

## Appendix 34

### Mount Emerald Wind Farm EPBC Offsets Assessment Guide

Prepared by CO2 Australia Limited



# EPBC ACT OFFSETS ASSESSMENT GUIDE PRELIMINARY RESULTS MOUNT EMERALD WIND FARM

Ratch-Australia Corporation Limited

Version 3 - May 2014



**REPORT TITLE:** EPBC Act Offsets Assessment Guide Preliminary Results

**PREPARED FOR:** Ratch-Australia Corporation Limited

**PREPARED BY:** Kate McBean and Meghan Farr

**APPROVED BY:** Rebecca Enright, Senior Manager Environmental Services

**DATE:** 5 May 2014

**VERSION:** 3.0



## IMPORTANT NOTICE

### COMMERCIAL IN CONFIDENCE

This document has been prepared by CO2 Australia Limited ABN 81 102 990 803 (CO2) in conjunction with, and based on information provided by, RATCH-Australia Corporation Ltd (RAC or the Client).

This document is provided expressly subject to the terms of the Purchase Order (PO 4506924111) between CO2 and the Client dated 31 October 2013 ('Engagement Agreement').

This advice is for the sole benefit of the Client. The information and opinions contained in this document are strictly confidential. Accordingly, the contents of this document or opinions subsequently supplied will constitute confidential information and may not, without the written consent of CO2, be published, reproduced, copied or disclosed to any person (other than your advisors having a need to know and who are aware that it is confidential), nor used for any purpose other than in connection with its intended use.

### DISCLAIMER

The information in this document has not been independently verified as to its accuracy or completeness. This document is based on the information available at the time of preparation as well as certain assumptions.

No representation or warranty, express or implied, is given by CO2 or any of its directors, officers, affiliates, employees, advisers or agents (and any warranty expressed or implied by statute is hereby excluded (to the extent permitted by law)) as to the accuracy or completeness of the contents of this document or any other information supplied, or which may be supplied at any time or any opinions or projections expressed herein or therein, nor is any such party under any obligation to update this document or correct any inaccuracies or omissions in it which may exist or become apparent.

To the extent permitted by law, CO2 limits its liability in accordance with the terms of the Engagement Agreement.

Subject to the terms of the Engagement Agreement, no responsibility or liability is accepted for any loss or damage howsoever arising that you may suffer as a result of this document or reliance on the contents of this document and any and all responsibility and liability is expressly disclaimed (to the extent permitted by law) by CO2 and any of its respective directors, partners, officers, affiliates, employees, advisers or agents.

### FORWARD LOOKING STATEMENTS

This document contains forward looking statements. Forward looking statements are statements that do not represent historical facts and may be based on underlying assumptions. These forward looking statements should not be relied upon as representing CO2's views as of any subsequent date, and CO2 is under no obligation to, and expressly disclaims any responsibility to, alter its forward-looking statements, whether as a result of new information, future events or otherwise.

### MARKETING

If, in any document or other communication to be made public or disclosed to a government agency, the Client wishes to make reference to the use of CO2's services, CO2's consent must first be obtained, and this will not unreasonably be withheld.

### MAPS

The maps in this document are based on or contain data that has been provided by the State which gives no warranty in relation to the data (including accuracy, reliability, completeness or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data.

# TABLE OF CONTENTS

Abbreviations and Acronyms .....	i
Executive Summary .....	ii
<b>1. Introduction .....</b>	<b>1</b>
1.1. Background .....	1
1.2. Report Purpose .....	1
<b>2. Proposed Offset Area .....</b>	<b>3</b>
2.1. Northern Quoll offset availability.....	3
2.2. Spectacled Flying-fox Offset availability .....	3
2.3. Bare-rumped Sheathtail Bat Offset availability .....	4
2.4. Grevillea glossadenia Offset Availability.....	4
2.5. Homoranthus Porteri Offset Availability .....	4
<b>3. Methods .....</b>	<b>12</b>
<b>4. Northern Quoll.....</b>	<b>13</b>
4.1. Summary of Results .....	13
4.2. Current Quality of Impact Area .....	13
4.3. Start Quality of Offset Area .....	14
4.4. Future Quality of Offset Area without Offset Management.....	14
4.5. Future Quality of Offset Area with Offset management.....	14
4.6. Confidence in Results – Future Quality .....	14
4.7. Risk of Loss Without Offset .....	15
4.8. Risk of Loss With Offset .....	15
4.9. Confidence in Results – Risk of Loss .....	15
4.10. Time Over Which Loss is Averted .....	15
4.11. Time Until Ecological Benefit.....	15
<b>5. Spectacled Flying-Fox .....</b>	<b>16</b>
5.1. Summary of Results .....	16
5.2. Current Quality of Impact Area .....	16
5.3. Start Quality of Offset Area .....	17
5.4. Future Quality of Offset Area without Offset Management.....	17
5.5. Future Quality of Offset Area with Offset management.....	17
5.6. Confidence in Results – Future Quality .....	17



5.7.	Risk of Loss Without Offset Management .....	17
5.8.	Risk of Loss With Offset .....	18
5.9.	Confidence in Results – Risk of Loss .....	18
5.10.	Time Over Which Loss is Averted .....	18
5.11.	Time Until Ecological Benefit.....	18
<b>6.</b>	<b>Bare-rumped Sheathtail Bat .....</b>	<b>19</b>
6.1.	Summary of Results .....	19
6.2.	Current Quality of Impact Area .....	19
6.3.	Start Quality of Offset Area .....	20
6.4.	Future Quality of Offset Area without Offset Management.....	20
6.5.	Future Quality of Offset Area with Offset management.....	20
6.6.	Confidence in Results – Future quality.....	20
6.7.	Risk of Loss Without Offset .....	20
6.8.	Risk of Loss With Offset.....	21
6.9.	Confidence in Results – Risk of Loss .....	21
6.10.	Time Over Which Loss is Averted .....	21
6.11.	Time Until Ecological Benefit.....	21
<b>7.</b>	<b>Grevillea glossadenia .....</b>	<b>21</b>
7.1.	Summary of Results .....	21
7.2.	Current Quality of Impact Area .....	22
7.3.	Start Quality of Offset Area .....	22
7.4.	Future Quality of Offset Area without Offset Management.....	22
7.5.	Future Quality of Offset Area with Offset management.....	22
7.6.	Confidence in Results – Future quality.....	23
7.7.	Risk of Loss Without Offset .....	23
7.8.	Risk of Loss With Offset.....	23
7.9.	Confidence in Results – Risk of Loss .....	24
7.10.	Time Over Which Loss is Averted .....	24
7.11.	Time Until Ecological Benefit.....	24
<b>8.</b>	<b>Homoranthus porteri .....</b>	<b>24</b>
8.1.	Summary of Results .....	24
8.2.	Current Quality of Impact Area .....	25

8.3.	Start Quality of Offset Area .....	25
8.4.	Future Quality of Offset Area without Offset Management.....	25
8.5.	Future Quality of Offset Area with Offset management.....	25
8.6.	Confidence in Results – Future QUality .....	25
8.7.	Risk of Loss Without Offset .....	26
8.8.	Risk of Loss With Offset .....	26
8.9.	Confidence in Results – Risk of Loss .....	26
8.10.	Time Over Which Loss is Averted .....	26
8.11.	Time Until Ecological Benefit.....	26
<b>9.</b>	<b>Summary of Results .....</b>	<b>27</b>
<b>10.</b>	<b>References.....</b>	<b>28</b>

## LIST OF FIGURES

Figure 1. Mount Emerald Wind Farm project area .....	2
Figure 2. Potential offset area .....	6
Figure 3: Remnant vegetation within the offset area .....	7
Figure 4: Northern quoll habitat within the offset area .....	8
Figure 5: Spectacled flying-fox habitat within the offset area .....	9
Figure 6: Bare-rumped sheahtail bat habitat within the offset area .....	10
Figure 7: <i>Grevillea glossadenia</i> and <i>Homoranthus porteri</i> habitat and records within the offset area .....	11

## LIST OF TABLES

Table 1: Results of flora and fauna surveys of the project area .....	5
Table 2. Habitat quality scores for the project site and the offset area .....	12
Table 3: Summary of values and results for the northern quoll offset assessment .....	13
Table 4: Summary of values and results for the spectacled flying-fox offset assessment .....	16
Table 5: Summary of values and results for the bare-rumped sheathtail bat offset assessment .....	19
Table 6: Summary of values and results for <i>Grevillea glossadenia</i> offset assessment .....	22
Table 7: Summary of values and results for <i>Homoranthus porteri</i> offset assessment .....	24
Table 8. Offsets assessment guide results .....	27



## ABBREVIATIONS AND ACRONYMS

<b>DoTE</b>	Australian Government Department of the Environment
<b>DERM</b>	Queensland Department of Environment and Resource Management (now the Department of Environment and Heritage Protection and the Department of Natural Resources and Mines)
<b>EPBC Act</b>	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)</i>
<b>EPBC Act offsets policy</b>	EPBC Act Environmental Offsets Policy (October 2012)
<b>ha</b>	hectares
<b>MNES</b>	matters of national environmental significance
<b>MW</b>	megawatts
<b>OAMP</b>	offset area management plan
<b>RAC</b>	RATCH-Australia Corporation Limited
<b>the project</b>	Mount Emerald Wind Farm project
<b>VM Act</b>	<i>Vegetation Management Act 1999 (Qld)</i>

## EXECUTIVE SUMMARY

RATCH-Australia Corporation Limited (RAC) is proposing to develop the Mount Emerald Wind Farm (the project). The project (Lot 7 SP235244) is located approximately 50 kilometres south-west of Cairns in north Queensland within the Tablelands Regional Council local government area. The project will include 70 wind turbines and associated access tracks and electrical infrastructure feeding into the main electricity grid.

The project is currently being assessed by the Australian Government in accordance with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act; Cwlth). While the project has been designed to avoid and mitigate impacts on the environment, unavoidable significant residual impacts on matters of national environmental significance remain, namely five threatened species:

- northern quoll (*Dasyurus hallucatus*)
- spectacled flying-fox (*Pteropus conspicillatus*)
- bare-rumped sheath-tail bat (*Saccolaimus saccolaimus nudiclunatus*)
- *Grevillea glosseia*
- *Homoranthus porteri*.

To compensate for these unavoidable impacts, RAC has committed to providing an offset in accordance with the EPBC Act Environmental Offsets Policy. A potential offset for the project has been identified on six contiguous lots located adjacent to the project area. The offset area is mapped with the same vegetation communities and is contiguous with vegetation in the project area. It is expected that due to its close proximity to the project area it also contains similar flora and fauna habitat values. The proposed offset includes the:

- protection of up to 583 ha of native remnant vegetation through the application of a statutory covenant under the *Land Title Act 1994*
- adaptive management of up to 583 ha of native remnant vegetation including weed control, pest animal control and fire management
- translocation of *Grevillea glosseia* and *Homoranthus porteri* individuals directly impacted by the project
- ongoing management of the translocated species
- implementation of a monitoring program to determine the success of management actions and inform adaptive management.

The suitability of the offset area in acquitting the project's offset requirements has been assessed using the EPBC Act Offsets Assessment Guide (the offsets assessment guide). The offsets assessment guide has been developed to give effect to the requirements of the EPBC Act Environmental Offsets Policy and utilises a balance sheet approach to estimate impacts and offsets for threatened species and ecological communities.

By applying conservative assumptions to populate the offsets assessment guide for the five threatened species listed above, CO2 Australia has determined that there is sufficient potential for RAC to configure a compliant offset on the identified offset property (**Table ES1**). While this assessment is preliminary in nature, the values generated from the offsets assessment guide indicate that the proposed offset is suitable to acquit the offset requirements of the project and that the percentage of impact offset is over 100% for all values.

The final configuration of the offset area will be determined following ecological surveys, the results of which will inform the final offsets assessment guide scores. The offset area provides for the long term protection of habitat for the five threatened species and through the implementation of adaptive management practices the quality of the habitat will be improved and maintained over time.

**Table ES1: Offsets assessment guide results**

OFFSETS ASSESSMENT GUIDE PARAMETER	MNES				
	northern quoll	spectacled flying-fox	bare-rumped sheathtail bat	<i>Grevillea glossadenia</i>	<i>Homoranthus porteri</i>
Size of impact area:	57.7 ha	57.7 ha	57.7 ha	10.2 ha	5.1 ha
Quality of impact area:	8	3	7	7	7
Start quality of offset area:	8	3	7	7	7
Future quality with offset:	9	4	8	8	8
Future quality without offset:	6	3	6	6	7
Confidence in results:	50%	70%	70%	70%	50%
Risk of loss with offset:	2%	2%	2%	2%	2%
Risk of loss without offset:	5%	5%	5%	5%	5%
Confidence in results:	70%	70%	70%	70%	70%
Time over which loss is averted:	20 years	20 years	20 years	20 years	20 years
Time until ecological benefit:	5 years	Immediate	Immediate	5 years	5 years
Minimum offset area:	315 <sup>1</sup> ha	213 ha	300 ha	50 ha	57 ha
Minimum % of impact offset:	100%	100%	100%	100%	100%
Maximum offset area:	347 <sup>1</sup> ha	360 ha	391 ha	167 ha	117 ha
Maximum % of impact offset:	112%	155 %	133%	346%	207%

<sup>1</sup> Includes denning habitat only; however, 236 ha of potential foraging habitat is also available within the proposed offset area.

# 1. INTRODUCTION

## 1.1. BACKGROUND

RATCH-Australia Corporation Limited (RAC) proposes to develop the Mount Emerald Wind Farm (the project). The project (Lot 7 SP235244) is located in the Tablelands Regional Council local government area, approximately 50 km south-west of Cairns in North Queensland (**Figure 1**). The project will include 70 wind turbines and associated access tracks and electrical infrastructure feeding into the main electricity grid (Chalumbin-Woree transmission line). Each tower will be approximately 80 – 90 m high with approximately 50 m blades, utilising 3 MW machines.

The project is currently being assessed by the Australian Government in accordance with the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). While the project has been designed to avoid and mitigate impacts on environmental values, unavoidable impacts on matters of national environmental significance (MNES) remain. To compensate for these unavoidable impacts, RAC is committed to delivering offsets in accordance with the EPBC Act Environmental Offsets Policy October 2012 (the EPBC Act offsets policy). RAC has prepared an Offset Plan (CO2 Australia, 2013), which outlines the project's offset requirements under the EPBC Act offsets policy and identifies a potential direct, land-based offset area located adjacent to the project area. The proposed offset includes the:

- protection of up to 583 ha of native remnant vegetation through the application of a statutory covenant under the *Land Title Act 1994*
- adaptive management of up to 583 ha of native remnant vegetation including weed control, pest animal management and fire management
- translocation of *Grevillea glossadenia* and *Homoranthus porteri* individuals directly impacted by the project
- ongoing management of the translocated species
- implementation of a monitoring program to determine the success of management actions and inform adaptive management.

## 1.2. REPORT PURPOSE

The suitability of the offset area is subject to an assessment against the EPBC Act Offsets Assessment Guide (the offsets assessment guide). The offsets assessment guide has been developed to give effect to the requirements of the EPBC Act offsets policy and utilises a balance sheet approach to assess the appropriateness of offsets to compensate for impacts on threatened species and ecological communities. A preliminary assessment of the area against the offsets assessment guide has been undertaken prior to ground-truthing of the offset site. This report presents the results of the preliminary assessment and includes:

- an overview of the proposed offset area
- methods of assessment
- scores reflecting quality and risk in relation to both the impact and proposed offset areas
- justification and supporting documentation for the scores used in this guide
- the results of the offsets assessment guide for each impacted MNES.





Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Ratch/Australia Corporation - Mount Emerald Wind Farm

LOCATION DIAGRAM

**Figure 1:  
Overview Map**

DATA SOURCE:  
The following datasets are © State of Qld 2013:  
- Cadastral Data (2011)

 Offset area

DATE	AUTHOR	REQUESTED BY
24-02-2014	RF	LW

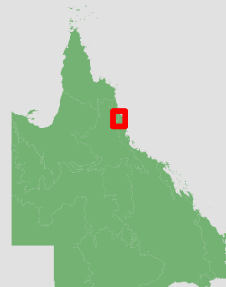
CO<sub>2</sub>

0 5 10 15

Kilometres

1:500,000

(A4) GCS GDA 1994



## 2. PROPOSED OFFSET AREA

RAC proposes to acquit the project's offset requirements by securing an offset area on six contiguous lots (based on the Digital Cadastral Database, current as of 11 August 2013) located adjacent to the project area (**Figure 2**; 7SP198648, 40SP258906, 21SP210202, 22SP210202, 23SP258905, 42SP258905). The potential offset area is approximately 583.49 ha in size and is located in the Tablelands Regional Council local government area. The land tenure is freehold and the property is zoned as general rural. The offset area fringes the southern boundary of the project area and provides connectivity to the Herberton Range State Forest, Baldy Mountain Forest Reserve and the Herberton Range National Park via the Herberton range (Queensland Government, 2013).

The offset area is characterised by high elevation ridges and valleys composed of remnant vegetation communities. The Queensland Government's regional ecosystem mapping has been assessed to identify the vegetation communities present within the offset area and the types of habitat for MNES that may be present. The majority of the remnant vegetation communities are listed as 'least concern' under the *Vegetation Management Act 1999* (VM Act; Qld); however approximately 159 ha of 'of concern' montane heath community (RE 7.12.57) is mapped within the offset area (**Figure 3**). A review of the EPBC Act Protected Matters Search Tool database indicates that the northern quoll, spectacled flying-fox, *Grevillea glossadenia* and *Homoranthus porteri* and/or their habitat are likely to occur in the offset area. The Atlas of Living Australia has known records within the offset area of the *Grevillea glossadenia* and *Homoranthus porteri*. In addition, a northern quoll was detected in an infrared camera trap near the northern boundary of the offset area during flora and fauna surveys (RPS, 2013).

The offset area is mapped with the same vegetation communities and is contiguous with vegetation in the project area. It is expected that due to its close proximity to the project area it also contains similar flora and fauna habitat values. To assist in the preparation of this preliminary assessment, the results of the survey efforts undertaken in the project area have been used to assess the habitat value of the offset area for the impacted MNES (**Table 1**). The specific method used to calculate the area of potential habitat present in the offset area for each impacted MNES is detailed in **Sections 2.1 to 2.5**.

### 2.1. NORTHERN QUOLL OFFSET AVAILABILITY

The maximum impact of the project on habitat for the northern quoll is 57.7 ha. The impacted area is considered to contain a mix of denning and foraging habitat (RPS, 2013). However, for the purpose of undertaking a conservative approach to offset assessment it has been assumed that all of the impacted habitat is denning habitat. Denning habitat on the project site consists of suitable fallen and standing (live or dead) hollow eucalypts and rocky outcrops along ridge tops and ridgelines.

As the offset area is yet to be ground-truthed a desktop GIS assessment was undertaken to determine the extent of northern quoll habitat within the offset area. Analysis of satellite imagery was used to divide the potential northern quoll habitat area into denning and foraging habitat types. Rocky areas along ridge tops and ridge lines were considered as denning habitat, while the steep slopes, gullies and low flats were considered as suitable foraging habitat. Based on this analysis the proposed offset area is estimated to contain 347 ha of denning habitat and 236 ha of foraging habitat for the northern quoll (**Figure 4**).

### 2.2. SPECTACLED FLYING-FOX OFFSET AVAILABILITY

The maximum impact of the project on habitat for the spectacled flying fox is 57.7 ha and includes foraging habitat only (RPS, 2013). Foraging habitat for the spectacled flying-fox in the project area consists of eucalyptus woodlands. The availability of spectacled flying-fox habitat within the offset area was calculated based on a desktop assessment and the



presence of regional ecosystems 9.12.4c, 9.12.2, 9.12.7a, 7.12.34, all of which contain eucalyptus forests and are considered suitable foraging habitat for the species. Regional ecosystem 7.12.7c (Simple to complex microphyll to notophyll vine forest) and regional ecosystem 7.12.57 (Shrubland and low woodland mosaic with *Syncarpia glomulifera*, *Corymbia abergiana*, *Eucalyptus portuensis*, *Allocasuarina littoralis* and *Xanthorrhoea johnsonii* on uplands and highlands on granite) were also included in the offset area calculation as they are considered suitable spectacled flying-fox foraging habitat. Based on an analysis of these regional ecosystems there is estimated to be 360 ha of potential foraging habitat for the spectacled flying-fox within the offset area (**Figure 5**).

### 2.3. BARE-RUMPED SHEATHTAIL BAT OFFSET AVAILABILITY

The project will impact on a maximum of 57.7 ha of potential roosting habitat for the bare-rumped sheath-tailed bat (RPS, 2013), which consists of eucalypt woodlands with microhabitat features such as hollow bearing trees. The availability of bare-rumped sheath-tail bat roosting habitat within the offset area was calculated based on the presence of the following regional ecosystems:

- 9.12.2, 9.12.30a, 7.12.34 – eucalypt forests
- 9.12.4c, 9.12.7a – open woodlands
- 9.12.20 – low woodlands containing eucalypts.

Based on an analysis of these regional ecosystems there is estimated to be 391 ha of potential roosting habitat for the bare-rumped sheath-tail bat within the offset area (**Figure 6**).

### 2.4. GREVILLEA GLOSSADENIA OFFSET AVAILABILITY

The project will impact on 10.2 ha of potential habitat for *Grevillea glossadenia* (RPS, 2014, pers. comm., 1 May). The availability of habitat in the offset area was calculated based on the presence of the following regional ecosystems:

- 7.12.57
- 7.12.65k
- 7.12.30

Based on an analysis of these regional ecosystems there is estimated to be 167 ha of habitat for *Grevillea glossadenia* within the offset area (**Figure 7**).

### 2.5. HOMORANTHUS PORTERI OFFSET AVAILABILITY

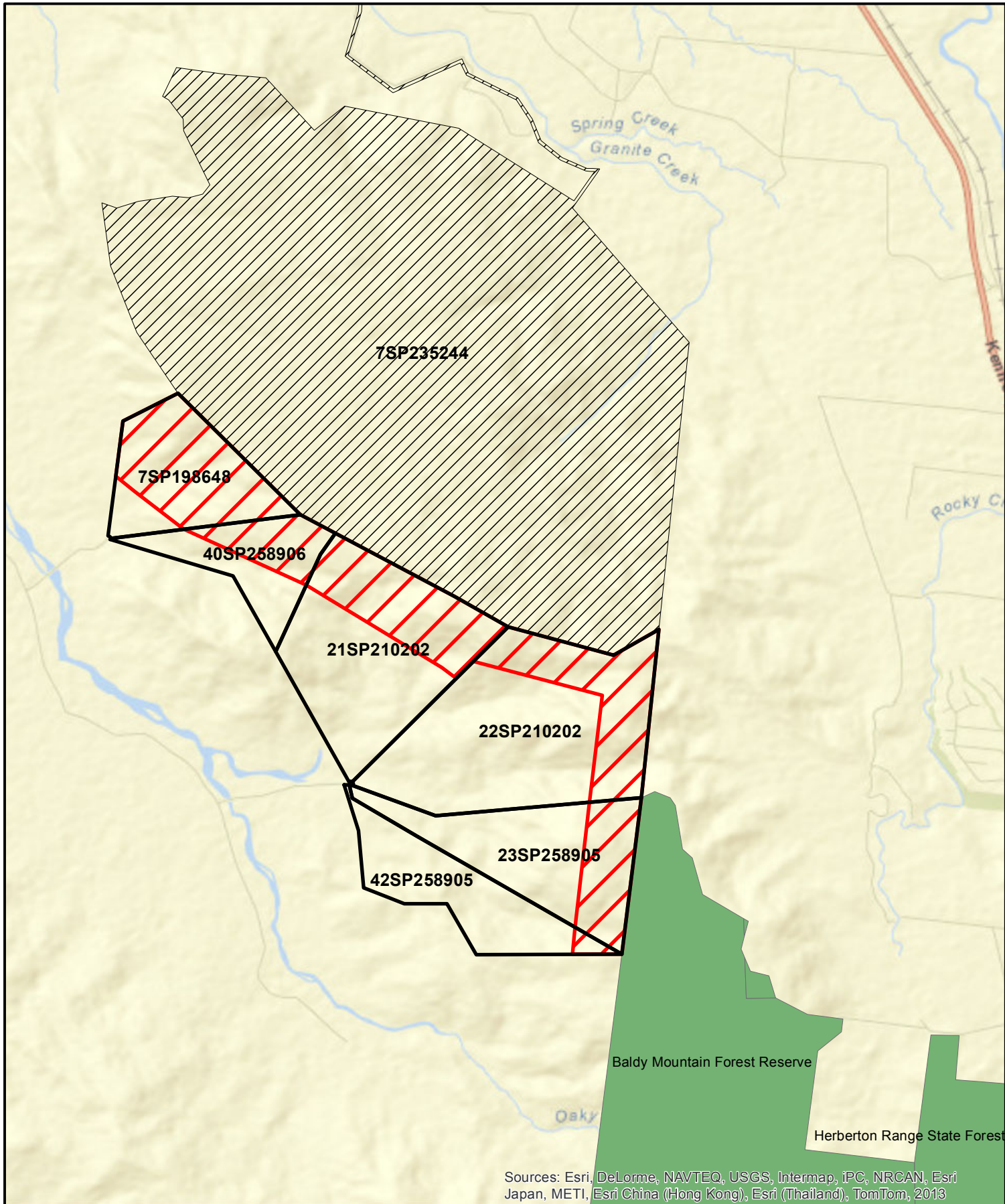
The project will impact on 5.1 ha of potential habitat for *Homoranthus porteri* (RPS, 2014, pers. comm., 1 May). *Homoranthus porteri* is generally found at altitudes above 900 m ASL. The availability of habitat in the offset area was therefore calculated based on the presence of the following regional ecosystems above 900 m ASL:

- 7.12.57
- 7.12.65k
- 7.12.30

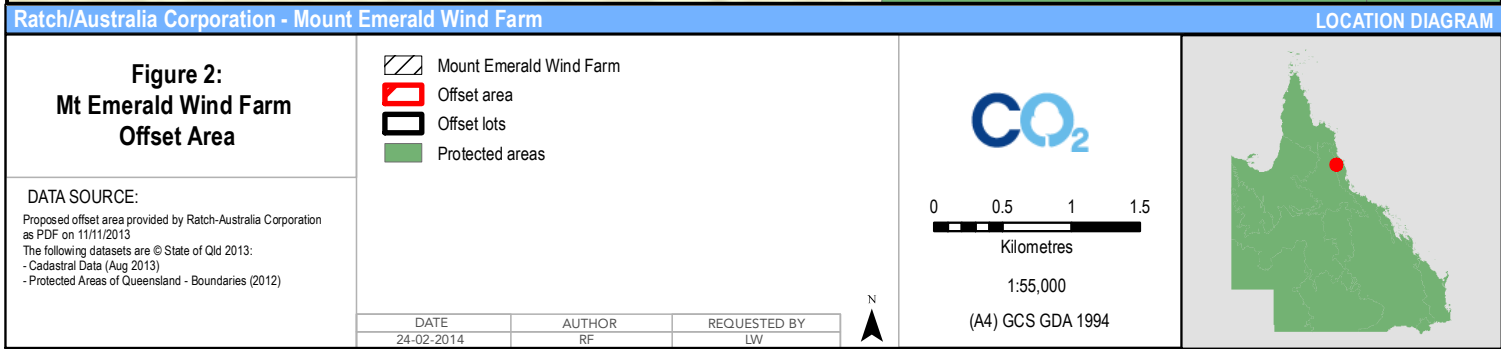
Based on an analysis of these regional ecosystems there is estimated to be 117 ha of habitat for *Homoranthus porteri* within the offset area (**Figure 7**).

**Table 1: Results of flora and fauna surveys of the project area**

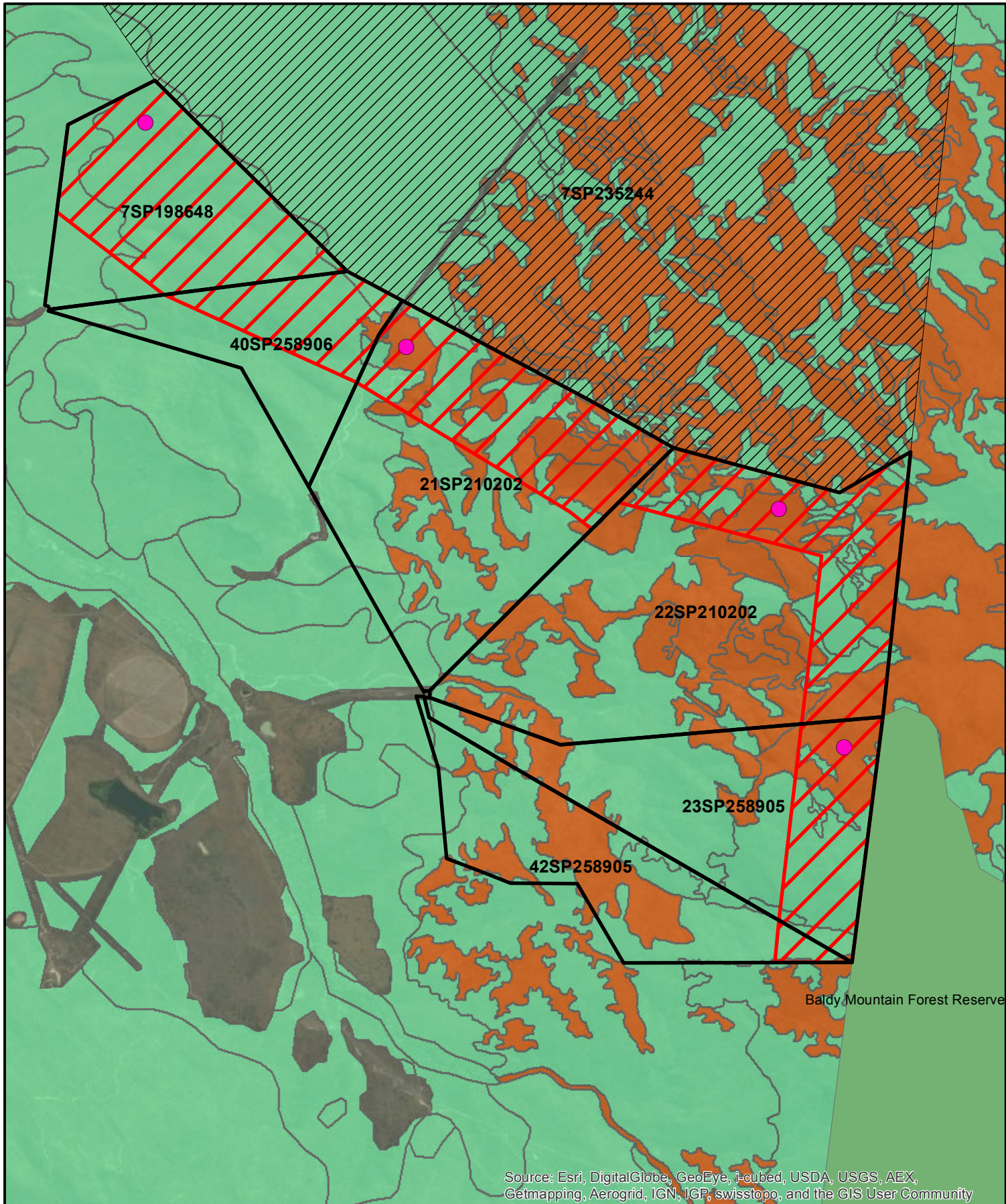
SPECIES	SURVEY EFFORT IN THE PROJECT AREA	RECORDS IN PROJECT AREA	HABITAT IN PROJECT AREA	RECORDS IN THE OFFSET AREA
northern quoll	<ul style="list-style-type: none"> <li>infrared camera traps at 131 sites (set for 7 consecutive nights at each site)</li> <li>detection dog survey over five days</li> <li>Elliott and wire cage trapping at 13 sites (up to 50 traps at each site)</li> <li>radio tracking of 26 captured individuals (including 5 females)</li> <li>opportunistic observations (scats and tracks)</li> </ul>	<ul style="list-style-type: none"> <li>images of the northern quoll were captured at 88 of the 131 infrared camera trap sites</li> <li>numerous scats belonging to the northern quoll were also identified throughout the project area</li> </ul>	<ul style="list-style-type: none"> <li>ridgetops and escarpments</li> <li>steep gullies and creeklines</li> <li>logs and rock piles (denning habitat)</li> </ul>	<ul style="list-style-type: none"> <li>one northern quoll detected on infrared camera trap in offset area during field surveys (northern boundary of offset area)</li> <li>several other northern quolls were recorded on infrared camera traps immediately to the north of the offset area</li> <li>several quolls that were radio tracked were recorded moving in the offset area (along the northern boundary)</li> <li>a denning site of a radio tracked female was recorded in the north of the offset area</li> </ul>
bare-rumped sheathtail bat	<ul style="list-style-type: none"> <li>ANABAT</li> <li>one harp net was deployed over four consecutive nights</li> <li>opportunistic observations</li> </ul>	<ul style="list-style-type: none"> <li>five calls potentially belonging to the bare-rumped sheathtail bat were recorded during the surveys</li> </ul>	<ul style="list-style-type: none"> <li>hollow bearing trees particularly along the lower reaches of Granite Creek</li> </ul>	<ul style="list-style-type: none"> <li>no known records in offset area</li> </ul>
spectacled flying-fox	<ul style="list-style-type: none"> <li>night vision goggles at 21 survey sites (one nights observation at each survey site)</li> <li>thermal imaging at three survey sites (one night at each site)</li> <li>opportunistic sightings</li> </ul>	<ul style="list-style-type: none"> <li>three individuals were observed during field surveys, two were flying overhead and one was foraging in <i>Melaleuca viridiflora</i> trees</li> </ul>	<ul style="list-style-type: none"> <li>foraging trees that are in flower (e.g. <i>Melaleuca viridiflora</i> during the time of the surveys)</li> </ul>	<ul style="list-style-type: none"> <li>no known records in offset area</li> </ul>
<i>Grevillea glossidenia</i>	<ul style="list-style-type: none"> <li>vegetation mapping and identification of potential habitat</li> <li>targeted searches</li> </ul>	<ul style="list-style-type: none"> <li>over 500 individuals recorded during surveys</li> </ul>	<ul style="list-style-type: none"> <li>ridges and rock pavements</li> <li>heath and sparse low woodland vegetation</li> </ul>	<ul style="list-style-type: none"> <li>records in the offset area from the Atlas of Living Australia</li> </ul>
<i>Homoranthus porteri</i>	<ul style="list-style-type: none"> <li>vegetation mapping and identification of potential habitat</li> <li>targeted searches</li> </ul>	<ul style="list-style-type: none"> <li>over 400 individuals recorded during surveys</li> </ul>	<ul style="list-style-type: none"> <li>ridgelines and rock pavements</li> <li>heath and sparse low woodland vegetation above 900 m ASL</li> </ul>	<ul style="list-style-type: none"> <li>records in the offset area from the Atlas of Living Australia</li> </ul>



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013







Ratch/Australia Corporation - Mount Emerald Wind Farm

LOCATION DIAGRAM

**Figure 3:**  
Regional ecosystems  
within the offset

**DATA SOURCE:**

Proposed offset area provided by Ratch-Australia Corporation as PDF on 11/11/2013  
The following datasets are © State of Qld 2013:  
- Cadastral Data (Aug 2013)  
- Protected Areas of Queensland - Boundaries (2012)  
- Vegetation Management Act Regional Ecosystems V6.1 (2011)

- Mount Emerald Wind Farm
- Offset area
- Offset lots
- Protected areas
- Photo monitoring points

**VMA Status**

- Containing Endangered regional ecosystems
- Containing Of Concern regional ecosystems
- Is a Least Concern regional ecosystem

DATE	AUTHOR	REQUESTED BY
24-02-2014	RF	LW

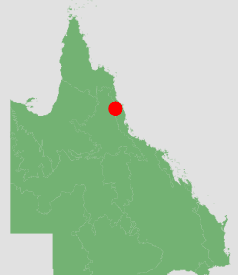
CO<sub>2</sub>

0 0.25 0.5 0.75 1

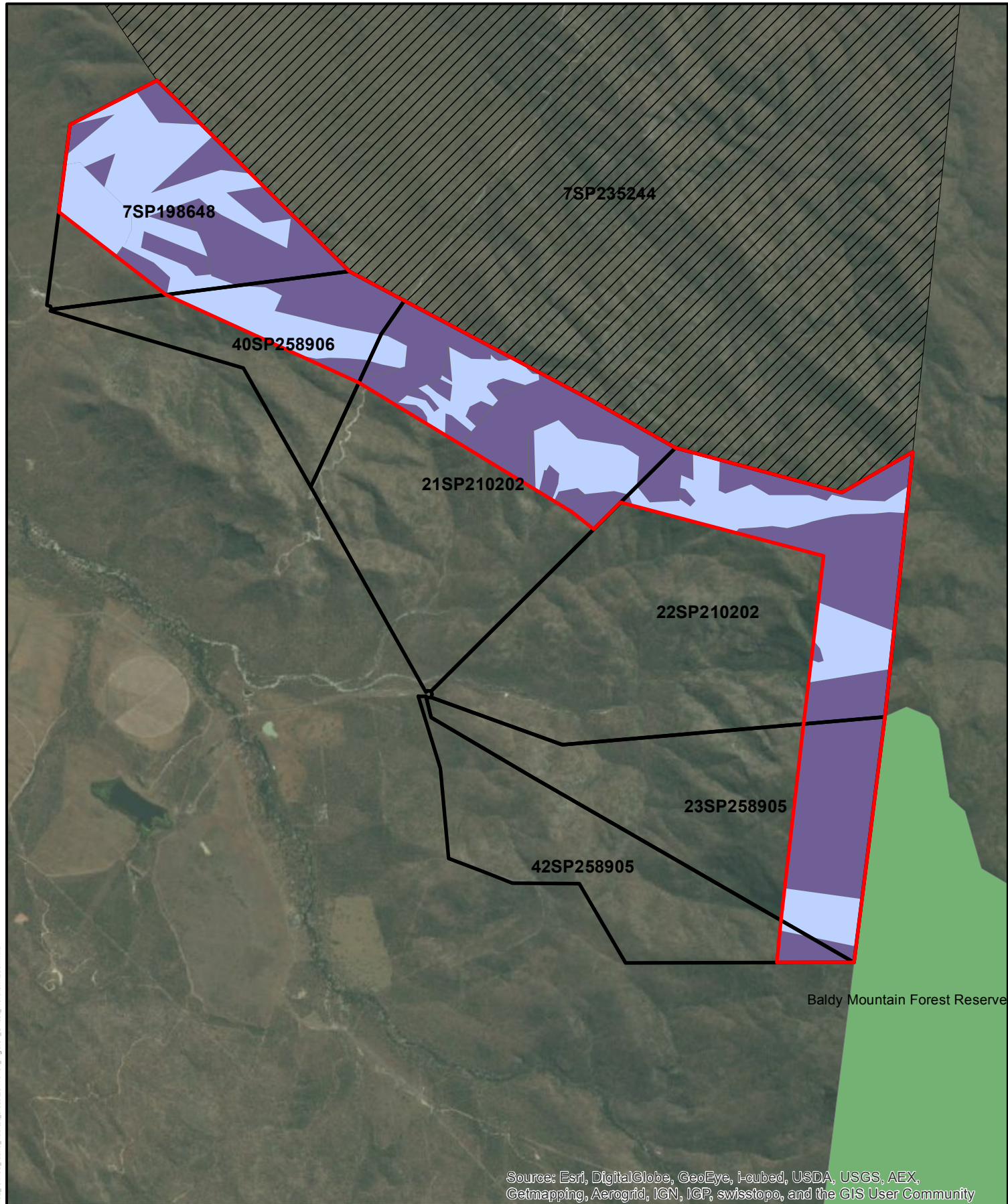
Kilometres

1:35,000

(A4) GCS GDA 1994







Ratch/Australia Corporation - Mount Emerald Wind Farm

LOCATION DIAGRAM

**Figure 4:**  
**Northern Quoll habitat**  
**within the offset**

**DATA SOURCE:**

Proposed offset area provided by Ratch-Australia Corporation as PDF on 11/11/2013  
The following datasets are © State of Qld 2013:  
- Cadastral Data (Aug 2013)  
- Protected Areas of Queensland - Boundaries (2012)  
- Vegetation Management Act Regional Ecosystems V6.1 (2011)  
- Habitat areas assessed by CO2 Australia (desktop analysis only)

- Mount Emerald Wind Farm
- Offset area
- Offset lots
- Protected areas

**Northern quoll habitat (approx 580 ha)**

- Denning habitat (approx 345 ha)
- Foraging and dispersal habitat (approx 235 ha)

DATE	AUTHOR	REQUESTED BY
04-04-2014	RF	LW

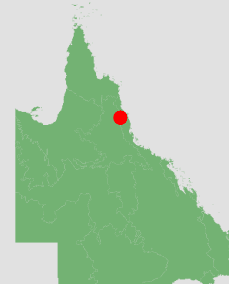


**CO<sub>2</sub>**

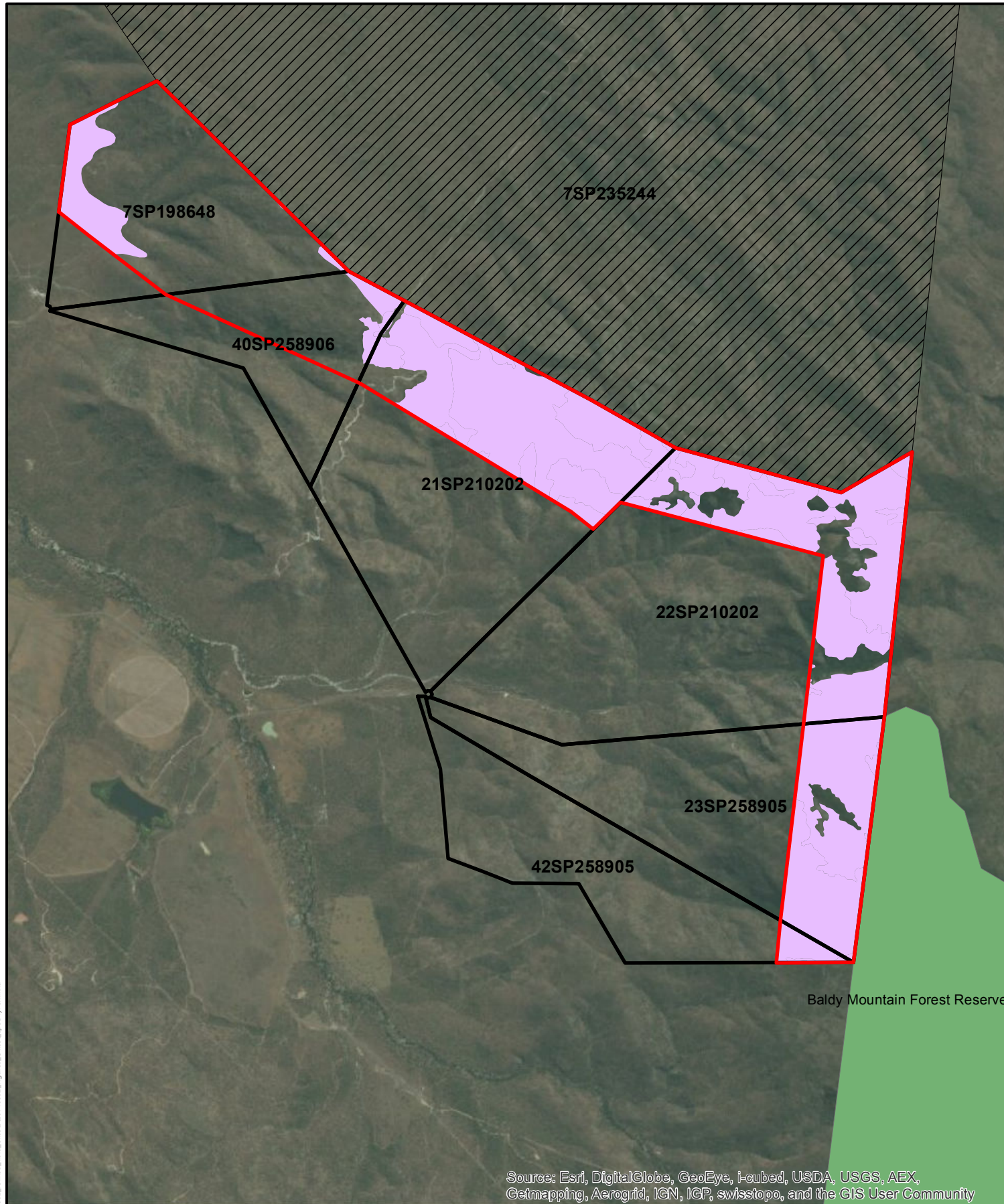
0 0.25 0.5 0.75 1  
Kilometres

1:35,000

(A4) GCS GDA 1994







Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

**Ratch/Australia Corporation - Mount Emerald Wind Farm** **LOCATION DIAGRAM**

**Figure 5:  
Spectacled flying-fox  
habitat within the offset**

**DATA SOURCE:**  
Proposed offset area provided by Ratch-Australia Corporation as PDF on 11/11/2013  
The following datasets are © State of Qld 2013:  
- Cadastral Data (Aug 2013)  
- Protected Areas of Queensland - Boundaries (2012)  
- Vegetation Management Act Regional Ecosystems V6.1 (2011)  
- Habitat areas assessed by CO2 Australia (desktop analysis only)

- Mount Emerald Wind Farm
- Offset area
- Offset lots
- Protected areas
- Spectacled flying-fox habitat (approx 360 ha)

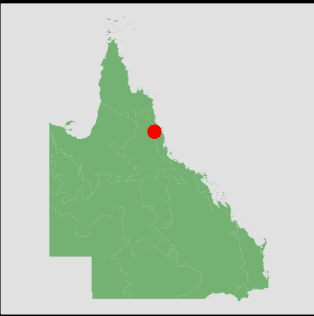
DATE	AUTHOR	REQUESTED BY
05-05-2014	RF	LW



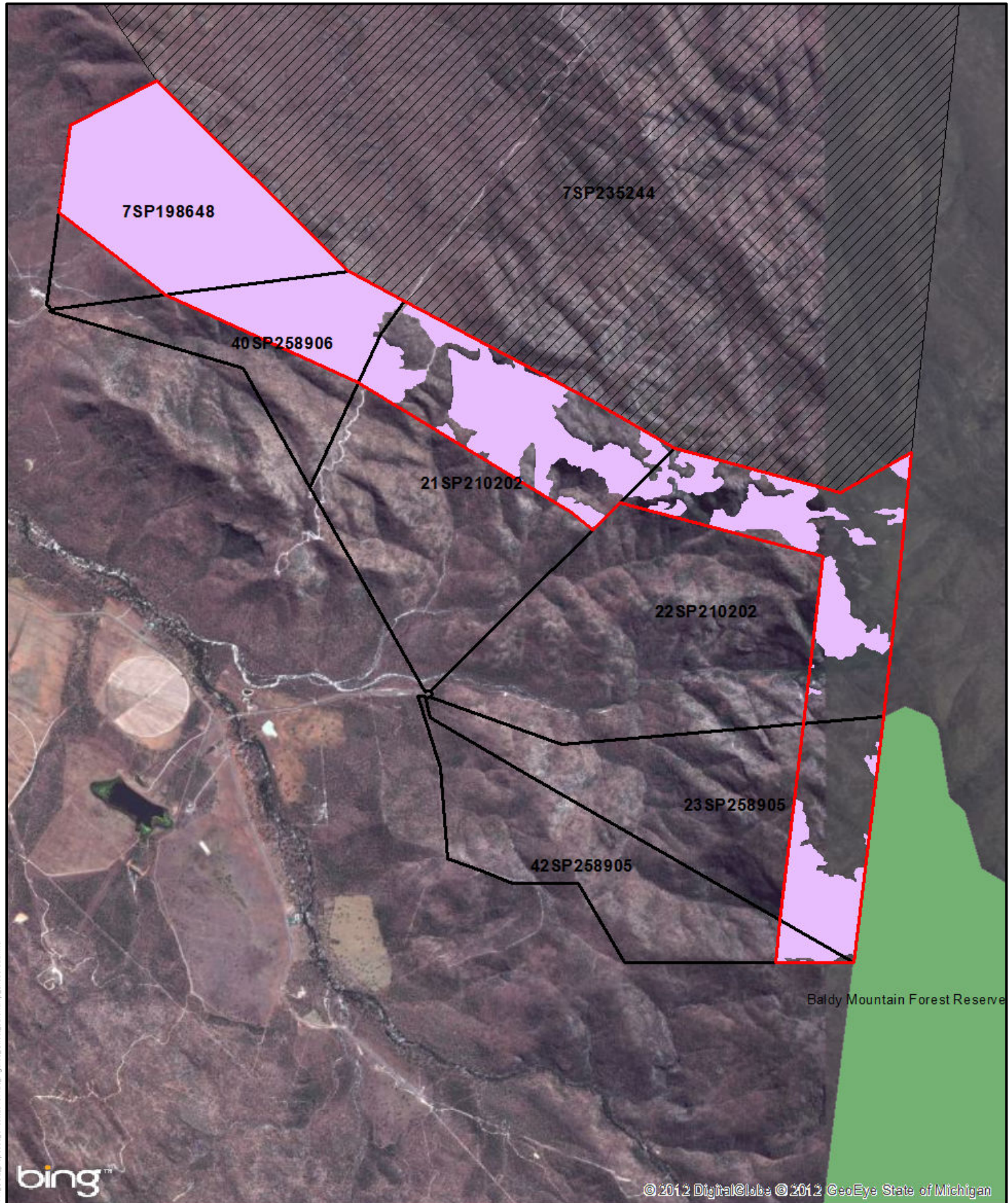
0 0.25 0.5 0.75 1  
Kilometres

1:35,000

(A4) GCS GDA 1994







Ratch/Australia Corporation - Mt Emerald Wind Farm

LOCATION DIAGRAM

**Figure 6:  
Potential bare-rumped  
shearwater bat habitat  
within the offset area**

**DATA SOURCE:**

Proposed offset area provided by Ratch-Australia Corporation as PDF on 11/11/2013  
The following datasets are © State of Qld 2013:  
- Cadastral Data (Aug 2013)  
- Protected Areas of Queensland - Boundaries (2012)  
- Vegetation Management Act Regional Ecosystems V6.1 (2011)  
- Habitat areas assessed by CO2 Australia (desktop analysis only)

- Bare-rumped shearwater bat habitat (approx 390 ha)
- Project area
- Offset area
- Offset lots
- Protected areas

DATE	AUTHOR	REQUESTED BY
25-11-2013	RF	LW

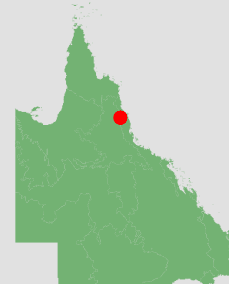


**CO<sub>2</sub>**

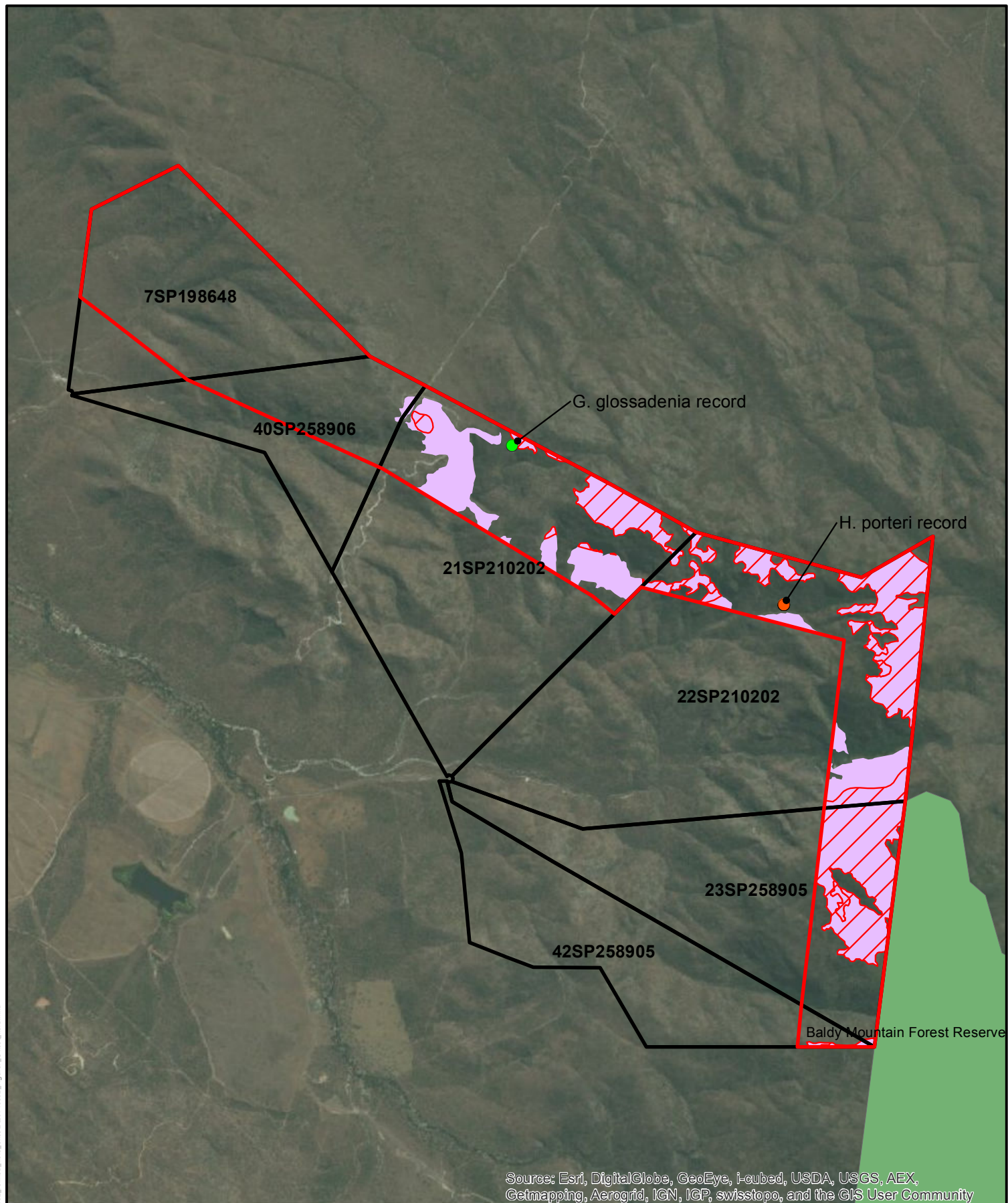
0 0.25 0.5 0.75 1  
Kilometres

1:35,000

(A4) GCS GDA 1994







**Figure 7:  
Flora habitat  
within the offset**

**DATA SOURCE:**

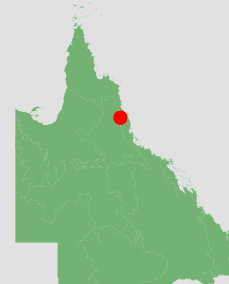
Proposed offset area provided by Ratch-Australia Corporation as PDF on 11/11/2013  
The following datasets are © State of Qld 2013:  
- Cadastral Data (Aug 2013)  
- Protected Areas of Queensland - Boundaries (2012)  
- Vegetation Management Act Regional Ecosystems V8 (2013)  
- Habitat areas assessed by CO2 Australia (desktop analysis only)  
- Species records from Atlas of Living Australia Records (May 2014)

- Offset area
- Offset lots
- Protected areas
- H. porteri habitat (approx 115 ha)
- G. glossadenia habitat (approx 165 ha)
- G. glossadenia record
- H. porteri record

DATE	AUTHOR	REQUESTED BY
05-05-2014	RF	LW



0 0.25 0.5 0.75 1  
Kilometres  
1:35,000 (A4) GCS GDA 1994



### 3. METHODS

The offsets assessment guide utilises a balance sheet approach to measure and compare values between the impact area and the offset area. The guide is used as a tool by Australian Government assessment officers to determine the suitability of the proposed offset. The offsets assessment guide requires the following values:

- the size of the impact area
- current quality of impact area
- start quality of the offset area
- future quality of the offset area with offsets
- future quality of the offset area without offsets
- risk of ecological loss of MNES-specific value with an offset
- risk of ecological loss of MNES-specific value without an offset
- the time over which ecological loss is averted
- the time until ecological benefit
- the confidence in results of the future quality of the offset area and the risk of loss with and without offsets.

Impact areas for each of the MNES were provided by RPS (RPS, 2013; RPS, 2014, pers. comm., 1 May). The quality of the impact and offset area (current, start and future) was determined by identifying the key ecological attributes of each MNES and comparing it to the values presented in **Table 2**. Key ecological attributes were summarised using the Species Profile and Threats database, recovery plans and relevant published literature. Habitat quality was ranked from one (poor) to 10 (high). Qualitative scores incorporate attributes that would affect habitat quality including, disturbance (e.g. introduced species, fire, current land use), connectivity, previous species records and the presence of microhabitat features necessary to each MNES assessed. The draft EIS prepared by RPS was reviewed for information about the current habitat quality of the impact area and offset area (where applicable).

**Table 2. Habitat quality scores for the project site and the offset area**

DESCRIPTION	QUALITATIVE SCORE	QUANTITATIVE SCORE
This area provides no habitat value for species.	Nil	0
The species or community is unlikely to occur or may occur in low densities as habitat features are lacking. Broad scale habitat may be present but micro habitat is lacking. The area may be exposed to disturbance effects limiting the sustainable presence or affecting the ecological quality of the species habitat or community.	Low	1-2
The species has the potential to occur based on the presence of some habitat features however the successful establishment of a population in the area is limited by disturbance. Essential habitat may be lacking for a stage within the species life cycle (if applicable).	Low-Moderate	3-4
This area supports, or is likely to support, the species/community due to the presence of macro and microhabitat features however, the site is exposed to disturbance effects that may hinder the success of the population or has poor connectivity.	Moderate	5-6
The species is known or likely to occur in this area based on the presence of suitable macro habitat as well as most micro features the species requires. This area is exposed to little disturbance.	Moderate-High	7-8
This area achieves the primary habitat values for the species including species-specific essential conditions and resources for all life cycle stages (if applicable). Habitat type is >50 ha and/or is ecologically connected with other suitable habitat. This area is exposed to little or negligible levels of disturbance.	High	9-10

## 4. NORTHERN QUOLL

### 4.1. SUMMARY OF RESULTS

The northern quoll (*Dasyurus hallucatus*) is listed as an endangered species under the EPBC Act. The project will impact on a maximum of 57.7 ha of habitat for the northern quoll, which consists of a mix of denning and foraging habitat (RPS, 2013). However, for the purpose of undertaking a conservative approach to offset assessment it has been assumed that the impacted habitat is denning habitat only. Denning habitat on the project site consists of suitable fallen and standing (live or dead) hollow eucalypts and rocky outcrops along ridge tops and ridgelines. As the offset area is yet to be ground-truthed a desktop GIS assessment was undertaken to determine the extent of northern quoll habitat within the offset area. Analysis of satellite imagery was used to divide the potential northern quoll habitat area into denning and foraging habitat types. Rocky areas on ridge lines were considered as denning habitat, while the steep slopes, gullies and low flats were considered as suitable foraging habitat. Based on this analysis the proposed offset area is estimated to contain 347 ha of denning habitat and 236 ha of foraging habitat for the northern quoll (**Figure 4**).

Using only the available denning habitat and by applying the offsets assessment guide, CO2 Australia has determined that there is sufficient potential for RAC to configure a compliant offset area on the identified offset property (**Table 3**). The actual extent and quality of the habitat within the offset area will require field verification and the final offset configuration will be determined based on the results of these surveys.

**Table 3: Summary of values and results for the northern quoll offset assessment**

Quality of impact area:	8	Risk of loss without offset:	5%
Quality of offset area:	8	Risk of loss with offset:	2%
Future quality without offset:	6	Confidence in result:	70%
Future quality with offset:	9	Time over which loss is averted (years):	20
Confidence in result:	50%	Time until ecological benefit (years):	5
Minimum offset area (ha):	315 <sup>2</sup> ha	Maximum offset area (ha):	347 <sup>2</sup> ha
% of impact offset	100%	% of impact offset	112%

### 4.2. CURRENT QUALITY OF IMPACT AREA

The northern quoll is distributed across northern Australia and occupies a variety of habitats including rocky areas, eucalypt forest and woodlands, rainforest, shrublands and sandy lowlands and beaches. Their habitat generally encompasses some type of rocky area, which they use for denning purposes, surrounded by vegetated habitats which they use for foraging and dispersal.

The northern quoll was found to be widely distributed across the project area and present in relatively high numbers (RPS, 2013). Northern quolls from different age groups were recorded during fauna surveys and the project area was

<sup>2</sup> Includes denning habitat only; however, 236 ha of potential foraging habitat is also available within the proposed offset area.

found to have high quality denning (i.e. exposed outcrops on rocky ridge tops and ridgelines) and foraging and dispersal (i.e. dense understory vegetation) habitat for the species.

Consequently, the project will result in the removal of approximately 57.7 ha of foraging and denning habitat for the northern quoll. The current quality of the habitat for the northern quoll in the project area is rated moderate to high (8).

### 4.3. START QUALITY OF OFFSET AREA

The offset area is mapped with the same vegetation communities, is contiguous with vegetation in the project area and provides connectivity to Baldy Mountain Forest Reserve. It is expected that due to its close proximity to the project area it also contains similar fauna habitat values and is similar in condition to the project area. A northern quoll was detected by an infrared camera trap near the northern boundary of the offset area (RPS, 2013) and it is expected that northern quoll utilise the offset area for denning and foraging purposes. The EPBC Act protected matters search tool database also indicates that northern quoll and/or their habitat area likely to occur in the offset area. A desktop assessment of regional ecosystem mapping indicates that the proposed offset area is likely to contain 347 ha of denning habitat and 236 ha of foraging habitat for the northern quoll. Based on an assessment of these factors, the current quality of habitat for the northern quoll in the offset area is rated as moderate to high (8).

### 4.4. FUTURE QUALITY OF OFFSET AREA WITHOUT OFFSET MANAGEMENT

Major threats to the northern quoll and its habitat include cane toad invasion, removal and fragmentation of habitat, inappropriate fire regimes, weeds and introduced predators (DoTE, 2014a). As cane toads are known to occur in the vicinity of the offset area (RPS, 2013) there is the potential for a decline of the population due to lethal toxic ingestion. Additionally, without the management afforded by offset protection, vegetation may be cleared and/or the area further developed. Weed encroachment may also reduce the establishment of native species and increase the fuel load with the potential to result in high intensity bush fires which would destroy microhabitat features for the species. The lack of feral predator control (specifically feral cats and dogs) may also lead to a steady decline in the northern quoll. Based on the factors described above, the future quality of the offset area without offset management is rated as moderate (6).

### 4.5. FUTURE QUALITY OF OFFSET AREA WITH OFFSET MANAGEMENT

The quality of habitat for the northern quoll will be improved through the establishment of the offset area. An Offset Area Management Plan (OAMP) will be developed which will detail land management actions to be implemented to improve habitat for the northern quoll. The management plan objectives will be developed in accordance with the draft National Recovery Plan for the Northern Quoll (Hill & Ward, 2010) and will aim to minimize the rate of decline of Northern Quoll in Australia. Management actions will include, but are not limited to:

- pest animal control
- weed control
- fire management.

Monitoring activities, including condition, presence or absence of species and monitoring of cane toad densities will also be undertaken as part of the implementation of the offset plan. Through the implementation of an adaptive management plan the future quality of habitat for the northern quoll in the offset area with offset management is rated as moderate to high (9).

### 4.6. CONFIDENCE IN RESULTS – FUTURE QUALITY

The management objectives detailed within the OAMP will target the threat abatement and recovery actions identified in the species recovery plan. The objectives of the OAMP will be based on published conservation recommendations and



best practice management. However, while most of the threats on the northern quoll and its habitat can be controlled there is significant difficulty in managing cane toads in areas where they already exist. Based on an assessment of these factors the level of certainty about the success of the offset area in improving the quality of habitat for the northern quoll is rated as 50%.

#### 4.7. RISK OF LOSS WITHOUT OFFSET

Far North Queensland is one of the fastest growing regions in Queensland and over the past 15 years has experienced continuous growth in resident population, visitation, economic activity and urban development. This trend is forecast to continue for at least the next 20 years with the population of the region set to increase by 100,000 people by 2029 (Queensland Government, 2011). This growth will result in increased urban, agricultural, infrastructure and transport development across the region.

The proposed offset area is located on six contiguous lots which are currently owned by four different landholders. The primary land use of the lots is described as vacant large house site and subdivided land. While the remnant vegetation in the offset area is protected by the VM Act, the *Sustainable Planning Act 2009* (Qld) and associated policies and codes, an application can made to the state government to clear remnant vegetation. It is possible that an application could be approved to clear remnant vegetation within the offset area for a number of activities including, but not limited to:

- residential activities
- service infrastructure (e.g. transmission lines)
- access roads.

However, given the location and topography of the proposed offset area, the risk that the habitat will be completely lost over the foreseeable future has been determined to be 5%. This accounts for the low risk that the vegetation in the offset area could be lost through future development activities.

#### 4.8. RISK OF LOSS WITH OFFSET

The offset area will be secured in perpetuity through a legally binding mechanism, such as a statutory covenant, registered under the *Land Title Act 1994* (Qld). The legally binding mechanism will be registered on the land title and will be binding on all current and future owners of the land. Land use within the offset area will be restricted in accordance with the legally binding mechanism and the OAMP. Therefore, the implementation of the legally binding mechanism will reduce the risk of loss of the offset area to 2%.

#### 4.9. CONFIDENCE IN RESULTS – RISK OF LOSS

The confidence in results in terms of the risk of loss is determined to be 70%. The legally binding mechanism will be registered on the land title and will remain in effect in perpetuity. The legally binding mechanism can only be removed by the relevant Queensland Government Minister with regard to a public interest.

#### 4.10. TIME OVER WHICH LOSS IS AVERTED

The offset area is proposed to be managed for a period of 20 years.

#### 4.11. TIME UNTIL ECOLOGICAL BENEFIT

By selecting offsets in areas where current habitat for the species already exists, the time lag in between the establishment of the offset area and the ecological benefit is reduced. The proposed offset area already provides suitable denning and foraging habitat for the northern quoll. The National Recovery Plan for the Northern Quoll (Hill and



Ward, 2010) aims to minimise the rate of decline of the species. Of the nine main objectives of the draft Plan, three objectives may practically apply on the offset area:

- reduce the impact of pastoral land management practices on northern quolls
- reduce the risk of northern quoll populations being impacted by disease
- halt declines in areas not yet or recently colonised by cane toads.

The delivery and management of targeted actions aimed at mediating threatening processes (e.g. feral predator control, cane toad management) is expected to have a measurable effect within five years.

## 5. SPECTACLED FLYING-FOX

### 5.1. SUMMARY OF RESULTS

The spectacled flying-fox (*Pteropus conspicillatus*) is listed as a vulnerable species under the EPBC Act. The project will impact on a maximum of 57.7 ha of foraging habitat for the spectacled flying-fox. The availability of spectacled flying-fox habitat within the offset area was calculated based on a desktop assessment and the presence of regional ecosystems 9.12.4c, 9.12.2, 9.12.7a, 7.12.34, all of which contain eucalyptus forests and are considered suitable foraging habitat for the species. Regional ecosystems 7.12.7c and 7.12.57 were also included in the offset area calculation as they are also considered to be suitable spectacled flying-fox foraging habitat. Based on an analysis of these regional ecosystems there is estimated to be 360 ha of potential foraging habitat for the spectacled flying-fox within the offset area (**Figure 5**).

By applying conservative assumptions to populate the offsets assessment guide, CO2 Australia has determined that there is sufficient potential for RAC to configure a compliant offset area on the identified offset property (**Table 4**). The actual extent and quality of the habitat within the offset area will require field verification and the final offset configuration will be determined based on the results of these surveys.

**Table 4: Summary of values and results for the spectacled flying-fox offset assessment**

Quality of impact area:	3	Risk of loss without offset:	5%
Quality of offset area:	3	Risk of loss with offset:	2%
Future quality without offset:	3	Confidence in result:	70%
Future quality with offset:	4	Time over which loss is averted (years):	20 years
Confidence in result:	70%	Time until ecological benefit (years):	Immediate
Minimum offset area (ha):	213 ha	Maximum offset area (ha):	360 ha
% of impact offset	100%	% of impact offset	155%

### 5.2. CURRENT QUALITY OF IMPACT AREA

The spectacled flying-fox inhabits tropical rainforest areas of north-eastern Queensland, with the largest population known from the Wet Tropics World Heritage Area between Townsville and Cooktown. The species feeds on fruit and blossom primarily in the canopy of a wide range of vegetation communities including tropical rainforests, eucalypt open forest and woodland, melaleuca swamps, mangroves, vegetation in urban environments and commercial fruit crops.

They may forage up to 50 to 100 km each night; however, their roosts are always found within 6 km of tropical rainforest (DoTE, 2014b).

The spectacled flying-fox was recorded during fauna surveys of the project area. No suitable roosting habitat for the spectacled flying-fox (i.e. rainforest) is present in the project area; however, it may sporadically forage in the project area during flowering and fruiting of Myrtaceous trees, including eucalypts (RPS, 2013). Consequently, the project will have a direct impact on 57.7 ha of potential foraging habitat for the spectacled flying-fox. This habitat is not considered to be critical to the survival of the species as foraging habitat for the spectacled flying-fox is widely available in the area surrounding the project (RPS, 2013). As such, the current quality of the project area for the spectacled flying-fox is rated as low-moderate (3).

### 5.3. START QUALITY OF OFFSET AREA

The offset area is mapped with the same vegetation communities, is contiguous with vegetation in the project area and provides connectivity to the Baldy Mountain Forest Reserve. It is expected that due to its close proximity to the project area it also contains similar fauna habitat values and is similar in condition to the project area. A review of the EPBC Act Protected Matters Search Tool database indicates that the spectacled flying-fox and/or its habitat are likely to occur in the offset area. Based on a desktop assessment of regional ecosystem mapping, the proposed offset area contains 360 ha of potential foraging habitat (i.e. Myrtaceous trees) for the spectacled flying-fox. No suitable roosting habitat (i.e. rainforest) for the spectacled flying-fox occurs on the offset area. Based on the proximity of the impact area to the offset area and the factors outlined above, the current quality of habitat for the spectacled flying-fox in the offset area is rated as low to moderate (3).

### 5.4. FUTURE QUALITY OF OFFSET AREA WITHOUT OFFSET MANAGEMENT

There is not anticipated to be a decline in quality of spectacled flying-fox habitat without offset management, primarily as the habitat is currently considered to be of low quality, as is the quality of habitat in the impact area. Therefore, the future quality of the offset area without offset management is rated as low to moderate (3).

### 5.5. FUTURE QUALITY OF OFFSET AREA WITH OFFSET MANAGEMENT

The quality of habitat for the spectacled flying-fox will be improved through active management. An OAMP will be developed, in accordance with the National Recovery Plan for the species (DERM, 2010), which will detail management actions to be implemented to improve habitat in the offset area for the spectacled flying-fox. Therefore, the future quality of habitat for the spectacled flying-fox in the offset area with offset management is rated as moderate (4).

### 5.6. CONFIDENCE IN RESULTS – FUTURE QUALITY

The level of certainty about the success of the offset area in improving the quality of habitat for the spectacled flying-fox is rated as 70%. The management objectives detailed within the OAMP will target the threat abatement and recovery actions identified in the species recovery plan. The objectives of the OAMP will be based on published conservation recommendations and best practice management.

### 5.7. RISK OF LOSS WITHOUT OFFSET MANAGEMENT

Far North Queensland is one of the fastest growing regions in Queensland and over the past 15 years has experienced continuous growth in resident population, visitation, economic activity and urban development. This trend is forecast to continue for at least the next 20 years with the population of the region set to increase by 100,000 people by 2029

(Queensland Government, 2011). This growth will result in increased urban, agricultural, infrastructure and transport development across the region.

The proposed offset area is located on six contiguous lots which are currently owned by four different landholders. The primary land use of the lots is described as vacant large house site and subdivided land. While the remnant vegetation in the offset area is protected by the VM Act, the *Sustainable Planning Act 2009* (Qld) and associated policies and codes, an application can be made to the state government to clear remnant vegetation. It is possible that an application could be approved to clear remnant vegetation within the offset area for a number of activities including, but not limited to:

- residential activities
- service infrastructure (e.g. transmission lines)
- access roads.

However, given the location and topography of the proposed offset area, the risk that the habitat will be completely lost over the foreseeable future has been determined to be 5%. This accounts for the low risk that the vegetation in the offset area could be lost through future development activities.

## 5.8. RISK OF LOSS WITH OFFSET

The offset area will be secured in perpetuity through a legally binding mechanism, such as a statutory covenant, registered under the *Land Title Act 1994* (Qld). The legally binding mechanism will be registered on the land title and will be binding on all current and future owners of the land. Land use within the offset area will be restricted in accordance with the legally binding mechanism and the OAMP. Therefore, the implementation of the legally binding mechanism will reduce the risk of loss of the offset area to 2%.

## 5.9. CONFIDENCE IN RESULTS – RISK OF LOSS

The confidence in results in terms of the risk of loss is determined to be 70%. The legally binding mechanism will be registered on the land title and will remain in effect in perpetuity. The legally binding mechanism can only be removed by the relevant Queensland Government Minister with regard to a public interest.

## 5.10. TIME OVER WHICH LOSS IS AVERTED

The offset area is proposed to be actively managed for a period of 20 years.

## 5.11. TIME UNTIL ECOLOGICAL BENEFIT

By selecting offsets in areas where current habitat for the species already exists, the time lag in between the acquisition of the offset area and the ecological benefit is reduced. The proposed offset area is likely to provide suitable foraging habitat for the spectacled flying-fox. Therefore, the ecological benefit of the offset for the spectacled flying-fox will be immediate. Furthermore, the establishment of the offset area is consistent with second recovery objective in the National Recovery Plan for the spectacled flying-fox which specifies that native foraging habitat critical to the survival of the species be identified and protected (DERM, 2010).

## 6. BARE-RUMPED SHEATHTAIL BAT

### 6.1. SUMMARY OF RESULTS

The bare-rumped sheathtail bat (*Saccolaimus saccolaimus nudiclunatus*) is listed as a critically endangered species under the EPBC Act. The project will impact on a maximum of 57.7 ha of potential roosting habitat for the bare-rumped sheathtailed bat. The availability of bare-rumped sheathtail bat roosting habitat within the offset area was calculated based on the presence of the following regional ecosystems:

- 9.12.2, 9.12.30a, 7.12.34 – eucalypt forests
- 9.12.4c, 9.12.7a – open woodlands
- 9.12.20 – low woodlands containing eucalypts.

Based on an analysis of these regional ecosystems there is estimated to be 391ha of potential roosting habitat for the bare-rumped sheathtail bat within the offset area (**Figure 6**). By applying conservative assumptions to populate the offsets assessment guide, CO2 Australia has determined that there is sufficient potential for RAC to configure a compliant offset area on the identified offset property (**Table 5**). The actual extent and quality of the habitat within the offset area will require field verification and the final offset configuration will be determined based on the results of these surveys.

**Table 5: Summary of values and results for the bare-rumped sheathtail bat offset assessment**

Quality of impact area:	7	Risk of loss without offset:	5%
Quality of offset area:	7	Risk of loss with offset:	2%
Future quality without offset:	6	Confidence in result:	70%
Future quality with offset:	8	Time over which loss is averted (years):	20 years
Confidence in result:	70%	Time until ecological benefit (years):	Immediate
Minimum offset area (ha):	300 ha	Maximum offset area (ha):	391ha
% of impact offset	100%	% of impact offset	133.25%

### 6.2. CURRENT QUALITY OF IMPACT AREA

The bare-rumped sheathtail bat inhabits tropical woodland and tall open forests in coastal lowlands of north-eastern Queensland and the Northern Territory. The species has a fast, direct flight and forages for aerial insects over woodland/forest canopy (Churchill, 1998). It has been recorded roosting in deep hollows in the trunks of a number of Eucalyptus species, including *E. miniata*, *E. tetradonta* and *E. platyphylla* (Churchill, 1998).

The project area will impact on approximately 57.7 ha of potential roosting habitat for the bare-rumped sheathtail bat (RPS, 2013). A number of suitable roost trees (*E. platyphylla*) were observed along the lower reaches of Granite Creek and calls potentially belonging to the bare-rumped sheathtail bat were recorded during fauna surveys of the project area (RPS, 2013). Therefore, the current quality of habitat for the bare-rumped sheathtail bat in the project area is rated as moderate to high (7).

### 6.3. START QUALITY OF OFFSET AREA

The offset area is mapped with the same vegetation communities, is contiguous with vegetation in the project area and provides connectivity to the Baldy Mountain Forest Reserve. It is expected that due to its close proximity to the project area it also contains similar fauna habitat values and is similar in condition to the project area. Based on a desktop assessment of regional ecosystem mapping, the proposed offset area is estimated to contain 391 ha of potential roosting habitat for the bare-rumped sheath-tail bat. The current quality of habitat for the bare-rumped sheath-tail bat in the offset area is rated as moderate to high (7).

### 6.4. FUTURE QUALITY OF OFFSET AREA WITHOUT OFFSET MANAGEMENT

Without active management there may be a decline in the quality of habitat for the bare-rumped sheath-tail bat within the offset area. Threats to the species that may impact on quality of habitat include vegetation clearance, changes in vegetation structure through altered fire regimes and invasion of exotic weeds (DoTE, 2014c). Potential weed encroachment can reduce the establishment of native species and increase the fuel load with the potential to result in high intensity bush fires which would destroy microhabitat features. Therefore, the future quality of habitat for the bare-rumped sheath-tail bat in the offset area without offset management is rated as moderate (6).

### 6.5. FUTURE QUALITY OF OFFSET AREA WITH OFFSET MANAGEMENT

The quality of habitat for the bare-rumped sheath-tail bat would be improved through the establishment of the offset area. An OAMP will be developed which will detail land management actions to be implemented to improve habitat in the offset area for the bare-rumped sheath-tail bat. These management actions will include, but are not limited to, weed control and fire management. Therefore, the future quality of habitat for the bare-rumped sheath-tail bat in the offset area with offset management is rated as moderate to high (8).

### 6.6. CONFIDENCE IN RESULTS – FUTURE QUALITY

The level of certainty about the success of the offset area in improving the quality of habitat for the bare-rumped sheath-tail bat is rated as 70%. The management objectives detailed within the OAMP will target the threat abatement and recovery actions identified in the species recovery plan. The objectives of the OAMP will be based on published conservation recommendations and best practice management.

### 6.7. RISK OF LOSS WITHOUT OFFSET

Far North Queensland is one of the fastest growing regions in Queensland and over the past 15 years has experienced continuous growth in resident population, visitation, economic activity and urban development. This trend is forecast to continue for at least the next 20 years with the population of the region set to increase by 100,000 people by 2029 (Queensland Government, 2011). This growth will result in increased urban, agricultural, infrastructure and transport development across the region.

The proposed offset area is located on six contiguous lots which are currently owned by four different landholders. The primary land use of the lots is described as vacant large house site and subdivided land. While the remnant vegetation in the offset area is protected by the VM Act, the *Sustainable Planning Act 2009* (Qld) and associated policies and codes, an application can be made to the state government to clear remnant vegetation. It is possible that an application could be approved to clear remnant vegetation within the offset area for a number of activities including, but not limited to:

- residential activities
- service infrastructure (e.g. transmission lines)

- access roads.

However, given the location and topography of the proposed offset area, the risk that the habitat will be completely lost over the foreseeable future has been determined to be 5%. This accounts for the low risk that the vegetation in the offset area could be lost through future development activities.

## 6.8. RISK OF LOSS WITH OFFSET

The offset area will be secured in perpetuity through a legally binding mechanism, such as a statutory covenant, registered under the *Land Title Act 1994* (Qld). The legally binding mechanism will be registered on the land title and will be binding on all current and future owners of the land. Land use within the offset area will be restricted in accordance with the legally binding mechanism and the OAMP. Therefore, the implementation of the legally binding mechanism will reduce the risk of loss of the offset area to 2%.

## 6.9. CONFIDENCE IN RESULTS – RISK OF LOSS

The confidence in results in terms of the risk of loss is determined to be 70%. The legally binding mechanism will be registered on the land title and will remain in effect in perpetuity. The legally binding mechanism can only be removed by the relevant Queensland Government Minister with regard to a public interest.

## 6.10. TIME OVER WHICH LOSS IS AVERTED

The offset area is proposed to be actively managed for a period of 20 years.

## 6.11. TIME UNTIL ECOLOGICAL BENEFIT

By selecting offsets in areas where current habitat for the species already exists, the time lag in between the establishment of the offset area and the ecological benefit is reduced. The proposed offset area already provides suitable foraging and roosting habitat for the bare-rumped sheath-tail bat. Therefore, the ecological benefit of the offset for the bare-rumped sheath-tail bat will be immediate. Furthermore, the establishment of the offset area is consistent with the second recovery objective in the National recovery plan for the bare-rumped sheath-tail bat which specifies the protection of roosting sites for the species outside of reserved lands (Schulz & Thomson, 2007).

# 7. GREVILLEA GLOSSADENIA

## 7.1. SUMMARY OF RESULTS

*Grevillea glossadenia* is listed as vulnerable under the EPBC Act. The project will impact on 10.2 ha of habitat for the species (RPS, 2014, pers. comm., 1 May) and will result in the removal of approximately 300-350 individuals (RPS, 2013). Based on a desktop assessment there is approximately 167 ha of habitat available for *Grevillea glossadenia* within the proposed offset area (**Figure 7**). By applying conservative assumptions to populate the offsets assessment guide, CO2 Australia has determined that there is sufficient potential for RAC to configure a compliant offset area on the identified offset property (**Table 6**). The actual extent and quality of the habitat within the offset area will require field verification and the final offset configuration will be determined based on the results of these surveys.



**Table 6: Summary of values and results for *Grevillea glossadenia* offset assessment**

Quality of impact area:	7	Risk of loss without offset:	5%
Quality of offset area:	7	Risk of loss with offset:	2%
Future quality without offset:	6	Confidence in result:	70%
Future quality with offset:	8	Time over which loss is averted (years):	20 years
Confidence in result:	70%	Time until ecological benefit (years):	5 years
Minimum offset area (ha):	50 ha	Maximum offset area (ha):	167 ha
% of impact offset	100%	% of impact offset	346%

## 7.2. CURRENT QUALITY OF IMPACT AREA

*Grevillea glossadenia* occurs in north-east Queensland and grows in eucalypt woodland or low open forest, in shallow skeletal granitic soils. The species prefers an exposed, fully-lit, free-draining habitat and is frequently encountered as a regenerating species in disturbed areas (e.g. along road verges).

*Grevillea glossadenia* has been recorded in a number of locations in the project area, primarily along ridges and on the edges of existing tracks. The species is associated with REs 7.12.57, 7.12.65k and 7.12.30 and over 500 individuals have been recorded in the project area. Approximately 300-350 individuals and 10.2 ha of habitat for the species will be directly impacted by the project.

The current quality of habitat for the *Grevillea glossadenia* in the project area is rated as moderate to high (7).

## 7.3. START QUALITY OF OFFSET AREA

The offset area is mapped with the same vegetation communities, is contiguous with vegetation in the project area and provides connectivity to Baldy Mountain Forest Reserve. It is expected that due to its close proximity to the project area it also contains similar habitat values and is similar in condition to the project area. Based on a desktop assessment of regional ecosystem mapping, the proposed offset area contains 167 ha of potential habitat for *Grevillea glossadenia*. A known record of the species is also located within the offset area (**Figure 7**). Therefore, the current quality of habitat for the *Grevillea glossadenia* in the offset area is rated as moderate to high (7).

## 7.4. FUTURE QUALITY OF OFFSET AREA WITHOUT OFFSET MANAGEMENT

Without active management there may be a decline in the quality of habitat for *Grevillea glossadenia* within the offset area. Threats to the species that may impact on quality of habitat include invasion of exotic weed species and extinction associated with stochastic events (DoTE, 2014d). The encroachment of exotic weeds, including *Agave sisalana* which is known to occur in and around the project area, can prevent the growth of *Grevillea glossadenia*. Therefore, the future quality of the offset area without offset management for *Grevillea glossadenia* is rated as moderate (6).

## 7.5. FUTURE QUALITY OF OFFSET AREA WITH OFFSET MANAGEMENT

The quality of habitat for *Grevillea glossadenia* will be improved through the establishment of the offset area. An OAMP will be developed for the offset area which will detail management actions to be implemented to improve habitat for the

species. These management actions will include weed control measures to prevent the introduction and/or spread of weeds in the offset area.

In addition to these measures, the individuals that will be directly impacted by the project will be translocated to establish a self-sustaining *Grevillea glossadenia* population in the offset area. A site specific Plant Translocation Plan will be developed based on the criteria and guidelines in Vallee et. al. (2004).

Therefore, the future quality of habitat for *Grevillea glossadenia* in the offset area with offset management is rated as moderate to high (8).

## 7.6. CONFIDENCE IN RESULTS – FUTURE QUALITY

The level of certainty about the success of the offset area in improving the quality of habitat for *Grevillea glossadenia* is rated as 70%. The management actions to be detailed within the OAMP will be based on published conservation recommendations and best practice management and will target improving existing habitat in the offset area for the species, threat abatement and will ensure the survival of the translocated population.

## 7.7. RISK OF LOSS WITHOUT OFFSET

Far North Queensland is one of the fastest growing regions in Queensland and over the past 15 years has experienced continuous growth in resident population, visitation, economic activity and urban development. This trend is forecast to continue for at least the next 20 years with the population of the region set to increase by 100,000 people by 2029 (Queensland Government, 2011). This growth will result in increased urban, agricultural, infrastructure and transport development across the region.

The proposed offset area is located on six contiguous lots which are currently owned by four different landholders. The primary land use of the lots is described as vacant large house site and subdivided land. While the remnant vegetation in the offset area is protected by the VM Act, the *Sustainable Planning Act 2009* (Qld) and associated policies and codes, an application can made to the state government to clear remnant vegetation. It is possible that an application could be approved to clear remnant vegetation within the offset area for a number of activities including, but not limited to:

- residential activities
- service infrastructure (e.g. transmission lines)
- access roads.

However, given the location and topography of the proposed offset area, the risk that the habitat will be completely lost over the foreseeable future has been determined to be 5%. This accounts for the low risk that the vegetation in the offset area could be lost through future development activities.

## 7.8. RISK OF LOSS WITH OFFSET

The offset area will be secured in perpetuity through a legally binding mechanism, such as a statutory covenant, registered under the *Land Title Act 1994* (Qld). The legally binding mechanism will be registered on the land title and will be binding on all current and future owners of the land. Land use within the offset area will be restricted in accordance with the legally binding mechanism and the OAMP. Therefore, the implementation of the legally binding mechanism will reduce the risk of loss of the offset area to 2%.

## 7.9. CONFIDENCE IN RESULTS – RISK OF LOSS

The confidence in results in terms of the risk of loss is determined to be 70%. The legally binding mechanism will be registered on the land title and will remain in effect in perpetuity. The legally binding mechanism can only be removed by the relevant Queensland Government Minister with regard to a public interest.

## 7.10. TIME OVER WHICH LOSS IS AVERTED

The offset area is proposed to be actively managed for a period of 20 years.

## 7.11. TIME UNTIL ECOLOGICAL BENEFIT

By selecting offsets in areas where current habitat for the species already exists, the time lag in between the establishment of the offset area and the ecological benefit is reduced. The proposed offset area already provides approximately 167 ha of suitable habitat for *Grevillea glossadenia*. Additionally, the individuals to be impacted by the project will be translocated and established in the offset area. Once translocated, these individuals will require further management in order to become a self-sustaining population in the offset area. Therefore, the time until the offset provides an ecological benefit for *Grevillea glossadenia* is expected to be approximately five years.

# 8. HOMORANTHUS PORTERI

## 8.1. SUMMARY OF RESULTS

*Homoranthus porteri* is listed as vulnerable under the EPBC Act. The project will impact on 5.1 ha of habitat for *Homoranthus porteri* (RPS, 2014, pers. comm., 1 May) and will result in the removal of approximately 300-350 individuals (RPS, 2013). Based on a desktop assessment there is approximately 117 ha of habitat available for *Homoranthus porteri* within the proposed offset area. By applying conservative assumptions to populate the offsets assessment guide, CO2 Australia has determined that there is sufficient potential for RAC to configure a compliant offset area on the identified offset property (**Table 7**). The actual extent and quality of the habitat within the offset area will require field verification and the final offset configuration will be determined based on the results of these surveys.

**Table 7: Summary of values and results for *Homoranthus porteri* offset assessment**

Quality of impact area:	7	Risk of loss without offset:	5%
Quality of offset area:	7	Risk of loss with offset:	2%
Future quality without offset:	7	Confidence in result:	70%
Future quality with offset:	8	Time over which loss is averted (years):	20 years
Confidence in result:	50%	Time until ecological benefit (years):	5 years
Minimum offset area (ha):	57 ha	Maximum offset area (ha):	117 ha
% of impact offset	100%	% of impact offset	207.03%

## 8.2. CURRENT QUALITY OF IMPACT AREA

*Homoranthus porteri* is restricted to north-east Queensland from near Mareeba southwards to near Ravenshoe (DoTE, 2014e). It occurs in shallow soils on rock outcrops, scree slopes, on the edge of rocky escarpments and rocky hillsides often in very exposed positions.

*Homoranthus porteri* has been recorded in a number of locations along ridges lines in the project area. Approximately 400 individuals have been recorded in the project area, of which 300 to 350 will be directly impacted by the project. The project will also result in the removal of approximately 5.1 ha of potential habitat for the species.

The current quality of habitat for the *Homoranthus porteri* in the project area is rated as moderate to high (7).

## 8.3. START QUALITY OF OFFSET AREA

The offset area is mapped with the same vegetation communities, is contiguous with vegetation in the project area and provides connectivity to Baldy Mountain Forest Reserve. It is therefore expected that the offset area will contain the same habitat value for *Homoranthus porteri* as the project area and is similar in condition to the project area. Based on a desktop assessment of regional ecosystem mapping, the proposed offset contains 117 ha of potential habitat for *Homoranthus porteri*. A known record of the species is also located within the offset area (Figure 7).

The current quality of habitat for the *Homoranthus porteri* in the offset area is rated as moderate to high (7).

## 8.4. FUTURE QUALITY OF OFFSET AREA WITHOUT OFFSET MANAGEMENT

As further research is needed to identify the threats to *Homoranthus porteri* the quality of the offset area without offset management has been determined to be the same as the start quality, moderate (7). Once further information about the species becomes available and field work is undertaken within the offset area, the future quality of the offset area without offset management may be revised. It is possible due to the restricted distribution of *Homoranthus porteri*, important populations of the species may be prone to disturbance from threatening processes such as vegetation clearance, weed invasion and fire.

## 8.5. FUTURE QUALITY OF OFFSET AREA WITH OFFSET MANAGEMENT

The quality of habitat for *Homoranthus porteri* will be improved through the establishment of the offset area. An OAMP will be developed for the offset area which will detail management actions to be implemented to improve habitat for the species. Further research will be undertaken to determine the threats to the species and appropriate threat abatement actions will be incorporated into the OAMP. In addition, the individual plants that will be directly impacted by the project will be translocated to establish a self-sustaining *Homoranthus porteri* population in the offset area. A site specific Plant Translocation Plan will be developed based on the criteria and guidelines in Vallee, et. al. (2004). Therefore, based on these actions, it is anticipated that the future quality of habitat for *Homoranthus porteri* in the offset area with offset management will be rated as high (8).

## 8.6. CONFIDENCE IN RESULTS – FUTURE QUALITY

The level of certainty about the success of the offset area in improving the quality of habitat for *Homoranthus porteri* is rated as 50%. While the management objectives and practices detailed within the OAMP will target protecting and improving existing habitat for the species in the offset area and will ensure the survival of the translocated population, there is some uncertainty regarding the threats to *Homoranthus porteri*. This uncertainty has been accounted for in this score. It is recognised that further research will be required to be undertaken to determine the threats to the species and develop appropriate management activities for this species within the offset area.



## 8.7. RISK OF LOSS WITHOUT OFFSET

Far North Queensland is one of the fastest growing regions in Queensland and over the past 15 years has experienced continuous growth in resident population, visitation, economic activity and urban development. This trend is forecast to continue for at least the next 20 years with the population of the region set to increase by 100,000 people by 2029 (Queensland Government, 2011). This growth will result in increased urban, agricultural, infrastructure and transport development across the region.

The proposed offset area is located on six contiguous lots which are currently owned by four different landholders. The primary land use of the lots is described as vacant large house site and subdivided land. While the remnant vegetation in the offset area is protected by the VM Act, the *Sustainable Planning Act 2009* (Qld) and associated policies and codes, an application can be made to the state government to clear remnant vegetation. It is possible that an application could be approved to clear remnant vegetation within the offset area for a number of activities including, but not limited to:

- residential activities
- service infrastructure (e.g. transmission lines)
- access roads.

However, given the location and topography of the proposed offset area, the risk that the habitat will be completely lost over the foreseeable future has been determined to be 5%. This accounts for the low risk that the vegetation in the offset area could be lost through future development activities.

## 8.8. RISK OF LOSS WITH OFFSET

The offset area will be secured in perpetuity through a legally binding mechanism, such as a statutory covenant, registered under the *Land Title Act 1994* (Qld). The legally binding mechanism will be registered on the land title and will be binding on all current and future owners of the land. Land use within the offset area will be restricted in accordance with the legally binding mechanism and the OAMP. Therefore, the implementation of the legally binding mechanism will reduce the risk of loss of the offset area to 2%.

## 8.9. CONFIDENCE IN RESULTS – RISK OF LOSS

The confidence in results in terms of the risk of loss is determined to be 70%. The legally binding mechanism will be registered on the land title and will remain in effect in perpetuity. The legally binding mechanism can only be removed by the relevant Queensland Government Minister with regard to a public interest.

## 8.10. TIME OVER WHICH LOSS IS AVERTED

The offset area is proposed to be actively managed for a period of 20 years.

## 8.11. TIME UNTIL ECOLOGICAL BENEFIT

By selecting offsets in areas where current habitat already exists, the time lag in between the establishment of the offset area and the ecological benefit for the species is reduced. The proposed offset area already provides approximately 117 ha of suitable habitat for *Homoranthus porteri*. Additionally, the individuals to be impacted by the project will be translocated and established in the offset area. Once translocated, these individuals will require further management in order to become a self-sustaining population in the offset area. Therefore, the time until the offset provides an ecological benefit for *Homoranthus porteri* is expected to be approximately five years.

## 9. SUMMARY OF RESULTS

Based on the results of the offset assessment, there is sufficient potential for RAC to configure an offset area that is compliant with the requirements of the Australian Government's EPBC Act Offsets Policy on the proposed offset property (**Table 8**). While this assessment is preliminary in nature, the values generated from the offsets assessment guide indicate that the proposed offset is suitable to acquire the offset requirements of the project and the percentage of impact offset is over 100% for all values.

The offset area provides for the long term protection of habitat for the five threatened species and through the implementation of adaptive management practices the quality of the habitat will be improved and maintained over time. The actual extent and quality of the habitat within the offset area will require field verification and the final offset configuration will be determined based on the results of these surveys.

**Table 8. Offsets assessment guide results**

OFFSETS ASSESSMENT GUIDE PARAMETER	MNES				
	northern quoll	spectacled flying-fox	bare-rumped sheath-tail bat	<i>Grevillea glossadenia</i>	<i>Homoranthus porteri</i>
Size of impact area:	57.7 ha	57.7 ha	57.7 ha	10.2 ha	5.1 ha
Quality of impact area:	8	3	7	7	7
Start quality of offset area:	8	3	7	7	7
Future quality with offset:	9	4	8	8	8
Future quality without offset:	6	3	6	6	7
Confidence in results:	50%	70%	70%	70%	50%
Risk of loss with offset:	2%	2%	2%	2%	2%
Risk of loss without offset:	5%	5%	5%	5%	5%
Confidence in results:	70%	70%	70%	70%	70%
Time over which loss is averted:	20 years	20 years	20 years	20 years	20 years
Time until ecological benefit:	5 years	Immediate	Immediate	5 years	5 years
Minimum offset area:	315 <sup>3</sup> ha	213 ha	300 ha	50 ha	57 ha
Minimum % of impact offset:	100%	100%	100%	100%	100%
Maximum offset area:	347 <sup>3</sup> ha	360 ha	391 ha	167 ha	117 ha
Maximum % of impact offset:	112%	155%	133%	346%	207%

<sup>3</sup> Includes denning habitat only; however, 236 ha of potential foraging habitat is also available within the proposed offset area.

## 10. REFERENCES

Churchill, S.K. (1998) *Australian Bats*. Sydney: Reed New Holland.

Department of Environment and Resource Management (2010) *National recovery plan for the spectacled flying-fox Pteropus conspicillatus*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra.

Department of the Environment (2014a) *Dasyurus hallucatus – Northern Quoll in Species Profiles and Threats (SPRAT) Database*. Available from: [http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon\\_id=331](http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=331)

Department of the Environment (2014b) *Pteropus conspicillatus – Spectacled Flying-fox in Species Profiles and Threats (SPRAT) Database*. Available from: [http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon\\_id=185](http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=185)

Department of the Environment (2014c) *Saccolaimus saccolaimus nudiclunatus – Bare-rumped Sheath-tail Bat in Species Profiles and Threats (SPRAT) Database*. Available from: [http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon\\_id=66889](http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66889)

Department of the Environment (2014d) *Grevillea glossadenia in Species Profiles and Threats (SPRAT) Database*. Available from: [http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon\\_id=7979#threats](http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=7979#threats)

Department of the Environment (2014e) *Homoranthus porteri in Species Profiles and Threats (SPRAT) Database*. Available from: [http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon\\_id=55196](http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=55196)

Hill, B, M and Ward, S.J. (2010) *National recovery plan for the northern quoll Dasyurus hallucatus*. Department of Natural Resources, Environment, The Arts and Sport, Darwin.

Queensland Government (2011) *Queensland Government population projections to 2056: Queensland and statistical divisions 2011 edition*. Available from: <http://www.oesr.qld.gov.au/products/publications/qld-govt-pop-proj-qld-sd/qld-govt-pop-proj-2056-qld-sd-2011.pdf>

RPS (2013) *Mount Emerald Wind Farm, Herberton Range North Queensland Environmental Impact Statement*. Prepared for: RATCH-Australia Corporation Ltd.

Schulz, M. and Thomson, B. (2007) *National recovery plan for the bare-rumped sheath-tail bat Saccolaimus saccolaimus nudiclunatus*. Report to Department of the Environment and Water Resources, Canberra. Queensland Parks and Wildlife Service, Brisbane.

Vallee, L., Hogbin, T., Monks, L., Makinson, B., Matthes, M. & Rossetto, M. (2004). *Guidelines for the Translocation of Threatened Plants in Australia (2nd ed.)*, Australian Network for Plant Conservation, Canberra.