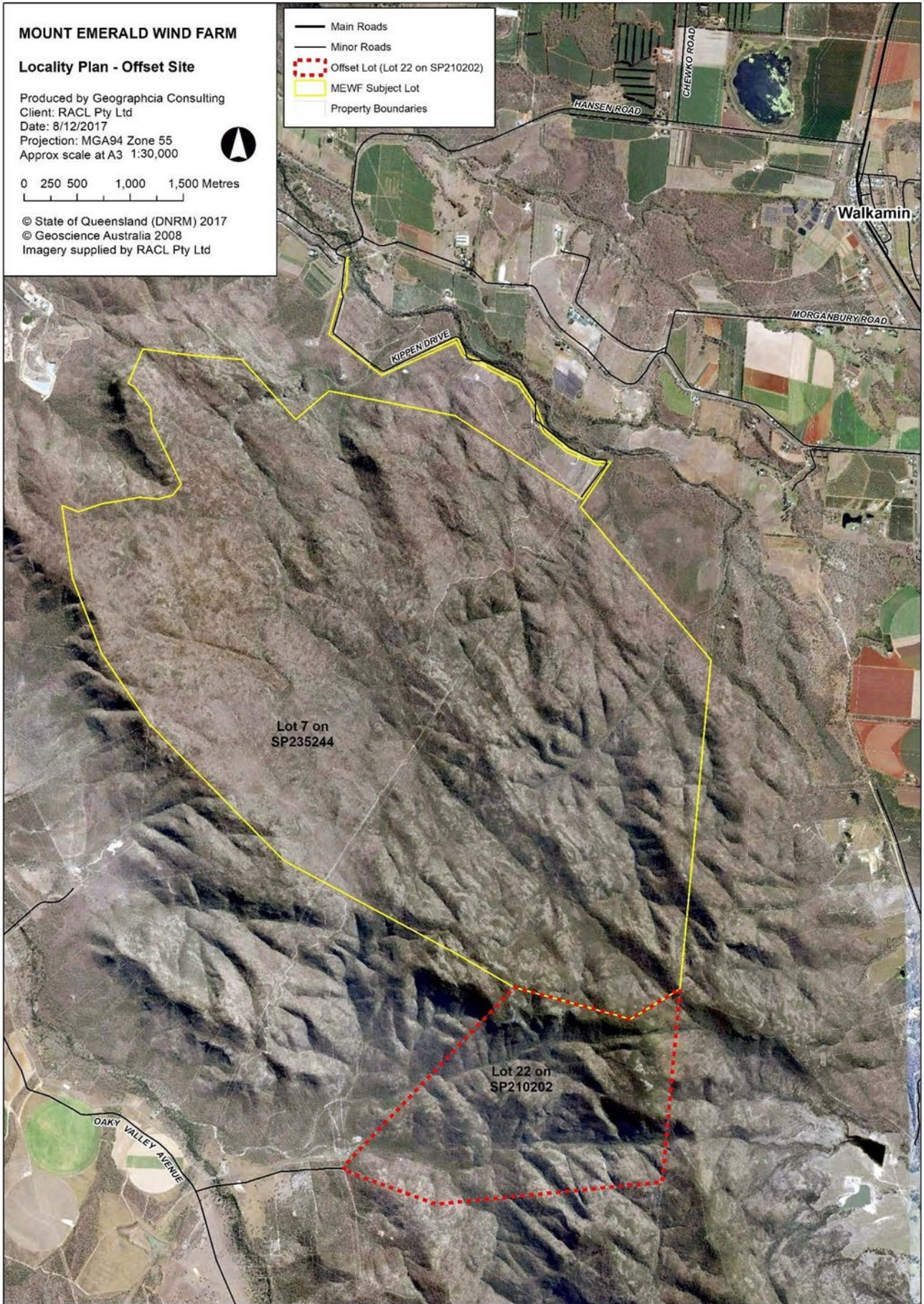


Figure 1 MEWF Offset Location

1.2 Objectives and Outcomes

As identified in the Offset Area Management Plan (RPS 2016), the offset area provides for the long-term protection of habitat for seven threatened species and, through the implementation of adaptive management practices, the quality of the habitat will be improved and maintained over time. The offset area is to be protected in perpetuity as a Nature Refuge. The management plan objectives and outcomes are to:

- ▶ Protect remnant vegetation communities within the offset area from degradation;
- ▶ Protect native fauna within the offset area from introduced weeds and pest fauna;
- ▶ Protect the site vegetation and fauna from wildfires;
- ▶ Maintain the ecological condition of remnant vegetation listed as Of Concern and Least Concern under the *Vegetation Management Act 1999* within the Offset area, where the BioCondition Class of 1, for each assessment unit does not change.

This ecological monitoring report presents the methods and results of the 2021 ecological monitoring program at the MEWF Biodiversity Offset Area, including a discussion of the findings and comparisons with the results of the baseline data conducted in 2016. Management recommendations that relate to the current monitoring phase are documented in **Section 5.0**.

1.2.1 Regional Ecosystems:

The Regional Ecosystems (REs) mapped for the offset site are described in **Table 1** and shown on the mapping in **Figure 2**. Baseline surveys in 2016 identified that RE mapping was consistent with ground truthed vegetation assessments.

Table 1 Regional Ecosystems Present Within the Proposed Offset Site

RE	RE Description	VMA ¹	Bio. ²	Area ³
7.3.26a	Riverine wetland or fringing riverine wetland. <i>Casuarina cunninghamiana</i> , <i>Eucalyptus tereticornis</i> , <i>Lophostemon suaveolens</i> , <i>Melaleuca leucadendra</i> , <i>M. fluviatilis</i> , <i>Buckinghamia celsissima</i> , <i>Mallotus philippensis</i> woodland and forest with an understorey of <i>Melaleuca viminalis</i> and <i>Bursaria tenuifolia</i> . Fringing forests of larger streams. (BVG1M: 16a).	OC	E	2.63
7.12.7c	Simple notophyll semi-evergreen vine forest. Uplands of the dry rainfall zone. Rhyolite. (BVG1M: 5c).	LC	NCP	1.24
7.12.9	<i>Acacia celsa</i> (brown salwood) open forest to closed forest. Foothills, uplands and highlands on granites and rhyolites, of the very wet and wet rainfall zone. (BVG1M: 5d).	OC	OC	1.16

RE	RE Description	VMA ¹	Bio. ²	Area ³
7.12.16a	Simple to complex notophyll vine forest, including small areas of <i>Araucaria bidwillii</i> (Bunya pine). Uplands and highlands on granites and rhyolites, of the cloudy wet to moist rainfall zones. (BVG1M: 6b).	LC	NCP	9.34
7.12.26a	<i>Syncarpia glomulifera</i> , <i>Allocasuarina torulosa</i> and/or <i>A. littoralis</i> open-forest and woodland. Uplands and highlands, often on steep slopes, of the wet rainfall zone. Granite and rhyolite. (BVG1M: 28e).	LC	NCP	4.41
7.12.26e	<i>Syncarpia glomulifera</i> low open forest and low woodland. Uplands on steep rocky slopes, of the moist and dry rainfall zone. Granite and rhyolite. (BVG1M: 28e).	LC	NCP	8.99
7.12.29a	<i>Corymbia intermedia</i> , <i>Eucalyptus tereticornis</i> , <i>E. drepanophylla</i> open forest to low open forest and woodland with <i>Allocasuarina torulosa</i> , <i>A. littoralis</i> , <i>Lophostemon suaveolens</i> , <i>Acacia cincinnata</i> , <i>A. flavescens</i> , <i>Banksia aquilonia</i> and <i>Xanthorrhoea johnsonii</i> . Uplands, on granite and rhyolite. (BVG1M: 9c).	LC	NCP	4.60
7.12.30d	Open woodland to open forest (10-20 m tall) mosaic with variable dominance, often including <i>Eucalyptus cloeziana</i> , <i>C. citriodora</i> , <i>E. portuensis</i> , <i>E. lockyeri</i> , <i>C. leichhardtii</i> , <i>E. atrata</i> , <i>E. pachycalyx</i> , <i>E. reducta</i> , <i>C. intermedia</i> and <i>E. shirleyi</i> . There is often a very sparse to mid-dense secondary tree layer of <i>C. abergiana</i> and/or <i>C. stockeri</i> . A very sparse to sparse tall shrub layer may be present and can include <i>Acacia flavescens</i> , <i>Persoonia falcata</i> , <i>Bursaria spinosa</i> subsp. <i>spinosa</i> , <i>Allocasuarina inophloia</i> , <i>Petalostigma pubescens</i> and <i>Grevillea glauca</i> . A sparse to dense lower shrub layer may include <i>Jacksonia thesioides</i> , <i>Acacia calyculata</i> , <i>Xanthorrhoea johnsonii</i> and <i>Grevillea glossadenia</i> . The ground layer may be dominated by species such as <i>Themeda triandra</i> , <i>Heteropogon triticeus</i> , <i>Mnesithea rottboellioides</i> , <i>Arundinella setosa</i> , <i>Cleistochloa subjuncea</i> , <i>Eriachne pallescens</i> var. <i>pallescens</i> , <i>Lepidosperma laterale</i> and <i>Xanthorrhoea johnsonii</i> . Rocky slopes on granite and rhyolite. (BVG1M: 9d).	LC	NCP	133.42
7.12.34	<i>Eucalyptus portuensis</i> (white mahogany) and/or <i>E. drepanophylla</i> (ironbark), +/- <i>C. intermedia</i> (pink bloodwood), +/- <i>C. citriodora</i> (lemon-scented gum), +/- <i>E. granitica</i> (granite ironbark) open woodland to open forest. Uplands on granite, of the dry rainfall zone. (BVG1M: 9d).	LC	NCP	23.76

RE	RE Description	VMA ¹	Bio. ²	Area ³
7.12.57a	Shrubland and low woodland mosaic with <i>Syncarpia glomulifera</i> (turpentine), <i>Corymbia abergiana</i> (range bloodwood), <i>Eucalyptus portuensis</i> (white mahogany), <i>Allocasuarina littoralis</i> (black sheoak) and <i>Xanthorrhoea johnsonii</i> (grasstree). Uplands and highlands on granite and rhyolite, of the moist and dry rainfall zones. (BVG1M: 9d). Vegetation communities in this regional ecosystem include: 7.12.57a: Shrubland and low woodland mosaic with <i>Syncarpia glomulifera</i> , <i>Corymbia abergiana</i> , <i>Eucalyptus portuensis</i> , <i>Allocasuarina littoralis</i> and <i>Xanthorrhoea johnsonii</i> . Uplands and highlands on granite and rhyolite, of the moist and dry rainfall zones. (BVG1M: 9d).	OC	OC	58.60
7.12.57c	Shrubland/low woodland (1.5-9 m tall) mosaic with variable dominance, often including <i>Eucalyptus cloeziana</i> , <i>Corymbia abergiana</i> , <i>E. portuensis</i> , <i>E. reducta</i> , <i>E. lockyeri</i> , <i>C. leichhardtii</i> , <i>Callitris intratropica</i> , <i>E. atrata</i> , <i>E. pachycalyx</i> , <i>E. shirleyi</i> , <i>E. drepanophylla</i> and <i>Homoranthus porteri</i> , on rhyolite and granite. There is occasionally a very sparse to sparse secondary tree layer of <i>C. abergiana</i> and/or <i>C. stockeri</i> . A very sparse to sparse tall shrub layer may be present and can include <i>Persoonia falcata</i> , <i>Exocarpos cupressiformis</i> and <i>Melaleuca viridiflora</i> var. <i>viridiflora</i> . A sparse to dense lower shrub layer may include <i>Jacksonia thesioides</i> , <i>Acacia calyculata</i> , <i>Coelospermum reticulatum</i> , <i>Xanthorrhoea johnsonii</i> , <i>Acacia humifusa</i> , <i>Dodonaea lanceolata</i> var. <i>subsessilifolia</i> , <i>Grevillea dryandri</i> subsp. <i>dryandri</i> , <i>Grevillea glossadenia</i> , <i>Acacia umbellata</i> and Ericaceae spp. The ground layer may be dominated by species such as <i>Themeda triandra</i> , <i>Xanthorrhoea johnsonii</i> , <i>Eriachne pallescens</i> var. <i>pallescens</i> , <i>Cleistochloa subjuncea</i> , <i>Borya septentrionalis</i> , and <i>Eriachne</i> spp. Includes open rocky dominated by herbs and grasses. This RE includes areas of 7.12.65k (rocky areas with shrubby/herbaceous cover) which are too small to map. Rocky slopes on granite and rhyolite. (BVG1M: 9d).	OC	OC	107.32

RE	RE Description	VMA ¹	Bio. ²	Area ³
7.12.58	<i>Eucalyptus reducta</i> woodland to open forest (6-18 m tall). Common associated species include <i>E. granitica</i> , <i>Corymbia dimorpha</i> , <i>C. citriodora</i> , <i>E. cloeziana</i> and occasionally <i>C. intermedia</i> . There is often a sparse secondary tree layer of <i>C. abergiana</i> and/or <i>E. lockyeri</i> . There may be a very sparse tall shrub layer of species such as <i>Acacia flavescens</i> , <i>Persoonia falcata</i> , <i>Allocasuarina littoralis</i> and <i>Acacia simsii</i> , and a very sparse to dense lower shrub layer of <i>Acacia calyculata</i> , <i>Pultenaea millarii</i> , <i>Jacksonia thesioides</i> , <i>Grevillea glossadenia</i> , <i>Grevillea dryandri</i> subsp. <i>dryandri</i> , <i>Homoranthus porteri</i> and <i>Dodonaea lanceolata</i> var. <i>subsessilifolia</i> . The ground layer is often dominated by species such as <i>Themeda triandra</i> , <i>Eriachne</i> spp., <i>Cleistochloa subjuncea</i> , <i>Lomandra longifolia</i> , <i>Mnesithea rottboellioides</i> , <i>Xanthorrhoea johnsonii</i> , <i>Heteropogon triticeus</i> and <i>Coronidium newcastlianum</i> . Granite and rhyolite. (BVG1M: 9d).	OC	OC	72.45
7.12.65k	Granite and rhyolite rock outcrop, of dry western areas, associated with shrublands to closed forests of <i>Acacia</i> spp. and/or <i>Lophostemon</i> spp. and/or <i>Allocasuarina</i> spp. In the Mount Emerald area, shrubs may include <i>Acacia umbellata</i> , <i>Melaleuca borealis</i> , <i>Homoranthus porteri</i> , <i>Leptospermum neglectum</i> , <i>Melaleuca recurva</i> , <i>Melaleuca uxorum</i> , <i>Grevillea glossadenia</i> , <i>Corymbia abergiana</i> , <i>Eucalyptus lockyeri</i> , <i>Sannantha angusta</i> , <i>Pseudanthus ligulatus</i> subsp. <i>ligulatus</i> , <i>Acacia aulacocarpa</i> , <i>Leptospermum amboinense</i> , <i>Xanthorrhoea johnsonii</i> and <i>Jacksonia thesioides</i> . Ground-cover species may include <i>Borya septentrionalis</i> , <i>Lepidosperma laterale</i> , <i>Eriachne</i> spp., <i>Cleistochloa subjuncea</i> , <i>Boronia occidentalis</i> , <i>Cheilanthes</i> spp., <i>Coronidium newcastlianum</i> , <i>Schizachyrium</i> spp., <i>Tripogon loliiformis</i> , <i>Gonocarpus acanthocarpus</i> and <i>Eragrostis</i> spp. Dry western areas. Granite and rhyolite. (BVG1M: 29b).	LC	OC	7.03

RE	RE Description	VMA ¹	Bio. ²	Area ³
9.5.8	Woodland to open-woodland of <i>Eucalyptus cullenii</i> (Cullen's ironbark) and/or <i>E. leptophleba</i> (Molloy red box) +/- <i>Corymbia erythrophloia</i> (red bloodwood) +/- <i>Erythrophleum chlorostachys</i> (Cooktown ironwood). <i>Eucalyptus tardecidens</i> (box) may also occur as a subdominant in northern extent of this regional ecosystem. A sparse shrub layer includes <i>Petalostigma</i> spp., <i>Melaleuca</i> spp., <i>Grevillea</i> spp., <i>Alphitonia pomaderroides</i> and <i>Maytenus cunninghamii</i> (yellowberry bush). The sparse to dense ground layer is dominated by <i>Heteropogon contortus</i> (black speargrass) and <i>Sarga plumosum</i> (plume sorghum). Occurs on undulating plains in valleys in ranges on Tertiary/Quaternary soils overlying granite and metamorphic geologies. (BVG1M: 13a)	LC	NCP	0.01
9.5.9a	Woodland to open-woodland of <i>Corymbia clarksoniana</i> (Clarkson's bloodwood) +/- <i>Eucalyptus platyphylla</i> (poplar gum) +/- <i>E. leptophleba</i> (Molloy red box) +/- <i>C. tessellaris</i> (Moreton Bay ash) with a distinct to sparse sub-canopy layer often including <i>Melaleuca viridiflora</i> (broad-leaved paperbark), <i>Grevillea glauca</i> (bushman's clothes peg), <i>Petalostigma pubescens</i> (quinine) and <i>Alphitonia pomaderroides</i> (soapbush). An open to sparse shrub layer includes <i>Melaleuca</i> spp., <i>Persoonia falcata</i> , <i>Grevillea</i> spp. and <i>Petalostigma pubescens</i> (quinine). The sparse to mid-dense ground layer is dominated by <i>Themeda triandra</i> (kangaroo grass), <i>Aristida</i> spp., <i>Heteropogon contortus</i> (black speargrass), <i>H. triticeus</i> (giant speargrass), and <i>Sarga plumosum</i> (plume sorghum). Occurs on undulating plains. (BVG1M: 9e).	LC	NCP	
9.12.7a	Woodland to open-woodland of <i>Eucalyptus cullenii</i> (Cullen's ironbark) +/- <i>Corymbia erythrophloia</i> (red bloodwood) +/- <i>Erythrophleum chlorostachys</i> (Cooktown ironwood) +/- <i>C. dallachiana</i> (Dallachy's gum). An open to mid-dense subcanopy can occur and includes a variety of species. The shrub layer is absent to open and dominated by <i>Maytenus cunninghamii</i> (yellowberry bush), <i>Alphitonia pomaderroides</i> (soapbush), <i>Petalostigma</i> spp., and <i>Acacia</i> spp. The ground layer is sparse to dense and dominated by <i>Heteropogon contortus</i> (black speargrass), <i>H. triticeus</i> (giant speargrass), <i>Themeda triandra</i> (kangaroo grass) and <i>Sarga plumosum</i> (plume sorghum) with a <i>Xanthorrhoea</i> sp. (grasstree) occurring in some areas. Occurs on rhyolite hills. (BVG1M: 13a).	LC	NCP	0.01

RE	RE Description	VMA ¹	Bio. ²	Area ³
9.12.40	Low open-woodland to low woodland of <i>Melaleuca citrolens</i> (scrub teatree) +/- <i>Terminalia platyptera</i> (yellow-wood) +/- <i>Corymbia dallachiana</i> (Dallachy's gum) +/- <i>Erythrophleum chlorostachys</i> (Cooktown ironwood). The sparse shrub layer consists of <i>Petalostigma banksii</i> (smooth-leaved quinine), <i>M. citrolens</i> and <i>Gardenia vilhelmii</i> (breadfruit). The ground layer is frequently bare, with patches of short grasses including <i>Eriachne</i> spp., <i>Aristida</i> spp. and <i>Schizachyrium</i> spp. (firegrass). This community also occurs as short open-tussock grassland wooded with low trees and shrubs of <i>Melaleuca citrolens</i> +/- <i>Terminalia</i> spp. Occurs on gentle slopes, footslopes, rolling hills and colluvial low slopes. (BVG1M: 21b).	LC	NCP	
Non-rem	Non-remnant: modified land, roads, clearings and tracks.			0.08
<p>¹ Status under Vegetation Management Act 1999: OC - Of Concern; LC - Least Concern.</p> <p>² Biodiversity management status: E - Endangered; OC - Of Concern, NCP - No Concern at Present.</p> <p>³ Area - total area in hectares of RE type within offset site.</p>				

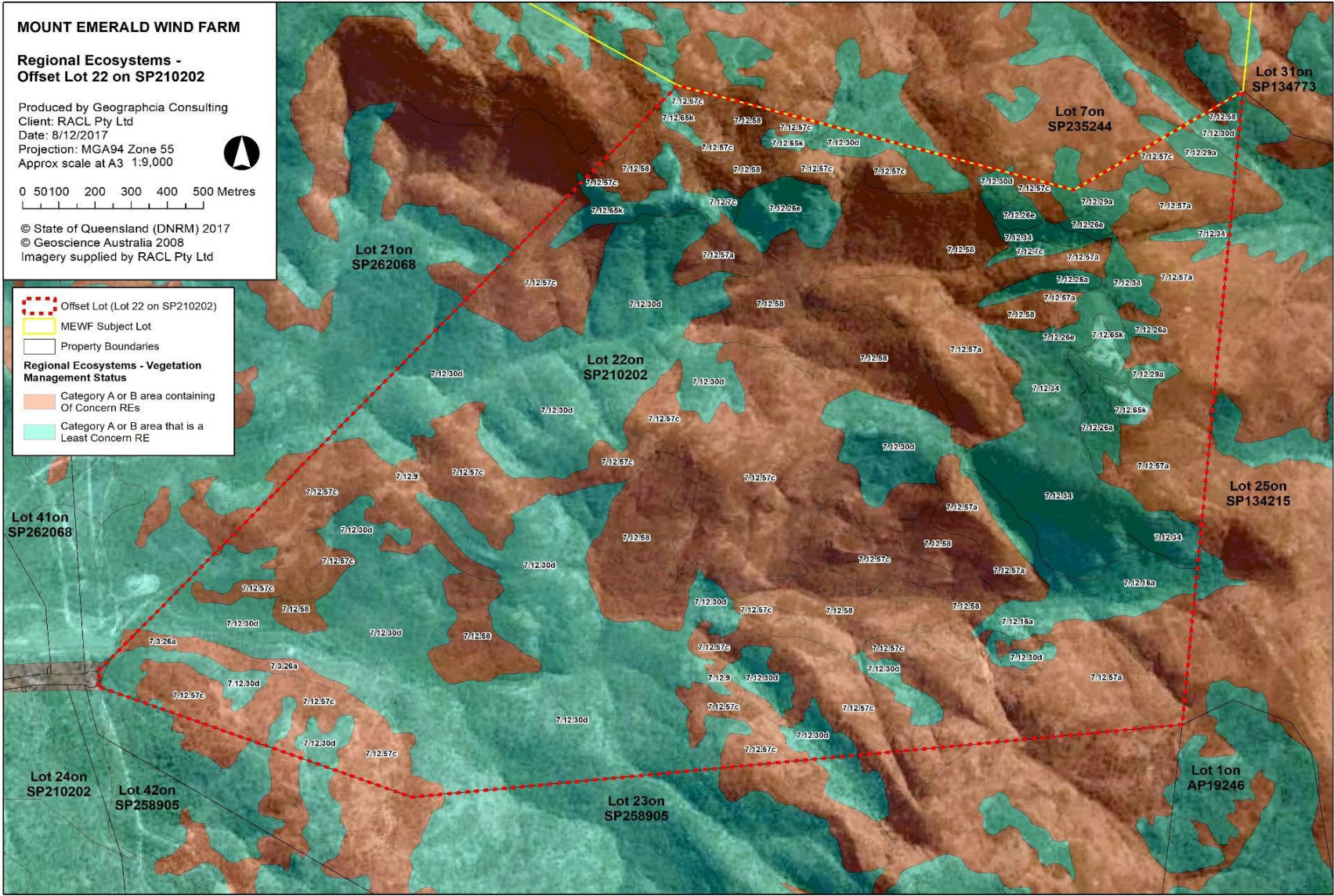


Figure 2 MEWF Offset Site Regional Ecosystems

2.0 Methods

The following sections detail the methods employed for the 2021 ecological offset area monitoring program. The methods employed as part of this monitoring program are consistent with those outlined in the MEWF Offset Area Management Plan (RPS 2016).

Field surveys were conducted on site over 5 days, from the 11-12 February and 1-3 March, 2021.

Total rainfall during the month of February was 235 mm. Mean minimum and maximum temperatures were 20.6 °C and 29.2°C respectively (BOM 2021).

2.1 Targeted Fauna Surveys for Conservation Significant Fauna

2.1.1 Northern Quoll (*Dasyurus hallucatus*)

Camera Trapping

The most suitable method for determining the presence of Northern Quoll is by undertaking a camera trapping survey. This method follows that of Eyre et al. (2014). This current survey has continued to annually replicate the original methodology, including camera deployment locations, of those of the 2016 surveys conducted by RPS (2016) shown in **Figure 3**.

A total of 19 camera traps (Bolyguard SG562-C) were used for the camera trapping survey, from the 11th of February to the 2nd of March, 2021. At each survey site a single camera trap was attached horizontally to the trunk of a tree with a 'dbh' (diameter at breast height) of at least 15 cm. Camera traps were attached using a metal 90° angle bracket, at ~1.5 metres above the ground facing directly over a single PVC bait cannister. Cannisters were made from 50 mm wide PVC piping capped at one end and partially exposed at the other with a vented cowling. Cannisters were baited with 3 chicken neck portions and fixed to the ground using a tent peg. Each camera was set at the medium-level trigger sensitivity. All loose vegetation (e.g. grass stalks, forbs and shrub branches) within the field of view of each camera were removed to minimize false triggers. Individual Northern Quolls were identified by visually assessing the unique spot patterns on the quolls back. Population metrics for the Northern Quoll were analysed using the Minimum Number Known to be Alive (MNKA) method, in which the total number of individual animals captured is used as the population metric.

Field surveys were conducted on site over 5 days, from the 11-12 February and 1-3 March, 2021.

Habitat Assessments

Habitat assessments were conducted at each site.

Measurements of habitat will also be made. Parameters monitored:

- ▶ Evidence of fire;
- ▶ Nature and extent of erosion;

-
- ▶ Extent of weed species;
 - ▶ Presence of feral animals;
 - ▶ Type of groundcover;
 - ▶ Structure and floristics of vegetation cover; and
 - ▶ Number of habitat trees.

2.1.2 Spectacled Flying-fox (*Pteropus conspicillatus*)

Diurnal searches for roosts and feeding signs were undertaken over a large proportion of the project site per Eyre et al. (2014). Surveys followed meandering transects while traversing the offset site during set up of the systematic camera trapping survey. A survey for the presence of flowering forage trees was undertaken by an ecologist.

Previously survey efforts RPS (2016) and 4 Elements Consulting (2017, 2019, 2020) included nocturnal spotlighting. The current survey protocol did not include nocturnal spotlighting on ridge lines as it was determined to be unsafe due to the rugged terrain. The current survey effort recorded the availability of forage trees as an indicator of habitat suitability for the Spectacled Flying-fox

2.1.3 Bare-rumped Sheath-tail Bat (*Saccolaimus saccolaimus nudicluniatus*)

To investigate the presence of Bare-rumped Sheath-tail Bat and the overall diversity of microbats on the offset site a microbat call analysis was undertaken. This was conducted by audio recording microbat echolocation call pulses using acoustic bat detection (Song Meter) devices. Acoustic devices, Song Meter SM4 BAT recording detectors, were deployed at six locations on the offset site (**Figure 3**). Each detector was placed within a suitable flyway (typically a passage of less dense vegetation) and in areas sheltered from strong prevailing winds. Each detector was fastened to the trunk of a tree and an SMM-U1 Ultrasonic Microphone was attached to each unit via an extension cable. The detectors were programmed to turn on automatically at 6 pm each evening and record for a 12-hour period. Call analysis was conducted by a 4 Elements Consulting ecologist. Species were identified by examining the shape and frequencies of the call pulses against known bat call pulses. Unknown calls were further examined by using published call keys in Reinhold (2001) and Milne (2002). Finally, all calls were then verified by Greg Ford (Balance! Environmental). Greg Ford is a recognised microbat call expert in the industry.

Song Meters were deployed from the 1-14 March and 2-15 June. The second deployment occurred to increase the data set due to the lack of BRSB calls in the previous survey and prior year and ensure that there was sufficient spatial and temporal data collection.

2.2 Targeted Weed Surveys

A weed assessment was undertaken within the MEWF Offset site which concentrated on the access track from Lemon Tree Drive and the Mount Emerald Walking Track that leads to the summit of Mount Emerald. The entire

length of these tracks was traversed on foot by a field botanist. Additional spot observations of weed presence in remnant, undisturbed vegetation was undertaken previously in 2016, 2017, 2019 and during the current survey effort.

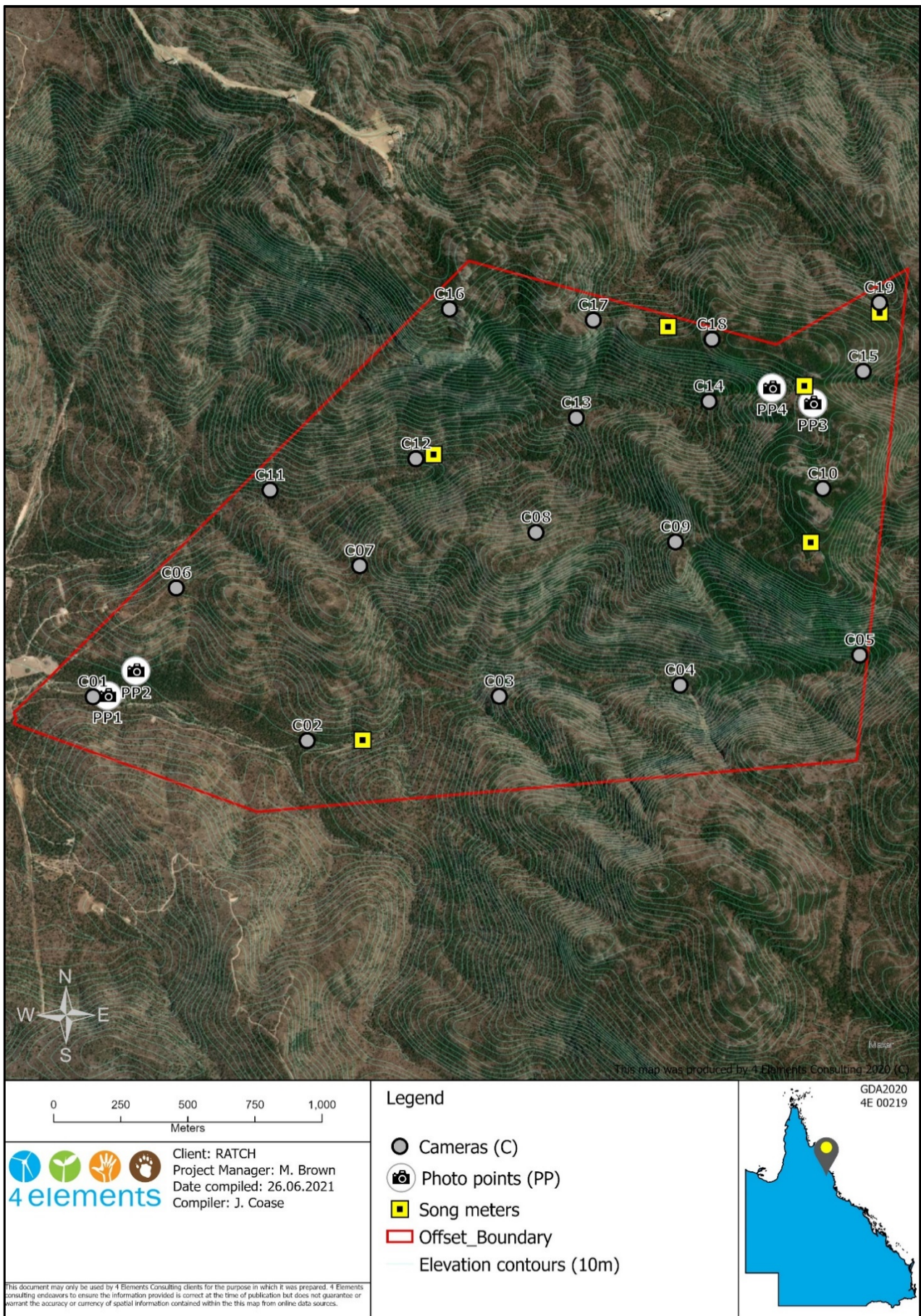


Figure 3 Monitoring Points on Offset Lot

2.3 Opportunistic Assessment

Opportunistic assessments of fauna were monitored at 19 sites. The parameters monitored were:

- ▶ Diurnal bird;
- ▶ Herpetofauna;
- ▶ Terrestrial mammal; and
- ▶ Threatened species presence.

2.4 Photo-Monitoring Points

Four photo monitoring points were established in 2016 within the offset area to enable a visual assessment of changes over time within distinct vegetation types (**Figure 3**). Each point was:

- ▶ Marked with a 1 m star picket which was flagged with yellow tape and the GPS points recorded;
- ▶ Each point had photographs taken in all cardinal directions; and
- ▶ Metadata which included GPS co-ordinates, data and time were recorded.
- ▶ Photographic and metadata records are taken at these photo monitoring points annually.

2.5 Vertebrate Pest Assessment

2.5.1 Camera Trap Locations

Secondary monitoring data was achieved from the deployed camera traps (refer to **Section 2.1**). Pigs, feral dogs and cats are all known to be attracted to the chicken neck bait used.

Data collection included:

- ▶ Species identification (feral pigs and other animals);
- ▶ Number of each species;
- ▶ Age class of feral pigs; and
- ▶ Sex of feral pigs.

3.0 Results

3.1.1 Fire Impacts on the MEWF Offset Site

A high intensity fire moved through parts of the MEWF Offset site in late September 2020 with three (3) of the four (4) photo monitoring points burning during the fire event (see **Figure 3** and Section 4.1 **Table 4**). The only photo monitoring point that did not burn was point 4 which is located in a deep boulder lined gully supporting dry rainforest vegetation. All other monitoring sites are within sclerophyll open woodland communities. All very high intensity canopy fires were recorded on the eastern boundary (**Plate 1**). At the time of survey, these areas were in recovery with nearly all canopy trees displaying epicormic budding. As a result of this fire event, no canopy tree flowering was observed in these areas (near to photo monitoring point 3). The same fire has travelled through to the western boundary of the property to impact a high proportion of the western slopes. At this section of the property visual assessment appeared to indicate a less intense fire. Although, much of the understory was burned in this section.

Plate 1 North East Facing Boundary Displaying Epicormic Sprouting in Regenerating Canopy



3.1.2 Northern Quoll Monitoring

A total of 333 camera trap nights were conducted on the offset site and all units captured images. Northern Quolls were detected at 11 of the 19 camera trap stations on the offset site. Trap histories over the survey period and corresponding camera trap locations showing where quolls were captured on the offset site are detailed in **Table 2** below. In total, seventeen (17) individual Northern Quolls were recorded during the camera trapping survey and many of the quolls revisited the same site on multiple nights (**Plate 2**). This total is an increase from 16 individuals in the previous survey conducted by 4 Elements Consulting (2019) and from the 2016 baseline surveys of 13 individuals RPS (2016). Two (2) Northern Quolls were located at multiple monitoring locations, identified from the unique spot marking on their backs.

Site 7 recorded the five (5) individual Northern Quolls which was the highest abundance of any other site. Site 6 had the next highest abundance which recorded three (3) individual quolls. Northern quolls were detected at all of the 19 camera trap locations on the offset site.

Plate 2 Northern Quoll at Camera Site 6



Table 2 Quoll Capture histories over the survey period. 17 individual Northern Quolls were captured at 11 camera trap sites.

SITE	QUOLL ID	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20	Day 21
1	Q01							1					1							1		
1	Q02																	1				
4	Q03		1																1			
6	Q04		1	1		1		1						1								
6	Q05					1		1					1									
6	Q06							1														
7	Q07				1				1													
7	Q08						1															
7	Q09								1													1
7	Q10									1			1	1								
7	Q06																	1				
8	Q11									1												
9	Q12								1				1									
11	Q13				1	1									1							
13	Q14					1																
14	Q15									1												
17	Q16	1																				
19	Q15							1														
19	Q17																	1				

3.1.3 Spectacled Flying-fox

Targeted diurnal searches for the Spectacled Flying-fox (SFF) habitat concentrated in areas where vegetation was either in fruit or flower. As with the previous year, this corresponded to the gully lines which support complex dry rainforest communities. These were considered important as they were some of the only areas not impacted by fire. At the time of the survey, these areas contained fruiting Burdekin Plum (*Pleigynium timorensis*) which may have provided some foraging potential for Spectacled Flying-fox. Very few flowering eucalypt trees were observed on the site due to the fire event of September 2020. No Spectacled Flying-foxes were observed in the current survey effort.

3.1.4 Microbat Analysis

A total of 77 detector nights, for microbat call surveys, were conducted within the project site between the 11th of February and the 16th of June 2021.

A total of eleven microbat species were detected as a definite occurrence within the study site. Two microbat species were identified as probable and four as a possible occurrence on the site (**Table 3**).

The call data was analysed for the presence of Bare-rumped Sheath-tail Bat (BRSB), listed as *Endangered* under NC Act, and listed as *Vulnerable* under EPBC Act. No Bare-rumped Sheath-tail Bats were recorded in the current survey data. Whilst some calls collected appear to be superficially like that of the Bare-rumped Sheath-tail Bat, call analysis—revealed these calls were from other species within the Emballonuridae family (*Saccolaimus flaviventris* and *Taphozous troughtoni*) and *Molossidae* family (*Chaerophon jobensis*). None of these species are listed threatened species under state or federal legislation.

Table 3 below provides a detailed summary of the bat call analysis undertaken by Greg Ford.

Table 3 Summary of Call Analysis

Species	Status EPBC	Status NCA	Confidence of Presence
<i>Austronomus australis</i>	-	Least Concern	Definite
<i>Chaerophon jobensis</i>	-	Least Concern	Definite
<i>Saccolaimus flaviventris</i>	-	Least Concern	Definite
<i>Chalinolobus gouldii</i>	-	Least Concern	Definite
<i>Ozimops ridei</i>	-	Least Concern	Definite
<i>Taphozous troughtoni</i>	-	Least Concern	Definite
<i>Miniopterus australis</i>	-	Least Concern	Definite
<i>Vespadelus pumulis</i>	-	Least Concern	Definite

Species	Status EPBC	Status NCA	Confidence of Presence
<i>Rhinolophus megaphyllus</i>	-	Least Concern	Definite
<i>Ozimops lumsdena</i>	-	Least Concern	Definite
<i>Chalinolobus nigrogriseus</i>	-	Least Concern	Possible
<i>Miniopterus oceanensis</i>	-	Least Concern	Definite
<i>Scrotoropens orion</i>	-	Least Concern	Possible
<i>Scrotoropens sanborni</i>	-	Least Concern	Possible
<i>Vespedalus troughoni</i>	-	Least Concern	Probable
<i>Pipistrellus adamsi</i>	-	Least Concern	Possible
<i>Scrotoropens greyii</i>	-	Least Concern	Probable

3.2 General Fauna Observations

From a combination of camera trap and opportunistic sightings during site traverses, a total of 44 species were able to be positively identified, except for the rodents, which could not be identified to the species level from camera trap images. In total, 21 birds and 24 mammals were positively identified.

The birds included species such as the Pheasant Coucal (*Centropus phasianinus*), Noisy Friarbird (*Philemon corniculatus*), Striated pardalote (*Pardalotus striatus*) and Tawny frogmouth (*Podargus strigoides*).

The cryptic Mareeba Rock-wallaby (*Petrogale mareeba*) was identified on the mid mountain slopes at site 14. The Echidna, *Tachyglossus aculeatus*, was sighted in multiple locations across the site as evidenced by scats.

A complete list of fauna species is provided in **Appendix A**.

3.3 Weed Monitoring & Control

Since it was first recorded in a weed survey conducted in January 2018, a population of Grader Grass (*Themeda quadrivalvis*) has established a seed bank along the main access track from Lemontree Drive. This species is readily detectable, had not been previously recorded on site prior to this January 2018 survey. In 2018, Grader Grass extended from the access track entry gate to the vehicle turnaround at the end of the track. The extent was similar in 2020, with the population distributed along the length of the access track with most individuals occurring at the vehicle turnaround (**Plate 3**). In 2020, the Grader Grass infestation was hand-pulled twice per wet season and placed into garbage bags and removed from site. This control method was continued in 2021 with a noticeable reduction in the size of the infestation at this location.

The Mount Emerald walking track, which provides pedestrian access to the summit of Mount Emerald, is another source of weeds for the study site. Close to the walking track, a number of weed populations have been recorded. These include Molasses Grass (*Melinis minutiflora*) which occurs in exposed situations at high elevations (**Plate 4**) and occasionally in rocky gullies. This species is potentially problematic and will be monitored to determine if it is likely to spread further and present a threat to high elevation rock pavement communities on the offset site. At this stage the site population of this species, as shown in **Plate 4**, is restricted and has no vehicular access to support herbicide application. The rock pavement communities have shallow soil lenses which may be eroded during the wet season if the current stabilising *Melinis* population is killed/removed. If the population is not invading the site further no action is recommended except to monitor the population for spread.

Three (3) discrete Grader Grass incursions have been recorded near the summit of Mount Emerald since 2018. These have been actively managed by hand pulling and covering in thick black builder's plastic as a method of killing the plants (solarisation). This control method has continued in the current weed treatment. No expansion of these three (3) populations has been recorded. Results of the treatment are shown in **Plate 5**.

Plate 3 Lemontree Drive Turnaround Grader Grass Incursion Post Treatment (-17.21175, 145.39055)



Plate 4 *Melinis minutiflora* Growing Near to Of Concern RE 7.12.65k (-17.20127, 145.40718)



Plate 5 Grader Grass Incursion Post Treatment (-17.19771, 145.40668)



4.0 Pest Vertebrate Monitoring

Two (2) individual feral cats were seen on the camera trapping images (see **Plate 6** and **Plate 7**) at site 6 and 19. Feral cats occur commonly across the region and have been recorded on the MEWF Offset Site and MEWF Project Site during previous targeted camera trapping events.

Plate 6 Feral cat identified at camera site 6

















4.1 Photo Monitoring Points





A visual assessment was undertaken at four photo monitoring points. These locations were selected based on habitat quality, Regional Ecosystem attributes and location. **Table 4** below summarises the characteristics of these sites where photographs are orientated towards the North, South, East and West facing directions. Whilst the photo will aid in the broad comparisons over time, they are best used in combination with floristic data (Gleed 2017) as they are unlikely to show fine scale changes on their own.

Table 4 Photo Monitoring Points

Site ID	Description	Photograph from North, South, East, West	
<p>Photo Point 1</p> <p>Location: UTM 55K 0327999, 8096486</p>	<p>Mapped as RE 7.3.26a</p> <p>Site only partially conforms to mapped RE absence of <i>Allocasuarina cunninghamii</i>.</p> <p>Alluvial sandy loam on riverine wetland.</p> <p>Canopy of <i>Eucalyptus tereticornis</i>, <i>Corymbia leichardtii</i> with a sparse shrub layer containing <i>Lophostemon grandiflorus</i>, <i>Bursaria tenuifolia</i>, <i>Exocarpus cupressiformis</i>, <i>Callitris intratropica</i>, <i>Acacia spp.</i> with a ground layer containing <i>Heteropogon triticeus</i>, <i>Sarga spp.</i> and <i>Themeda triandra</i>.</p>		
		<p>North</p>	<p>South</p>
			
		<p>East</p>	<p>West</p>

Site ID	Description	Photograph from North, South, East, West	
<p>Photo Point 2 Location: UTM 55K 0328099, 8096579</p>	<p>Mapped 7.12.30d Site conforms to RE containing dominant canopy and shrub and ground layer associates. Rocky slopes on granite and rhyolite. Canopy <i>Eucalyptus cloeziana</i>, <i>Corymbia leichardtii</i> and <i>Eucalyptus crebra</i> with a very sparse shrub layer containing <i>Petalostigma pubescens</i>, <i>Coelospermum reticulatum</i>, <i>Persoonia falcata</i>, <i>Grevillea parrallela</i> and a ground layer containing <i>Heteropogon triticeus</i>, <i>Sarga spp.</i> and <i>Themeda triandra</i>.</p>	 <p data-bbox="936 683 1016 711">North</p>	 <p data-bbox="1729 683 1809 711">South</p>
		 <p data-bbox="949 1216 1008 1244">East</p>	 <p data-bbox="1733 1216 1800 1244">West</p>

Site ID	Description	Photograph from North, South, East, West	
<p>Photo Point 3</p> <p>Location: UTM 55K 0330501, 8097591</p>	<p>Site conforms to RE 7.12.57a containing low open woodland to shrubland containing key canopy and lower level associates.</p> <p>High uplands slopes on granite and rhyolite. Tall shrub/ low tree layer</p> <p><i>Syncarpia glomulifera</i>, <i>Corymbia abergiana</i>, <i>Eucalyptus portuensis</i>, <i>Eucalyptus crebra</i>, <i>Allocasuarina littoralis</i>, <i>Banksia aquilonia</i>. Ground layer <i>Xanthorrea johnsoni</i>, <i>Themeda triandra</i>, <i>Imperata cylindrica</i>, <i>Pteridium esculentum</i>,</p>	 <p data-bbox="936 641 1016 673" style="text-align: center;">North</p>	 <p data-bbox="1729 641 1809 673" style="text-align: center;">South</p>
		 <p data-bbox="949 1225 1003 1257" style="text-align: center;">East</p>	 <p data-bbox="1733 1225 1805 1257" style="text-align: center;">West</p>

Site ID	Description	Photograph from North, South, East, West	
<p>Photo Point 4</p> <p>Location: UTM 55K 0330355, 8097647</p>	<p>Mapped as RE 7.12.16a</p> <p>Site conforms to mapped RE containing simple to complex notophyll vine forest with emergent <i>Agathis microstachya</i> on granite and rhyolite in the uplands of the moist rainfall zone.</p> <p><i>Agathis microstachya</i> emergent layer absent. All other vegetation layers conform to RE 7.12.16a.</p>	 <p data-bbox="936 675 1016 703" style="text-align: center;">North</p>	 <p data-bbox="1727 675 1807 703" style="text-align: center;">South</p>
		 <p data-bbox="947 1166 1010 1195" style="text-align: center;">East</p>	 <p data-bbox="1733 1166 1805 1195" style="text-align: center;">West</p>

5.0 Discussion

5.1 Threatened fauna

Results from the current survey effort reveal the Northern Quoll population has remained generally stable since surveys began in 2016. Small population fluctuations have occurred, although this can be attributed to seasonal variations within a population across the survey periods, as seasonality is known to affect quoll populations (i.e., greater numbers within the winter periods). Overall, the offset site has maintained its ecological integrity and the habitat observed remains as high-quality habitat with large refugial areas of rock outcrops, tree hollows and fallen logs for the Northern Quoll. The ephemeral creeks from the Mt Emerald Offset Site had good flow due to the good wet season conditions at the time of survey, with freshwater crustaceans, fish and an abundance of insects observed across the site.

No Spectacled Flying-foxes were detected during the current survey effort. During this time, none of the potential forage trees were observed to be in fruit or flower and the lack of sightings probably reflects the absence of a food source at the time of survey. Despite lack of sightings, the offset site is still deemed to be adequate for the Spectacled Flying-fox and detections of this species may be recorded during different survey seasons and periods (nocturnal spotlighting surveys).

No Bare-rumped Sheathtail Bats were recorded during the current survey, despite a greater survey effort. Previous audio surveys have recorded this species as a probable occurrence on the offset site, however, the call pulses of this bat are superficially similar to other common bat species, which may lead to difficulties in identification. Furthermore, there is the potential that a population of Bare-rumped Sheathtail Bats may have previously resided on the offset site and have since moved on to other areas, either from natural movements or forced migration due to environmental stressors (i.e., intense fires). Very little information on the population dynamics of this species exists across its range, thus the extent of the population of this species in the region remains unknown. Whilst this is the case, the offset site displays ecological habitat characteristics that would be beneficial for the Bare-rumped Sheathtail Bat. Further surveys across a greater area of the offset site are recommended to determine the species presence on the offset site and potential expansion of the monitoring program to include the Mount Emerald Project Site may be useful in determining the presence of this species in the region.

5.2 Biodiversity Management Issues

5.2.1 Weeds

The most prominent biodiversity management issue for the offset site is the control of invasive weeds. Whilst several weed species occur across the offset site, a major weed of concern is Grader Grass (*Themeda quadrivalvis*). Incursion of this invasive grass has occurred along areas of the access track off Lemontree Drive, as well as three (3) small patches on the northern slopes of the offset site. These populations have been effectively managed in

the current weed treatment; however, ongoing monitoring and management will be required at the commencement of the next wet season to prevent populations from re-establishing. Other weeds, such as *Mesosphaerum suaveolens* (syn: *Hyptis suaveolens*) have been recorded on the access track and will require further control and monitoring prior to the next wet season. No expansion of weeds has been recorded in the last four (4) years of monitoring. This would indicate that although eradication of these weeds has not been achieved, management to prevent spread has been effective. With continued management it is expected that the weed seed bank will be further reduced in subsequent years.

5.2.2 Pest Species

The biodiversity offset area is considered to contain a low density of pest fauna species, with only two (2) feral cats being observed in the current survey effort.

No feral pigs were observed during the current survey round. Typically, the offset site provides high quality foraging habitat for feral pigs within the dry season as moisture is retained on the offset site due to the south-easterly aspect of the highest elevation area producing a cloud stripping effect. This allows for moisture to be retained for longer periods than elsewhere on the MEWF project site. However, the lack of feral pig sightings during the current survey suggests that the feral pig population is dispersed across the local region as foraging conditions are ideal during the current survey period (late wet season).

Camera traps should be selectively used to record feral pig activity across the site. This will give an indication of the proportion of pigs which are impacting the habitat. The employment of bait stations will assist in obtaining more accurate records of feral pig visitation rates.

5.2.3 Timing

It is recommended further monitoring surveys be conducted in April– July 2023, close to the end of the wet season, to encompass full flowering of plants to ensure feeds trees are available and fauna are most mobile throughout their range.

6.0 Summary

This report presents results of the fourth biennial fauna survey for the Mount Emerald Windfarm Offset Site. One threatened fauna species, the Northern Quoll (*Dasyurus hallucatus*), was confirmed on the offset site. Population estimates using the Minimum Number Known to be Alive (MNKA) method have revealed that quoll population estimates have not changed significantly since surveys began.

Fauna habitat resources remain abundant within the MEWF Offset Site, and the habitat is of high quality. The offset site has a high density of the large hollows that several nocturnal birds of prey, bat and small to medium sized mammal species require for breeding. In addition, small mammals (terrestrial and arboreal), which are the respective prey of a number of predatory species, were identified throughout the site. Canopy tree species and understorey shrubs within the site provide abundant foraging resources such as foliage, seeds, pollen, nectar and invertebrates for variety of species on a seasonal basis and may potentially influence the occurrence and abundance of arboreal mammal species and birds.

The ground cover layer has remained relatively consistent on the site since surveys began in 2016, despite the recent fire which occurred in October 2020. Recent good rains have promoted a dense ground layer across the site. Suitable amounts of coarse woody debris remain across the site, which provides excellent habitat for small mammals and reptiles.

Weed surveys indicate there are currently no priority listed weed species on site, however, vigilance will be required along the walking track and road entry to ensure there are no access points for these threats. Continued management measures to remove weeds from tracks and external site boundaries will reduce the risks significantly.

The ecological condition of the MEWF Offset Site has been maintained since baselines surveys were conducted in 2016.

7.0 References

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- RPS Australia East (2016) Offset Area Management Plan. Unpublished Report prepared for RATCH Australia Corporation Limited, Brisbane.

Appendix A Fauna List

A summary of species identified during survey on the MEWF Offset Site.

Species	Common Name
Bird	
<i>Alectura lathami</i>	Australian Brush-turkey
<i>Milvus migrans</i>	Black Kite
<i>Lichmera indistincta</i>	Brown Honeyeater
<i>Colluricincla harmonica</i>	Grey Shrike Thrush
<i>Dacelo novaeguineae</i>	Laughing Kookaburra
<i>Myiagra rubecula</i>	Leaden Flycatcher
<i>Meliphaga lewinii</i>	Lewin's Honeyeater
<i>Philemon corniculatus</i>	Noisy Friarbird
<i>Manorina melanocephala</i>	Noisy Miner
<i>Platycercus adscitus</i>	Pale-headed Rosella
<i>Centropus phasianinus</i>	Pheasant Coucal
<i>Strepera graculina</i>	Pied Currawong
<i>Merops ornatus</i>	Rainbow Bee-eater
<i>Malurus melanocephalus</i>	Red-backed Fairywren
<i>Neochmia temporalis</i>	Red-browed Finch
<i>Dicrurus bracteatus</i>	Spangled Drongo
<i>Smicrornis brevirostris</i>	Weebil
<i>Haliastur sphenurus</i>	Whistling Kite
<i>Melithreptus lunatus</i>	White-naped Honeyeater
<i>Pardalotus striatus</i>	Striated Pardalote
<i>Podargus strigoides</i>	Tawny Frogmouth
Mammal	
<i>Dasyurus hallucatus</i>	Northern Quoll
<i>Petrogale marreba</i>	Mareeba Rock Wallaby
	Rodent sp.

Species	Common Name
<i>Trichosurus vulpecula</i>	Common Brushtail Possum
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
<i>Felis catus</i>	Feral Cat
<i>Isoodon macrourus</i>	Northern Brown Bandicoot
<i>Wallabia bicolor</i>	Swamp Wallaby
<i>Austronomus australis</i>	White-striped Free-tailed Bat
<i>Chaerophon Jobensis</i>	Northern Freetail Bat
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tailed Bat
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat
<i>Ozimops ridei</i>	Ride's Free-Tailed Bat
<i>Taphozous troughtoni</i>	Troughton's Sheath-tailed Bat
<i>Miniopterus australis</i>	Little Bent-wing Bat
<i>Vespadelus pumulis</i>	Eastern Forest Bat
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat
<i>Ozimops lumsdenae</i>	-
<i>Chalinolobus nigrogriseus</i>	Hoary Wattled Bat
<i>Miniopterus oceanensis</i>	Eastern Bent-winged Bat
<i>Scrotoropens orion</i>	Eastern Broad-nosed Bat
<i>Scrotoropens sanborni</i>	-
<i>Vespedalus troughtoni</i>	Eastern Cave Bat
<i>Pipistrellus adamsi</i>	Forest Pipistrelle
<i>Scrotoropens greyii</i>	Little Broad-nosed Bat