



Offset Area Management Plan

Haughton Pipeline Stage 2

Townsville City Council

30 January 2023

→ **The Power of Commitment**



GHD Pty Ltd | ABN 39 008 488 373

71 Stanley Street,

Townsville, Queensland 4810, Australia

T +61 7 4720 0400 | **F** +61 7 4772 6514 | **E** tsvmail@ghd.com | **ghd.com**

Printed date	30/01/2023 11:30:00 AM
Last saved date	30 January 2023
File name	https://projectsportal.ghd.com/sites/pp10_01/haughtonpipelinedupl2/ProjectDocs/EPBC Offset/Offset Area Management Plan/12537606-REP-Offset Area Management Plan_600 ha.docx
Author	Laurence Liessmann, Aimee Chambers, Simon Hodgkison
Project manager	Daniel Willis
Client name	Townsville City Council
Project name	Haughton Pipeline Stage 2
Document title	Offset Area Management Plan Haughton Pipeline Stage 2
Revision version	Rev 1
Project number	12537606

Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S3	Rev 0	L. Liessmann A. Chambers S. Hodgkison H. Rosnell	J. Simmonds M. Ward D. Willis	<i>D. Willis*</i>	S.Orr	<i>S. Orr*</i>	28.10.2022
S3	Rev 1	S. Hodgkinson	M. Ward D. Willis	<i>D. Willis*</i>	S.Orr	<i>S. Orr*</i>	30.01.2023

© GHD 2023

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Executive summary

Townsville City Council (TCC) is undertaking the Houghton Pipeline Stage 2 (HPS2) Project (the Project) which comprises a new pump station at the Burdekin River Clare Weir Storage, high voltage substation, overhead power supply from the substation to the pump station, and a 1.8 m diameter pipeline approximately 28.5 km long connecting to the already constructed Stage 1 pipeline. The purpose of the overall Project is to provide transfer of 364 ML/day of raw water from the Burdekin River to the Ross River Dam to provide water supply security for Townsville City. The Project is currently under assessment by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under Part 9 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The purpose of this report is to provide an Offset Area Management Plan (OAMP) outlining the approach and methodology to deliver an environmental offset to compensate for predicted significant residual impacts of the proposed HPS2 project on the following Matters of National Environmental Significance (MNES):

- Southern black-throated finch (southern) (*Poephila cincta cincta*) – Endangered
- Bare-rumped sheathtail bat (*Saccolaimus saccolaimus nudicluniatatus*) – Vulnerable
- Koala (*Phascolarctos cinereus*) – Endangered

The proposed offset has been developed in accordance with the overarching principles and aims of the EPBC Act and EPBC Act Environmental Offsets Policy 2012.

The proposed offset area has been identified on a series of adjoining land parcels located immediately south of Lake Ross (Ross River Dam) in southern Townsville, encompassing an extent of 640.35 ha, of which 625.58 ha will be actively managed as the offset. Ecological surveys were undertaken in March through to August 2022 by Biodiversity Australia to assess the suitability of the offset area. These have confirmed the area provides suitable habitat and opportunity for improvement.

Both the impact area and offset area support a mix of coastal floodplain open woodland vegetation that has been subject to substantial historical impacts from habitat fragmentation, cattle grazing, replacement of the ground later with pasture grass species and extensive weed infestation, notably woody weeds invasive grasses.

The bare-rumped sheathtail bat was confirmed present in the offset area during surveys undertaken by Biodiversity Australia (2022b), and the southern black-throated finch and koala are likely to occur due to the presence of suitable habitat and proximity to nearby historical records.

Ecological field surveys have been completed to assess the habitat quality within the impact area (Ecological Interpretations 2022) and the offset area (Biodiversity Australia 2022b, c). Specifically, habitat quality was scored in accordance with the Queensland *Guide to Determining Terrestrial Habitat Quality* (DES 2020), the *Modified QLD Habitat Quality spreadsheet* (provided by DCCEEW directly for this purpose), and the EPBC Act *Offsets Assessment Guide* (DSEWPaC 2012b), with the scoring comprised of the following elements:

- Site condition
- Site context
- Species stocking rate

The results of the ecological surveys identified that the impact area and offset area are ecologically similar, with comparable condition scores between the impact area and offset area for each of the three MNES. The offset therefore represents a 'like for like' compensation, as is required by the EPBC Act Environmental Offsets Policy 2012.

The offset area will be secured through the legally binding mechanism of a Voluntary Declaration (VDec) under the *Vegetation Management Act 1999*. A series of ecological outcomes, consistent with relevant recovery plans, have been identified for each of the three MNES (Table ES 1.1). The offset outcomes are summarised in Table ES 1.2.

Table ES 1.1 Ecological outcomes for the relevant MNES

Bare-rumped sheathtail bat	Southern black-throated finch	Koala
Increase the area of habitat for the bare-rumped sheathtail bat by 315.76 ha within 20 years via planting non-remnant areas with roost trees (<i>E. platyphylla</i>) and allowing regrowth areas to naturally regenerate.	Increase the area of potential habitat for the southern black-throated finch by 352.52 ha within 20 years via re-establishing native food grasses in key areas (i.e. within 400 m of waterbodies) and planting non-remnant areas with native tubestock.	Increase the area of habitat for the koala by 315.76 ha within 20 years via planting non-remnant areas with locally important koala food trees and allowing regrowth areas to naturally regenerate.
Increase the bare-rumped sheathtail bat offset area habitat quality by at least two points (when compared to baseline data measured by the site condition, site context and species stocking rate) within 20 years.	Increase the southern black-throated finch offset area habitat quality by two points (when compared to baseline data measured by the site condition, site context and species stocking rate) within 20 years.	Increase the koala offset area habitat quality by at least two points (when compared to baseline data measured by the site condition, site context and species stocking rate) within 20 years.
Reduction in key shrubby weed densities by 90% of baseline level within 20 years.	Reduce the density and extent of shrubby weeds and grassy weeds within the offset area by 70% of baseline level within 20 years.	Reduction in key shrubby weed densities by 70% of baseline level within 20 years.
Increase species richness of canopy and shrub level vegetation compared to baseline levels as a surrogate to increase invertebrate food availability within 20 years.	Provide artificial permanent water sources to ensure that southern black-throated finch utilisation of the area is not constrained by a lack of water.	Reduce densities of wild dogs to reduce the predation pressures on the local koala population.
	Implement a fire management strategy to enhance the southern black-throated finch offset area resulting in no uncontrolled bushfires that burn more than 50% of the offset area for 20 years.	
	Reduction in densities of feral animals (i.e. wild pigs) to prevent the degradation of habitat.	

Table ES 1.2 Summary of Offset Outcomes

Species						
	Impact	Risk of Loss	Start Quality	Future Quality	Confidence	Offset Area
Bare-rumped sheathtail bat	92.23 ha	0.05%	6	8	80%	551.79 ha
Southern black-throated finch	96.34 ha	0.05%	5	7	80%	625.58 ha
Koala	134.2 ha	0.05%	4	6	80%	551.79 ha

A number of management actions have been proposed with reference to the key habitat requirements of the three MNES in order to improve the quality of their habitat within the offset area. Key management actions include:

1. Legally securing offset area
2. Revegetation and regeneration management
3. Weed management
4. Water source management
5. Fire management
6. Control of feral animals
7. Reduction of cattle densities

These improvements have the potential to make a real contribution to the three MNES by increasing the availability of resources for foraging, shelter and breeding and increasing mobility through increased habitat connectivity. The proposed offset area achieves 160.91 percent of the direct offset requirement for the bare-rumped sheathtail bat, 100.09 percent of the direct offset requirement for the southern black-throated finch and 108.72 percent of the direct offset requirement for the koala.

Completion criteria have been derived from the site habitat quality to demonstrate the improvement in the quality of habitat in the offset area over a 20-year period. Additionally, interim milestones that set targets at 5-yearly intervals for progress towards achieving these offset completion criteria have been developed. Monitoring results will be used to determine if the interim milestones are being achieved. These interim milestones provide an indication of the success of the management measures being implemented for southern black-throated finch, bare-rumped sheathtail bat and koala habitat and serve as trigger values where failure to achieve these will result in the implementation of corrective actions.

Contents

Acronyms and abbreviations	1
1. Introduction	2
1.1 Purpose of this report	2
1.2 Report structure	2
1.3 Scope and limitations	7
1.4 Suitably qualified personnel	7
2. Overview of the proposed offset	9
2.1 Summary of matters being offset	9
2.1.1 Vegetation communities impacted	9
2.1.2 Summary of MNES habitat areas impacted	10
2.2 Offset area	11
2.2.1 Overview of the offset approach	11
2.2.2 Land tenure	11
2.2.1 Landscape context	12
2.2.2 Vegetation communities	14
2.2.3 Water resource availability	16
2.2.4 Existing land use and disturbances at the offset area	16
2.2.5 Potential to contribute to landscape connectivity	16
3. Suitability of the offset area	19
3.1 Overview	19
3.1.1 Desktop assessments	19
3.1.2 Field surveys	19
3.2 Suitability for the bare-rumped sheath-tail bat	20
3.2.1 Ecology of the bare-rumped sheath-tail bat	20
3.2.2 Bare-rumped sheath-tail bat presence within the offset area	21
3.2.3 Suitability of habitat for the bare-rumped sheath-tail bat within the offset area	21
3.3 Suitability for the southern black-throated finch	24
3.3.1 Ecology of the southern black-throated finch	24
3.3.2 Presence of southern black-throated finch within the offset area	25
3.3.3 Suitability of habitat for the southern black-throated finch	25
3.4 Suitability for the koala	28
3.4.1 Ecology of the koala	28
3.4.2 Presence of koalas within the offset area	29
3.4.3 Suitability of habitat for the koala within the offset area	32
3.5 Summary of existing habitat availability for MNES	32
3.6 Offset condition suitability and potential for enhancement	32
4. Methods used to assess habitat quality	33
4.1 Overview of the approach	33
4.2 Habitat quality scoring methods	33
4.3 Overview of assessment units	33
4.4 Site condition assessment	36
4.4.1 BioCondition plot methodology	36
4.4.2 Quality and availability of food and foraging habitat	39

4.4.3	Quality and availability of shelter	40
4.5	Site context	41
4.5.1	GIS derived site context attributes	41
4.5.2	Role of the site location to the overall population in the state	42
4.5.3	Threats to the species	42
4.5.4	Species mobility capacity	44
4.6	Species stocking rate assessment	44
5.	Habitat quality scores	47
5.1	Quality of habitats within the impact area	47
5.1.1	BioCondition	47
5.1.2	Habitat scores for the bare-rumped sheathtail bat	48
5.1.3	Habitat scores for the southern black-throated finch	49
5.1.4	Habitat scores for the koala	51
5.2	Quality of habitats within the offset area	52
5.2.1	BioCondition	52
5.2.2	Habitat scores for the bare-rumped sheathtail bat	53
5.2.3	Habitat scores for the southern black-throated finch	54
5.2.4	Habitat scores for the koala	56
5.3	Summary	57
5.4	Commonwealth <i>Offsets Assessment Guide</i> score	59
5.4.1	Bare-rumped sheathtail bat Commonwealth offset scores	60
5.4.2	Southern black-throated finch Commonwealth offset scores	62
5.4.3	Koala Commonwealth offset scores	65
6.	Offset delivery	68
6.1	Offset management responsibility	68
6.2	Legally securing the offset area	68
6.3	Indicative timeframes	68
6.4	Ecological outcomes	68
7.	Management actions	71
7.1	Overview of management aims	71
7.2	Management actions	73
7.3	Completion criteria and corrective actions	84
7.4	Monitoring commitments	87
7.5	Adaptive management	88
7.6	Reporting	89
7.6.1	Auditing and review	89
7.6.2	Monitoring reporting	89
7.6.3	Compliance reporting	89
8.	Compliance with EPBC Act Policies	90
8.1	EPBC Act Environmental Offsets Policy	90
8.2	EPBC Act Environmental Management Plan Guidelines	91
9.	Risk assessment	92
10.	References	102

Table index

Table ES 1.1	Ecological outcomes for the relevant MNES	ii
Table ES 1.2	Summary of Offset Outcomes	ii
Table 1.1	Offset Area Management Plan Requirements	3
Table 2.1	Summary of habitat loss representing a significant residual impact for MNES	9
Table 2.2	BioCondition field-verified REs within the impact area	9
Table 2.3	Area of bare-rumped sheathtail bat habitat requiring offsetting based on Offsets Assessment Guide (DoEE 2012)	10
Table 2.4	Area of southern black-throated finch habitat requiring offsetting based on Offsets Assessment Guide (DSWEPaC 2012b)	10
Table 2.5	Area of koala habitat requiring offsetting based on Offsets Assessment Guide (DSWEPaC 2012b)	11
Table 2.6	Summary of offset area	12
Table 2.7	Regional Ecosystem mapping within the offset area	14
Table 3.1	Summary of the area of current and future habitat for each MNES within the offset area	32
Table 4.1	Summary of replicate BioCondition plots in each assessment unit	34
Table 4.2	Site context scoring framework	42
Table 4.3	Threat matrix used to score absence of threats	42
Table 4.4	Species stocking rate scoring criteria	45
Table 4.5	Summary of targeted survey methods to assess local utilisation by relevant MNES	45
Table 4.6	Role/importance of the species population on site	46
Table 5.1	BioCondition scores for the impact area	47
Table 5.2	Average habitat scores for the bare-rumped sheathtail bat within impact area assessment units	48
Table 5.3	Species stocking rate scores for the bare-rumped sheathtail bat within the impact area	49
Table 5.4	Southern black-throated finch habitat quality scores for the impact area	49
Table 5.5	Species stocking rate scores for the southern black-throated finch within the impact area	51
Table 5.6	Average koala habitat quality scores for the impact area	51
Table 5.7	Species stocking rate scores for the koala within the impact area	52
Table 5.8	BioCondition scores for the offset area	53
Table 5.9	Average bare-rumped sheathtail bat habitat quality scores for the offset area	53
Table 5.10	Species stocking rate scores for the bare-rumped sheathtail bat within the offset area	54
Table 5.11	Southern black-throated finch habitat quality scores for the offset area	55
Table 5.12	Species stocking rate scores for the southern black-throated finch within the offset area	56
Table 5.13	Average koala habitat quality scores for the offset area	56
Table 5.14	Species stocking rate scores for the koala within the offset area	57
Table 5.15	Summary of bare-rumped sheathtail bat habitat scores for the impact area and offset area	57
Table 5.16	Summary of southern black-throated finch habitat scores for the impact area and offset areas	58
Table 5.17	Summary of koala habitat scores for the impact area and offset areas	59
Table 5.18	Offsets assessment guide for the bare-rumped sheathtail bat	60

Table 5.19	Projected habitat quality gains for the bare-rumped sheathtail bat over the offset's 20 year lifetime	61
Table 5.20	Offset assessment guide for the southern black-throated finch	62
Table 5.21	Projected habitat quality gains for the southern black-throated finch over the offset's 20 year lifetime	64
Table 5.22	Offset assessment guide for the koala	65
Table 5.23	Projected habitat quality gains for the koala over the offset's 20 year lifetime	66
Table 6.1	Offset delivery indicative timeframes	68
Table 6.2	Ecological outcomes for bare-rumped sheathtail bat	69
Table 6.3	Ecological outcomes for southern black-throated finch	69
Table 6.4	Ecological outcomes for koala	70
Table 7.1	Summary of major threats to the species	71
Table 7.2	Summary of key habitat requirements for the relevant MNES	72
Table 7.3	Proposed management and mitigation measures for the relevant MNES	75
Table 7.4	Queensland Herbarium (2021b) fire management guidelines for each of the Queensland Regional Ecosystems in the offset area	83
Table 7.5	Interim milestones, completion criteria and corrective actions	85
Table 7.6	Habitat quality scores at completion and 5-yearly interim milestones	87
Table 7.7	Monitoring commitments	87
Table 8.1	EPBC Act Environmental Offsets Policy Principles	90
Table 8.2	Offset compliance with EMP guidelines	91
Table 9.1	Risk matrix	92
Table 9.2	Assessment of risks on the local bare-rumped sheathtail bat population with and without the Project	93
Table 9.3	Assessment of risks on the local southern black-throated finch population with and without the Project	96
Table 9.4	Assessment of risks on the local koala population with and without the Project	99

Figure index

Figure 1.1	Haughton Pipeline Stage 2 Project area	5
Figure 2.1	Proposed offset area	13
Figure 2.2	Field-verified Regional Ecosystems within the proposed offset area	15
Figure 2.3	Water sources located within the proposed offset area	17
Figure 2.4	Connectivity of the proposed offset area to State and regional biodiversity corridors	18
Figure 3.1	Historical records of the bare-rumped sheathtail bat near the proposed offset area	22
Figure 3.2	Distribution of current and future potential habitat for the bare-rumped sheathtail bat within the offset area	23
Figure 3.3	Historical records of the southern black-throated finch near the proposed offset area	26
Figure 3.4	Distribution of current and future potential habitat for the southern black-throated finch within the offset area	27
Figure 3.5	Historical records of the koala within the vicinity of the proposed offset area	30
Figure 3.6	Distribution of current koala habitat and future potential koala habitat within the proposed offset area.	31
Figure 4.1	Distribution of assessment units in the proposed offset area	35

Figure 4.2	Layout of the BioCondition plot	37
Figure 4.3	Location of habitat condition scoring plots within the proposed offset area	38
Figure 7.1	Proposed land management actions within the offset area	74

Appendices

Appendix A	Habitat scoring parameters for each species
Appendix B	DCCEEW <i>Modified QLD Habitat Quality spreadsheet for current values of the impact area and offset area</i>
Appendix C	DCCEEW <i>Modified QLD Habitat Quality spreadsheet future forecast values of the offset area</i>
Appendix D	EPBC Act Offset Assessment Guide

Acronyms and abbreviations

Acronym	Description
au	assessment unit
DAWE	(Former Commonwealth) Department of Agriculture, Water and the Environment
DCCEEW	(Commonwealth) Department of Climate Change, Energy, the Environment and Water
DES	(Queensland) Department of Environment and Science
DoE	(Former Commonwealth) Department of Environment
DoEE	(Former Commonwealth) Department of the Environment and Energy
DoR	(Queensland) Department of Resources
DSEWPC	(Former Commonwealth) Department of Sustainability, Environment, Water, Populations and Communities
EPBC Act	(Commonwealth) <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GHD	GHD Pty Ltd
Ha	Hectares
HPS2	Haghton Pipeline Stage 2
Km	Kilometres
KoRV	koala retrovirus
LRSA	Lake Ross Storage Area
m	metres
ML	Megalitres
MNES	Matters of National Environmental Significance
NC Act	(Queensland) <i>Nature Conservation Act 1992</i>
NRA	Natural Resource Assessments
OAMP	Offset Area Management Plan
PD	Preliminary Documentation
PMAV	Property Map of Assessable Vegetation
PMST	Protected Matters Search Tool
RE	Regional Ecosystem
SQP	Suitably Qualified Person
TCC	Townsville City Council
TSSC	Threatened Species Scientific Committee
VDec	Voluntary Declaration
VM Act	(Queensland) <i>Vegetation Management Act 1999</i>

1. Introduction

GHD Pty Ltd was engaged by Townsville City Council (TCC) to prepare an Offset Area Management Plan (OAMP) for the Haughton Pipeline Stage 2 (HPS2) Project (the Project). The HPS2 Project involves a 28.5 km extension of the complete Stage 1 DN1800 water transfer pipeline from the Upper Haughton Irrigation Channel to a new 364 ML/day pump station located on the Burdekin River adjacent the SunWater Tom Fenwick pump station (Figure 1.1). The Project is to provide water supply security for Townsville City.

The HPS2 was referred under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 21 December 2021 and subsequently declared a “Controlled Action” requiring assessment by Preliminary Documentation (PD) pursuant to Section 18 and 18A (*listed threatened species and communities*).

As part of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) PD requirements, a land-based offset is proposed to compensate for significant residual impacts arising from clearing habitat critical to the survival of the following Matters of National Environmental Significance (MNES):

- 96.34 ha of southern black-throated finch habitat – endangered under the EPBC Act and the Queensland *Nature Conservation Act 1992* (NC Act)
- 92.23 ha of bare-rumped sheath-tail bat habitat – vulnerable under the EPBC Act and the NC Act
- 134.2 ha of koala habitat – endangered under the EPBC Act and vulnerable under the NC Act.

This Offset Area Management Plan (OAMP) provides required information on the proposed offset and has been prepared in accordance with the following guiding documents:

- EPBC Act *Environmental Offset Policy* (Department of Sustainability Environment, Water, Population and Communities (DSEWPAC) 2012a)
- *Offsets Assessment Guide* (DCCEEW)
- *How to Use the Offsets Assessment Guide* (DSEWPAC 2012b).
- *Environmental Management Plan Guidelines* (DoE 2014)
- *Guide to Determining Terrestrial Habitat Quality: A toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy* (Department of Environment and Science (DES) 2020)
- *BioCondition- A Condition Assessment Framework for Terrestrial Biodiversity in Queensland Assessment Manual V2.2* (Eyre et al. 2015).

1.1 Purpose of this report

This OAMP has been prepared to guide the delivery and compliance of offset commitments specified in the Preliminary Documentation requirements issued by DCCEEW for the Haughton Pipeline Stage 2 (HPS2) Project (EPBC ref: 2021/9133). MNES that require delivery of an offset due to significant residual impacts, and are thus the focus of this plan, are the koala, southern black-throated finch and bare-rumped sheath-tail bat.

This OAMP will also be submitted to the Queensland Department of Resources (DoR) in support of a voluntary declaration (Vdec) application to secure the offset parcel. In this regard, requirements identified by the Guide to Voluntary Declarations under the *Vegetation Management Act 1999* (effective 21 June 2019) (State of Queensland 2019) have been addressed within this OAMP.

1.2 Report structure

This OAMP contains the following sections:

- Section 1 – Introduction to the Project and scope of the report
- Section 2 – Overview of offset area
- Section 3 – Suitability of the offset area including the presence and suitability of habitat for each species
- Section 4 – Methods used to assess habitat value including desktop and field survey

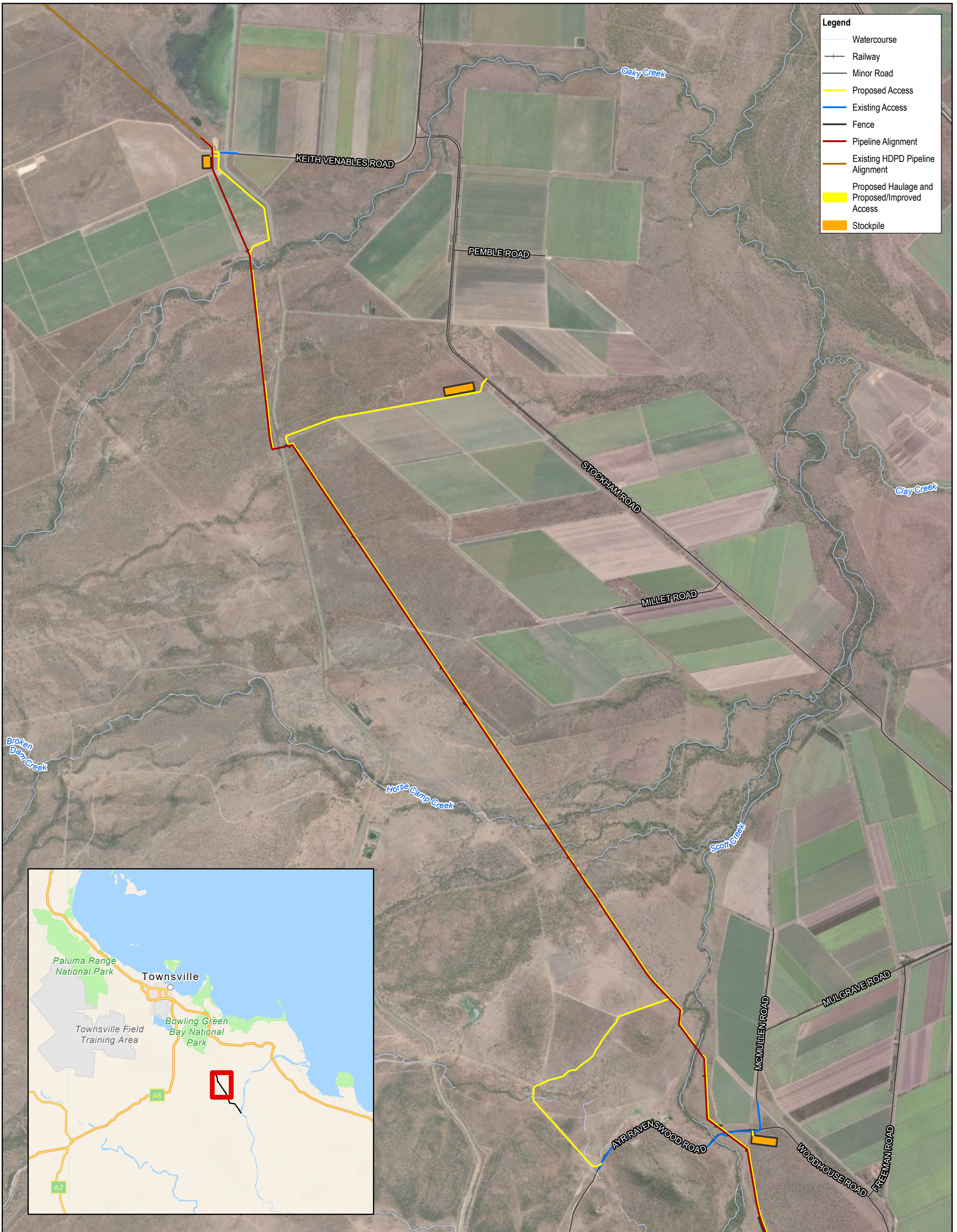
- Section 5 – Results of habitat value assessments including habitat quality scoring and the calculations in the *Offsets Assessment Guide* (DSEWPaC 2012b)
- Section 6 – Offset delivery including offset responsibility and ecological outcomes
- Section 7 – Management actions to achieve the ecological outcomes and corresponding completion criteria
- Section 8 – Compliance with EPBC Act Environmental Offsets Policy and Environmental Management Plan Guidelines
- Section 9 – Risk assessment
- Section 10 – References
- Appendix A – Department of Agriculture, Water and the Environment (DAWE) Preliminary Documentation further information
- Appendix B – DCCEEW *Modified QLD Habitat Quality spreadsheet*
- Appendix C – EPBC Act Offset Assessment Guide.

Table 1.1 identifies sections of the OAMP which satisfy Preliminary Documentation Section 7.0 (OAMP requirements).

Table 1.1 **Offset Area Management Plan Requirements**

Item Number	Information Request	Section of this plan
7.3.1	Specific, committal and measurable environmental outcomes which detail the nature of the conservation gain to be achieved for relevant MNES, including the creation, restoration and revegetation of habitat in the proposed offset area/s.	Section 6.4 and Section 7
7.3.2	Details, with supporting evidence, to demonstrate how the environmental offset/s compensate for residual significant impacts of the proposed action on relevant MNES, and/or their habitat, in accordance with the principles of the Offsets Policy and all requirements of the <i>Offsets Assessment Guide</i> including: <ul style="list-style-type: none"> – time over which loss is averted (max. 20 years); – time until ecological benefit; – risk of loss (%) without offset; – risk of loss (%) with offset; and – confidence in result (%). 	Section 5.4
7.3.3	A description of the offset area/s, including location, size, condition, environmental values present and surrounding land uses.	Section 2.2
7.3.4	Baseline data and other supporting evidence that documents the presence of the relevant MNES, and the quality of their habitat within the offset area/s.	Section 3
7.3.5	An assessment of the site habitat quality for the offset area/s (e.g. using the Queensland Government <i>Guide to Determining Terrestrial Habitat Quality: A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy</i> [2020]). Please note that a methodology that is suitable for each species (i.e., approved by the department or supported by literature) must be used to assess habitat quality, noting the same scoring mechanism must be used at both impact and offset sites.	Section 4 Section 5
7.3.6	Details of how the offset area/s will provide connectivity with other habitats and biodiversity corridors and/or will contribute to a larger strategic offset for the relevant MNES.	Section 2.2.5
7.3.7	Maps and shapefiles to clearly define the location and boundaries of the offset area/s, accompanied by the offset attributes (e.g., physical address of the offset area/s, coordinates of the boundary points in decimal degrees, the relevant MNES that the environmental offset/s compensates for, and the size of the environmental offset/s in hectares).	Figure 2.1 and mapping of MNES habitat in Section 3
7.3.8	Specific offset completion criteria derived from the site habitat quality to demonstrate the improvement in the quality of habitat in the offset area/s over a 20-year period.	Section 7.3

Item Number	Information Request	Section of this plan
7.3.9	Details of the management actions, and timeframes for implementation, to be carried out to meet the offset completion criteria.	Section 6.3 and Section 7.2
7.3.10	Interim milestones that set targets at 5-yearly intervals for progress towards achieving the offset completion criteria.	Section 7.3
7.3.11	Details of the nature, timing and frequency of monitoring to inform progress against achieving the 5-yearly interim milestones (the frequency of monitoring must be sufficient to track progress towards each set of milestones, and sufficient to determine whether the offset area/s are likely to achieve those milestones in adequate time to implement all necessary corrective actions).	Section 0
7.3.12	Proposed timing for the submission of monitoring reports which provide evidence demonstrating whether the interim milestones have been achieved.	Section 7.6.2
7.3.13	Timing for the implementation of tangible, on-ground corrective actions to be implemented if monitoring activities indicate the interim milestones have not been achieved.	Section 7.3
7.3.14	Risk analysis and a risk management and mitigation strategy for all risks to the successful implementation of the OAMP and timely achievement of the offset completion criteria, including a rating of all initial and post-mitigation residual risks in accordance with a risk assessment matrix.	Section 9
7.3.15	Evidence of how the management actions and corrective actions take into account relevant approved conservation advice/s and are consistent with relevant recovery plans and threat abatement plans.	Section 6.4 and Section 7.2
7.3.16	Details and execution timing of the mechanism to legally secure the proposed offset area/s, such that legal security remains in force over the offset area/s for at least 20 years to provide enduring protection for the offset area/s against development incompatible with conservation.	Section 6.2
7.3.17	All proposed management actions, monitoring approach and corrective actions must be written using committed language (e.g., 'will' and 'must').	All



Legend

- Watercourse
- Railway
- Minor Road
- Proposed Access
- Existing Access
- Fence
- Pipeline Alignment
- Existing HDPD Pipeline Alignment
- Proposed Haulage and Proposed/Improved Access
- Stockpile

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.

Paper Size ISO A3

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

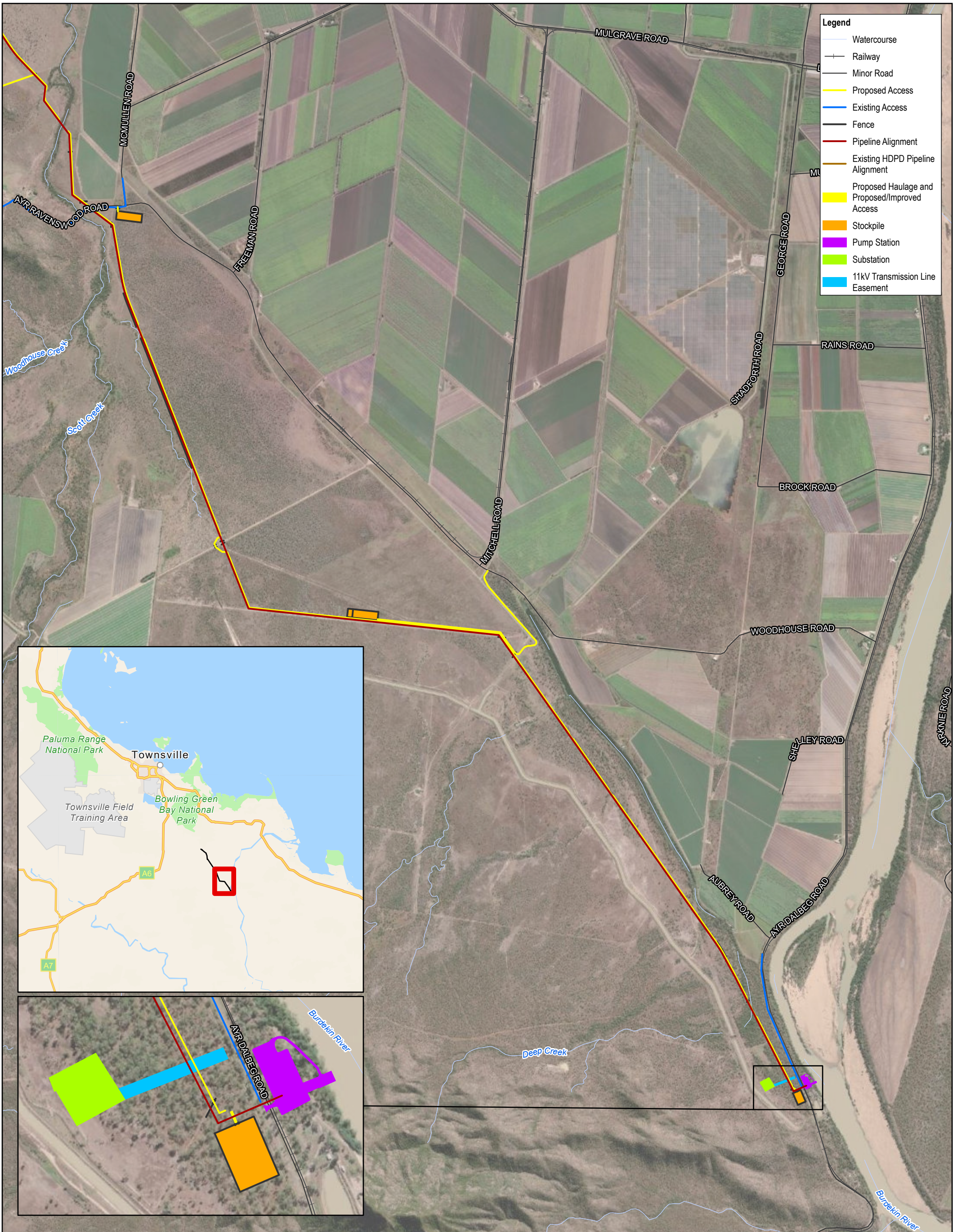


Townsville City Council
Houghton Pipeline Stage 2 -
Offset Area Management Plan

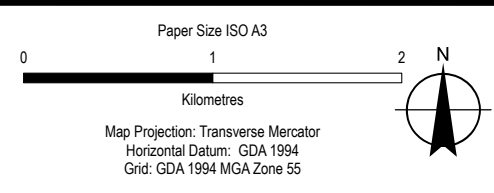
Houghton Pipeline Stage 2 project area

Project No. 12537606
Revision No. 0
Date 9/29/2022

FIGURE 1-1



Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.



Townsville City Council
**Houghton Pipeline Stage 2 -
 Offset Area Management Plan**

Project No. 12537606
 Revision No. 0
 Date 9/29/2022

Houghton Pipeline Stage 2 project area **FIGURE 1-1**

1.3 Scope and limitations

This report has been prepared by GHD for Townsville City Council and may only be used and relied on by Townsville City Council for the purpose agreed between GHD and Townsville City Council as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Townsville City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of infrastructure, suitable access and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

GHD has prepared this report on the basis of information provided by third parties (i.e. Biodiversity Australia and Ecological Interpretation) who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

1.4 Suitably qualified personnel

Commonwealth offsets typically require baseline surveys to be conducted by a suitably qualified person (SQP) in accordance with the following Commonwealth survey guidelines:

- Survey guidelines for Australia’s threatened birds (DEWHA 2010a)
- Survey guidelines for Australia’s threatened bats (DEWHA 2010b)
- Survey Guidelines for Australia’s threatened mammals (DSEWPaC 2011)
- Further information on the guidelines used to inform the methodology is detailed in Section 4.
- Within the definitions of EPBC 2021/9133, a SQP for this Project is defined as:

A person who has professional qualifications, training, skills and at least three years of relevant experience specific to locating, identifying and conserving the MNES. The SQP must be able to give authoritative independent assessment, advice and analysis using the relevant protocols, standards, methods and/or literature. Where the person does not have the appropriate professional qualifications, they must have at least five years of relevant experience specific to the MNES.

In order to comply with this requirement, all work has been undertaken under the direction of the following SQPs:

- Dr Greg Calvert (Biodiversity Australia) – BSc Hons (James Cook University) PhD (James Cook University). Greg designed the habitat scoring criteria for the southern black-throated finch and bare-rumped sheath-tail bat and designed and led BioCondition surveys of the offset area. Greg has over 28 years’ of ecological and consulting experience. Greg has applied his knowledge of threatened species, regional ecosystems, pest and weed management and revegetation techniques to a broad range of clients including traditional owner groups, linear infrastructure, mining and extractive industry companies, natural resource management groups, Defence and all tiers of government.
- Chris Kahler (Ecological Interpretation) – BSc (University of Queensland). Chris undertook the BioCondition surveys for the impact area. Chris has over 20 years’ experience in ecological research and consulting. Chris

has worked extensively within the savannah woodlands, wetlands, grasslands and vine thickets of central and north Queensland for a range of constituents. Chris has an interest in landscape scale ecology and the drivers of change (human, biotic and initiate) in our ecosystems and in how our management of landscapes impacts on their related species and other elements.

- Dr Simon Hodgkison (GHD) – BSc (Adelaide), MSc (James Cook University), PhD (Griffith University). Simon designed the habitat scoring for the koala and undertook habitat scoring surveys for the impact area. Simon has over 20 years' experience in ecological research and consulting. Simon has extensive experience delivering ecological assessments to support Commonwealth environmental approvals for infrastructure projects in the renewables, mining, gas, defence, road, rail, power and water development sectors. Simon has developed Commonwealth environmental offsets for a range of MNES including the koala, southern black-throated finch and bare-rumped sheathtail bat.

2. Overview of the proposed offset

2.1 Summary of matters being offset

The OAMP provides a land-based offset for the following MNES species that will be subject to significant residual impacts due to the Project:

- Bare-rumped sheath-tail bat – due to the clearance of 92.23 ha of habitat critical to the survival of the species
- Southern black-throated finch – due to the clearance of 96.34 ha of habitat critical to the survival of the sub-species associated with localised indiscriminate loss of trees within 1 km of water
- Koala – due to clearance of 134.2 ha of habitat critical to the survival of the species

Habitat loss representing a significant residual impact for MNES cleared for the Project is summarised in Table 2.1.

Table 2.1 Summary of habitat loss representing a significant residual impact for MNES

Species	Loss of habitat
Bare-rumped sheath-tail bat	Loss of 92.23 ha (in aggregate), comprising: <ul style="list-style-type: none"> – Foraging and roosting habitat 36.44 ha – Foraging only habitat 49.11 ha – Roosting only habitat 6.68 ha
Black-throated finch (southern)	Loss of 96.34 ha (in aggregate), comprising: <ul style="list-style-type: none"> – Nesting and foraging habitat 82.14 ha – Foraging only habitat 14.19 ha
Koala	Loss of 134.2 ha

2.1.1 Vegetation communities impacted

Recent BioCondition vegetation surveys undertaken by ecologists from Ecological Interpretation in March 2022 have mapped the distribution of regional ecosystems (REs) within the impact area. During BioCondition surveys, the following REs were identified, providing habitat for MNES that will be impacted by the Project. These BioCondition REs are summarised in Table 2.2.

Table 2.2 BioCondition field-verified REs within the impact area

RE	VM Act status	Vegetation	Area	Value for MNES
Remnant 11.3.7	Least concern	<i>Corymbia</i> spp. Open woodland on alluvial plains	18.06 ha	Koala, BTF, BRSTB
Remnant 11.3.35	Least concern	<i>Eucalyptus platyphylla</i> , <i>Corymbia clarksoniana</i> woodland on alluvial plains	51.97 ha	Koala, BTF, BRSTB
Remnant 11.3.25b	Least concern	<i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i> , <i>Nauclea orientalis</i> open forest	1.47 ha	Koala, BTF
Remnant 11.3.4a	Of concern	<i>Corymbia tessellaris</i> woodland. On alluvial sandridges to elevated levees and level terraces adjacent to larger stream channels which are irregularly flooded or possibly relict	1.70 ha	Koala, BTF, BRSTB
Remnant 11.3.31	Of concern	<i>Ophiuros exaltatus</i> , <i>Dichanthium</i> spp. Grassland on alluvial plains	0.44 ha	Koala
Non-remnant 11.3.35	Category X	<i>Eucalyptus platyphylla</i> , <i>Corymbia clarksoniana</i> woodland on alluvial plains	5.47 ha	Koala
Non-remnant 11.3.7	Category X	<i>Corymbia</i> spp. Open woodland on alluvial plains	4.30 ha	Koala

RE	VM Act status	Vegetation	Area	Value for MNES
Non-remnant 11.3.31	Category X	<i>Ophiuros exaltatus</i> , <i>Dichanthium</i> spp. Grassland on alluvial plains	43.79 ha	Koala
Non-remnant 11.3.30	Category X	<i>Eucalyptus crebra</i> , <i>Corymbia dallachiana</i> woodland on alluvial plains	7.00 ha	Koala

VM Act – Queensland Vegetation Management Act 1999, BTF = southern black-throated finch, BRSTB = bare-rumped sheathtail bat

2.1.2 Summary of MNES habitat areas impacted

This section presents a summary of the area of habitat required to be offset, based on the area and quality of habitat impacted. This is based on the EPBC Act *Offsets Assessment Guide* (DSWEPaC 2012b).

2.1.2.1 Bare-rumped sheathtail bat

The Project will impact on 92.23 ha of habitat for the bare-rumped sheathtail bat, with a habitat score of 5.81. A summary of impact area values used within the Offset Assessment Guide (DSWEPaC 2012b) is presented in Table 2.3.

Table 2.3 Area of bare-rumped sheathtail bat habitat requiring offsetting based on Offsets Assessment Guide (DoEE 2012)

Attribute	Result	Rationale
Conservation status	Vulnerable	In accordance with the species listing status under the EPBC Act at the time of the Project referral.
Area impacted	92.23 ha	Significant residual impact as per the MNES report in the PD submission (GHD 2022)
Habitat quality score	5.81	Scores based on BioCondition assessments
Total quantum of impact to be offset	55.34 ha	As per <i>Offsets Assessment Guide</i> (DSWEPaC 2012b)

2.1.2.2 Southern black-throated finch

The Project will impact on 96.34 ha of habitat for the southern black-throated finch, with a habitat score of 5.19. A summary of impact area values used within the Offset Assessment Guide (DSWEPaC 2012b) is presented in Table 2.4.

Table 2.4 Area of southern black-throated finch habitat requiring offsetting based on Offsets Assessment Guide (DSWEPaC 2012b)

Attribute	Result	Rationale
Conservation status	Endangered	In accordance with the species listing status under the EPBC Act at the time of the Project referral.
Area impacted	96.34 ha	Significant residual impact as per the MNES report in the PD submission (GHD 2022)
Habitat quality score	5.19	Scores based on BioCondition assessments
Total quantum of impact to be offset	48.17 ha	As per <i>Offsets Assessment Guide</i> (DSWEPaC 2012b)

2.1.2.3 Koala

The Project will impact on 134.2 ha of habitat for the koala, with a habitat score of 4.63. A summary of impact area values used within the Offset Assessment Guide (DSWEPaC 2012b) is presented in Table 2.5.

Table 2.5 Area of koala habitat requiring offsetting based on Offsets Assessment Guide (DSWEPaC 2012b)

Attribute	Result	Rationale
Conservation status	Endangered	In accordance with the species listing status under the EPBC Act at the time of the Project referral.
Area impacted	134.2 ha	Significant residual impact as per the MNES report in the PD submission (GHD 2022)
Habitat quality score	4.63	Scores based on BioCondition assessments
Total quantum of impact to be offset	67.10 ha	As per <i>Offsets Assessment Guide</i> (DSWEPaC 2012b)

2.2 Offset area

2.2.1 Overview of the offset approach

A land-based offset has been proposed on seven contiguous land parcels located 2.7 km south-east of Lake Ross (Ross River Dam) in southern Townsville. The proposed offset area is shown in Figure 2.1. Ecological surveys have been undertaken in the offset area shown in Figure 2.1 and are detailed in Section 3. The proposed offset area provides suitable habitat for all three MNES and occurs in an area where all three species have been historically recorded. The suitability of the habitat for each MNES is detailed in Section 3.2 to 3.5. The offset area supports a combination of remnant woodland vegetation, regrowth and non-remnant areas that have been historically cleared and subject to cattle grazing. The area including remnant woodland areas has been extensively degraded by weeds including woody weeds and invasive grassy weeds that are known to negatively impact the quality of habitat for the southern black-throated finch, bare-rumped sheath-tail bat and koala. An area of suitable land is available that will attain low-moderate scores (i.e. 4 – 5). The quality of habitat for MNES can be improved by the offset. The following management actions are proposed to improve the quality and connectivity of the habitats for the three MNES:

- Active planting of tubestock in non-remnant areas, particularly around waterbodies
- Natural or assisted regeneration of native woodland in regrowth areas
- Establishing native food grasses for the southern black-throated finch within 400 m of waterbodies
- Maintenance of existing waterbodies and provision of additional drinking sites
- Active weed management in areas of high weed density and surrounding waterbodies
- Implementing appropriate fire regimes and maintaining fire breaks
- Reducing cattle densities to reduce degradation of understorey vegetation

The results of the assessment identified that the current habitat condition scores are very similar between the impact area and the offset area. Through the management measures detailed above, (and discussed in more detail in Section 7), there is potential to increase the condition of habitats across the proposed offset area by an estimated 2 points. Given the large area of land, and the opportunity for improvement, the offset will meet the requirements of the Commonwealth offset calculator. Specifically, at least 100 percent of the offset requirements for each relevant species can be delivered via the land-based offset.

2.2.2 Land tenure

A land-based offset has been proposed on 23 contiguous land parcels located 2.7 km south-east of Lake Ross (Ross River Dam) in southern Townsville. The proposed offset area is shown in Figure 2.1. Details of the property descriptions, ownership and areas are summarised in Table 2.6. The area of land that will be actively managed as the offset has an extent of 625.58 ha and forms part of a larger 640.35 ha area.

Lot on plan 103 EP1450, presently owned by the State of Queensland, is in the process of being acquired by TCC. An offer from the Department of Resources has been accepted for transfer of ownership by TCC which is anticipated to be finalised by December 2022.

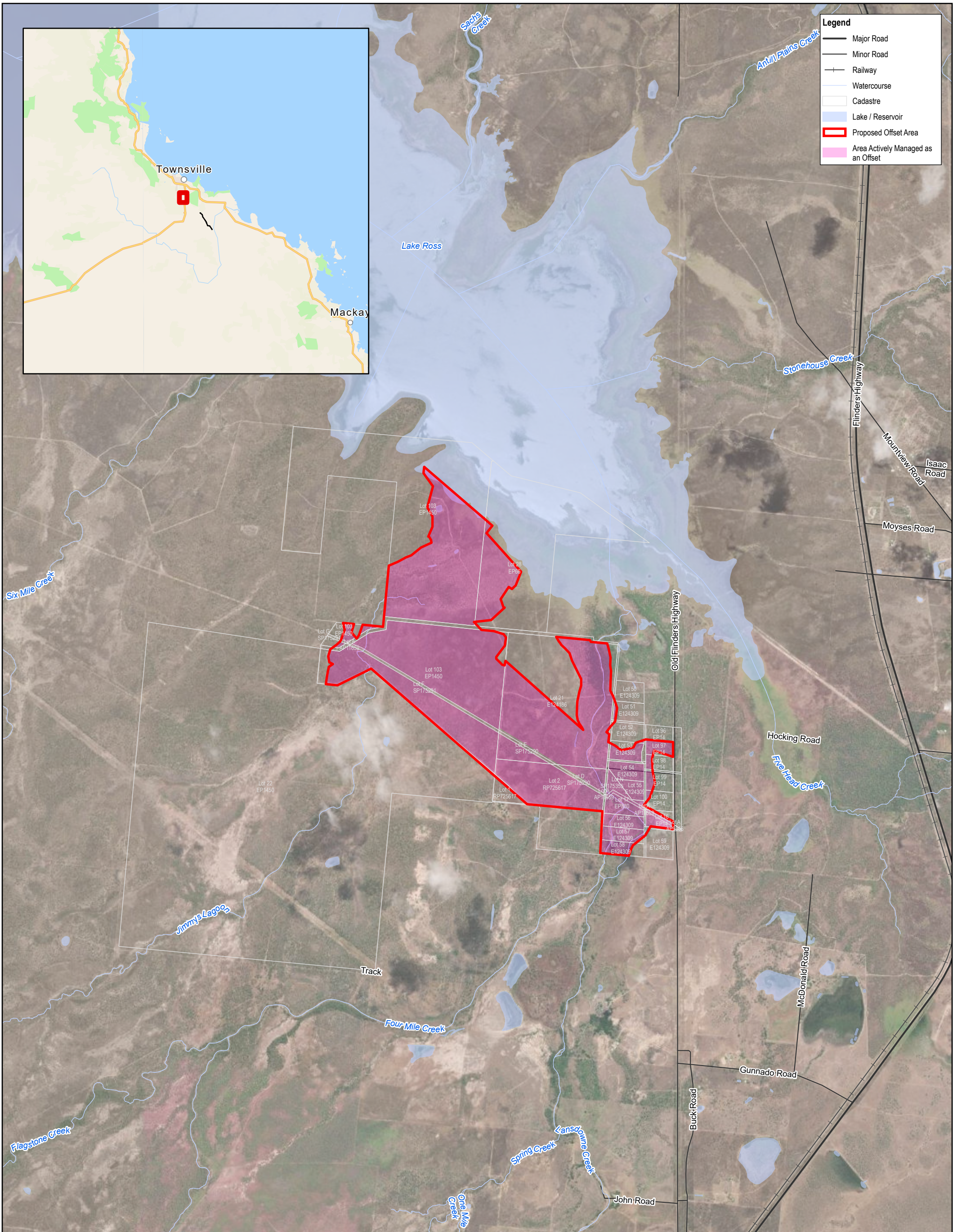
Table 2.6 Summary of offset area

Lot and Plan	Ownership	Tenure	Area actively managed as offset (ha)	Total lot area (ha)
Lot 21 E124186	TCC	Freehold	132.31	193.50
Lot 1 RP725617	TCC	Freehold	0.71	6.79
Lot 2 RP725617	TCC	Freehold	55.32	57.93
Lot 103 EP1450	State of Qld – transfer of ownership to TCC in progress	State land	320.65	986.07
Lot 28 EP66	TCC	Freehold	32.36	258.70
Lot 52 E124309	TCC	Freehold	0.00	5.32
Lot 53 E124309	TCC	Freehold	0.67	7.28
Lot 54 E124309	TCC	Freehold	0.23	8.09
Lot 55 E124309	TCC	Freehold	6.29	8.06
Lot 56 E124309	TCC	Freehold	8.16	10.77
Lot 57 E124309	TCC	Freehold	5.31	4.72
Lot 58 E124309	TCC	Freehold	7.23	6.47
Lot 59 E124309	TCC	Freehold	7.55	1519.24
Lot 16 EP14	TCC	Freehold	5.02	5.14
Lot 22 EP1450	TCC	Freehold	1.81	5.56
Lot 94 EP14	TCC	Freehold	5.59	5.56
Lot 95 EP14	TCC	Freehold	0.00	5.56
Lot 96 EP14	TCC	Freehold	0.00	7.26
Lot 97 EP14	TCC	Freehold	4.94	7.27
Lot 98 EP14	TCC	Freehold	1.34	14.14
Lot 99 EP14	TCC	Freehold	2.10	3,196.28
Lot 100 EP14	TCC	Freehold	0.81	193.50
Lot 17 EP880	TCC	Freehold	14.05	6.79

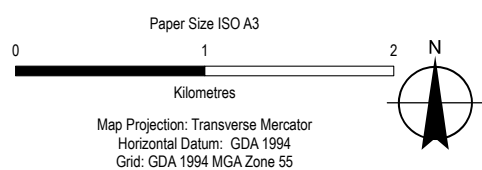
2.2.1 Landscape context

The proposed offset area is located south of Ross River Dam in the Lake Ross Storage Area (LRSA), the primary reservoir for Townsville. The dam has a catchment area of approximately 75 km² and a maximum capacity of 233,187 ML.

The proposed offset area comprises a mix of open eucalypt woodlands and forests, shrublands or low woodlands of *Melaleuca viridiflora* (broad-leaf tea-tree) and/or *Petalostigma* spp. (quinine bush) and/or *Ziziphus mauritiana* (chinee apple), riparian forests and open grasslands dominated by exotic grass species (NRA 2018). The area has been historically subject to cattle grazing and cattle are still present in low densities. Given the primary role of providing safe water quality for the Townsville population, public access to the area is restricted.



Based on or contains data provided by the State of QLD 2021.
 In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.



Townsville City Council
 Houghton Pipeline Stage 2 -
 Offset Area Management Plan

Project No. 12537606
 Revision No. 2
 Date 10/26/2022

Map of the proposed offset area

FIGURE 2-1

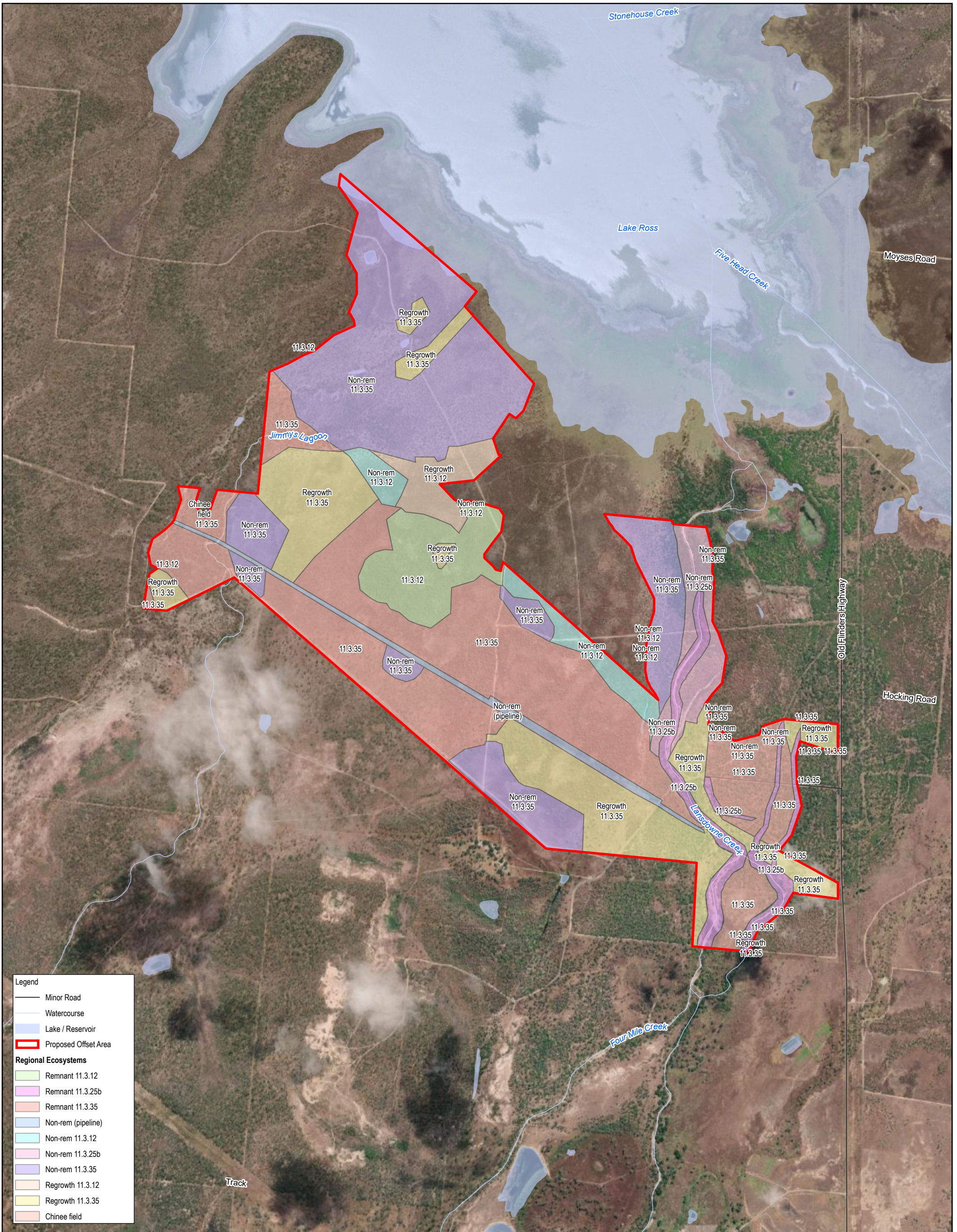
2.2.2 Vegetation communities

Recent vegetation surveys undertaken by ecologists from Biodiversity Australia (detailed in Section 3) have mapped the distribution of REs within the offset area (shown in red in Figure 2.1). Field verified REs that have been confirmed present within the offset area are detailed in Table 2.7 and mapped in Figure 2.2. While the field-verified REs are only a sub-set of those present within the impact area, they are ecologically comparable and provide suitable habitat values for the three MNES for which impacts are being offset. The vegetation communities represent a mix of remnant and regrowth REs and non-remnant areas that previously have supported suitable woodland REs according to DoR version 12.1 pre-clear mapping. Areas of remnant RE represent existing habitat values for the MNES, whilst areas of non-remnant and regrowth REs have future potential habitat values that will be actively managed to enhance the habitat values of the proposed offset. The final area of REs secured are presented in Table 2.7. Given the offset area provides a mix of existing habitat and future potential habitat (i.e. areas of former habitat that have been historically cleared for agriculture), the offset area offers substantial opportunities to increase habitat connectivity through the strategic replanting of regrowth and non-remnant areas.

Table 2.7 Regional Ecosystem mapping within the offset area

Regional Ecosystem	VM Act Status	Description	Status	Area	Habitat for MNES
11.3.12	Least Concern	<i>Melaleuca viridiflora</i> , <i>M. argentea</i> +/- <i>M. dealbata</i> woodland on alluvial plains	Remnant	37.03 ha	Current value for BTF
			Regrowth	17.00 ha	Future value for BTF
			Non-remnant	19.76 ha	
11.3.25b	Least Concern	<i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i> , <i>Nauclea orientalis</i> open forest	Remnant	28.38 ha	Current value for BTF, BRSTB, koala
			Non-remnant	21.48 ha	Future value for BTF, BRSTB, koala
11.3.35	Least Concern	<i>Eucalyptus platyphylla</i> , <i>Corymbia clarksoniana</i> woodland on alluvial plains	Remnant	207.65 ha	Current value for BTF, BRSTB, koala
			Regrowth	110.40 ha	Future value for BTF, BRSTB, koala
			Non-remnant	183.88 ha	
			Total	625.58 ha	

BTF = southern black-throated finch, BRSTB = bare-rumped sheath-tail bat



Legend

- Minor Road
- Watercourse
- Lake / Reservoir
- ▭ Proposed Offset Area

Regional Ecosystems

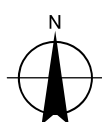
- ▭ Remnant 11.3.12
- ▭ Remnant 11.3.25b
- ▭ Remnant 11.3.35
- ▭ Non-rem (pipeline)
- ▭ Non-rem 11.3.12
- ▭ Non-rem 11.3.25b
- ▭ Non-rem 11.3.35
- ▭ Regrowth 11.3.12
- ▭ Regrowth 11.3.35
- ▭ Chinese field

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.

Paper Size ISO A3

0 250 500
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Townsville City Council
Houghton Pipeline Stage 2 -
Offset Area Management Plan

**Field verified Regional Ecosystems
within the proposed offset area**

Project No. 12537606
Revision No. 1
Date 10/26/2022

FIGURE 2-2

2.2.3 Water resource availability

Water resource availability for drinking sites is a key ecological requirement for all three MNES, particularly for the southern black-throated finch which relies on access to nearby drinking sites during the breeding season (DEWHA 2009). The proposed offset area has high local availability of suitable wet season drinking sites. Lake Ross is located immediately north of the offset area. Five mapped watercourses intersect the proposed offset area including four 1st order watercourses and one 5th order watercourse (Lansdowne Creek). The area is low-lying and subject to seasonal inundation, with four wetlands mapped within the offset area in the Queensland inland waters watercourse mapping. These would be seasonally available during the breeding season, providing additional drinking sites for the southern black-throated finch. Three permanent stock dams are located at the north and north-east of the offset area and additional stock dams are located 480 m to the south and 590 m to the east outside the offset area. The distribution of water resources is mapped in Figure 2.3.

2.2.4 Existing land use and disturbances at the offset area

The majority of the offset area has been historically used for cattle grazing on freehold land. TCC has been acquiring land parcels over time and however cattle continues to be stocked on acquired properties at varying densities. Although grazing ceased on the parcels that are the focus of the proposed offset in 2002 (pers. Comm. Bradley Drinkwater (Ross River Dam Ranger)), grazing still occurs from time to time within and surrounding the proposed offset area when boundary fences are down (flooding etc). Sustained cattle grazing has caused a reduction in the abundance of native perennial and annual grasses and relatively high abundance of exotic plant species in the LRSA (NRA 2018).

The offset area is subject to extensive weed infestation, with invasive shrubby weeds, particularly chinee apple and *Cryptostegia grandiflora* (rubber vine) occurring in high local densities. Exotic herbs including *Stylosanthes scabra* (stylo), *Chamaecrista rotundifolia* (Wynn cassia) and *Sida* spp. And exotic introduced pasture grasses such as *Urochloa mosambicensis* (Sabi grass) dominate the ground layer (Biodiversity Australia 2022b). These invasive weed species are known to adversely impact habitat values for the southern black-throated finch (Rechetelo 2015) and bare-rumped sheathtail bat (Duncan et al. 1999; Woinarski and Milne 2002 cited in Schulz and Thomson 2007).

Within the proposed offset area, fire has been infrequent (at most, one fire since 2000) (NRA 2018). In other areas of the proposed offset area, fire has been more frequent, predominantly occurring during periods of relatively low rainfall and warm or hot weather (NRA 2018). NRA (2018) suggested that historical fire regimes have been unfavourable to southern black-throated finch and has likely contributed to proliferation of certain weedy grasses and forbs. Similarly, inappropriate fire regimes are known to exacerbate the abundance of shrubby weeds that are known to adversely impact the bare-rumped sheathtail bat.






Introduced animals including feral pigs (*Sus scrofa*) and wild dogs (*Canis familiaris*) are considered common within the LSRA and proposed offset area. Feral pigs are known to degrade ground-level habitats and water sources, and thus have the potential to impact on potential southern black-throated finch habitat at the offset area. Each year TCC conduct an aerial shooting program where they control approximately 30 wild dogs and 220 wild pigs per year (pers. comm. Bradley Drinkwater (Ross River Dam Ranger)). While rabbits (*Oryctolagus cuniculus*) are considered uncommon within the LSRA (NRA 2018; pers comm. Bradley Drinkwater (Ross River Dam Ranger)), the species can substantially degrade habitats for the southern black-throated finch (BTF Recovery Team 2004) and has the potential for adverse impact on habitats at the offset area. More information on the habitat values of the proposed offset area and the specific threats faced by each MNES are detailed in Section 4.

2.2.5 Potential to contribute to landscape connectivity

As shown in Figure 2.4, the proposed offset area is located between two State significant biodiversity corridors, mapped in Queensland's Biodiversity Planning Assessment mapping; one that covers Lake Ross, and another larger biodiversity corridor that runs east-west at the southern half of the offset area – linking Hervey's Range in the west to Toonpan in the east. A regionally significant biodiversity corridor also runs north-south through the proposed offset area, along Lansdowne Creek. By revegetating parts of the offset area that currently support non-remnant and regrowth vegetation, the offset has the potential to increase local and regional habitat connectivity at multiple scales.



Legend

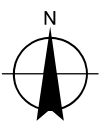
-  Minor Road
-  Proposed Offset Area
-  Watercourse
-  Lake / Reservoir
-  Stock Dam

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.

Paper Size ISO A3

0 250 500
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

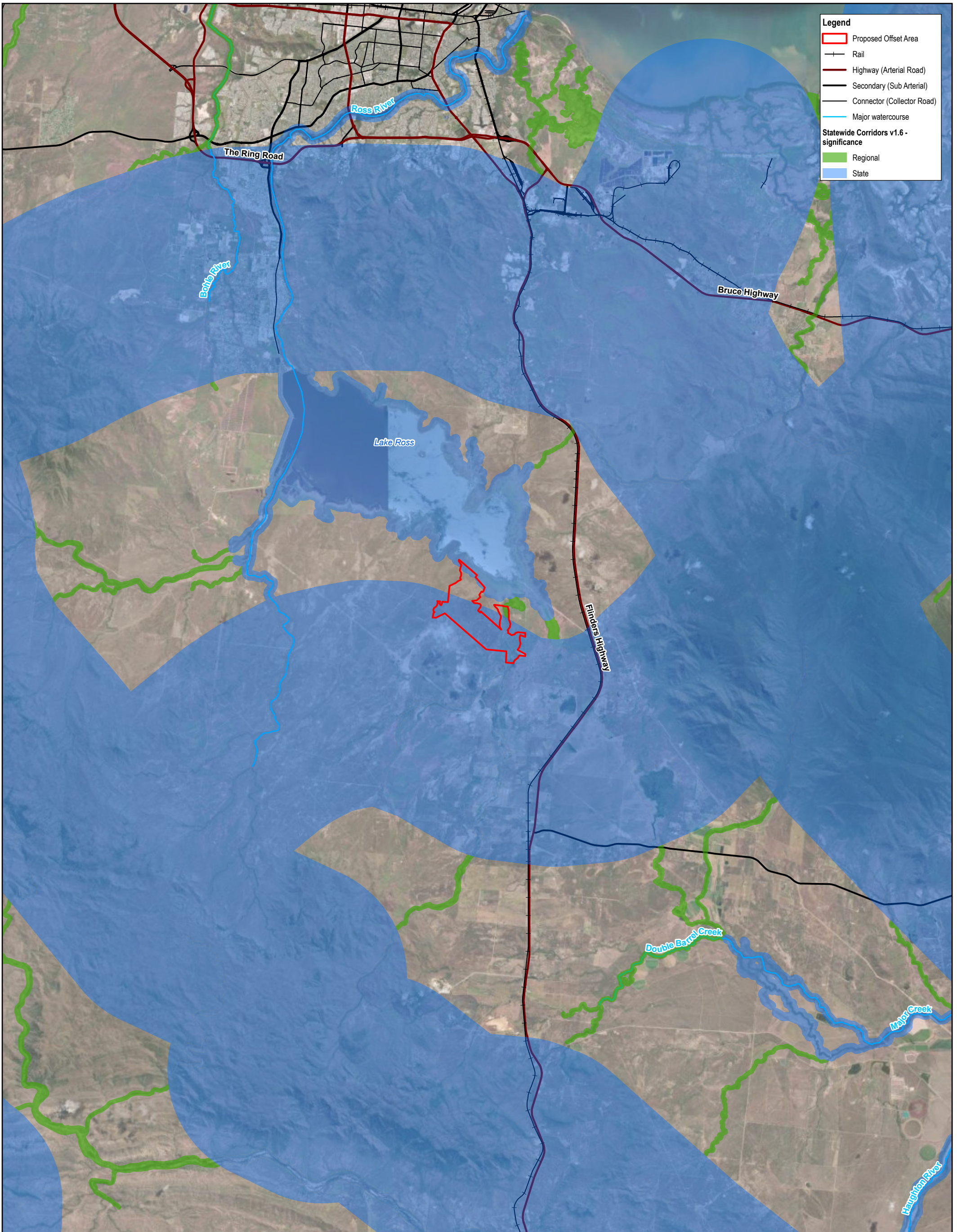


Townsville City Council
Haughton Pipeline Stage 2 -
Offset Area Management Plan

**Water sources located within
the proposed offset area**

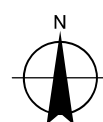
Project No. 12537606
Revision No. 1
Date 10/26/2022

FIGURE 2-3



Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.

Paper Size ISO A3
 0 1.5 3
 Kilometres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 55



Townsville City Council
 Haughton Pipeline Stage 2 -
 Offset Area Management Plan
**Connectivity within the proposed
 offset area to State and regional
 biodiversity corridors**

Project No. 12537606
 Revision No. 1
 Date 10/26/2022

FIGURE 2-4

3. Suitability of the offset area

3.1 Overview

The suitability of the offset area has been assessed through a combination of desktop and field investigations.

3.1.1 Desktop assessments

A desktop review of the following sources was undertaken searching a 10 km radius of the approximate centre of the offset area:

- Commonwealth Protected Matters Search Tool (PMST)
- DES Wildlife Online database
- DES Species Profile Search
- Atlas of Living Australia database search
- Birddata database search
- DES Biomaps mapping layers
- Biodiversity Planning Assessment mapping layers
- DES essential habitat mapping layer

3.1.2 Field surveys

Information on the distribution and suitability of habitat within the proposed offset area has been gathered in three ecological field surveys commissioned for the Project:

- **Biodiversity Australia (2022a) Rapid habitat assessment – Black-throated finch.** This survey undertaken over two days in March 2022 involved a rapid assessment of habitat values for the southern black-throated finch at three initial offset areas, two within the current proposed offset area at Lake Ross and an additional offset area located further to the west in Hervey's Range.
- **Biodiversity Australia (2022b) Offset area investigation.** This survey undertaken between April and May 2022 comprised a detailed investigation of the ecological values of initially identified land areas with the proposed offset site in Figure 2.1, including:
 - Field-verification and mapping of REs to form the basis of offset assessment units
 - BioCondition surveys to assess the condition of assessment units in accordance with the methodology detailed in the *BioCondition- A Condition Assessment Framework for Terrestrial Biodiversity in Queensland Assessment Manual V2.2* (Eyre et al. 2015)
 - Habitat scoring for the southern black-throated finch and bare-rumped sheath-tail bat using scoring criteria devised for the Project in accordance with guidance provided in the Queensland *Guide to Determining Terrestrial Habitat Quality* (DES 2020), the *Modified QLD Habitat Quality spreadsheet* (provided by DCCEEW directly for this purpose), and the EPBC Act *Offsets Assessment Guide* (DSEWPaC 2012b).
 - Targeted surveys for the southern black-throated finch and bare-rumped sheath-tail bat including visual searches for birds within suitable nesting habitat and full spectrum analysis of microbat echolocations recorded by passive deployment of Anabat detectors along suitable flyways (i.e. watercourses) for a combined period of 26 nights.

Information on the methods used to assess habitat quality are detailed in Section 4.

- **Biodiversity Australia (2022c) Houghton area investigation.** This survey undertaken in July and August 2022 comprised a detailed investigation of additional land areas within the offset area shown in Figure 2.1, including:
 - Field-verification and mapping of REs to form the basis of offset assessment units

- BioCondition surveys to assess the condition of assessment units in accordance with the methodology detailed in the *BioCondition- A Condition Assessment Framework for Terrestrial Biodiversity in Queensland Assessment Manual V2.2* (Eyre et al. 2015)
- Habitat scoring for the koala, southern black-throated finch and bare-rumped sheath-tail bat using scoring criteria devised for the Project in accordance with guidance provided in the Queensland *Guide to Determining Terrestrial Habitat Quality* (DES 2020), the *Modified QLD Habitat Quality spreadsheet* (provided by DCCEEW directly for this purpose), and the EPBC Act *Offsets Assessment Guide* (DSEWPac 2012b).
- Targeted surveys for koalas using systematic SAT searches in suitable habitat and nocturnal spotlighting.

Additional targeted surveys for the southern black-throated finch were previously undertaken within the LRSA:

- **NRA Environmental Consultants (2018) Management Plan for Black-throated Finch (*Poephila cincta cincta*) Habitat at Lake Ross Storage Area, Townsville.** This survey undertaken over 3.5 days in July and August 2017 assessed the value and distribution of habitats and water resources for the southern black-throated finch with the intent to provide advice on the practical land management of the LRSA to protect values for the southern black-throated finch. Information from this survey has been used to inform the assessment of habitat values.

3.2 Suitability for the bare-rumped sheath-tail bat

3.2.1 Ecology of the bare-rumped sheath-tail bat

Information on the ecology of the bare-rumped sheath-tail bat is relatively limited, partly restricted by the difficulties of trapping the species or detecting it via conventional echolocation surveys (DAWE 2022A). While the species was only known from two recent historical locations at the time the listing advice was prepared, recent advances in acoustic detection via full-spectrum echolocation analysis have increased detection of the species. The species may be more widespread and common than previously thought (Schulz and Thomson 2007).

Commonwealth habitat definition: The Commonwealth listing advice identifies habitat as including mostly in lowland areas, typically in a range of woodland, forest and open environments (Schulz and Thomson 2007; Reardon et al. 2010; Dennis 2012). In north Queensland, the species occurs in lowland open woodland areas dominated by *Eucalyptus platyphylla* (poplar gum) (Compton and Johnson 1983).

Foraging habitat: The bare-rumped sheath-tail bat has been suggested to forage over habitat edges such as the edges of rainforest and forest clearings (Churchill 1998). It has been suggested that the species forages on aerial insects over the canopy or along the edges of woodland and forest communities and around open clearings.

Roosting habitat: In Australia, all confirmed roosting records are from deep tree hollows in *E. platyphylla*, *Eucalyptus miniata* (Darwin woollybutt), *Eucalyptus tetradonta* (Darwin stringybark) and *Melaleuca leucadendra* (weeping paperbark) (Churchill 1998; Compton and Johnson 1983; McKean et al. 1981; Murphy 2002). In Queensland, the bare-rumped sheath-tail bat has been recorded roosting in large *E. platyphylla* in colonies of 3 – 4 bats (Churchill 1998). The long deep hollows in the poplar gum provide suitable roosting habitat and maternity sites for the bare-rumped sheath-tail bat (Churchill 1998; Compton and Johnson 1983). All known roosts have been in large hollows 18 – 29 cm in diameter. Roosts are typically high in the tree with recorded roosts ranging between 7 and 8 m in height (Schulz and Thomson 2007). Potential roosting trees are considered to include all suitable roost tree species with deep hollows > 10 cm diameter that are >8 m in height (Greg Ford, pers. Comm.).

Behaviour: The bare-rumped sheath-tail bat is a high-flying species, foraging for flying insects above canopy height (Churchill 1998). The species is known to fly at altitudes up to and above 400 m and capable of moving long distances (Clague pers. comm. 2015, cited in Threatened Species Scientific Community (TSSC) 2016).

Key threats: Key threats to the bare-rumped sheath-tail bat include habitat loss, degradation of habitat by weeds particularly *Mimosa pigra* (giant sensitive tree), inappropriate fire regimes, timber collections and targeted tree removal, as well as disease and competition for tree hollows by termites, bees, feral birds such as the common myna (*Acridotheres tristis*) and native birds such as the rainbow lorikeet (*Trichoglossus haematodus*) and sulphur-crested cockatoo (*Cacatua galerita*) (Schulz and Thomson 2007).

Status as important population: Important populations of the bare-rumped sheath-tail bat have not been formally defined in the Commonwealth listing advice (DAWE 2022A). The National Recovery Plan (Schulz and Thomson 2007) identified all populations as important populations. However, this designation was made at a time when the species was listed as critically endangered. Despite this, given the paucity of records, any confirmed populations should be considered important.

Habitat critical to the survival of the species: Habitat critical to the survival of the species has not been formally defined in the Commonwealth listing advice or National Recovery Plan for the species. In the absence of a formal definition, habitat critical to the survival of the species has been defined for the purposes of this assessment using the definition outlined in the Significant impact guidelines 1.1 (DoE 2013), which state that habitat critical to the survival of a particular species refers to areas that are necessary:

- For activities such as foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- To maintain genetic diversity and long-term evolutionary development, or/
- For the reintroduction of populations or recovery of the species or ecological community.

In this context, all foraging and roosting habitat is considered habitat critical to the survival of the species.

3.2.2 Bare-rumped sheath-tail bat presence within the offset area

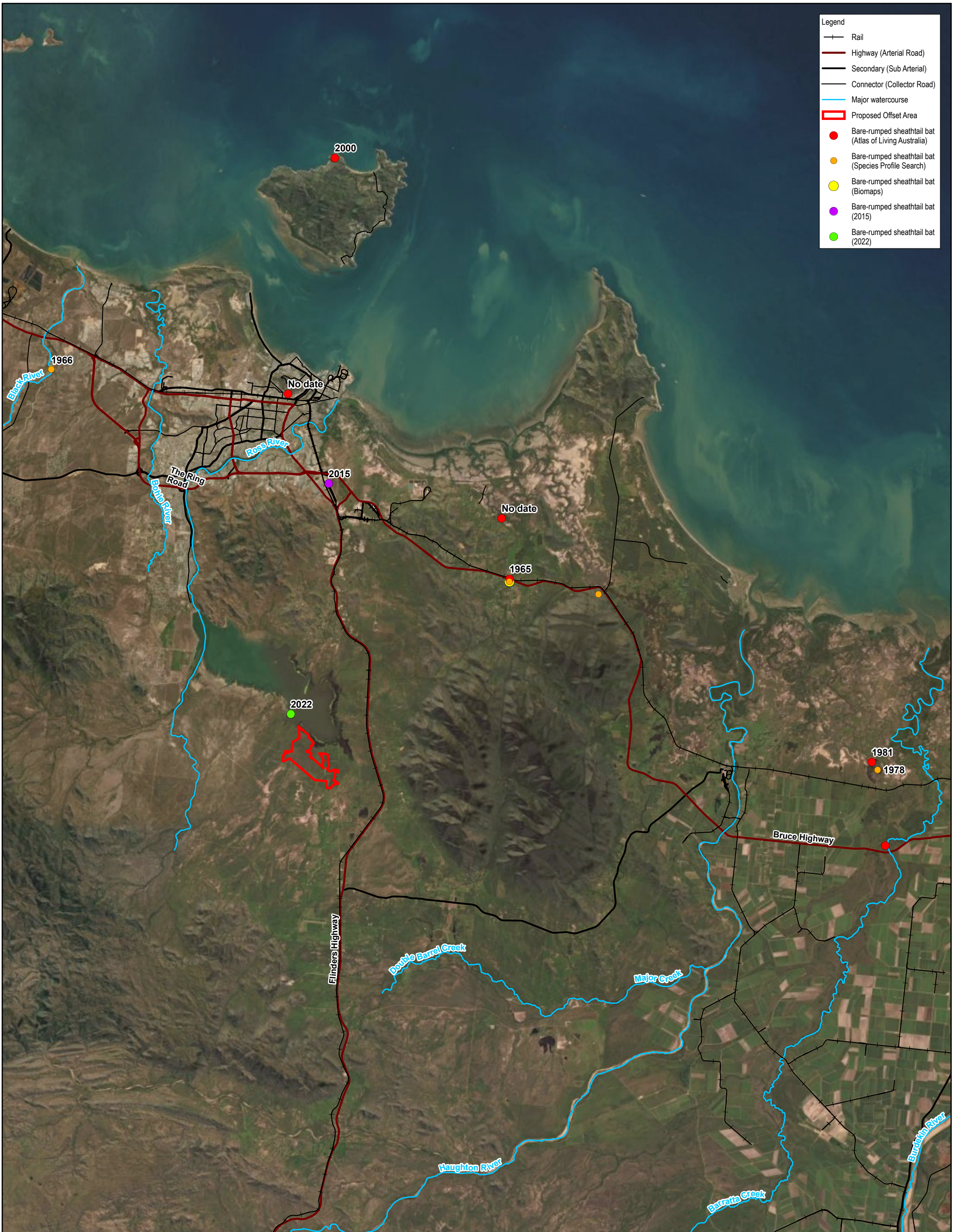
The bare-rumped sheath-tail bat was positively detected from a full spectrum echolocation call, captured immediately north of the offset area during targeted baseline surveys for the offset (Biodiversity Australia 2022b). The call was positively identified by bat call analysis expert Greg Ford from Balance Environmental!. Numerous historical records are also known from the Townsville region, as shown in Figure 3.1. Most are relatively recent records that have been confirmed since recent advances in acoustic detection via full spectrum analysis have increased the capacity to detect the species.

3.2.3 Suitability of habitat for the bare-rumped sheath-tail bat within the offset area

Suitable habitat for the bare-rumped sheath-tail bat was broadly distributed across the proposed offset area. The following RE communities that are known to provide habitat for the bare-rumped sheath-tail bat were present:

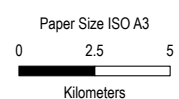
- RE11.3.35 *Eucalyptus platyphylla*, *Corymbia clarksoniana* woodland on alluvial plains
- RE 11.3.25b *Melaleuca leucadendra* and/or *M. fluviatilis*, *Nauclea orientalis* open forest.

Approximately 236.03 ha of remnant RE 11.3.35 and RE 11.3.25b currently provides habitat for the bare-rumped sheath-tail bat. An additional 315.76 ha of regrowth and non-remnant RE 11.3.35 and RE 11.3.25b represent future potential habitat for the bare-rumped sheath-tail bat. The distribution of current and future potential habitat for the bare-rumped sheath-tail bat is mapped in Figure 3.2. With the existing and future potential habitat, there is sufficient land area to provide a land-based offset for the bare-rumped sheath-tail bat that will increase in value with active management. The existing condition of habitats has been assessed and is detailed in Section 4.

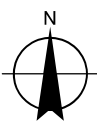


- Legend**
- +— Rail
 - Highway (Arterial Road)
 - Secondary (Sub Arterial)
 - Connector (Collector Road)
 - Major watercourse
 - ▭ Proposed Offset Area
 - Bare-rumped sheathtail bat (Atlas of Living Australia)
 - Bare-rumped sheathtail bat (Species Profile Search)
 - Bare-rumped sheathtail bat (Biomaps)
 - Bare-rumped sheathtail bat (2015)
 - Bare-rumped sheathtail bat (2022)

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

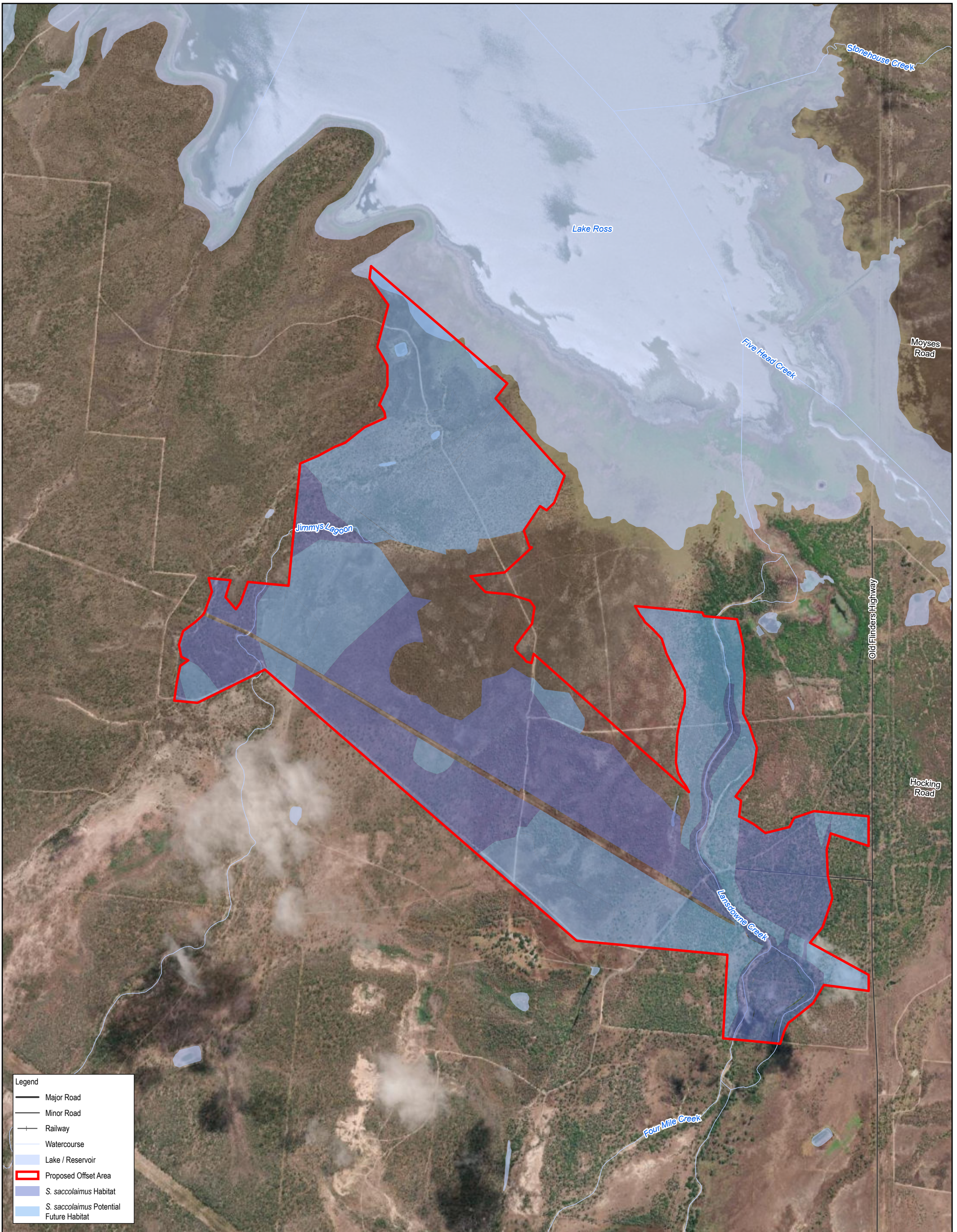


Townsville City Council
Haughton Pipeline Stage 2 -
Offset Area Management Plan

Project No. 12537606
Revision No. 1
Date 10/26/2022

**Bare-rumped sheathtail bat records
near the proposed offset area**

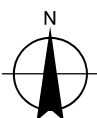
FIGURE 3-1



- Legend**
- Major Road
 - Minor Road
 - +— Railway
 - Watercourse
 - Lake / Reservoir
 - ▭ Proposed Offset Area
 - ▭ S. saccolaimus Habitat
 - ▭ S. saccolaimus Potential Future Habitat

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.

Paper Size ISO A3
 0 250 500
 Meters
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 55



Townsville City Council
 Houghton Pipeline Stage 2 -
 Offset Area Management Plan

Project No. 12537606
 Revision No. 3
 Date 10/26/2022

Habitat for the bare-rumped
 sheathtail bat within the offset area

FIGURE 3-2

3.3 Suitability for the southern black-throated finch

3.3.1 Ecology of the southern black-throated finch

The southern black-throated finch occurs in grassy open woodlands dominated by *Eucalyptus*, *Corymbia* and *Melaleuca*, in close proximity to water and where seeding grasses occur (Black-throated finch Recovery Team 2007). In the wet season, southern black-throated finches require a mosaic of different habitats for foraging. Within suitable habitats, the southern black-throated finch requires access to three key resources:

- Water sources
- Grass seeds, and
- Trees providing suitable nesting habitat (DEWHA 2009)

Foraging habitat: The species diet includes a variety of grass species, such as *U. mosambicensis*, *Digitaria ciliaris* (crabgrass), *Melinis repens* (red Natal grass) and *Chloris inflata* (purple-top chloris), and typically varies seasonally (Mitchell 1996). At Ross River Dam, the southern black-throated finch has been recorded foraging in cleared, open areas and in tall open eucalypt woodlands dominated by *Corymbia erythrophloia* (red bloodwood) or *E. platyphylla* (Mitchell 1996). It is also known that the species forages on seeds of *U. mosambicensis* during the non-breeding period, and during the breeding period, the species mainly feeds on seeds of *D. Ciliaris* (Mitchell 1996). The species is also known to feed on insects (i.e. termites) and their larvae, especially during the wet season (Black-throated finch Recovery Team 2007). The Townsville population of the southern black-throated finch experiences a critical resource bottleneck at the start of the wet season (November and December) due to a local shortage of seeding species (NRA 2007). Early-flowering perennial grass species that produce seed in November and December represent a critical resource for the species locally (NRA 2007). Key perennial food grass species that are thought to dominate the southern black-throated finch diet include *U. mosambicensis*, *Enteropogon acicularis* (curly windmill grass), *Panicum decompositum* (native millet), *Panicum effusum* (hairy panic), *Dichanthium sericeum* (bluegrass), *Alloteropsis semialata* (cockatoo grass), *Eragrostis sororia* (woodland lovegrass) and *Themeda triandra* (kangaroo grass) (Mitchell 1996; NRA 2007).

Nesting habitat: In Townsville, the southern black-throated finch typically breeds during the wet season between February and May, mainly in non-remnant vegetation (Higgins et al. 2006). In Townsville, nesting habitat is typically located within 400 m of permanent water sources (NRA 2006). Nesting sites also need to be near foraging habitat as observations suggest that during the breeding season the subspecies travels smaller distances than it does during the dry season and rarely ventures more than 1 km from nesting sites during the breeding season (Mitchell 1996; NRA 2006; NRA 2007 cited in (DEWHA 2009). While suitable nesting sites are likely to be relatively common in the landscape, the distribution and availability of water and foraging habitat is much more limited and will, in turn, limit the number of nesting sites available to the black-throated finch (southern) (DEWHA 2009). Nests are composed of grass and are constructed in hollow branches, or in the fork of trees or shrubs.

Key threats: Key threats to the southern black-throated finch include the loss and fragmentation of habitat, degradation of habitat by domestic livestock and rabbits, and invasion of weeds including exotic grasses, and predation by introduced predators.

Status as important population: At sites around Townsville and Charters Towers, the southern black-throated finch is still considered locally common (DEWHA 2009). However, given that a reliable estimate of population size is currently not available, and the sub-species is under threat throughout its' range, recovery efforts should aim to conserve all existing populations of the southern black-throated finch (DAWE 2022A). Accordingly, all populations, including the Townsville population, are considered important in the national context.

Habitat critical to the survival of the sub-species: Habitat critical to the survival of the sub-species has not been formally defined in *the National recovery plan for the black-throated finch southern sub-species Poephila cincta cincta* (Black-throated finch Recovery Team 2007) or the *Significant impact guidelines for the endangered black-throated finch (southern) (Poephila cincta cincta)* (DEWHA 2009). Habitat critical to the survival of the species is likely to include nesting habitat. In the Townsville region, the southern black-throated finch typically nests within 400 m of a water source and is rarely seen more than 1 km from permanent water during the breeding season (NRA 2006). Nesting sites also need to be near foraging habitat as observations suggest that during the breeding season the subspecies travels smaller distances than it does during the dry season (Mitchell 1996; NRA

2006; NRA 2007). The presence of suitable trees for breeding, and requisite foraging resources, close to seasonal water sources is critical for the southern black-throated finch.

3.3.2 Presence of southern black-throated finch within the offset area

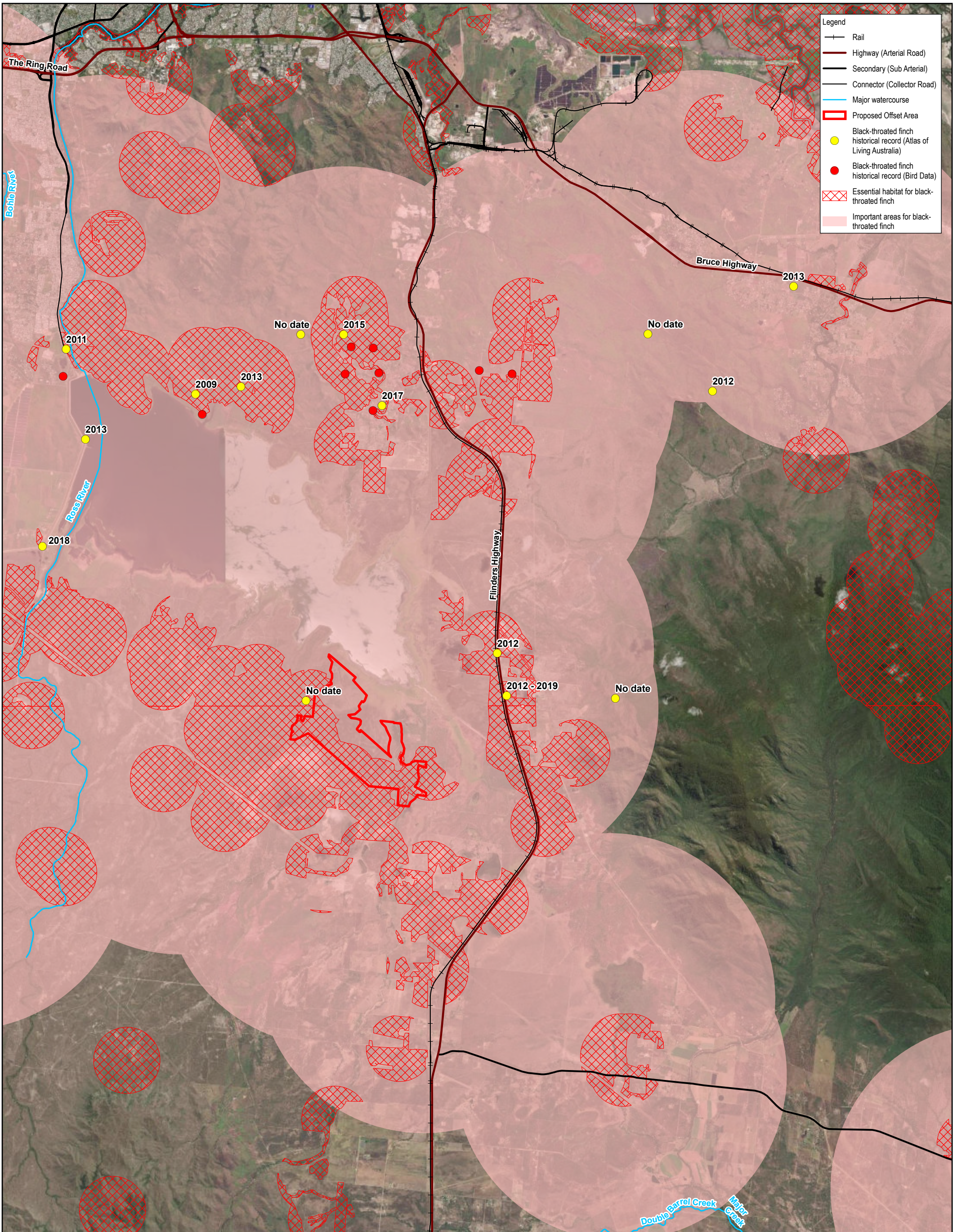
The offset area occurs within the centre of a mapped important area for the southern black-throated finch, recognised in the Commonwealth's Greater Townsville important areas mapping (DEWHA 2009). While no individual black-throated finches were recorded within the offset area in targeted surveys (Biodiversity Australia 2022a,b), Ross River Dam area is considered a hotspot for the species, with the Atlas of Living Australia and Birddata identifying high densities of historical records of the species within the local area as shown in Figure 3.3. There are a total of 201 historical records of the southern black-throated finch within a 20 km radius of the proposed offset area. Based on this information, the species is known to occur within the proposed offset area.

3.3.3 Suitability of habitat for the southern black-throated finch

Suitable habitat for the southern black-throated finch is broadly distributed across the proposed offset area. The following RE communities that are known to represent habitat for the southern black-throated finch were present within the offset area:

- RE11.3.35 *Eucalyptus platyphylla*, *Corymbia clarksoniana* woodland on alluvial plains
- RE 11.3.25b *Melaleuca leucadendra* and/or *M. fluviatilis*, *Nauclea orientalis* open forest
- RE 11.3.12 *Melaleuca viridiflora*, *M. argentea* +/- *M. dealbata* woodland on alluvial plains

Approximately 273.06 ha of remnant RE 11.3.35, RE 11.3.25b and RE 11.3.12 currently provides habitat for the southern black-throated finch. An additional 352.52 ha of regrowth and non-remnant RE 11.3.35, RE 11.3.25b and RE 11.3.12 represent future potential habitat for the southern black-throated finch. The distribution of current and future potential habitat for the southern black-throated finch is mapped in Figure 3.4. With the existing and future potential habitat, there is sufficient land area to provide a land-based offset for the southern black-throated finch that will increase in value with active management. The existing condition of habitats has been assessed and is detailed in Section 4.



Legend

- Rail
- Highway (Arterial Road)
- Secondary (Sub Arterial)
- Connector (Collector Road)
- Major watercourse
- Proposed Offset Area
- Black-throated finch historical record (Atlas of Living Australia)
- Black-throated finch historical record (Bird Data)
- Essential habitat for black-throated finch
- Important areas for black-throated finch

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.

Paper Size ISO A3

0 2.5 5

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

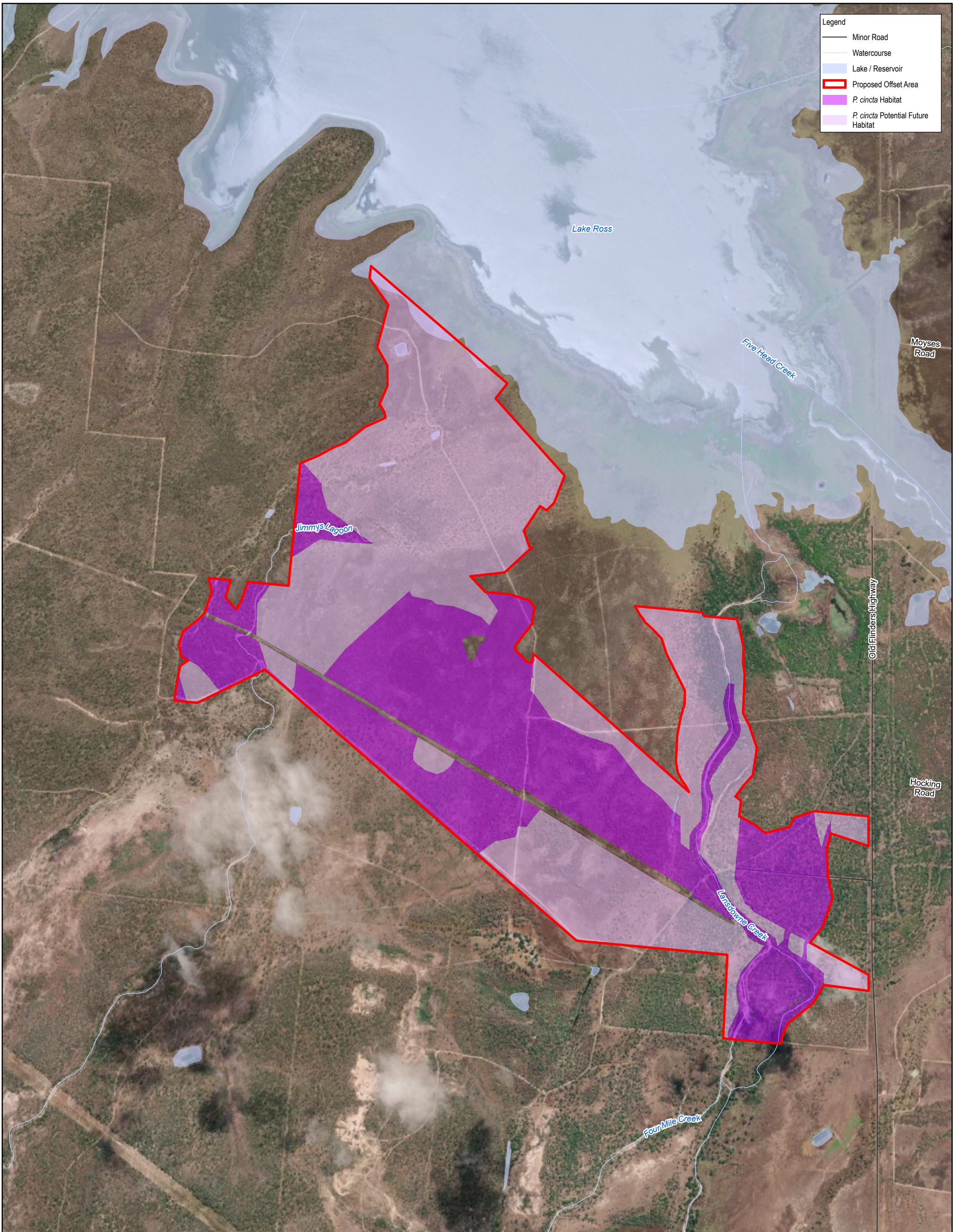


Townsville City Council
Houghton Pipeline Stage 2 -
Offset Area Management Plan

**Historical records of the southern
black-throated finch near the
proposed offset area**

Project No. 12537606
Revision No. 1
Date 10/26/2022

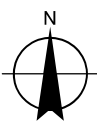
FIGURE 3-3



Legend	
	Minor Road
	Watercourse
	Lake / Reservoir
	Proposed Offset Area
	<i>P. cincta</i> Habitat
	<i>P. cincta</i> Potential Future Habitat

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.

Paper Size ISO A3
 0 250 500
 Meters
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 55



Townsville City Council
 Houghton Pipeline Stage 2 -
 Offset Area Management Plan

Project No. 12537606
 Revision No. 3
 Date 10/26/2022

Habitat for the southern black-throated finch within the proposed offset area

FIGURE 3-4

3.4 Suitability for the koala

3.4.1 Ecology of the koala

The koala occurs in coastal and inland habitats from the Herberton area in Queensland, westward into hotter and dryer semi-arid climates through central Queensland, and south into coastal and inland New South Wales and the Australian Capital Territory. The species' distribution is not continuous across this range (DAWE 2022b).

Foraging habitat: The koala has a specialist diet, feeding on the leaves of select species of *Eucalyptus*, *Lophostemon*, *Corymbia*, *Angophora* and occasionally *Melaleuca* and *Leptospermum* (Martin and Handasyde 1999; Moore and Foley 2000). Consequently, koalas are reliant on access to stands of forest and woodland that support those key food-tree species. Shelter (non-food) tree species are also used to rest and assist in thermoregulation (Crowther et al. 2013; Briscoe et al. 2015).

Koala habitat is generally defined as coastal and inland areas characterised by *Eucalyptus* forests and woodlands (DAWE 2022b). Koala habitat includes places that contain resources necessary for foraging, survival, growth, reproduction and movement. This includes forests or woodlands, road-side and rail vegetation and paddock trees, safe intervening ground matrix for travelling between trees and patches to forage and shelter and reproduce, and access to vegetated corridors or paddock trees to facilitate movement between patches (DAWE 2022b).

The way in which koalas move through the landscape also influences their use of habitat. In general, koalas are relatively sedentary, typically changing trees only a few times each day (DAWE 2022A). Koala movement increases in spring when young dispersing males move distances of up to 10 km in urban south-east Queensland (Dique et al. 2003) and 16 km in rural south-east Queensland (White 1999). For the rest of the year koalas move relatively little within home ranges that vary between 8 ha and 135 ha (Ellis et al. 2002; Goldingay and Dobner 2014). Home range size generally increases with distance from the coast, as inland koalas need to move more widely to derive sufficient sources of food and water (Davies et al. 2013).

Key factors that influence the quality of habitat for koalas are the presence and density of preferred food tree species, food trees' nutritional foliar chemistry, and shelter trees and vegetation structure. Koalas move between trees and patches, and the safety or hostility of these areas also contributes to the quality of koala habitat (DAWE 2022b). Broadly, these are determined by a number of factors including climate variables, disturbance (i.e. fire, vegetation clearance), and landforms of the natural and built environment. At a landscape scale, the total amount of available habitat and its' quality are the primary factors that influence koala presence (DAWE 2022b). In the assessment of habitat quantity and quality, the National Recovery Plan for the koala (DAWE 2022b) highlights the importance of considering landscape patch size, form and spatial configuration within the context of the wider landscape, which can vary among landscapes and varies regionally (DAWE 2022b). In fragmented landscapes, the use of isolated paddock trees is commonly recorded, along with the use of roadside vegetation. In more arid areas, riparian habitats and surface water bodies are essential for the survival of koalas, particularly in the western margins of the species' distribution. Additionally, riparian vegetation facilitates local movement and provides important dispersal pathways for long-distance movement (DAWE 2022b).

Key threats: Known threats to the koala and koala habitat include loss and fragmentation of climatically suitable habitat due to land clearing, increased intensity and frequency of drought, increased intensity and frequency of heatwaves, increased intensity and frequency of uncontrolled bushfires, declining nutritional value of foliage, mortality due to dog attacks and vehicle collisions and increased incidence of disease including koala retrovirus (KoRV) and Chlamydia (*Chlamydia pecorum*).

Status as important population: The concept of 'important populations' has been applied to the koala in general terms in the current Conservation listing advice (DAWE 2022b). This considers important populations as those that are valued for cultural, social, and economic reasons as well as for the species conservation. For the species conservation, it will be imperative to maintain populations that:

- Have the potential to act as source populations to adjacent areas of suitable, or potentially suitable, habitat
- Exist in areas of climatically suitable refugia during periods of environmental stress including droughts, heatwaves, and long-term climate change
- Are genetically diverse
- Are disease free and/or exhibit low rates of infection with important pathogens

- Contain genes which may confer adaptation to current and future environmental stressors
- Are geographical or environmental outliers within the species' range.

Populations that are also valued for social, cultural or economic reasons, and may or may not overlap with populations listed above:

- Cultural and spiritual importance to Indigenous people
- The social value and enjoyment of having koalas close to residential areas
- The economic value brought to local business and tourism
- The iconic species value at the national and international political and community level.

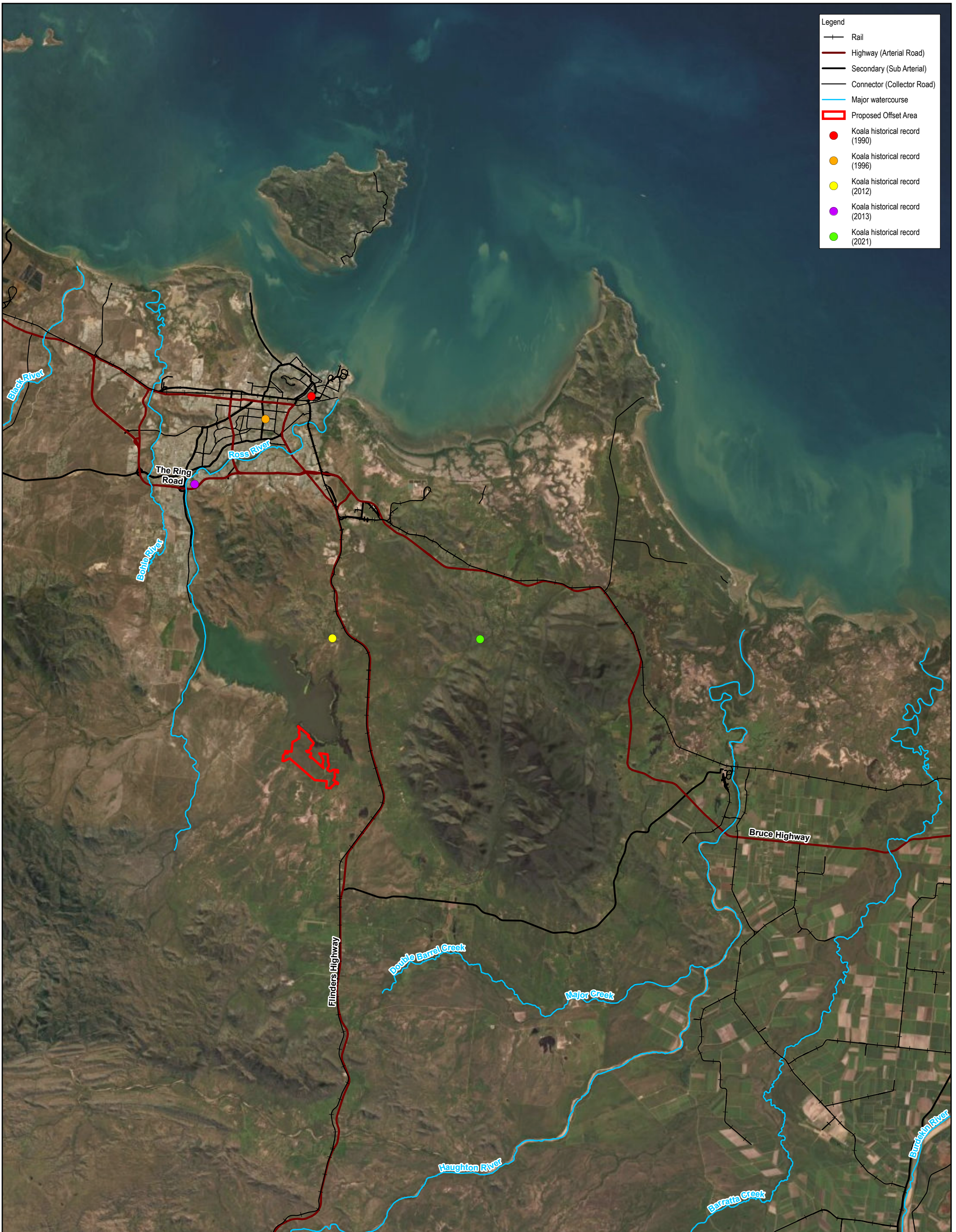
The low density of historical records within the Project area and geographical location would suggest the local population is not likely to be classified as an important population. However, at the national level, the Queensland subpopulation occurring north of the Clarence Valley in New South Wales is considered a genetically important population (DAWE 2022b).

Habitat critical to the survival of the species: The definition of habitat critical to the survival of the koala is formally defined in the conservation advice for *Phascolarctos cinereus* (DAWE 2022b) as '*the areas that the species relies on to avoid or halt decline and promote the recovery of the species.*' The conservation advice further defines habitat critical to the survival of the koala in general terms, outlining the definition that is relevant to all species protected under the EPBC Act as:

- Habitat that is used during periods of stress (examples: flood, drought or fire);
- Habitat that is used to meet essential life cycle requirements (examples: foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes);
- Habitat that is used by important populations;
- Habitat that is necessary to maintain genetic diversity and long-term evolutionary development;
- Habitat that is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements;
- Habitat that is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation;
- Habitat that may in any other way be critical to the survival of a listed threatened species or a listed threatened ecological community.

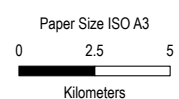
3.4.2 Presence of koalas within the offset area

Koalas are known to occur in low local densities within the Townsville coastal floodplain and surrounding coastal regions of north Queensland. Due to their low density of occurrence, targeted koala surveys undertaken in the proposed impact area using methods recommended in the former Commonwealth referral guidelines for the vulnerable koala (DoE 2014) could not detect the species. For the same reason, koala surveys within the offset area in August 2022 did not detect the species. However, in both instances, the presence of suitable habitat and proximity to historical koala records indicates koalas are likely to occur in low densities (Figure 3.5). In the case of the impact area, one koala was recorded 2 km west of the impact area in 1987. For the offset area, more recent records of koalas are known, with koalas recorded 6 km north of the offset area in 2012 and 14 km north-east of the offset area in 2022 (Figure 3.6). The closest record, from Oak Valley is connected to habitats within the offset area via riparian corridor along Sachs Creek and Antill Creek. This record is well within the dispersal range of the koala (i.e. 10 – 16 km). While the offset area does not represent an area of high koala density, it is consistent with the principles of the Commonwealth Environmental Offset Policy in that it offers a 'like for like' compensation for the habitat lost within the impact area. The provision of a comparable offset in a similar area of low koala density, within the same coastal floodplain is therefore considered a suitable offset. While alternative offset areas with higher koala densities are likely to occur west of the Great Dividing Range in areas like Collinsville or Ravenswood, these areas would not compensate for the loss of koala habitat within the coastal floodplain and for that reason are not considered as suitable.

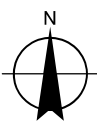


- Legend**
- +— Rail
 - Highway (Arterial Road)
 - Secondary (Sub Arterial)
 - Connector (Collector Road)
 - Major watercourse
 - ▭ Proposed Offset Area
 - Koala historical record (1990)
 - Koala historical record (1996)
 - Koala historical record (2012)
 - Koala historical record (2013)
 - Koala historical record (2021)

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.



Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 55

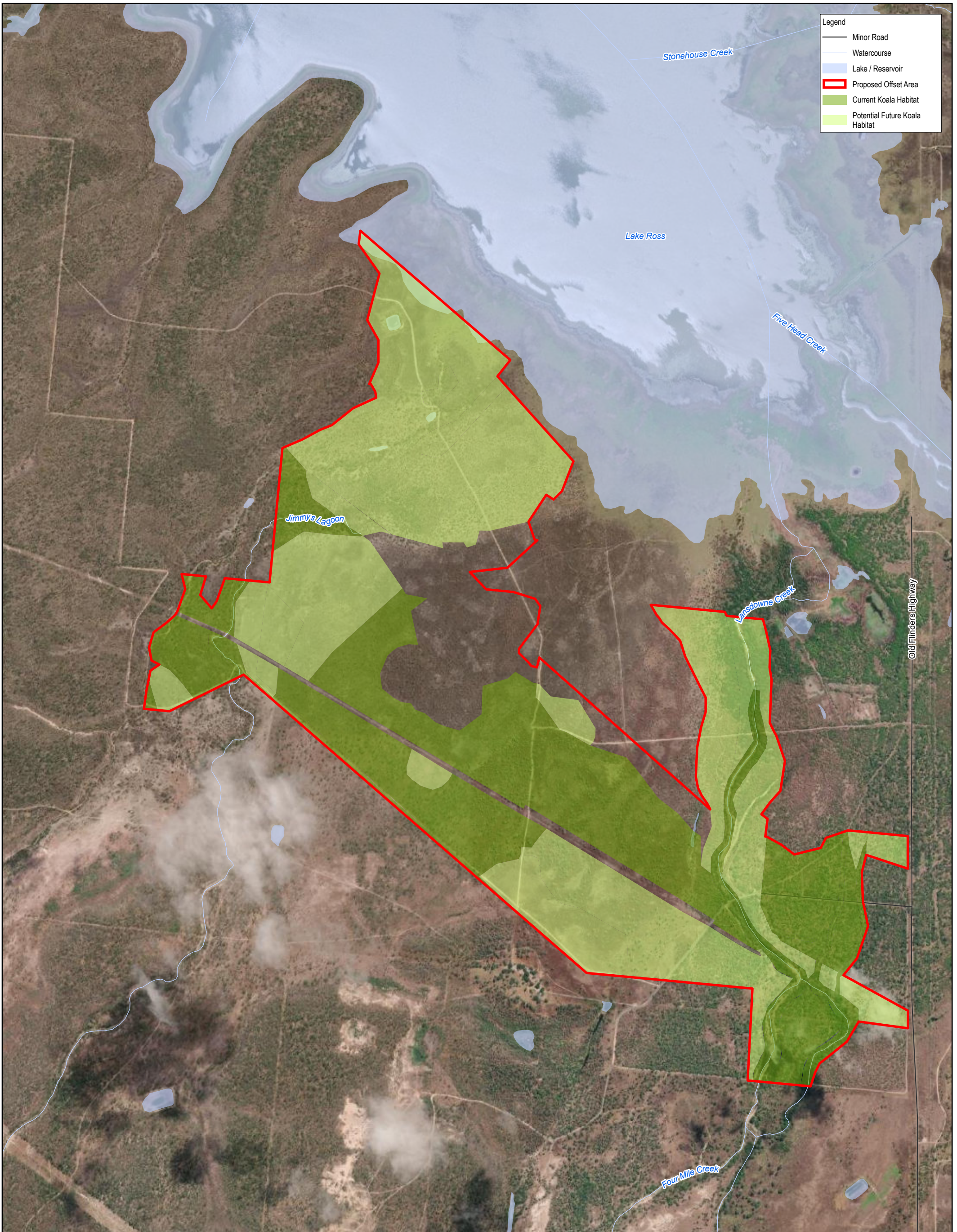


Townsville City Council
 Haughton Pipeline Stage 2 -
 Offset Area Management Plan

**Koala records near the
 proposed offset area**

Project No. 12537606
 Revision No. 1
 Date 10/26/2022

FIGURE 3-5



Legend

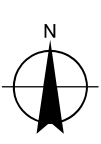
- Minor Road
- Watercourse
- Lake / Reservoir
- ▭ Proposed Offset Area
- ▭ Current Koala Habitat
- ▭ Potential Future Koala Habitat

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.

Paper Size ISO A3

0 250 500
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Townsville City Council
Houghton Pipeline Stage 2 -
Offset Area Management Plan

Project No. 12537606
Revision No. 3
Date 10/26/2022

**Habitat for the koala within
the proposed offset area**

FIGURE 3-6

3.4.3 Suitability of habitat for the koala within the offset area

Suitable habitat for the koala is broadly distributed across the proposed offset area. The following RE communities that are known to represent habitat for the koala have been recorded in the offset area:

- RE11.3.35 *Eucalyptus platyphylla*, *Corymbia clarksoniana* woodland on alluvial plains
- RE 11.3.25b *Melaleuca leucadendra* and/or *M. fluviatilis*, *Nauclea orientalis* open forest

Approximately 236.03 ha of remnant RE 11.3.35 and RE 11.3.25b within the offset area currently provides habitat for the koala. An additional 315.76 ha of regrowth and non-remnant RE 11.3.35 and RE 11.3.25b represent future potential habitat for the koala. The distribution of current and future potential habitat for the koala is mapped in Figure 3.6. With the existing and future potential habitat, there is sufficient land area to provide a land-based offset for the koala that will increase in value with active management. The existing condition of habitats has been assessed and is detailed in Section 4.

3.5 Summary of existing habitat availability for MNES

The proposed offset area provides substantial existing habitat that can be enhanced and future potential habitat that can be created through revegetation and rehabilitation. The land areas available are summarised in Table 3.1.

Table 3.1 Summary of the area of current and future habitat for each MNES within the offset area

Species	Existing habitat	Future potential habitat	Total
Southern black-throated finch	273.06 ha	352.52 ha	625.58 ha
Bare-rumped sheathtail bat	236.03 ha	315.76 ha	551.79 ha
Koala	236.03 ha	315.76 ha	551.79 ha

3.6 Offset condition suitability and potential for enhancement

Habitat condition assessments have been undertaken across the proposed offset area shown in Figure 2.1. Information on the methods used to assess habitat quality are discussed in more detail in Section 4. These have confirmed the presence of suitable habitat for each of the MNES as summarised in Table 3.1. From the investigations detailed in Section 4, the condition of habitat at the impact and offset areas is consistent. Both impact and offset areas have been subject to existing impacts including:

- Historical loss and fragmentation of habitat
- Exposure to decades of cattle grazing
- Exposure to inappropriate fire regimes
- Extensive coverage of invasive woody weeds (i.e. chinee apple, rubber vine) and grassy weeds (i.e. Guinea grass, grader grass)
- Localised degradation of habitat by pigs
- Extensive coverage of exotic pasture grasses.

Based on the extent and condition of habitat within the offset area, there are opportunities for habitat improvement through replanting of non-remnant areas with canopy, sub-canopy and shrub-layer species to reinstate the pre-clear RE communities, natural and assisted rehabilitation of regrowth areas, re-establishing native food grass species for the southern black-throated finch, extensive weed control including removal of chinee apple, rubber vine, lantana and other woody weeds and removal of invasive grassy weeds. These improvements have the potential to make a real contribution to MNES by increasing the availability of resources for foraging, shelter and breeding and increasing mobility through increased habitat connectivity. Methods used to assess habitat quality are detailed in Section 4. The results of habitat quality assessments are detailed in Section 5.

4. Methods used to assess habitat quality

4.1 Overview of the approach

As detailed in Section 1, the proponent will provide a direct land-based offset within the offset area by securing and managing the areas of existing habitat (i.e. remnant areas) and areas of future suitable habitat (i.e. regrowth and non-remnant).

The following methodology has been used to identify and assess the value of habitats within the impact area and proposed offset area:

- Potential offset sites were identified from pre-clear RE mapping, selecting REs that represent suitable habitat for each species using mapping criteria consistent with that used to assess habitat values in the impact area.
- Targeted field surveys of the impact area were undertaken by Ecological Interpretation in March 2022 and targeted field surveys of the offset area were undertaken by Biodiversity Australia between March 2022 to August 2022 to complete the following:
 - Field-verify RE mapping to provide a basis for mapping habitat values for each MNES
 - Assess the habitat quality of sites within the impact and proposed offset areas. Habitat quality was scored in accordance with the Queensland *Guide to Determining Terrestrial Habitat Quality* (DES 2020), the *Modified QLD Habitat Quality spreadsheet* (provided by DCCEE directly for this purpose), and the EPBC Act *Offsets Assessment Guide* (DSEWPaC 2012b).
- Identify site-specific offset management strategies and monitoring requirements, with specific ecological outcomes and performance indicators.
- A risk assessment was undertaken against the risk matrix template supplied by DCCEE.

4.2 Habitat quality scoring methods

The EPBC Act *Offsets Assessment Guide* (DSEWPaC 2012b) was used to determine the percentage of the offset liability that would be met by the proposed offset area, considering the following elements to assess habitat quality:

- Site condition
- Site context
- Species stocking rate

The *Modified QLD Habitat Quality spreadsheet* (provided by DCCEE) was used to input data obtained during field surveys and desktop analysis for impact areas and offset areas.

Habitat scores were weighted with the ratios of site condition 30%, site context 30%, and species stocking rate 40%, consistent with recommendations provided by DCCEE.

Site condition and site context scores were calculated using the *Guide to Determining Terrestrial Habitat Quality* (DES 2020), including scores for fauna species habitat (refer to Section 4.4.2 and 4.4.3) as per the *Modified QLD Habitat Quality spreadsheet*. Species stocking rate was informed by the results of three targeted surveys of the impact area (NRA 2021, GHD 2022a, GHD 2022b) and three targeted surveys of the offset area (NRA 2021; Biodiversity Australia 2022b,c) and published information on the ecology of each species (DEWHA 2009a, b; Schulz and Thomson 2007).

4.3 Overview of assessment units

Site condition within the impact area and proposed offset area was assessed within a series of assessment units (AU) as recommended in the Queensland environmental offsets framework, with nine assessment units identified in the impact area and eight assessment units identified within the offset area, as summarised in Section 3. Within each assessment unit, a number of replicate condition plots was established in accordance with the number specified in Table 1.2 of the *Guide to Determining Terrestrial Habitat Quality* (DES 2020). Assessment at multiple

condition plots is necessary to measure vegetation condition at representative locations across the spatial extent of each assessment unit.

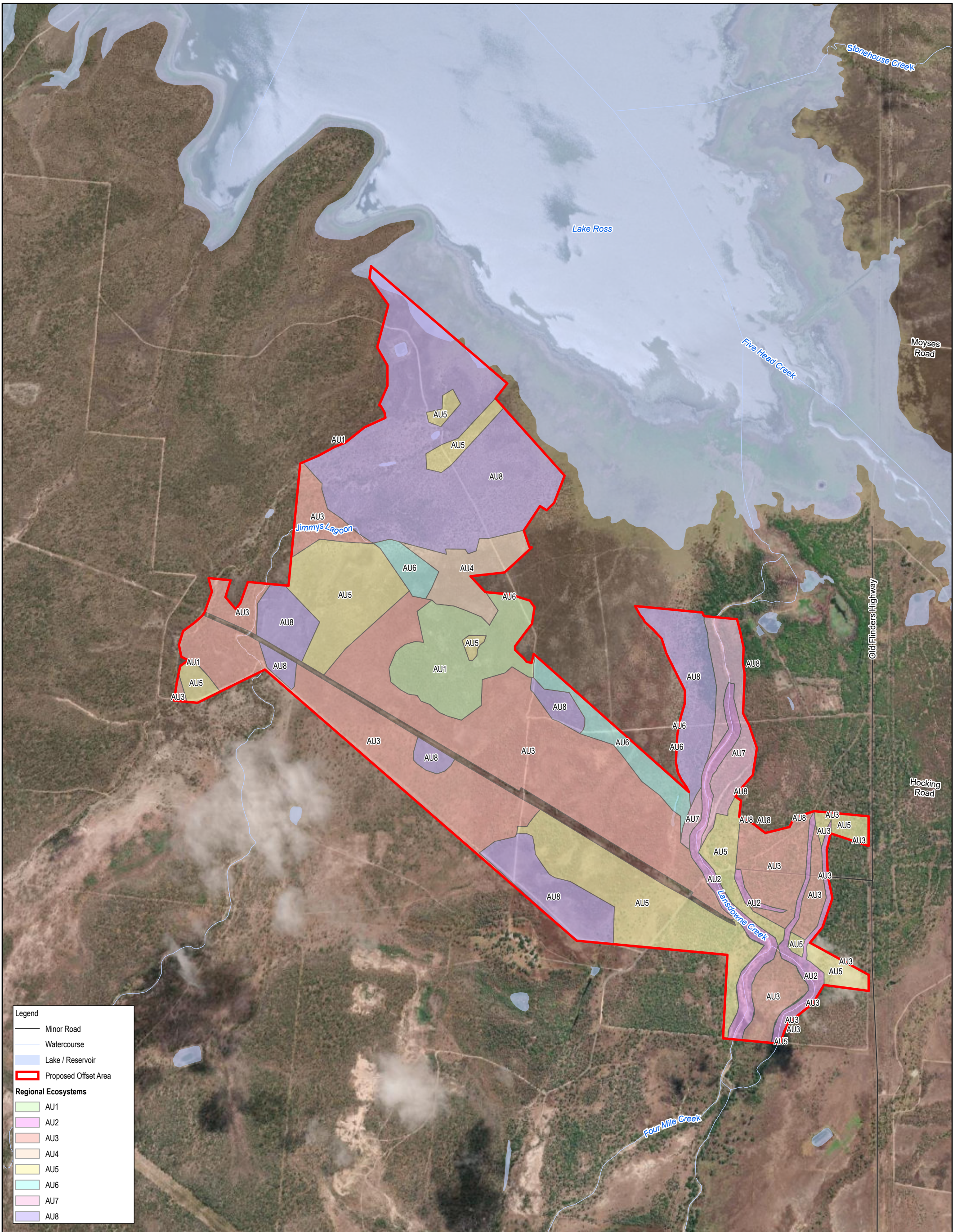
Site condition was assessed at 46 plots; comprising 24 within the impact area and 22 within the offset area. The locations of condition plots within the offset area is mapped in Figure 4.1.

Condition plots were assigned individual site codes, representing sequential numbering of sites within the impact area assessment units (i.e. IAU-1 - 26) and offset area assessment units (i.e. OAU-1 - 8), with the I = Impact, O = Offset and AU = Assessment Unit. Sites and assessment units are detailed in Table 4.1.

Table 4.1 Summary of replicate BioCondition plots in each assessment unit

Assessment unit	Vegetation type	Area	Number of sites required	BioCondition plots	Value for MNES
Impact area					
IAU-1	Remnant 11.3.7	18.06 ha	2	BC1, BC19	Koala, BTF, BRSTB
IAU-2	Remnant 11.3.35	51.97 ha	3	BC4, BC7, BC8, BC9, BC12, BC14, BC15, BC16	Koala, BTF, BRSTB
IAU-6	Remnant 11.3.25b	1.47 ha	2	BC11, BC18	Koala, BTF
IAU-8	Remnant 11.3.4a	1.70 ha	2	BC13, BC20	Koala, BTF, BRSTB
IAU-5	Non-remnant 11.3.35	5.47 ha	2	BC17, BC21	Koala
IAU-7	Non-remnant 11.3.7	4.3 ha	2	BC2, BC22	Koala
IAU-15	Non-remnant 11.3.31	43.79 ha	2	BC23, BC24	Koala
IAU-16	Remnant 11.3.31	0.44 ha	2	BC5, BC6	Koala
IAU-17	Non-remnant 11.3.30	7.00 ha	2	BC25, BC26	Koala
Offset area					
OAU-1	Remnant 11.3.12	37.03 ha	2	BC5, BC9	BTF
OAU-2	Remnant 11.3.25b	28.38 ha	2	BC3, BC4	Koala, BTF
OAU-3	Remnant 11.3.35	207.65 ha	4	BC1, BC2, BC16, BC18	Koala, BTF, BRSTB
OAU-4	Regrowth RE 11.3.12	17.00 ha	1	BC10	BTF
OAU-5	Regrowth RE 11.3.35	110.40 ha	4	BC6, BC14, BC19, B25	Koala, BTF, BRSTB
OAU-6	Non-remnant RE 11.3.12	19.76 ha	3	BC8, BC11, BC17	BTF
OAU-7	Non-remnant RE 11.3.25b	21.48 ha	2	BC12, BC13	Koala, BTF, BRSTB
OAU-8	Non-remnant RE 11.3.35	183.88 ha	4	BC7, BC15, BC23, BC24	Koala, BTF, BRSTB

BTF = southern black-throated finch, BRSTB = bare-rumped sheath-tail bat



Legend

- Minor Road
- Watercourse
- Lake / Reservoir
- Proposed Offset Area

Regional Ecosystems

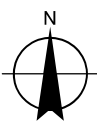
- AU1
- AU2
- AU3
- AU4
- AU5
- AU6
- AU7
- AU8

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.

Paper Size ISO A3

0 250 500
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Townsville City Council
Houghton Pipeline Stage 2 -
Offset Area Management Plan

Project No. 12537606
Revision No. 1
Date 10/26/2022

Map of assessment units

FIGURE 4-1

4.4 Site condition assessment

Site condition was calculated for each assessment unit using the following criteria detailed in the EPBC Act *Offsets Assessment Guide* (DSEWPaC 2012b):

- BioCondition data consistent with the *Guide to Determining Terrestrial Habitat Quality* (DES 2020)
- Quality and availability of food and foraging habitat using species-specific criteria detailed in Section 4.4.2
- Quality and availability of shelter using species-specific criteria detailed in Section 4.4.3

Habitat quality criteria for the bare-rumped sheath-tail bat and southern black-throated finch were derived by suitably qualified ecologists from Biodiversity Australia. Habitat quality criteria for the koala were derived by suitably qualified ecologists from GHD. For each condition parameter, scores out of 25 were assigned (in accordance with the *Guide to Determining Terrestrial Habitat Quality* (DES 2020)). These were then converted to a score out of 10 to align with the EPBC Act *Offsets Assessment Guide* (DSEWPaC 2012b) scoring framework as detailed in the *Modified QLD Habitat Quality spreadsheet*.

4.4.1 BioCondition plot methodology

Each BioCondition plot measured 100 m by 50 m and was established along the direction of the contour (i.e. along the slope rather than upslope or downslope). The location of the centre of each plot was marked with a GPS and representative photographs of the plot were taken in each aspect (i.e. north, east, south, west). Each plot was then divided into sub-plots, as illustrated by the plot layout diagram provided as Figure 4.2, and the following attributes were recorded:

- 100 m transect:
 - Tree canopy cover.
 - Shrub canopy cover.
- 100 m by 50 m plot:
 - Total number of large eucalypt and non-eucalypt trees.
 - Height of ecologically dominant layer and other canopy/sub-canopy/emergent layers.
 - Tree species richness.
 - Proportion of the dominant canopy species with evidence of recruitment.
- 50 m by 10 m plot:
 - Species richness of shrubs, grass, forbs and other native species.
 - Weed cover.
- Five 1 m by 1 m quadrats:
 - Percent cover of native perennial grass.
 - Percent cover of organic litter.

The data was entered into the DES scoring sheet and compared to representative benchmark data for each RE containing habitat for the MNES. The Queensland Herbarium (2021a) has published benchmark data for individual REs, which is based on the above BioCondition assessment method using field-based reference sites that are best-on-offer for that RE. Benchmark data is used as a comparison against the data collected on site to derive the habitat quality score for each assessment unit, based on the scoring criteria outlined in the BioCondition Assessment Manual (Eyre et al. 2015). A single point score is then derived for BioCondition out of a total score of 80 (for woodland communities) and out of 30 (for grassland communities). The BioCondition score (out of 1) is then incorporated into the overall condition score for each assessment unit by combining with species foraging and shelter habitat values (refer Sections 4.4.2 and 4.4.3, respectively).

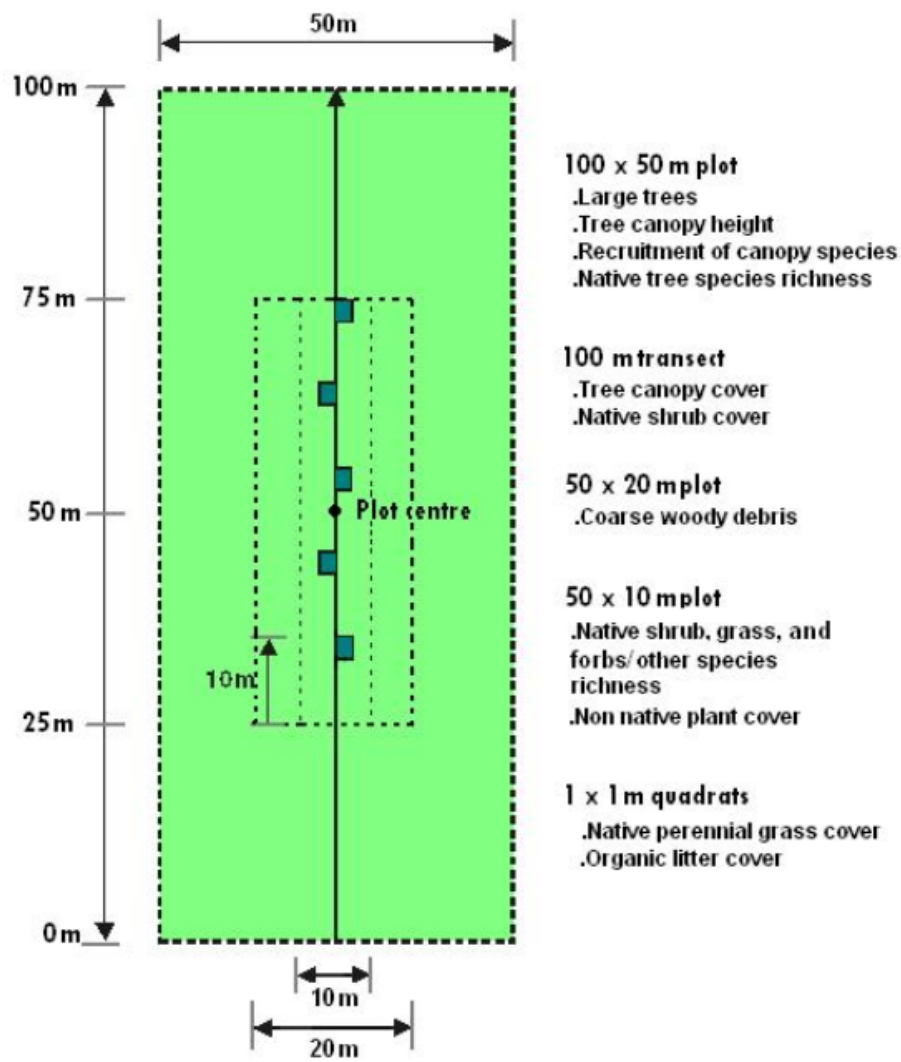
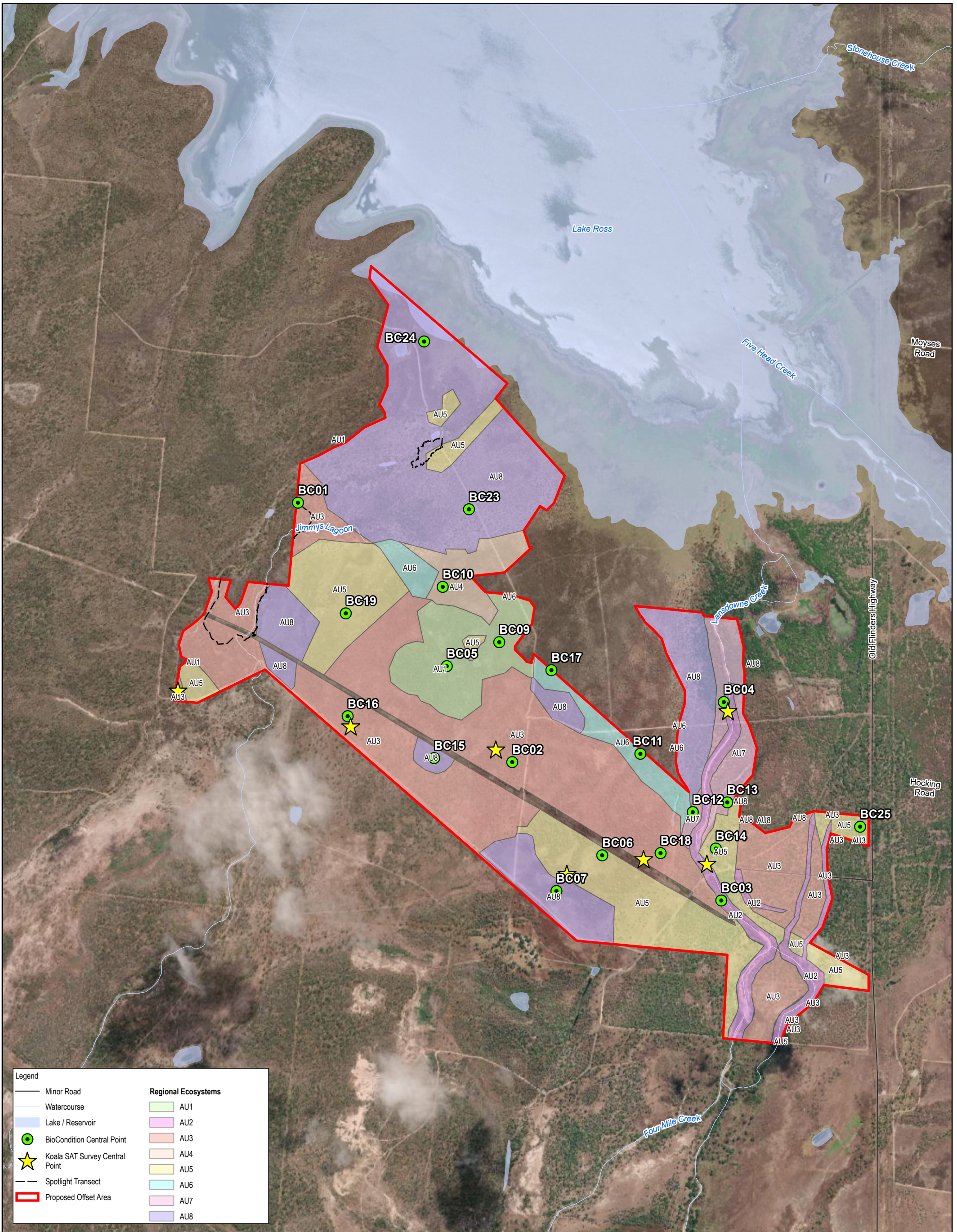


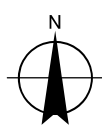
Figure 4.2 Layout of the BioCondition plot



Legend	
	Minor Road
	Watercourse
	Lake / Reservoir
	BioCondition Central Point
	Koala SAT Survey Central Point
	Spotlight Transect
	Proposed Offset Area
Regional Ecosystems	
	AU1
	AU2
	AU3
	AU4
	AU5
	AU6
	AU7
	AU8

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.

Paper Size ISO A3
 0 250 500
 Meters
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA 1994
 Grid: GDA 1994 MGA Zone 55



Townsville City Council
 Haughton Pipeline Stage 2 -
 Offset Area Management Plan
**Location of BioCondition
 scoring plots within
 the proposed offset area**

Project No. 12537606
 Revision No. 1
 Date 10/26/2022

FIGURE 4-3

4.4.2 Quality and availability of food and foraging habitat

The quality and availability of food and foraging habitat was determined for each species using criteria detailed below. Food quality/availability scores were calculated for each assessment unit based on the average of all plot scores, with all criteria scored out of 10. Criteria for the bare-rumped sheath-tail bat and southern black-throated finch were derived by ecologists from Biodiversity Australia, while criteria for the koala were derived by ecologists from GHD. Justification for all criteria is detailed below. Scoring parameters for all species are detailed in Appendix A.

4.4.2.1 Bare-rumped sheath-tail bat

Foraging habitat quality for the bare-rumped sheath-tail bat was scored based on the following criteria:

- **Presence and maturity of remnant woodland:** This relatively simple criteria reflects the unspecialised foraging habitat requirements of the species. The bare-rumped sheath-tail bat is known to forage in a wide range of habitats. For this reason, foraging habitat is not particularly limiting. The Commonwealth listing advice states the species occurs mostly in eucalypt forests and woodlands, generally in near-coastal areas. In Queensland, it is known to be associated with coastal lowland rainforests, and more open forests dominated by *Eucalyptus* or *Corymbia* species interspersed with coastal lowland rainforest (TSSC 2016).

4.4.2.2 Southern black-throated finch

Foraging habitat quality for the southern black-throated finch was scored based on the average of the following criteria, each scored out of 25, with scoring parameters for each criteria shown in Figure 4.3:

- **Abundance of food grass:** The abundance of preferred food grasses was calculated in 1 m x 1 m BioCondition quadrats, where preferred food grasses were the 41 grass species that have been recorded in the literature as a known food source for the species (e.g. Mula Laguna et al. 2019, Williams et al. 2020). This metric was consistent with performance indicators used by NRA (2011) – “Early flowering perennial grasses, such as cockatoo grass, occur in >25% of 20 randomly-spaced 0.5 m by 0.5 m plots in areas used by southern black throated finches during the early wet season and wet season (November to February). This functional group of grasses is to be dominated by native species”.
- **Species richness of food grasses:** The number of food grass species was calculated in 1 m x 1 m BioCondition quadrats. This indicator is consistent with performance indicators by NRA (2011) “At least six different grass species occur in 20 randomly spaced 0.5 m by 0.5 m plots in areas used by southern black throated finches. At least four should be native”.
- **Mosaic of bare patches and grass:** The ratio of bare ground to native grasses was calculated within the BioCondition plots. Southern black-throated finch habitat must encompass patches with bare ground or low vegetation density to allow southern black-throated finches access to the seed bank (Rechetelo 2015). NRA (2011) provided the grazing recommendation aim for over 50% ground cover at the end of the dry season. They prefer areas with low vegetation density have a positive relationship with bare ground and a negative association with high total ground cover (Rechetelo 2015). If bare ground is too high, then there may be too few grasses to provide sufficient food resources. In preferred habitat areas (areas with observed use), a bare ground cover of 40.59% ± 19.28% with a maximum of 85% bare ground area was measured (Rechetelo 2015).

4.4.2.3 Koala

The quality of food and foraging habitat for the koala was scored based on the average of the following criteria:

- **The abundance of non-juvenile locally important food trees:** The number of *locally important* koala food trees in each 50 m x 100 m BioCondition plot that meet the size criteria to qualify as non-juvenile koala food trees was calculated. This was based on the definition of *locally important* food trees as specified for the Brigalow belt in Youngentob et al. (2021) and the non-juvenile koala food tree definition outlined in the Queensland *Environmental Offsets Policy* (i.e. any koala habitat tree that is more than 4 m high or has a trunk with circumference of more than 31.5 cm at 1.3 m above the ground). This criteria provides a measure of the biomass of food resources available to local koalas.

- **Relative diversity of locally important koala food trees:** This was calculated by dividing the number of *locally important* koala food tree species present in each 50 m x 100 m BioCondition plot by the total number of locally important food tree species listed in the technical description for that RE community (Pollock 2018). Koalas are known to forage on a variety of food tree species. While koalas can persist in areas with only a single food tree species where that species meets its' nutritional requirements, the provision of a diversity of food tree species increases the adaptability of foraging resources available to koalas. In north Queensland, koalas have been shown to occur in higher densities in riparian habitats where there is higher food tree species richness (Munks et al. 1996).
- **Ease of movement:** This was scored based on the relative connectivity of habitat and the anticipated physical barriers (i.e. fences, dense vegetation) and behavioural barriers (i.e. large gaps) to koala movement. This observes that while koalas are capable of moving large distances across open ground when dispersing, during foraging activities, they tend to forage preferentially through habitats that have higher levels of connectivity and pose lower risks of mortality from dog attack and other forms of misadventure (Rus et al. 2020).

4.4.3 Quality and availability of shelter

The quality and availability of shelter was determined for each species using criteria detailed below. Shelter quality/availability scores were calculated for each assessment unit based on the average of all plot scores, with criteria scored out of 25 (as recommended in the *Guide to Determining Terrestrial Habitat Quality* DES 2020) and then converted to scores out of 10 to align with the EPBC Act QLD *Modified QLD Habitat Quality spreadsheet*.

4.4.3.1 Bare-rumped sheathtail bat

The quality and availability of shelter for the bare-rumped sheathtail bat was scored based on the average of the following criteria:

- **The abundance of preferred trees:** The number of individuals of the three preferred tree species (i.e. *E. platyphylla*, *Corymbia tessellaris* and *M. leucadendra*) within each 50 m x 100 m BioCondition plot. The bare-rumped sheathtail bat is an obligate hollow-roosting species (Milne et al. 2009). At the time of publication of the national recovery plan for the bare-rumped sheathtail bat (Schulz and Thomson 2007), it had only been recorded from poplar gum (*E. platyphylla*), Darwin woollybutt (*E. miniata*) and Darwin stringybark (*E. tetradonta*), however, it has since also been located in *M. leucadendra* (Greg Ford pers. comm.) and *C. tessellaris* (Reside et al. 2016). Due to difficulties in determining their presence in tree hollows, it is likely that the species utilises hollows in a broader range of tree species, particularly eucalypts. As the bats only occur at low densities in the region (Schulz and Thomson 2007), only a small minority of available tree hollows would be likely to be utilised.
- **The abundance of suitable deep hollows in roost tree species:** The number of suitable hollows (i.e. > 10 cm diameter and > 8 m high in *E. platyphylla*, *C. tessellaris* or *M. leucadendra* (G. Ford pers. comm.)) was counted in each 50 m x 100 m BioCondition plot. The bare-rumped sheathtail bat has specific hollow-requirements, only known to roost in large, deep hollows in *E. platyphylla*, *E. miniata*, *E. tetradonta* and *M. leucadendron* (TSSC 2016).

4.4.3.2 Southern black-throated finch

The quality and availability of shelter for the southern black-throated finch was scored, based on the average of the following criteria:

- **The abundance of suitable nesting sites and known nesting tree species:** The canopy cover of typical nest tree species (i.e. *E. platyphylla* and *Melaleuca viridiflora*) was calculated for each 50 m x 100 m BioCondition plot. The woodland species *E. platyphylla* and *M. viridiflora* are the preferred nest trees with nests occasionally recorded in *C. tessellaris* and *C. dallachyana* (Rechetelo 2015). The nests are often built in a hollow branch of a tree, or in a fork of a tree, shrub or sapling. A single tree may contain several active nests (e.g. two to five nests have been observed in one tree). Nests are used for breeding and roosting, with individuals returning each night to roost (NRA 2011). Flocks are also negatively associated with high tree abundance (Rechetelo 2015). The mean number of large trees was 1.3/ha, medium trees 63/ha and small trees 181/ha (Rechetelo 2015). They occur in grassy open woodland (Buosi 2011), defined by Specht (1970)

as having a crown cover <20% of trees 10-30m height. BioCondition benchmarks for 11.3.35 notes a 30% tree canopy cover.

- **Distance to water:** The distance to the nearest suitable breeding season drinking site was measured for each BioCondition plot. Proximity to drinking sites is a critical requirement. During the breeding season, southern black-throated finches rarely venture far from the nest and therefore need to be able to access food and drinking resources in close proximity. Southern black throated finches nest an average of 167 m from water but generally require a water source to be within 200 m of breeding and foraging areas, and no more than 400 m (NRA 2011).

4.4.3.3 Koala

The quality and availability of shelter for the koala was scored, based on the average of the following criteria:

- **The abundance of non-juvenile ancillary habitat trees:** The number of *ancillary habitat* trees in each 50 m x 100 m BioCondition plot that meet the size criteria to qualify as non-juvenile koala habitat trees was calculated. This was based on the *ancillary habitat* trees identified for the Brigalow belt in Youngentob et al. (2021) and the non-juvenile koala food tree definition outlined in the Queensland *Environmental Offsets Policy* (i.e. any koala habitat tree that is more than 4 m high or has a trunk with circumference of more than 31.5 cm at 1.3 m above the ground). This criterion provides a measure of the biomass of shelter resources available to local koalas.
- **Relative diversity of ancillary habitat trees:** This was calculated by dividing the number of *ancillary habitat* tree species present in each 50 m x 100 m BioCondition plot by the total number of locally *ancillary habitat* tree species listed in the technical description for that RE community (Pollock 2018). Ancillary habitat elements such as shelter vegetation may not contribute substantially to a koala's diet but is important for movement and thermoregulation. Shelter tree species that do not provide nutritional value can play an important role when they co-occur with *locally important* koala trees. Although these species do not constitute habitat in the absence of *locally important* koala trees, they are thought to make an important and potentially necessary contribution to koala habitat in many regions (Youngentob et al. 2021).
- **The relative abundance of shrub cover:** This was calculated directly from the shrub canopy cover scores calculated from the BioCondition plot data detailed in Section 4.4.1. This provides an additional measure of shelter abundance for the koala.

4.5 Site context

For each assessment unit, site context scores were assigned based on the average of all plot scores for:

- Size of patch
- Connectedness
- Context
- Role of the site location to the overall population in the state
- Threats to the species
- Species mobility capacity.

4.5.1 GIS derived site context attributes

The first four GIS attributes of size of patch, connectedness, context and ecological corridors were calculated as part of the desktop analysis using the *Guide to Determining Terrestrial Habitat Quality* (DES 2020). This involved geospatial analysis to calculate the following indicators for each condition plot:

- Patch size, which involves measurement of the area of vegetation in which the assessment unit is contained and all other directly connecting areas of mapped remnant vegetation (total score of 10)
- Connectedness, which involves measurement of the length of remnant vegetation along the boundary of the site (total score of 5)
- Context, which involves measuring the percentage of remnant vegetation within a 1 km buffer around the site (total score of 5).

The information on each attribute was then used to determine the site context score in accordance with the framework provided by the *Guide to Determining Terrestrial Habitat Quality* (DES 2020), as shown in Table 4.2. These scores are then incorporated into the overall condition score for each assessment unit.

Table 4.2 Site context scoring framework

1 Size of Patch*	Score	0	2	5	7	10
	Description	<5ha	5-25ha	26-100ha	101-200ha	>200ha
2 Connectedness*	Score	0	2	4	5	
	Description	0-10%	>10%-<50%	50-75%	>75% or >500ha	
3 Context*	Score	0	2	4	5	
	Description	<10% remnant	>10%-30% remnant	>30-75% remnant	>75% remnant	
4 Distance to permanent watering point †	Score	0	2	5	10	20
	Description	0-500m	>500m-1km	>1-3km	>3-5km	>5km
5 Ecological corridors	Score	0	4	5		
	Description	Not within	Sharing a common boundary	Within (whole or part)		

* Measured for fragmented bioregions only

† Measured for intact bioregions only

4.5.2 Role of the site location to the overall population in the state

As detailed in the Commonwealth *How to Use the Offsets Assessment Guide*, this value was obtained from the species stocking rate (detailed in Section 4.2), adjusted to a score of 10.

4.5.3 Threats to the species

At each assessment unit, threats to each species were assessed based on an average of all plot scores using criteria detailed below. For all species, the absence of threats were calculated as a score out of 25 using the risk matrix detailed in Table 4.3, taken from the *Guide to Determining Terrestrial Habitat Quality* (DES 2020), with the absence of threat score assigned based on the lowest score assigned for any threat. The score was then adjusted to a score out of 10 to align with the EPBC Act *Modified QLD Habitat Quality spreadsheet*.

Table 4.3 Threat matrix used to score absence of threats

Threat matrix		Severity					
		Very high	High	Medium	Low	Very low	
Scope	Very high	1	1	2	3	4	5
	High	2	2	4	6	8	10
	Medium	3	3	6	9	12	15
	Low	4	4	8	12	16	20
	Very low	5	5	10	15	20	25

4.5.3.1 Bare-rumped sheath-tail bat

The following key threats faced by the bare-rumped sheath-tail bat were scored out of 25, using the threat matrix above, scored for the following threats that are identified in the National Recovery Plan for the species (Schulz and Thomson 2007) and relevant to the Project area:

- **Abundance of exotic invasive weedy shrubs:** For each BioCondition plot, the proportional cover of invasive weedy shrubs including leucaena (*Leucaena leucocephala*), chinee apple and rubber vine was used to assign scores using the threat matrix based on the severity and scope of weed coverage. Numerous introduced plant species may have the potential to negatively impact on their preferred roosts in hollow trees. Without mitigation measures, the spread and invasion of these species could pose a significant threat to the long-term persistence of the bare-rumped sheath-tail bat.

4.5.3.2 Southern black-throated finch

Threats faced by the southern black-throated finch were scored out of 25, using the threat matrix above, scored for the following threats that are identified in the Significant impact guidelines for the endangered black-throated finch (southern) *Poephila cincta cincta* (DEWHA 2009):

- **Reduction in the availability of drinking water:** Southern black-throated finches need to drink water on at least a daily basis and drink more frequently during the drier times of the year (Buosi 2011).
- **Inappropriate grazing regimes:** Southern black-throated finch often occur in areas grazed by cattle. However, inappropriate heavy grazing may result in the alteration of fuel loads, vegetation structure and the availability of food during the wet season (DEWHA 2009). Additional impacts include soil compaction and degradation, trampling of fallen grass seed, and alteration of the composition and abundance of different grass species (Buosi 2011).
- **Inappropriate fire regimes:** Fire influences grass and herb diversity and the abundance of grass seed, and can alter the extent of *Stylosanthes* in a pasture (Williams et al. 2020). Altered fire regimes (e.g. landscape wide fire damage) reduced ground cover, impact seed production, damage nesting habitat and promote introduced invasive weeds (Buosi 2011).
- **Introduction of exotic weeds:** Although new weeds may colonise the site over time, the bigger issue is the increase spread of weeds on site, including vegetation thickening by woody weeds (e.g. chinee apple) that modifies the habitat away from the desired open grassy woodland community, replacement of desirable forage grasses with pasture improvement species (especially stylos, which is negatively associated with the Black Throated Finch (Rechetelo 2015)), and changes in fire regimes due to introduced grasses that alter fuel loads and subsequent fire regimes.

4.5.3.3 Koala

Threats faced by the koala were scored out of 25, using the threat matrix above, scored for the following threats that are identified in the Conservation listing advice for the koala (DAWE 2022b):

- **Risk of uncontrolled wildfire:** Koalas experienced extreme population losses throughout their range as a result of the devastating Black Summer fires. Climate change has increased the level of threat faced by koalas from uncontrolled wildfires. While there has been a universal increase in the wildfire threat profile, inappropriate fire regimes can exacerbate the local threats by elevating fuel loads and increasing fire frequencies.
- **Risk of drought:** Changes in the climate are exposing koala populations to increased risk of decline from drought. This is particularly relevant for populations at the western edges of the species' range in habitats that are already more marginal in terms of their suitability.
- **Injury and mortality due to dog attacks:** Koalas are highly susceptible to injury and mortality from dog attacks. While this is particularly prevalent in peri-urban and residential areas, it is an ongoing threat to the species in all areas where wild or domestic dogs occur.
- **Collision with vehicles:** Injury and mortality of koalas represents a substantial threat to local koala populations in peri-urban and residential areas. This can exert negative pressures on local populations by increasing mortality and imposing barrier effects that restrict access to regional resources.

4.5.4 Species mobility capacity

The species mobility capability was scored for the bare-rumped sheathtail bat and southern black-throated finch using criteria detailed below.

4.5.4.1 Bare-rumped sheathtail bat

For each site, a species mobility capability score was assigned for the bare-rumped sheathtail bat. This was a score out of 25, based on an average of the following scores:

- **Habitat connectivity:** For each BioCondition plot a score of connectivity was assigned based on the following criteria: 5 (totally isolated), 10 partially isolated, 15 (periodically isolated), 20 major connectivity, 25 (totally connected).

This bat species is generally considered to be a high-flying species, feeding on insects above the canopy to a height of 80 m, though sometimes swooping down to within 2m of the ground in pursuit of prey (Churchill 1998). Their presence on Magnetic Island (4.37km from coast) implies that they are capable of flying over expanses of open water, and this ability to fly between land masses is supported by their extra-limital distribution which ranges from India in the west to Bougainville Island (PNG) in the East (Churchill 1998). Evidence therefore supports the theory that open treeless areas are not a barrier to movement, and it is reasonable then to expect that a high-flying species capable of flying hundreds of kilometres over open ocean would not regard roads and tracks as a barrier to movement. As such for the purpose of this assessment the species was assigned very high mobility scores due to its highly mobile nature.

4.5.4.2 Southern black-throated finch

For each site, a species mobility capability score was assigned for the southern black-throated finch. This was a score out of 25, based on an average of the following scores:

- **Presence of shrubs:** For each BioCondition plot, the density of shrubs was calculated and used as an index of mobility. Southern black-throated finches prefer a general absence of shrubs but the scattered presence of a medium strata (Rechetelo 2015). Flocks are negatively associated with shrub abundance, shrub cover, large tree abundance and high total ground cover (Rechetelo 2015). Rechetelo (2015) noted a mean shrub density of 395 shrubs/ha but with a range of 0-2788. Biocondition benchmarks for 11.3.35 notes a 5% shrub canopy cover. Sparse shrub cover is optimal (NRA 2011), defined by Specht (1970) as 10-30%.
- **Presence of suitable open grassy woodland:** For each BioCondition plot, the relative presence and connectivity of suitable canopy vegetation was scored. Connectivity in the canopy vegetation is a critical element influencing the movement capabilities of the southern black-throated finch.

4.5.4.3 Koala

For each site, a species mobility capability score was assigned for the koala. This was a score out of 25, based on an average of the following scores:

- **Habitat connectivity:** For each BioCondition plot a score of connectivity was assigned based on the following criteria: 5 (totally isolated), 10 partially isolated, 15 (periodically isolated), 20 major connectivity, 25 (totally connected)

4.6 Species stocking rate assessment

For each assessment unit in the impact area and offset area, a single value of species stocking rate will be calculated using the criteria detailed in Table 4.4, based on the scoring system in the EPBC Act *How to Use the Offsets Assessment Guide*.

Table 4.4 Species stocking rate scoring criteria

Criteria	Score			
Presence detected on or adjacent to the site	0	5		10
	No	Yes – adjacent		Yes – on site
Species usage of the site	0	5	10	15
	Not habitat	Dispersal	Foraging	Breeding
Approximate density per ha	0	10	20	30
Role/importance of species population on site	0	5	10	15
	0	5 – 15	20 – 35	40 – 45

Scores for species stocking rate will be based on information on the likely presence and abundance of each species, based on the results of targeted assessments undertaken within the impact area and offsets area, with survey effort summarised for each species below in Table 4.5. For species with low density (i.e. koala) nominal low density scores will be used to calculate species stocking rate. As directed in the *Modified QLD Habitat Quality spreadsheet*, where information on changes in density is not available due to low density, these will be kept relatively constant and improvements in habitat quality will rely on increases in site condition scores (i.e. BioCondition, foraging habitat value, shelter habitat value, mobility habitat value and reduction in threat scores.

Table 4.5 Summary of targeted survey methods to assess local utilisation by relevant MNES

Survey	Targeted survey methods		
	Southern black-throated finch	Bare-rumped sheathtail bat	Koala
Impact area			
NRA April / May 2021	32 quaternary RE confirmation sites 32 habitat assessments Visual bird surveys	32 quaternary RE confirmation sites 3 Anabat detector nights 32 habitat assessments	32 quaternary RE confirmation sites 32 habitat assessments Visual koala searches
GHD October 2021	8 quaternary RE confirmation sites 35 habitat assessments 14 waterbody watches Vigilant bird surveys over 6 x 10 hr days	8 quaternary RE confirmation sites 35 habitat assessments Inventory of all potential roost trees	8 quaternary RE confirmation sites 35 habitat assessments 30 SAT searches for koala pellets Visual koala searches
GHD March / April 2022	14 area searches around waterbodies for nests and birds 14 waterbody watches Vigilant bird surveys over 4 x 10 hr days	6 dusk roost watches 5 Anabat detector nights	25 SAT searches for koala pellets
Ecological Interpretation March 2022	Field-verification of RE mapping within the impact area 18 BioCondition assessments	Field-verification of RE mapping within the impact area 18 BioCondition assessments	Field-verification of RE mapping within the impact area 18 BioCondition assessments
Offset area			
Biodiversity Australia March 2022	80 rapid vegetation assessment sites 32 rapid habitat assessments for black-throated finch	80 rapid vegetation assessment sites	80 rapid vegetation assessment sites
Biodiversity Australia April 2022	Field verification of RE mapping in red area shown in Figure 2.1 20 BioCondition plots	Field verification of RE mapping in red area shown in Figure 2.1 9 BioCondition plots	Field verification of RE mapping in red area shown in Figure 2.1 13 BioCondition plots

Survey	Targeted survey methods		
	Southern black-throated finch	Bare-rumped sheathtail bat	Koala
	20 habitat scoring plots using methods in Section 4.4.2, 4.4.3, 4.5.3 and 4.5.4 Targeted surveys for southern black-throated finches and nest sites	9 habitat scoring plots using methods in Section 4.4.2, 4.4.3, 4.5.3 and 4.5.4 26 nights passive deployment of Anabat detectors on flyways	13 habitat scoring plots using methods in Section 4.4.2, 4.4.3, 4.5.3 and 4.5.4
Biodiversity Australia August 2022	Field verification of RE mapping in blue area shown in Figure 2.1 3 BioCondition plots 3 habitat scoring plots using methods in Section 4.4.2, 4.4.3, 4.5.3 and 4.5.4	Field verification of RE mapping in blue area shown in Figure 2.1 6 BioCondition plots 6 habitat scoring plots using methods in Section 4.4.2, 4.4.3, 4.5.3 and 4.5.4	Field verification of RE mapping in blue area shown in Figure 2.1. 4 BioCondition plots 4 habitat scoring plots using methods in Section 4.4.2, 4.4.3, 4.5.3 and 4.5.4 SAT searches for koala faecal pellets

4.6.1.1 Role / importance of the species population on site

For each assessment unit, the role / importance of the site for the species will be assessed using the criteria detailed in Table 4.6. Based on the supplementary table to the Species Stocking Rate in the EPBC Act Offsets Guide.

Table 4.6 Role/importance of the species population on site

Criteria	Score	
Key source population for breeding	0	10
	No	Yes/Possibly
Key source population for dispersal	0	5
	No	Yes/Possibly
Necessary for maintaining genetic diversity	0	15
	No	Yes/Possibly
Near the limit of the species range	0	15
	No	Yes

5. Habitat quality scores

5.1 Quality of habitats within the impact area

5.1.1 BioCondition

BioCondition scores were low to moderate within the impact area, scoring between 0.04 and 0.61 out of 1. The average score across all assessment units was 0.36 out of 1. BioCondition scores for the impact area are shown in Table 5.1. BioCondition results are shown in the *Modified QLD Habitat Quality spreadsheet*, presented in Appendix B. The low-moderate scores were attributed to the history of grazing and land clearing across much of the impact area which has reduced the complexity of the shrub and ground layer and led to loss of canopy vegetation, coarse woody debris and reduced species richness in the ground layer.

Table 5.1 BioCondition scores for the impact area

	IAU1	IAU2	IAU6	IAU8	IAU16	IAU7	IAU5	IAU15	IAU17
Regional Ecosystem	11.3.7	11.3.35	11.3.25b	11.3.4a	11.3.31	11.3.7	11.3.35	11.3.31	11.3.30
Rem/Reg/NR	Rem	Rem	Rem	Rem	Rem	NR	NR	NR	NR
Recruitment of woody perennial species in EDL	0	3.25	2.5	0	0	0	1.5	0	2.5
Native plant species richness - trees	3.75	2.1875	3.75	5	0	5	1.25	0	1.25
Native plant species richness - shrubs	5	2.8125	5	5	0	5	2.5	0	5
Native plant species richness - grasses	2.5	3.4375	1.25	0	2.5	2.5	2.5	0	2.5
Native plant species richness - forbs	2.5	3.125	2.5	0	2.5	2.5	1.25	2.5	2.5
Tree canopy height*	5	5	4	5	0	5	2.5	0	1.5
Tree canopy cover*	5	2.3125	2	1.5	0	2.5	1.25	0	0
Shrub canopy cover	3	0.75	0	0	0	0	0	0	1.5
Native grass cover	3	2.5	1.5	0	0	1	0	0	2
Organic litter	3	4.5	5	5	3	5	4	0	1.5
Large trees	2.5	5	15	10	0	10	2.5	0	0
Coarse woody debris	1	3.25	2	2	0	5	1	0	2.5
Non-native plant cover	1.5	4	4	0	0	0	0	0	2.5
Total (out of 80)**	37.75	42.13	48.5	33.5	8.0	43.5	20.25	2.5	25.25
Score out of 1	0.47	0.53	0.61	0.42	0.14	0.54	0.25	0.04	0.32

*(average of emergent, canopy, sub-canopy), **Grassland RE 11.3.31 (AU15 and AU16) scored out of 56
 Rem = remnant, Reg = regrowth, NR = non-remnant

5.1.2 Habitat scores for the bare-rumped sheathtail bat

Average bare-rumped sheathtail bat habitat quality scores for the impact area are presented in Table 5.2. Foraging habitat values were moderate - high across all sites (consistent with their relatively broad foraging habitat requirements). Shelter habitat values were more variable between sites. The species has specific shelter habitat requirements, with high scores recorded in areas with higher local densities of large hollows.

Table 5.2 Average habitat scores for the bare-rumped sheathtail bat within impact area assessment units

	AU1	AU2	AU6	AU8	AU16	AU7	AU5	AU15	AU17
Regional Ecosystem	11.3.7	11.3.35	11.3.25 b	11.3.4a	11.3.31	11.3.7	11.3.35	11.3.31	11.3.30
Rem/Reg/NR	Rem	Rem	Rem	Rem	Rem	NR	NR	NR	NR
Foraging habitat									
Presence of remnant	6	6	6	6	6	6	2	6	6
Shelter habitat									
Presence of preferred trees	6	5	6	2	2	2	2	2	2
Presence of deep hollows	2	3	4	5	2	2	2	2	2
Average shelter score	4	4	5	3.5	2	2	2	2	2
Role of site to overall population	5	5	5	5	5	5	5	5	5
Absence of threats*									
Habitat degradation by weeds	7.2	5.1	3.6	2.4	2.4	1.6	1.6	1.6	1.6
Species mobility capacity	10	10	10	10	10	10	10	10	10
Species habitat score	5.51	5.5	5.66	5.12	4.49	4.66	4.66	4.16	4.98

*Scored out of 15
 Rem = remnant, Reg = regrowth, NR = non-remnant

5.1.2.1 Foraging habitat scores

Foraging habitat scores for the impact area were high. Given the bare-rumped sheathtail bat forages over a range of remnant vegetation communities, all remnant assessment units were assigned scores of between 4 and 8, with an average of 6 overall for all assessment units.

5.1.2.2 Shelter habitat scores

Shelter habitat scores for the impact area were moderate. Most sites had an abundance of preferred roosting tree species, predominantly *E. platyphylla* and *M. leucadendra*. The abundance of suitably large deep hollows was variable, with moderate densities of deep hollows in REs 11.3.25b and 11.3.4 and lower densities in REs 11.3.35 and 11.3.7.

5.1.2.3 Absence of threats

Absence of threats scores ranged between 2.4 and 7.2 out of 15. Large parts of the impact area were covered with dense chinee apple infestations. This presents a substantial threat to the bare-rumped sheathtail bat, restricting the natural regeneration of roost tree species.

5.1.2.4 Species mobility

The bare-rumped sheathtail bat has high mobility, with the capacity to cross all gaps in vegetation within the impact area. Mobility was scored maximum of 10 at all impact area sites accordingly.

5.1.2.5 Species stocking rate

The bare-rumped sheath-tail bat was assigned a species stocking rate of 45 out of 70 for all assessment units. Scoring for each criterion is shown in Table 5.3.

Table 5.3 Species stocking rate scores for the bare-rumped sheath-tail bat within the impact area

Criterion	Scoring			
	Presence detected on or adjacent to the site	0	5	10
	No	Yes - adjacent		Yes – on site
Species usage of the site	0	5	10	15
	Not habitat	Dispersal	Foraging	Breeding
Approximate density per ha	0	10	20	30
Role/importance of species population on site	0	5	10	15
	0	5-15	20 - 35	40 - 45
Species stocking rate	45/70			
SSR (out of 4)	2.57			

5.1.3 Habitat scores for the southern black-throated finch

Average habitat quality scores out of 10 for the southern black-throated finch are presented in Table 5.4. Habitat values were moderate – high with a localised areas of high foraging and shelter habitat.

Table 5.4 Southern black-throated finch habitat quality scores for the impact area

	AU1	AU2	AU6	AU8	AU16	AU7	AU5	AU15	AU17
Regional Ecosystem	11.3.7	11.3.35	11.3.25b	11.3.4a	11.3.31	11.3.7	11.3.35	11.3.31	11.3.30
Rem/Regr/NR	Rem	Rem	Rem	Rem	Rem	NR	NR	NR	NR
Foraging habitat									
Abundance of food grass	5	4.5	2	2	2	2	2	2	3
Food grass species richness	6	9.3	4	4	8	2	5	4	5
Mosaic of bare patches	4	4	3	4	4	4	3	4	4
Average foraging score	5	5.9	3	3.3	4.7	2.7	3.3	3.3	4
Shelter and breeding habitat									
Nesting sites	5	6	2	4	2	6	4	2	2
Distance to water	9	5.8	9	6	8	10	8	9	9
Average shelter score	7	5.9	5.5	5	5	8	6	5.5	5.5
Role of site to overall population	5	5	5	5	5	5	5	5	5
Absence of threats									
Drought	15	15	15	15	15	15	15	15	15

	AU1	AU2	AU6	AU8	AU16	AU7	AU5	AU15	AU17
Inappropriate grazing	8.4	5.4	6.3	2.4	2.4	2.4	3	3	2.4
Uncontrolled wildfire	4.5	5.33	9.6	5.4	5.4	5.4	6.3	6.3	7.2
Habitat degradation by weeds	3.9	3.9	3.6	2.4	3.9	3.9	2.4	2.4	7.2
Lowest score	3.9	3.9	3.6	2.4	2.4	2.4	2.4	2.4	2.4
Species mobility capacity									
Presence of shrubs	6	5	2	2	10	10	10	10	10
Suitable open grassy woodland	6	6.3	3	4	2	2	2	2	2
Average mobility score	6	5.6	2.5	3	6	6	6	6	6
Species habitat score	6.12	6.25	6.06	5.61	5.04	5.35	4.72	4.56	5.49

*Scored out of 15

Rem = remnant, Reg = regrowth, NR = non-remnant

5.1.3.1 Foraging habitat scores

Southern black-throated finch foraging habitat scores ranged from 3 to 5.9 out of 10. Food grass species richness was moderate to high but abundance was generally low. This was limited by localised grazing pressure and potentially the season of survey, the late season, when some grasses are already declined in density. This was consistent between the impact area and offset area.

5.1.3.2 Shelter habitat scores

Shelter scores were moderate to high for the impact area. Suitable tree species were present in moderate to high densities and generally were close to drinking sites, providing access to nesting, foraging and drinking resources necessary for successful breeding.

5.1.3.3 Species mobility

Species mobility scores were highly variable between assessment units. Riparian vegetation units (RE11.3.4 and 11.3.25b) had lower mobility scores compared with the more open woodland communities RE11.3.7 and 11.3.35. This was attributed to the more open shrub layer.

5.1.3.4 Absence of threats

Absence of threats scores ranged between 2.4 and 3.9 out of 15. The principal threat to habitat quality was degradation by weeds. This would substantially reduce the abundance and diversity of foraging habitat across most of the impact area.

5.1.3.5 Species stocking rate

The southern black-throated finch was assigned a species stocking rate of 45 out of 70 for all assessment units. Scoring for each criterion is shown in Table 5.5.

Table 5.5 Species stocking rate scores for the southern black-throated finch within the impact area

Criterion	Scoring			
Presence detected on or adjacent to the site	0	5		10
	No	Yes - adjacent		Yes – on site
Species usage of the site	0	5	10	15
	Not habitat	Dispersal	Foraging	Breeding
Approximate density per ha	0	10	20	30
Role/importance of species population on site	0	5	10	15
	0	5-15	20 - 35	40 - 45
Species stocking rate	35/70			
SSR (out of 4)	2			

5.1.4 Habitat scores for the koala

Koala habitat values were typically low across the impact area due to low foraging habitat values. Average koala habitat quality scores for the impact area are presented in Table 5.6. Raw scores are presented in Appendix B.

Table 5.6 Average koala habitat quality scores for the impact area

	AU1	AU2	AU6	AU8	AU16	AU7	AU5	AU15	AU17
Regional Ecosystem	11.3.7	11.3.35	11.3.25 b	11.3.4a	11.3.31	11.3.7	11.3.35	11.3.31	11.3.30
Rem/Regr/NR	Rem	Rem	Rem	Rem	Rem	NR	NR	NR	NR
Foraging habitat									
Food tree species richness	3	2	2	2	2	2	2	2	2
Abundance of food trees	3	2	2	2	2	2	2	2	2
Ease of movement	6	5.5	6	6	4	8	5	5	4
Average foraging score	4	3.2	3.3	3.3	2.7	4	3	3	2.7
Shelter habitat value									
Species richness of shelter trees	10	6.75	6	6	6	10	5	5	2
Abundance of shelter trees	9	5.5	5	6	4	8	4	4	2
Shrub cover	10	2.5	2	2	2	2	2	3	2
Average shelter score	9.7	4.9	4.3	4.7	4	6.7	3.7	4	2
Role of site to overall population	5	5	5	5	5	5	5	5	5
Absence of threats									
Uncontrolled wildfire	4.5	6.1	6.3	9.6	5.4	9.6	8.4	5.4	7.2
Drought	7.2	7.0	7.2	7.2	7.2	7.2	7.2	7.2	7.2
Dog attack	4.5	5.1	4.5	4.5	5.4	3.6	3.6	3	2.4
Vehicle strike	7.2	7.8	5.1	6	7.2	4.8	6.9	4.8	4.8
Lowest score	4.5	5.1	4.5	4.5	5.4	3.6	3.6	3	2.4
Species mobility capacity	7	5.8	4	7	4	4	5	5	4
Species habitat score	5.5	5.33	5.69	5	4.16	5.17	3.41	3.53	4.48

Rem = remnant, Reg = regrowth, NR = non-remnant

5.1.4.1 Foraging habitat scores

Foraging habitat value was low across the impact area. Very few food tree species were present. Food tree species included *Eucalyptus crebra* and *E. tereticornis* and *E. camaldulensis*. These were present in low species richness and abundance. The majority of trees in the impact area were trees nominated as ‘ancillary’ trees in Youngentob et al. (2015).

5.1.4.2 Shelter habitat scores

A moderate to high diversity of shelter tree species were present within the impact area. These included *Corymbia dallachiana*, *C. tessellaris*, *C. erythrophloia* and *Eucalyptus platyphylla*. Shrub cover was generally low, reducing the thermal shelter values provided to local koalas.

5.1.4.3 Species mobility

Koala has high mobility, able to cross open ground to move between trees while foraging and to disperse. Generally, mobility scores were moderate to high as a result, ranging between 4 and 7 out of 10.

5.1.4.4 Absence of threats

Absence of threats scores were low to moderate, ranging between 2.4 and 5.4 out of 15. The key threat was attributed to attack from wild dogs and uncontrolled wildfire.

5.1.4.5 Species stocking rate

The koala was assigned a species stocking rate of 30 out of 70 for all assessment units. Scoring for each criterion is shown in Table 5.7.

Table 5.7 Species stocking rate scores for the koala within the impact area

Criterion	Scoring			
Presence detected on or adjacent to the site	0	5		10
	No	Yes - adjacent		Yes – on site
Species usage of the site	0	5	10	15
	Not habitat	Dispersal	Foraging	Breeding
Approximate density per ha	0	10	20	30
Role/importance of species population on site	0	5	10	15
	0	5-15	20 - 35	40 - 45
Species stocking rate	30/70			
SSR (out of 4)	1.71			

5.2 Quality of habitats within the offset area

5.2.1 BioCondition

BioCondition scores were low to moderate within the offset area, scoring between 0.15 and 0.44 out of 1. The average score across all assessment units was 0.28 out of 1. BioCondition scores for the offset area are shown in Table 5.8. BioCondition results are shown in the *Modified QLD Habitat Quality spreadsheet*, presented in Appendix B. The low-moderate scores were attributed to the history of grazing and land clearing across much of the offset area.

Table 5.8 BioCondition scores for the offset area

	OAU1	OAU2	OAU3	OAU4	OAU5	OAU6	OAU7	OAU8
Regional Ecosystem	11.3.12	11.3.25b	11.3.35	11.3.12	11.3.35	11.3.12	11.3.25b	11.3.35
Rem/Regr/NR	Rem	Rem	Rem	Regr	Regr	NR	NR	NR
Recruitment of woody perennial species in EDL	4	1.5	3.25	3	3	3	0	1.6
Native plant species richness - trees	2.5	1.25	2.5	2.5	3.1	3.3	0	1
Native plant species richness - shrubs	1.25	2.5	3.125	0	1.3	0.8	0	0.5
Native plant species richness - grasses	3.75	0	3.125	2.5	2.5	3.3	1.25	2.5
Native plant species richness - forbs	1.25	0	0.625	2.5	1.9	0.8	1.25	2
Tree canopy height*	3.75	2.5	4.75	1.5	3.9	2.2	0.75	0.9
Tree canopy cover*	3	0.5	1.25	1	0.5	0	0	0
Shrub canopy cover	1.5	0	0	0	0	1	0	0
Native grass cover	0	0	0.25	1	0	0	0	0.4
Organic litter	5	4	4	5	3.5	2	4	2.8
Large trees	10	2.5	2.5	5	3.8	0	0	0
Coarse woody debris	3.5	2.5	2.25	2	2.3	2.3	5	1.2
Non-native plant cover	0	5	0.75	0	0	0	0	0
Total (out of 80)	35.50	22.25	28.38	26.00	25.80	18.70	12.25	12.90
Score out of 1	0.44	0.28	0.35	0.33	0.32	0.23	0.15	0.16

*(average of emergent, canopy, sub-canopy)

Rem = remnant, Regr = regrowth, NR = non-remnant

5.2.2 Habitat scores for the bare-rumped sheathtail bat

Average bare-rumped sheathtail bat habitat quality scores for the offset area are presented in Table 5.9. As with the impact area, foraging habitat values were moderate-high across all sites and shelter habitat values were somewhat lower, limited by low densities of deep hollow-bearing trees in different assessment units.

Table 5.9 Average bare-rumped sheathtail bat habitat quality scores for the offset area

	AU2	AU3	AU5	AU7	AU8
Regional Ecosystem	11.3.35	11.3.25b	11.3.35	11.3.25b	11.3.35
Rem/Regr/NR	Rem	Rem	Regr	NR	NR
Foraging habitat					
Presence of remnant	8.00	8.40	5.50	6.00	5.00
Shelter habitat					
Presence of preferred trees	4.00	4.00	3.50	2.00	3.50
Presence of deep hollows	4.00	7.60	6.50	6.00	3.00
Average shelter score	4.00	5.80	5.00	4.00	3.25
Role of site to overall population	5	5	5	5	5
Habitat degradation by weeds	7.2	7.2	7.2	7.2	7.2

	AU2	AU3	AU5	AU7	AU8
Species mobility capacity	10.00	10.00	10.00	10.00	10.00
Species habitat score	5.71	6.19	6.07	5.13	5.65

Rem = remnant, Reg = regrowth, NR = non-remnant

5.2.2.1 Foraging habitat scores

Bare-rumped sheath-tail bat foraging habitat scores for the offset area ranged between 5.0 and 8.40, with high values in remnant woodland assessment units and lower values in the regrowth and non-remnant assessment units. Scores were more variable than the impact area, given the offset includes both remnant and areas of regrowth and non-remnant that have the potential to be improved.

5.2.2.2 Shelter habitat scores

As with the impact area, shelter habitat scores for the offset area were variable between assessment units, depending on the local densities of large, deep hollows. While remnant woodland assessment units had the highest shelter value scores, non-remnant areas retained some shelter values due to the retention of isolated large hollow-bearing trees in low densities.

5.2.2.3 Species mobility scores

As with the impact area, bare-rumped sheath-tail bat mobility scores were consistently high across the offset area, attributed to the species' capacity to cross gaps in vegetation.

5.2.2.4 Species stocking rate

The bare-rumped sheath-tail bat was assigned a species stocking rate of 45 out of 70 for all assessment units. Scoring for each criterion is shown in Table 5.10.

Table 5.10 Species stocking rate scores for the bare-rumped sheath-tail bat within the offset area

Criterion	Scoring			
	Presence detected on or adjacent to the site	0	5	10
	No	Yes - adjacent		Yes – on site
Species usage of the site	0	5	10	15
	Not habitat	Dispersal	Foraging	Breeding
Approximate density per ha	0	10	20	30
Role/importance of species population on site	0	5	10	15
	0	5-15	20 - 35	40 - 45
Species stocking rate	45/70			
SSR (out of 4)	2.57			

5.2.3 Habitat scores for the southern black-throated finch

Southern black-throated finch habitat scores for the offset area are presented in Table 5.11. Habitat scores were consistently moderate – high across most assessment units. Scores were slightly higher than the impact area. This reflects the high foraging and shelter scores consistent with Ross River dam, a hotspot for the species due to the local proximity and abundance of suitable drinking sites, nesting sites and suitable foraging habitat.

Table 5.11 Southern black-throated finch habitat quality scores for the offset area

	AU1	AU2	AU3	AU4	AU5	AU6	AU7	AU8
Regional Ecosystem	11.3.12	11.3.35	11.3.25b	11.3.12	11.3.35	11.3.12	11.3.25b	11.3.35
Rem/Regr/NR	Rem	Rem	Rem	Regr	Regr	NR	NR	NR
Foraging habitat								
Abundance of food grass	4.00	5.00	5.20	5.00	4.00	4.67	5.00	4.50
Species richness of food grass	7.00	6.00	6.40	5.00	4.50	6.67	4.00	5.00
Mosaic of bare patches	10.00	7.00	7.60	6.00	9.50	6.67	10.00	6.00
Average foraging score	6.89	6.00	6.40	5.33	6.00	6.00	6.33	5.17
Shelter habitat								
Nesting sites	10.00	4.00	6.80	4.00	4.00	4.00	3.00	3.00
Distance to water	6.00	10.00	6.40	5.00	8.00	5.33	10.00	7.50
Average shelter score	8.00	6.50	6.60	4.50	6.00	4.67	6.50	5.25
Role of site to overall population	5	5	5	5	5	5	5	5
Absence of threats								
Drought	15	15	15	15	15	15	15	15
Inappropriate grazing	15	15	15	15	15	15	15	15
Uncontrolled wildfire	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Habitat degradation by weeds	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Lowest absence of threat score	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Species mobility								
Presence of shrubs	10.00	2.00	7.20	8.00	4.50	5.33	3.00	4.00
Suitable open grassy woodland	7.00	4.00	7.60	4.00	3.00	2.00	4.00	3.00
Average mobility score	8.67	2.50	7.40	6.00	3.75	3.67	3.50	4.00
Species habitat score	6.07	4.93	5.5	5.41	5.28	4.38	4.32	4.33

Rem = remnant, Reg = regrowth, NR = non-remnant

5.2.3.1 Foraging habitat scores

Southern black-throated finch foraging habitat values were consistently moderate-high across the offset area, with scores ranging between 5.17 and 6.89. Both remnant and non-remnant/regrowth areas had moderate abundance of food grasses. Species richness of food grasses was higher in remnant woodland assessment units than in non-remnant and regrowth areas.

5.2.3.2 Shelter habitat scores

Shelter habitat scores ranged between 4.5 in regrowth assessment unit 6.5 to 8 in remnant assessment unit 1. All assessment units had moderate to high proximity to water but varied in the abundance of suitable nesting sites.

5.2.3.3 Species mobility scores

Southern black-throated finch mobility scores were highly variable across the offset area assessment units ranging between 2.5 and 8.67. Variation was attributed to both variations in the local presence of shrubs and presence of open grassy woodland.

5.2.3.4 Species stocking rate

The southern black-throated finch was assigned a species stocking rate of 40 out of 70 for all assessment units. Scoring for each criterion is shown in Table 5.12.

Table 5.12 Species stocking rate scores for the southern black-throated finch within the offset area

Criterion	Scoring			
Presence detected on or adjacent to the site	0	5		10
	No	Yes - adjacent		Yes – on site
Species usage of the site	0	5	10	15
	Not habitat	Dispersal	Foraging	Breeding
Approximate density per ha	0	10	20	30
Role/importance of species population on site	0	5	10	15
	0	5-15	20 - 35	40 - 45
Species stocking rate	40/70			
SSR (out of 4)	2.29			

5.2.4 Habitat scores for the koala

Koala habitat values for the offset area were comparable to those in the impact area, with low foraging habitat values and low – moderate shelter habitat scores. Average koala habitat quality scores for the impact area are presented in Table 5.13. Raw scores are presented in Appendix B.

Table 5.13 Average koala habitat quality scores for the offset area

	AU2	AU3	AU5	AU7	AU8
Regional Ecosystem	11.3.35	11.3.25b	11.3.35	11.3.25b	11.3.35
Rem/Regr/NR	Rem	Rem	Regr	NR	NR
Foraging habitat					
Species richness of food trees	4	2	2.5	2	2
Abundance of food trees	4	2	2.5	2	2
Ease of movement	4	2	2.5	2	2
Average foraging score	4	2	2.5	2	2
Shelter habitat					
Species richness of shelter trees	4	3.6	10	3	4.00
Abundance of shelter trees	4	4.8	4.5	2	4.50
Shrub cover	4	6	6	6	5.00
Average shelter score	4	4.8	6.8	3.7	4.50
Role of site to overall population	5	5	5	5	5
Absence of threats					
Uncontrolled wildfire	3.6	3.6	3.6	3.6	3.6
Drought	3.6	3.6	3.6	3.6	3.6
Dog attack	5.4	5.4	5.4	5.4	5.4
Vehicle strike	7.2	7.2	7.2	7.2	7.2
Lowest absence of threat score	3.6	3.6	3.6	3.6	3.6
Species mobility					
Species mobility capacity	10	7.6	5.75	10	4.00
Species habitat score	4.65	4.78	4.86	4.02	3.72

Rem = remnant, Reg = regrowth, NR = non-remnant

5.2.4.1 Foraging habitat scores

As with the impact area, koala foraging habitat value was low across the offset area. Very few food tree species were present. Food tree species included *E. crebra* and *E. tereticornis* and *E. camaldulensis*. These were present in low species richness and abundance. The majority of trees in the impact area were trees nominated as ‘ancillary’ trees in Youngentob et al. (2015).

5.2.4.2 Shelter habitat scores

Koala shelter habitat scores were moderate across the offset area and slightly lower than the impact area. Common shelter tree species recorded included *E. platyphylla*, *E. tereticornis*, *Corymbia clarksoniana*, *C. tessellaris* and *C. dallachiana*. The abundance of shelter trees and shrubs varied substantially across the offset area with higher local abundance in remnant woodland assessment units than in regrowth and non-remnant area.

5.2.4.3 Species mobility scores

Koala mobility scores were relatively high across the offset area. This reflects the conservative scoring which acknowledges koalas have the capacity to move across open ground.

5.2.4.4 Species stocking rate

The koala was assigned a species stocking rate of 30 out of 70 for all assessment units. Scoring for each criterion is shown in Table 5.14.

Table 5.14 Species stocking rate scores for the koala within the offset area

Criterion	Scoring			
Presence detected on or adjacent to the site	0	5		10
	No	Yes - adjacent		Yes – on site
Species usage of the site	0	5	10	15
	Not habitat	Dispersal	Foraging	Breeding
Approximate density per ha	0	10	20	30
Role/importance of species population on site	0	5	10	15
	0	5-15	20 - 35	40 - 45
Species stocking rate	30/70			
SSR (out of 4)	1.71			

5.3 Summary

Habitat scores for the impact area and offset area are summarised below for the bare-rumped sheath-tail bat (Table 5.15), southern black-throated finch (Table 5.16) and koala (Table 5.17).

Table 5.15 Summary of bare-rumped sheath-tail bat habitat scores for the impact area and offset area

Value	Score	Impact area	Offset area
Condition			
BioCondition	80	27.42	19.4
Quality and availability of food and foraging habitat	10	5.56	6.5
Quality of habitat for shelter and breeding	10	2.89	4.4
Sum of condition scores (out of 100)	100	35.87	30.25
Final condition score	3	1.08	0.91
Context			
Size of patch	10	4.44	6

Value	Score	Impact area	Offset area
Connectedness	5	3.79	2.8
Context	5	3.11	3.45
Ecological corridors	6	0	6
Role of site to species overall population in the state	5	5	5
Absence of threats	15	3.57	7.2
Species mobility capacity	10	10	10
Sum of context scores (out of 56)		29.91	40.45
Final context score	3	1.60	2.17
Species stocking rate			
Presence on the site	10	10	10
Species usage of the site	15	15	15
Approximate density	30	10	10
Role/importance of the site	15	10	10
Final species stocking rate score	4	2.57	2.57
Overall Habitat Quality Score	10	5.81	5.75

Table 5.16 Summary of southern black-throated finch habitat scores for the impact area and offset areas

Value	Score	Impact area	Offset area
Condition			
BioCondition	80	29.04	27.1
Quality and availability of food and foraging habitat	10	3.92	6.4
Quality of habitat for shelter and breeding	10	5.93	6.2
Sum of condition scores (out of 100)	100	38.89	39.72
Final condition score	3	1.17	1.19
Context			
Size of patch	10	4.67	6.25
Connectedness	5	3.51	2.75
Context	5	3.11	3.57
Ecological corridors	6	0	6
Role of site to species overall population in the state	5	5	5
Absence of threats	15	2.78	2.4
Species mobility capacity	10	4.68	4.99
Sum of context scores (out of 56)		23.75	30.96
Final context score	3	1.43	1.66
Species stocking rate			
Presence on the site	10	5	5
Species usage of the site	15	15	15
Approximate density	30	10	10
Role/importance of the site	15	10	10
Final species stocking rate score	4	2	2.29
Overall Habitat Quality Score	10	5.19	5.05

Table 5.17 Summary of koala habitat scores for the impact area and offset areas

Value	Score	Impact area	Offset area
Condition			
BioCondition	80	27.42	20.7
Quality and availability of food and foraging habitat	10	3.40	4.2
Quality of habitat for shelter and breeding	10	4.82	5.1
Sum of condition scores (out of 100)	100	35.64	30.04
Final condition score	3	1.07	0.90
Context			
Size of patch	10	9	6
Connectedness	5	3.78	2.8
Context	5	3.13	3.45
Ecological corridors	6	0	6
Role of site to species overall population in the state	5	5	5
Absence of threats	15	3.86	3.60
Species mobility capacity	10	4.41	6.65
Sum of context scores (out of 56)		29.18	33.50
Final context score	3	1.56	1.79
Species stocking rate			
Presence on the site	10	5	5
Species usage of the site	15	5	5
Approximate density	30	10	10
Role/importance of the site	15	10	5
Final species stocking rate score	4	1.71	1.71
Overall Habitat Quality Score	10	4.63	4.41

5.4 Commonwealth Offsets Assessment Guide score

For each species, the data were input to the EPBC Act *Offsets assessment guide* (DSEWPac 2012b), as detailed in Table 5.18 to Table 5.22 and summarised below.

Time over which loss is averted

The proposed offset area will be owned and managed by TCC. As such, the offset can be managed for the life of the Project. Construction of the Project is proposed to last three years. To maximise the benefits of the offset, the time over which loss is averted will be set at 20 years, exceeding the impacts of the Project.

Time until ecological benefit

Time until ecological benefit will be relatively short for the southern black-throated finch. Improvement of habitat quality for these species are predominantly linked to the rehabilitation of the ground layer and increase in native food grass abundance and diversity. These values can be improved within a 5-year timeframe.

Enhancement of values for the koala and bare-rumped sheath-tail bat are more closely linked to the rehabilitation of regrowth and non-remnant woodland areas with the aims of increasing food availability and habitat connectivity for both species. Koalas are known to forage in relatively immature regrowth (Youngentob 2021) and the bare-rumped sheath-tail bat is capable of foraging widely. The benefits of the offset are therefore likely to be achieved within a 20-year timeframe.

Risk of loss without the offset

Risk of loss has been informed by the *Guidance for informing 'risk of loss' estimates when evaluating biodiversity offsets proposals under the EPBC Act* (Maseyk et al. 2017) and knowledge on existing threats detailed in Section 3.2. The land within the proposed offset area represents a mix of remnant, regrowth and non-remnant vegetation on freehold and state land. Given there is no credible evidence that the offset area will be subject to development in the foreseeable future, the default risk of loss value of 1.10 percent for the Townsville Local Government Area recommended in Maseyk et al. (2017) has been used.

Risk of loss with the offset

The potential for total loss of habitat at the site will be negligible with the land legally secured as an offset. The land as an offset will be managed and monitored specifically for the conservation of the southern black-throated finch and less likely to suffer from deterioration in habitat quality and decline of the population.

Confidence in the result

There is a moderately high degree (80 percent) confidence in this assessment due to strong evidence for existing threats and factors limiting the shelter and foraging value. Active management of weeds and rehabilitation of the proposed offset areas provides a clear opportunity for improvement in the ecological value of habitats and reduction in the threats facing the local population. Scoring of future habitat values for anticipated improvement have been conservative to provide confidence they can be delivered and still meet the improvement requirements of the Offset. However, there are external factors that can threaten the success of the habitat and its management as an offset area, as per the risk of loss factors described above (thereby lowering the confidence level).

5.4.1 Bare-rumped sheathtail bat Commonwealth offset scores

The proposed offset is projected to offset 153.60% of the impact on habitat for the bare-rumped sheathtail bat. The offset assessment guide for the bare-rumped sheathtail bat is provided in Table 5.18.

Table 5.18 Offsets assessment guide for the bare-rumped sheathtail bat

Category	Description	Calculator Input
IMPACT CALCULATOR		
Area of habitat	Disturbance footprint of bare-rumped sheathtail bat within the Project area	92.23 ha
Quality	Weighted habitat quality score of 5.81 (rounded to 6 for input to the calculator). Refer to Section 4.4 for inputs to habitat quality scores.	6
Total quantum of impact		55.34 (adjusted ha)
OFFSET CALCULATOR		
Time over which loss is averted (max 20 years)	The time over which loss is averted will extend for the life of the proposed Project. The impacts caused by removal of mature canopy trees will require approximately 20 years to overcome.	20 years
Time until ecological benefit	As the proposed offset is based on the maturation of planted Eucalypt woodland joining areas of roosting habitat with areas of foraging habitat, the offset will be achieved over the maximum timeframe. This is proposed to be achieved over a 20-year minimum timeframe.	20 years
Start area (hectares)	551.79 ha	551.79 ha
Start quality (scale of 0-10)	Weighted habitat quality score of 5.75 (rounded to 6 for input to the calculator) Refer to Section 4.4 for inputs to habitat quality scores.	6
Future quality without offset	The impact area is relatively stable, managed for pastoral used with cattle grazing and ongoing land management for that purpose. While areas along the pipeline route are heavily infested with chinee apple and other woody weeds that would restrict recruitment of roosting and foraging habitat, there is some level of active management. As such, a conservative approach has been taken to the calculations and no decline in quality is expected over the timeframe.	6

Category	Description	Calculator Input
Future quality with offset	It is anticipated that the securing, managing, improving and monitoring of the offset areas will increase the habitat quality for the bare-rumped sheath-tail bat. A number of management actions have been proposed that will maintain and/or improve the habitat quality at the offset site and surrounds. The planting of <i>Eucalyptus platyphylla</i> and management of chinee apple will increase connectivity of foraging habitat in an area that provides existing roosting values but which is heavily degraded by past land clearing and woody weed infestation. Considering the proposed management actions, it is likely that the future quality of the habitat for the species will increase over 20 years to be a score 7.50, (rounded to 8), as per the Offset Assessment Guide calculator inputs.	8
Risk of loss (%) without offset	The default risk of loss value estimated for the Townsville LGA has been applied based on the annual risk of loss estimate provided in the Guide to deriving risk of loss (Maseyk et al. 2017).	0.05%
Risk of loss (%) with offset	The potential total loss of habitat at the site will be negligible with the land legally secured as an offset. The land as an offset will be managed and monitored specifically for the conservation of the bare-rumped sheath-tail bat and less likely to suffer from deterioration in habitat quality and decline of the population.	0%
Confidence in result (%)	There is a moderate-high degree of confidence in this assessment due to strong evidence for existing threats and factors limiting the shelter and foraging value. Active management of weeds and rehabilitation of the proposed offset areas provides a clear opportunity for substantial improvement in the ecological value of habitats and reduction in the threats facing the local population and the increase in the structure and value of foraging habitat. Assessment methods are consistent and undertaken at representative locations. Management, monitoring and reporting measures proposed provide confidence that the offset areas will improve the habitat quality and protect the species from future threats and disturbances. However, there are external factors that can threaten the success of the habitat and its management as an offset area, as per the risk of loss factors described above (thereby lowering the confidence level).	80%

5.4.1.1 Summary of projected habitat quality gains for the bare-rumped sheath-tail bat

On the basis of management measures proposed in Section 7, habitat quality for the bare-rumped sheath-tail bat is projected to increase by two points over 20 years. An overview of the anticipated gains in habitat quality is summarised in Table 5.19. The projected increase will be associated with improvements in the following criteria:

- A 1.36 point increase in site condition score, driven largely by:
 - Weed management and resulting increases in scores for non-native plant cover and native grass cover
 - Active planting and natural regeneration which will lead to increases in woody species recruitment, species richness, canopy height and cover and shrub canopy cover.
- A 0.47 point increase in site context score, resulting from an increase in the score for absence of threats, created by the removal of woody weeds that are known to suppress germination of woodland tree species and fire management which will reduce the risk of extreme fire events, which unmanaged, represent a key threat to roosting sites for the bare-rumped sheath-tail bat.

Table 5.19 Projected habitat quality gains for the bare-rumped sheath-tail bat over the offset's 20 year lifetime

Criteria	Starting score	Final score	Increase	Maximum score
Site Condition				
Recruitment of woody species	2.0	4.6	+2.6	5
Native plant species richness - trees	1.6	4.6	+3	5
Native plant species richness - shrubs	1.5	4.6	+3.1	5
Native plant species richness - grasses	2.0	4.6	+2.6	5
Native plant species richness - forbs	1.1	3.4	+2.3	5
Tree canopy height	2.6	4.8	+2.2	5

Criteria	Starting score	Final score	Increase	Maximum score
Tree canopy cover	0.5	3.1	+2.6	5
Shrub canopy cover	0	3.0	+3.0	5
Native grass cover	0.2	4.3	+4.1	5
Organic litter	3.7	4.7	+1	5
Large trees	1.8	1.8	-	15
Coarse woody debris	2.7	4.9	+2.2	5
Non-native plant cover	0.2	9.0	+8.8	10
Quality and availability of food and foraging habitat	6.5	10	+3.5	10
Quality and availability of shelter	4.4	6.9	+2.5	10
Site Condition Score	0.91	2.27	+1.36	3
Site Context				
Size of patch	6	10	+4	10
Connectedness	2.8	2.8	-	5
Context	3.5	3.5	-	5
Ecological corridors	6	6	-	6
Role of site to overall species population in state	5	5	-	5
Threats to species	7.2	12	+4.8	15
Species mobility capacity	10	10	-	10
Site Context Score	2.17	2.64	+0.47	3
Species Stocking Rate				
Presence on or adjacent to site	10	10	-	10
Species usage of the site	15	15	-	15
Approximate density	10	10	-	30
Role/importance of the species population on site	10	10	-	15
Species Stocking Rate Score	2.57	2.57	-	4
Overall Habitat Score	5.75 (6)	7.50 (8)	+2	10

5.4.2 Southern black-throated finch Commonwealth offset scores

The proposed offset will offset 163.96% of the impact on habitat for the southern black-throated finch. The offset assessment guide for the southern black-throated finch is provided in Table 5.20.

Table 5.20 Offset assessment guide for the southern black-throated finch

Category	Description	Calculator Input
IMPACT CALCULATOR		
Area of habitat	Disturbance footprint of southern black-throated finch within the Project area	96.34 ha
Quality	Weighted habitat quality score of 5.19 (rounded to 5 for input to the calculator). Refer to Section 4.4 for inputs to habitat quality scores.	5
Total quantum of impact		48.17 (adjusted ha)

Category	Description	Calculator Input
OFFSET CALCULATOR		
Time over which loss is averted (max 20 years)	The time over which loss is averted will extend for the life of the proposed Project. The impacts caused by removal of mature canopy trees will require approximately 20 years to overcome.	20 years
Time until ecological benefit	As the proposed offset is based on the increase in nesting habitat through planting of <i>Eucalyptus platyphylla</i> and <i>Melaleuca viridiflora</i> woodland and the control of woody and grassy weeds, the offset is likely to be achieved in a 20-year minimum timeframe.	20 years
Start area (hectares)	625.58 ha	625.58 ha
Start quality (scale of 0-10)	Weighted habitat quality score of 5.05 (rounded to 5 for input to the calculator) Refer to Section 4.4 for inputs to habitat quality scores.	5
Future quality without offset	The impact area is relatively stable, managed for pastoral used with cattle grazing and ongoing land management for that purpose. While areas along the pipeline route are heavily infested with chinee apple and other woody weeds that would restrict recruitment of roosting and foraging habitat, there is some level of active management. As such, a conservative approach has been taken to the calculations and no decline in quality is expected over the timeframe.	5
Future quality with offset	It is anticipated that the securing, managing, improving and monitoring of the offset areas will increase the habitat quality for the southern black-throated finch. A number of management actions have been proposed that will maintain and/or improve the habitat quality at the offset site and surrounds. The active control of grassy and woody weeds that displace potential foraging habitat, the active planting of native grasses that provide foraging habitat and canopy trees that provide nesting habitat, the provision of additional drinking sites and implementation of fire management protocols and prescribed burns will increase the value and distribution of foraging and nesting habitat. Considering the proposed management actions, it is likely that the future quality of the habitat for the species will increase over 20 years to be a score of 7 (rounded from 6.50), as per the Offset Assessment Guide calculator inputs.	7
Risk of loss (%) without offset	The default risk of loss value estimated for the Townsville LGA has been applied based on the annual estimate provided in the Guide to deriving risk of loss (Maseyk et al. 2017).	0.05%
Risk of loss (%) with offset	The potential total loss of habitat at the site will be negligible with the land legally secured as an offset. The land as an offset will be managed and monitored specifically for the conservation of the southern black-throated finch and less likely to suffer from deterioration in habitat quality and decline of the population.	0%
Confidence in result (%)	There is a moderate-high degree of confidence in this assessment due to strong evidence for existing threats and factors limiting the shelter and foraging value. Active management of weeds and rehabilitation of the proposed offset areas provides a clear opportunity for substantial improvement in the ecological value of habitats and reduction in the threats facing the local population. Assessment methods are consistent and undertaken at representative locations. Management, monitoring and reporting measures proposed provide confidence that the offset areas will improve the habitat quality and protect the species from future threats and disturbances. However, there are external factors that can threaten the success of the habitat and its management as an offset area, as per the risk of loss factors described above (thereby lowering the confidence level).	80%

5.4.2.1 Summary of projected habitat quality gains for the black-throated finch

On the basis of management measures proposed in Section 7, habitat quality for the southern black-throated finch is projected to increase by two points over 20 years. An overview of the anticipated gains in habitat quality is summarised in Table 5.21. The projected increase will be associated with improvements in the following criteria:

- A 1.04 point increase in site condition score, driven largely by:
 - Weed management and resulting increases in scores for non-native plant cover and native grass cover
 - Active planting and natural regeneration which will lead to increases in woody species recruitment, species richness, canopy height and cover and shrub canopy cover.
- A 0.3 point increase in site context score, resulting from an increase in the score for absence of threats, created by the removal of grassy and woody weeds that are known to reduce the extent and diversity of native food grasses, pest management which will reduce predation threats from cats and habitat degradation by pigs and rabbits and fire management which will reduce the risk of extreme fire events, which unmanaged, represent a key threat to foraging habitat and nesting sites for the southern black-throated finch.

Table 5.21 Projected habitat quality gains for the southern black-throated finch over the offset's 20 year lifetime

Criteria	Starting score	Final score	Increase	Maximum score
Site Condition				
Recruitment of woody species	3.1	4.7	+1.6	5
Native plant species richness - trees	2.2	4.6	+2.4	5
Native plant species richness - shrubs	2.0	4.6	+2.6	5
Native plant species richness - grasses	2.5	4.6	+2.1	5
Native plant species richness - forbs	1.5	4.6	+3.1	5
Tree canopy height	3.2	4.7	+1.5	5
Tree canopy cover	1.0	3.3	+2.3	5
Shrub canopy cover	0.2	3.2	+3.0	5
Native grass cover	0.3	4.3	+4.0	5
Organic litter	3.9	4.7	+0.8	5
Large trees	4.1	4.5	+0.4	15
Coarse woody debris	2.3	2.7	+0.4	5
Non-native plant cover	0.8	8.4	+7.6	10
Quality and availability of food and foraging habitat	6.4	8.2	+1.8	10
Quality and availability of shelter	6.2	8.1	+1.9	10
Site Condition Score	1.19	2.23	+1.04	3
Site Context				
Size of patch	6.25	6.25	-	10
Connectedness	2.75	2.75	-	5
Context	3.57	3.57	-	5
Ecological corridors	6	6	-	6
Role of site to overall species population in state	5	5	-	5
Threats to species	2.4	8	+5.6	15
Species mobility capacity	4.9	4.9	-	10
Site Context Score	1.66	1.96	+0.3	3
Species Stocking Rate				

Criteria	Starting score	Final score	Increase	Maximum score
Presence on or adjacent to site	5	5	-	10
Species usage of the site	15	15	-	15
Approximate density	10	10	-	30
Role/importance of the species population on site	10	10	-	15
Species Stocking Rate Score	2.29	2.29	-	4
Overall Habitat Score	5.05 (5)	6.50 (7)	+2	10

5.4.3 Koala Commonwealth offset scores

The proposed offset will offset 103.79% of the impact on koala habitat. The offset assessment guide for the koala is provided in Table 5.22.

Table 5.22 Offset assessment guide for the koala

Category	Description	Calculator Input
IMPACT CALCULATOR		
Area of habitat	Disturbance footprint of koala within the impact area	134.2 ha
Quality	Weighted habitat quality score of 4.63 (rounded to 5 for input to the calculator). Refer to Section 4.4 for inputs to habitat quality scores.	5
Total quantum of impact		67.10 (adjusted ha)
OFFSET CALCULATOR		
Time over which loss is averted (max 20 years)	The time over which loss is averted will extend for the life of the proposed Project. The impacts caused by removal of mature canopy trees will require approximately 20 years to overcome.	20 years
Time until ecological benefit	As the proposed offset is based on combination of improvement of mature remnant woodland and active planting of non-remnant and regrowth areas, the management and improvement over time will require approximately 20 years to mature and reach the offset goals.	20 years
Start area (hectares)	551.79 ha	551.79 ha
Start quality (scale of 0-10)	Weighted habitat quality score of 4.41 (rounded to 4 for input to the calculator) Refer to Section 4.4 for inputs to habitat quality scores.	4
Future quality without offset	The impact area is relatively stable, managed for pastoral used with cattle grazing and ongoing land management for that purpose. While areas along the pipeline route are heavily infested with chinese apple and other woody weeds that would restrict koala movement and foraging capacity, there is some level of active management. As such, a conservative approach has been taken to the calculations and no decline in quality is expected over the timeframe.	4
Future quality with offset	It is anticipated that the securing, managing, improving and monitoring of the offset areas will increase the habitat quality for the koala. A number of management actions have been proposed that will maintain and/or improve the habitat quality at the offset site and surrounds. The planting of food and shelter trees and management of weeds and management of fire will result in an increase to 'quality and availability of food and shelter across the offset area. The proposed management actions, it is likely that the future quality of the habitat for the species will increase over 20 years to be a score of 5.67, (rounded to 6) as per the Offset Assessment Guide calculator inputs.	6

Category	Description	Calculator Input
Risk of loss (%) without offset	The default risk of loss value estimated for the Townsville LGA has been applied based on the annual estimate provided in the Guide to deriving risk of loss (Maseyk et al. 2017).	0.05%
Risk of loss (%) with offset	The potential total loss of habitat at the site will be negligible with the land legally secured as an offset. The land as an offset will be managed and monitored specifically for the conservation of the koala and less likely to suffer from deterioration in habitat quality and decline of the population.	0%
Confidence in result (%)	There is a moderate-high degree of confidence in this assessment due to strong evidence for existing threats and factors limiting the shelter and foraging value. Active management of weeds and rehabilitation of the proposed offset areas provides a clear opportunity for substantial improvement in the ecological value of habitats and reduction in the threats facing the local population. Assessment methods are consistent and undertaken at representative locations. Management, monitoring and reporting measures proposed provide confidence that the offset areas will improve the habitat quality and protect the species from future threats and disturbances. However, there are external factors that can threaten the success of the habitat and its management as an offset area, as per the risk of loss factors described above (thereby lowering the confidence level).	80%

5.4.3.1 Summary of projected habitat quality gains for the koala

On the basis of management measures proposed in Section 7, habitat quality for the koala is projected to increase by two points over 20 years. An overview of the anticipated gains in habitat quality is summarised in Table 5.23. The projected increase will be associated with improvements in the following criteria:

- A 0.92 point increase in site condition score, driven largely by:
 - Weed management and resulting increases in scores for non-native plant cover and native grass cover
 - Active planting and natural regeneration which will lead to increases in woody species recruitment, species richness, canopy height and cover and shrub canopy cover.
- A 0.4 point increase in site context score, resulting from an increase in the patch size scores through planting and natural regeneration of non-remnant and regrowth areas and an increase in the score for absence of threats, created by a reduction in dog predation threats and a reduction in the risk of extreme fire events through active fire management.

Table 5.23 Projected habitat quality gains for the koala over the offset's 20 year lifetime

Criteria	Starting score	Final score	Increase	Maximum score
Site Condition				
Recruitment of woody species	2.0	4.9	+2.9	5
Native plant species richness - trees	1.6	3.9	+2.3	5
Native plant species richness - shrubs	1.5	3.4	+1.9	5
Native plant species richness - grasses	2.0	4.0	+2	5
Native plant species richness - forbs	1.1	3.6	+2.5	5
Tree canopy height	2.6	4.0	+1.4	5
Tree canopy cover	0.5	3.0	+2.5	5
Shrub canopy cover	0	3.0	+3	5
Native grass cover	0.2	3.0	+2.8	5
Organic litter	3.7	4.9	+1.2	5
Large trees	1.8	1.8	-	15

Criteria	Starting score	Final score	Increase	Maximum score
Coarse woody debris	2.5	2.7	+0.2	5
Non-native plant cover	1.2	5.5	+4.3	10
Quality and availability of food and foraging habitat	4.2	6.1	+1.9	10
Quality and availability of shelter	5.1	7.1	+2	10
Site Condition Score	0.90	1.82	+0.92	3
Site Context				
Size of patch	6	10	+4	10
Connectedness	2.8	2.8	-	5
Context	3.5	3.5	-	5
Ecological corridors	6	6	-	6
Role of site to overall species population in state	5	5	-	5
Threats to species	3.6	7	+3.4	15
Species mobility capacity	6.65	6.65	-	10
Site Context Score	1.79	2.19	+0.4	3
Species Stocking Rate				
Presence on or adjacent to site	5	5	-	10
Species usage of the site	5	5	-	15
Approximate density	10	10	-	30
Role/importance of the species population on site	5	5	-	15
Species Stocking Rate Score	1.71	1.71	-	4
Total Habitat Score	4.41 (4)	5.67 (6)	+2	10

6. Offset delivery

6.1 Offset management responsibility

The proponent will be responsible for management of the LRSA offsets area, compliance reporting and notification to DCCEEW of any incidents or non-compliance.

Suitably qualified persons will be engaged to undertake monitoring surveys and reporting.

Suitably qualified and licensed contractors will be engaged to undertake specific control programs as appropriate (e.g. feral animal control, weed control, bushfire control).

6.2 Legally securing the offset area

The offset area will be secured through the legally binding mechanism of a VDec under the *Vegetation Management Act 1999* (VM Act). The VDec process provides a simplified and streamlined protection procedure for landholders seeking to voluntarily protect areas of generally non-remnant native vegetation on their land. A VDec must be accompanied by a management plan that outlines the activities required to achieve the management intent and outcomes.

The VDec is declared by DoR, is registered in title, and is binding on all current and future owners of the land until the intent and outcomes of the management plan have been achieved. The VDec provides protection for native vegetation for a range of purposes, including legal security for offset areas and addressing Federal offset requirements under the EPBC Act.

6.3 Indicative timeframes

Timing and indicative dates for delivery of the offset are provided in Table 6.1.

Table 6.1 Offset delivery indicative timeframes

Action	Timing	Indicative date
Submit OAMP to DCCEEW	Prior to commencement	Q4 2022
Offset proposal (this report) approved by DCCEEW	Prior to commencement	Q1 2023
Apply for legal securing (VDec)	Prior to commencement	Q1 2023
Commence offset	Within 6 months of Project approval by DCCEEW	Q3 2023
Develop and implement monitoring	Within six months of Project approval by DCCEEW	Q2 in year 1 (2024), year 3 (2025) and year 5 (2027) Then every 5 years until relevant ecological outcome demonstrated or end of approval (whichever is sooner)
Compliance reporting	Annually	Annually from time of commencement

6.4 Ecological outcomes

For the relevant MNES, the offset is to achieve the ecological outcomes detailed in Table 6.2 to Table 6.4 in order to improve the population viability and overall habitat quality for the species.

Table 6.2 *Ecological outcomes for bare-rumped sheathtail bat*

Number	Outcome	Statement of outcome
1.	Increase the area of habitat for the bare-rumped sheathtail bat by 378.40 ha within 20 years via planting non-remnant areas with roost trees (<i>E. platyphylla</i>) and allowing regrowth areas to naturally regenerate.	This outcome is desirable as it helps to achieve the overall recovery objective of increasing the area and quality of habitat for populations.
2.	Increase the bare-rumped sheathtail bat offset area habitat quality by at least two points (when compared to baseline data measured by the site condition, site context and species stocking rate) within 20 years.	This outcome is desirable as it helps to achieve the specific recovery objective within the Recovery Plan of reducing the rate of habitat loss and fragmentation.
3.	Reduction in key shrubby weed densities by 90% of baseline level within 20 years.	This outcome is desirable as it helps to achieve the specific recovery objective within the Recovery Plan of understanding threatening processes on the bare-rumped sheathtail bat.
4.	Increase species richness of canopy and shrub level vegetation compared to baseline levels as a surrogate to increase invertebrate food availability within 20 years.	This outcome is desirable as it helps to achieve the specific recovery objective within the Recovery Plan (Schulz and Thomson 2007) of investigating key aspects of the biology and ecology of the bare-rumped sheathtail bat better determine and document foraging habitat requirements of the species.

Table 6.3 *Ecological outcomes for southern black-throated finch*

Number	Outcome	Statement of outcome
1.	Increase the area of potential habitat for the southern black-throated finch by 493.19 ha within 20 years via re-establishing native food grasses in key areas (i.e. within 400 m of waterbodies) and planting non-remnant areas with native tubestock.	This outcome is desirable as it helps achieve the overall recovery objective of the Recovery Plan, to protect and enhance habitat for the southern black-throated finch.
2.	Increase the southern black-throated finch offset area habitat quality by at least one point (when compared to baseline data measured by the site condition, site context and species stocking rate) within 20 years.	This outcome is desirable as it helps to achieve the specific recovery objective within the Recovery Plan of protecting and enhancing habitat.
3..	Reduce the density and extent of shrubby weeds and grassy weeds within the offset area by 70% of baseline level within 20 years.	This outcome is desirable as it helps to achieve the specific recovery objective within the Recovery Plan of managing threats to breeding areas for the southern black-throated finch.
5.	Provide artificial permanent water sources to ensure that southern black-throated finch utilisation of the area is not constrained by a lack of water.	This outcome is desirable as it helps to achieve the overall recovery objective within the Recovery Plan of protecting and enhancing habitat through the introduction and the securing of permanent water sources to ensure offset area provides a permanent breeding and foraging habitat.
6.	Implement a fire management strategy to enhance the southern black-throated finch offset area resulting in no uncontrolled bushfires that burn more than 50% of the offset area for 20 years.	This outcome is desirable as it helps to achieve the overall recovery objective within the Recovery Plan of protecting and enhancing habitat through the implementation of strategic burning to assist in the restoration of suitable foraging grass species.
7.	Reduction in densities of feral animals (i.e. wild pigs) to prevent the degradation of habitat.	This outcome is desirable as it helps to achieve the recovery objective with the Recovery Plan of protecting and enhancing habitat through the implementation of feral animal control.

Table 6.4 Ecological outcomes for koala

Number	Outcome	Statement of outcome
1.	Increase the area of habitat for the koala by 378.40 ha within 20 years via planting non-remnant areas with locally important koala food trees and allowing regrowth areas to naturally regenerate.	This outcome is desirable as it helps to achieve the overall recovery objective of increasing the area and quality of refugial habitat for populations whose primary threat is climate change.
2.	Increase the koala offset area habitat quality by at least two points (when compared to baseline data measured by the site condition, site context and species stocking rate) within 20 years.	This outcome is desirable as it helps to achieve the specific recovery objective within the Recovery Plan of reducing the rate of habitat loss and fragmentation.
3.	Reduction in key shrubby weed densities by 70% of baseline level within 20 years.	This outcome is desirable as it helps to achieve the overall recovery objective of increasing the area and quality of refugial habitat for populations whose primary threat is climate change.
4.	Reduce densities of wild dogs to reduce the predation pressures on the local koala population.	This outcome is desirable as it helps reduce the negative pressures adversely impacting the size and viability of the local koala population.

The ecological outcomes follow the SMART principles by being:

- Specific to the conservation of the relevant MNES population and the protection of the offset area.
- Measurable with quantifiable criteria and/or outcomes that can be compared over time to baseline levels, with performance indicators across a number of years to indicate failure of measures or decline of values as early as possible.
- Achievable through having realistic gains or maintaining of existing conditions to demonstrate no reduction in values.
- Relevant by addressing the potential direct loss of habitat of the relevant species.
- Time-bound with performance indicators over a 20-year period.

7. Management actions

7.1 Overview of management aims

The proposed offset site is made up of a combination of REs (Table 2.7) over a total area of 625.58 ha that will be actively managed as the offset, across several properties (Table 2.6), all of which are owned and managed by TCC except for Lot on plan 103 EP1450. Lot on plan 103 EP1450, presently owned by the State of Queensland, is in the process of being acquired by TCC. An offer from the Department of Resources has been accepted for transfer of ownership by TCC which is anticipated to be finalised by December 2022. Grazing occurs from time to time within or surrounding the proposed offsite area when boundary fences are destroyed in flooding etc.

Major threats to the species (as listed in the Significant impact guidelines and Conservation Advice) are detailed in Table 7.1.

Management actions have been proposed with consideration of the Significant impact guidelines for the endangered black-throated finch (southern) (*Poephila cincta cincta*) (DEWHA 2009), the National recovery plan for the black-throated finch southern subspecies (DECC), the Conservation Advice for *Saccolaimus saccolaimus nudicluniatus* bare-rumped sheath-tail bat (TSSC 2016), the National recovery plan for the koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DAWE 2022c), relevant threat abatement plans (e.g. Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses and the Threat abatement plan for competition and land degradation by rabbits), site-specific desktop and field assessments, and numerous studies and peer-reviewed papers relevant to the respective species.

While some of the proposed management actions relevant to habitat improvement will focus on specific areas within the proposed offset site, a number of management activities will be undertaken across the entire proposed offset site including feral animal control, fire management and land use management. A description of each of these measures is provided in Table 7.3.

Table 7.1 Summary of major threats to the species

Southern black-throated finch ¹	Bare-rumped sheath-tail bat ²	Koala ³
<ul style="list-style-type: none"> – Clearing and fragmentation of woodland, riverside habitats and wattle shrubland. – Degradation of habitat by domestic stock and rabbits, including alterations to fuel load, vegetation structure and wet season food availability. – Alteration of habitat by changes in fire regime. – Invasion of habitat by exotic weed species, including exotic grasses. – Illegal trapping of birds. – Predation by introduced predators. – Hybridisation with escapees of the northern subspecies. 	<ul style="list-style-type: none"> – Habitat loss and fragmentation. – Vegetation clearing. – Timber collection and targeted tree removal. – Competition for tree hollows by bees, non-native and native birds. – High fire frequency of preferred forest habitat. – Disease. 	<ul style="list-style-type: none"> – Clearing and fragmentation of habitat – Drought – Altered fire regimes – Mortality from dogs and vehicles – Disease prevalence

Source:

¹ DEWHA 2009

² TSSC 2016

³ DAWE 2022

As outlined by Peter Buosi (NRA 2011), three key objectives for managing southern black-throated finch habitat are considered to be:

- Objective 1 – Maintain open woodlands with a grassy understorey that is dominated by native perennial grasses. Grasses include a high proportion of early flowering perennial grasses such as Cockatoo Grass (*Alloteropsis semialata*).
- Objective 2 – Maintain water sources accessible to southern black-throated finch near foraging habitat and near woody vegetation.
- Objective 3 – Maintain tall woody vegetation near foraging habitat and water.

Key habitat requirements for the southern black-throated finch, bare-rumped sheath-tail bat and koala have been developed based on these key objectives, the Significant impact guidelines and Conservation Advice, and key habitat requirements for the relevant MNES (Table 7.2).

Table 7.2 Summary of key habitat requirements for the relevant MNES

Habitat requirements		
Southern black-throated finch	Bare-rumped sheath-tail bat	Koala
<ul style="list-style-type: none"> – Wood vegetation in which to build nests. – The availability of water all year round and resources (water, vegetation, grasses) located in reasonable proximity to one another i.e. a mosaic (NRA 2011). Accessibility and availability of water within close proximity to populations is necessary for the survivorship of the species (NRA 2011). There is a high importance of reliable water for the southern black-throated finch species with the need to drink water on a daily basis, and more frequently during drier times of the year (NRA 2011). The southern black-throated finch species typically nests and breeds near water; the Townsville southern black-throated finch population were found to nest on average 167 m from water (NRA 2009). – Suitable seeding grasses for foraging habitat. Seeding grasses being available all year round will provide sufficient resources to support multiple individuals within populations (NRA 2011). The presence of grass species which produce seed early in the wet season are likely to be essential resource for the survival of the black-throated finch (southern). Such grass species provide a critical resource at the start of the wet season (November to December), when existing fallen seed germinates, but new seed has yet to be produced (NRA 2007). The availability of woody vegetation will allow an increase in nests being built, the protection of young and juveniles, and encourage connectivity to other populations, allowing recruitment and encourage genetic diversity (NRA 2011). 	<ul style="list-style-type: none"> – Hollow bearing trees (in Australia, roosts have been recorded in poplar gum (<i>Eucalyptus platyphylla</i>), Darwin woollybutt (<i>E. miniata</i>), Darwin stringybark (<i>E. tetradonta</i>) and weeping paperbark (<i>Melaleuca leucadendra</i> syn. <i>Leucodendron</i>)) for roosting habitat. – Eucalypt forests and woodlands, generally in near-coastal areas. In Queensland, associated with coastal lowland rainforests, and more open forests dominated by <i>Eucalyptus</i> or <i>Corymbia</i> species interspersed with coastal lowland rainforest. – Food resources including flying insects which fly above the canopy. 	<ul style="list-style-type: none"> – Forests and woodlands comprising <i>Eucalyptus</i>, <i>Lophostemon</i>, <i>Corymbia</i>, <i>Angophora</i> and occasionally <i>Melaleuca</i> and <i>Leptospermum</i> (Martin and Handasyde 1999; Moore and Foley 2000). – Larger and shadier trees for shelter brigalow <i>Acacia harpophylla</i> and black tea-tree <i>Melaleuca bracteata</i> (Ellis et al. 2002).

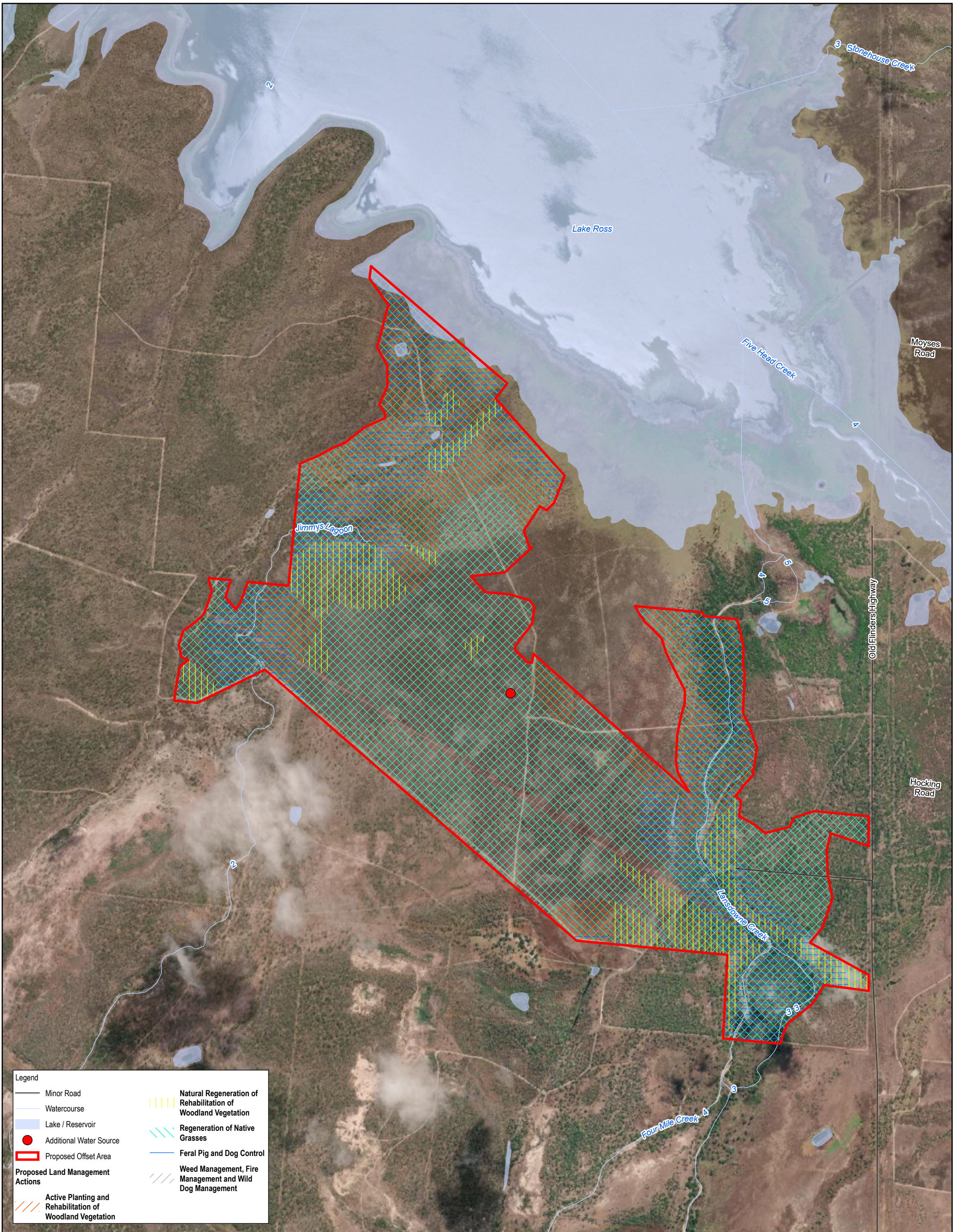
7.2 Management actions

A number of management actions have been proposed (Table 7.3) with reference to the key habitat requirements of the three MNES as outlined in Table 7.2, to improve the quality of their habitat within the proposed offset area.

Key management actions include:

1. Legally securing offset area
2. Revegetation and regeneration management
3. Weed management
4. Water source management
5. Fire management
6. Control of feral animals
7. Reduction in cattle densities

An overview of proposed land management actions is presented in Figure 7.1.



Legend

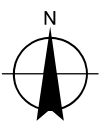
Minor Road	Natural Regeneration of Rehabilitation of Woodland Vegetation
Watercourse	Regeneration of Native Grasses
Lake / Reservoir	Feral Pig and Dog Control
Additional Water Source	Weed Management, Fire Management and Wild Dog Management
Proposed Offset Area	
Proposed Land Management Actions	
Active Planting and Rehabilitation of Woodland Vegetation	

Based on or contains data provided by the State of QLD 2021. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency 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. Data must not be used for marketing or be used in breach of the privacy laws.

Paper Size ISO A3

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55



Townsville City Council
Houghton Pipeline Stage 2 -
Offset Area Management Plan

**Preliminary indicative map of
proposed land management
actions within the offset area**

Project No. 12537606
Revision No. 2
Date 10/26/2022

FIGURE 7-1

Table 7.3 Proposed management and mitigation measures for the relevant MNES

Justification	Proposed action
Management Action 1 – Legally securing offset area	
<p>It is proposed to use a voluntary declaration (VDec) to secure the offset area. A VDec is an option under the VM Act that provides a simplified, streamlined process for landholders to voluntarily protect areas of native vegetation not otherwise protected by the VM Act. A VDec can be used to protect areas of high nature conservation values (or areas vulnerable to land degradation), and to secure areas of land to satisfy statutory offset requirements.</p>	<p>The proponent will follow the process outlined in the Guide to Voluntary Declarations under the VM Act (effective 21 June 2019) to obtain the VDec, which is summarised below.</p> <p>A Request for a voluntary declaration application is submitted to the Queensland Department of Resources (DoR), including written consent from all registered owners, a description of the purpose of the VDec and how the area meets the criteria of high nature conservation value, and a copy of the offset area management plan.</p> <p>The DoR will assess the VDec request to ensure it meets all criteria required and to ensure the management plan contains the appropriate elements to ensure the declared area is managed to achieve the desired outcomes.</p> <p>Once the DoR is satisfied that the VDec request meets the criteria for a declaration, a VDec offer will be sent that includes a draft:</p> <ul style="list-style-type: none"> – Declaration notice. – Declared area code (if proposed). – Property Map of Assessable Vegetation (PMAV) showing the area as Category A vegetation, giving it a high level of protection similar to endangered regional ecosystems within a Category B area. – Declared area management plan, including map of the declared area. <p>After the DoR and the proponent agree to the offer, DoR will make the declaration and provide a finalised VDec package. The declaration takes effect from the date the chief executive signs the declaration notice. The offset area management plan has effect under the VDec process from the same date. The VDec will be applied over the offset areas in perpetuity.</p> <p>There are no statutory timeframes for the VDec application and approval process.</p>
Management Action 2 - Revegetation and regeneration management	
<p>Southern black-throated finch</p> <p>Southern black-throated finch habitat is broadly defined as grassy open woodlands and forests, typically dominated by <i>Eucalyptus</i>, <i>Acacia</i> and <i>Melaleuca</i>, especially on alluvium (river and creek flats). Nests are generally constructed in open areas with a low species diversity, a sparse shrub layer and low tree abundance. Nests are commonly constructed on a horizontal fork or within the twiggy branches of <i>Eucalyptus</i> spp., and occasionally in a hollow limb of a tree, termite mound, among grass, in old babbler nests and at the base of raptor nests (Higgins et al. 2006). In two heavily studied areas on the Townsville Coastal Plain, southern black-throated finch preferred <i>E. platyphylla</i> and <i>Melaleuca</i> spp., for nesting purposes (Rechetelo 2015).</p>	<p>Within 6 months of Project approval by DCCEEW, revegetation will commence within nominated areas.</p> <p>The rehabilitation program will be undertaken by a suitably qualified bush regeneration contractor and will include measures to ensure the maintenance and survival of new nesting (southern black-throated finch) and roosting (bare-rumped sheathtail bat) trees in the offset areas.</p> <p>Within mapped regrowth areas, natural regeneration is preferred to the reconstruction of the vegetation community (i.e. soil improvements, dense planting etc). Management of these areas will focus on controlling weeds and restricting access from vehicles or stock animals, or other existing significant disturbances, in order to promote further growth</p>

Justification	Proposed action
<p>The Project is anticipated to result in the loss of 96.34 ha (in aggregate) of potential habitat critical to the survival of the species. This comprises 82.14 ha of nesting and foraging habitat 82.14 ha and 14.19 ha of foraging only habitat 14.19 ha.</p> <p>The proposed offset area is subject to disturbance including some historical clearing (NRA 2011). Clearing and fragmentation of woodland is listed in the Significant Impact Guidelines as a major threat.</p> <p>Rehabilitation and revegetation is a key action that will improve BTF habitat values within the offset area, while also expanding habitat values in areas that have been subject to weed infestations. Rehabilitation aims to reinstate existing degraded areas and areas exposed as a result of management action 3 (weed management), with southern black-throated finch nesting trees consistent with the mapped regional ecosystem.</p> <p>The proposed offset area has been chosen as it contains remnant and regrowth <i>E. platyphylla</i> woodland (nesting habitat) and non-remnant vegetation (foraging habitat). The active revegetation (including the planting of tubestock) of non-remnant areas within the offset area has the potential to increase population by increasing the availability of nesting sites, and seeding the ground layer with native food grass species for the southern black-throated finch will increase the quality and abundance of food resources.</p>	<p>and new seedlings. Where natural regeneration is unsuccessful minor infill planting will be implemented to facilitate recovery.</p> <p>A planting program will be designed for areas where disturbances occur within the offset sites (e.g. non-remnant). The species selected will be site-specific and dependent on localised habitat features and landforms and consistent with the mapped regional ecosystem or pre-clear regional ecosystem over the area, with key focus also on providing native grass food species for the southern black-throated finch.</p> <p>A monitoring and maintenance schedule will be implemented to provide adequate watering, weed control and replacement of tubestock or re-seeding, as necessary.</p>
<p>Koala</p> <p>The koala has a specialist diet, feeding on the leaves of select species of <i>Eucalyptus</i>, <i>Lophostemon</i>, <i>Corymbia</i>, <i>Angophora</i> and occasionally <i>Melaleuca</i> and <i>Leptospermum</i> (Martin and Handasyde 1999; Moore and Foley 2000). Consequently, koalas are reliant on access to stands of forest and woodland that support those key food-tree species. Shelter (non-food) tree species are also used to rest and assist in thermoregulation (Crowther et al. 2013; Briscoe et al. 2015).</p> <p>The Project is anticipated to result in loss of 134.2 ha of habitat that constitutes habitat critical to the survival of the species, comprising 74.33 ha of forest or woodland and 48.25 ha of non-remnant (e.g. road-side, paddock trees) vegetation.</p> <p>Rehabilitation and revegetation is a key action that will improve koala habitat values within the offset area. Specifically, reinstating the natural RE communities has the potential to increase habitat connectivity and increase the availability of key resources including food and shelter trees for the koala.</p>	
<p>Bare-rump sheathtail bat</p> <p>The Commonwealth listing advice identifies habitat as including mostly in lowland areas, typically in a range of woodland, forest and open environments (Schulz and Thomson 2007; Reardon et al. 2010; Dennis 2012). In north Queensland, the species occurs in lowland open woodland areas dominated by <i>Eucalyptus platyphylla</i> (poplar gum) (Compton and Johnson 1983). The species has been recorded using large, deep hollows for roosting and breeding in species <i>E. platyphylla</i>, <i>E. miniata</i>, <i>E. tetradonta</i> and <i>Melaleuca leucadendra</i> (TSSC 2016). Information on the dimensions of known roosting hollows is presented in the</p>	

Justification	Proposed action
<p>National Recovery Plan for the bare-rumped sheathtail bat (Schulz and Thomson 2007) and Australian bats (Churchill 1998), with all hollows ranging in size between 18 cm and 29 cm diameter. There are only two records in the last two decades, both from north-eastern Queensland (DAWE 2022A).</p> <p>The Project is anticipated to result in the following impact to bare-rumped sheathtail bat habitat:</p> <ul style="list-style-type: none"> – Loss of 92.23 ha (in aggregate), comprising: <ul style="list-style-type: none"> • Foraging and roosting habitat 36.44 ha • Foraging only habitat 49.11 ha • Roosting only habitat 6.68 ha – Direct loss of 10 large hollow-bearing trees and 27 moderate <i>E. platyphylla</i> hollow-bearing trees which represent potential roosting habitat for the bare-rumped sheathtail bat. – The loss of 325 small hollow-bearing <i>E. platyphylla</i> trees represents a loss of future potential roosting trees for the species. <p>Small hollows with narrow entrances take approximately 100 years to form. Hollows of a medium size will take around 200 years to form, and larger and deeper hollows can take a lot longer (Mackowski 1984; Menkorst 1984; and Scotts 1991). Vegetation clearing is listed as a major threat in the Conservation Advice for bare-rumped sheathtail bat.</p> <p>Rehabilitation and revegetation is a key action that will improve bare-rumped sheathtail bat habitat values within the offset area, while also expanding habitat values in areas that have been subject to weed infestations. Rehabilitation aims to reinstate existing degraded areas and areas exposed as a result of management action 3 (weed management), with future roosting trees consistent with the mapped regional ecosystem.</p> <p>The proposed offset area has been chosen as it contains remnant <i>E. platyphylla</i> woodland which contains roosting habitat (moderate to large hollows). The area also contains regrowth <i>E. platyphylla</i> representing future roosting habitat and non-remnant vegetation (foraging habitat). The active revegetation (including the planting of tubestock) of non-remnant areas within the offset area has the potential to increase population by increasing the availability of roosting sites.</p>	
Management Action 3 - Weed management	
<p>The vegetation communities understorey within the offset area were observed to be in an altered condition due to weed infestation. Many parts of the site contain a mid-dense to dense shrub layer of chinee apple (<i>Ziziphus mauritiana</i>) (listed under the <i>Biosecurity Act 2014</i>).</p> <p>Under normal conditions these communities would have a grassy woodland to open woodland structure suitable for a range of granivorous birds. These species commonly forage on grass seeds in open areas; however, the closure of the understorey has substantially reduced this habitat from both a structural</p>	<p>Weed management measures will be implemented within 6 months of Project approval by DCCEEW and an ongoing weed control program will commence. Methods for weed control will be site-specific and appropriate to each species, with regard to best practice and relevant guidelines, such as:</p> <ul style="list-style-type: none"> – Townsville City Biosecurity Plan 2020 – 2024. – Biosecurity Queensland fact sheets. <p>Treatment options should be undertaken using an integrated approach. Methods may involve a combination of physical, chemical and/or biological methods, depending on the</p>

Justification	Proposed action
<p>perspective and through competition with the native grass food source. Southern black-throated finch tend to avoid sites with high shrub cover and abundance, particular chinee apple (<i>Ziziphus mauritiana</i>), lantana (<i>Lantana camara</i>) and Townsville wattle (<i>Acacia leptostachya</i>) (Rechetelo 2015). Chinee apple also limits the application of fire as a management tool leading to vegetation thickening, which also alters the vegetation community structure. The closure of the understorey also suppresses the recruitment of native canopy species.</p> <p>Stylosanthes* (an introduced pasture legume) was also common within the ground layer strata, whereby potentially suppressing southern black-throated finch foraging grasses. Fire management has been recommended to maintain the balance between Stylosanthes* and palatable grass species in improved pastures (Partridge et al. 1996). Fire management is further discussed below.</p> <p>The field investigations identified the following weed species that are likely to lead to the degradation of southern black-throated finch habitat:</p> <p>Woody weeds</p> <ul style="list-style-type: none"> – Chinee apple (<i>Ziziphus mauritiana</i>) – Lantana (<i>Lantana camara</i>) – Townsville wattle (<i>Acacia leptostachya</i>) – Rubber vine (<i>Cryptostegia grandiflora</i>) – Parkinsonia (<i>Parkinsonia aculeata</i>) – Prickly Acacia (<i>Vachellia nilotica</i>; syn. <i>Acacia nilotica</i>) – Siam Weed (<i>Chromolaena odorata</i>). <p>Exotic forbs</p> <ul style="list-style-type: none"> – Snakeweed (<i>Stachytarpheta jamaicensis</i>) – Stylosanthes spp. Bellyache bush (<i>Jatropha gossypifolia</i>) – Horehound (<i>Mesosphaerum</i> (syn. <i>Hyptis</i>) <i>suaveolens</i>) – Sidas (mostly <i>Sida acuta</i>) – Broad-leaf Tea-tree – Quinine (<i>Petalostigma pubescens</i>). <p>Exotic grasses</p> <ul style="list-style-type: none"> – Sheda Grass (<i>Dichanthium annulatum</i>) – Parra Grass (<i>Urochloa mutica</i>) – Guinea Grass (<i>Megathyrsus maximus</i>) – Rhodes Grass (<i>Chloris gayana</i>) – Grader Grass (<i>Themeda quadrivalis</i>). <p>Invasion of habitat by exotic weed species, including exotic grasses is listed in the National Recovery Plan as a major threat and the Habitat Management Guidelines (NRA 2011) recommend the control of lantana* and chinee apple*.</p>	<p>species and extent of infestations. Fire management as discussed below should also form part of the overall integrated approach. Some species may require subsequent treatments due to viability of seed banks for longer periods.</p> <p>Prior to any use of mechanical clearing, proposed treatment sites should be examined, and desirable trees and regrowth clearly marked with pink flagging tape to help reduce native vegetation.</p> <p>Appropriate minor use permits from the Commonwealth Australian Pesticides and Veterinary Medicines Authority may apply.</p>

Justification	Proposed action
<p>To improve habitat value the removal and control of chinese apple and other invasive weeds is required to return the vegetation community to an open woodland structure with a sparse shrub stratum as recommended by NRA (2011).</p>	
Management Action 4 - Water source management	
<p>The provision of drinking sites will enhance the value of habitats for the southern black-throated finch and help reduce the impact of drought on the koala.</p> <p>Habitat critical to the survival of the species has not been formally defined in the National Recovery Plan for the southern black-throated finch (Black-throated finch Recovery Team 2007) or the Referral guidelines for the Black-throated finch (southern) (DEWHA 2009). Habitat critical to the survival of the species is likely to include nesting habitat. In the Townsville region the southern black-throated finch typically nests within 400 m of a water source and is rarely seen more than 1 km from permanent water during the breeding season (NRA 2006). Nesting sites also need to be near foraging habitat as observations suggest that during the breeding season the subspecies travels smaller distances than it does during the dry season (Mitchell 1996; NRA 2006; NRA 2007). The presence of suitable trees close to seasonal water sources is critical for the southern black-throated finch.</p> <p>Performance indicators for water supply detailed in the habitat management guidelines (NRA 2011) include:</p> <ul style="list-style-type: none"> – Southern black-throated finch using water sources. – Water sources are located within 200 m of and not more than 400 m from foraging habitat and near woody vegetation. <p>Compromised water sources due to drought and intense grazing regimes is listed in the Significant Impact Guidelines as a major threat.</p> <p>A permanent water source which contains water during an average wet season is located on the lower reaches of Landsdowne Creek, located greater than 700 m to the north-east of the offset area eastern extent. A section of Landsdowne Creek is located within the offset site (21 on E124186 and 2 on RP725617) and flows parallel to its eastern boundary. Within this reach Lansdowne Creek is considered semi-permanent. There are a number of farm dams located to the south of the offset area's southern extent which are considered permanent, the closest being within 200 m.</p> <p>Although one permanent dam is located within 400 m from the proposed offset area's south-eastern extent (Figure 2.3), due to the size of the proposed offset area, the lack of permanent water sources may restrict southern black-throated finch utilisation of the area. NRA (2011) suggests that water sources can be used to manipulate the distribution of southern black-throated finch within the landscape, in which species have been known to drink from artificial water sources (e.g. cattle troughs) if suitable perches are available. The installation of artificial permanent water points are proposed to ensure the distribution of southern black-throated finch is not restricted within the offset area.</p>	<p>Within 12 months of Project approval, permanent water sources will be installed at locations identified in Figure 7.1 in a manner that excludes livestock, macropods and limits predation by feral cats (water troughs mounted on extended legs above ground level). Feral cats have been observed ambushing birds, including finches, at cattle troughs (NRA 2011).</p> <p>The permanent water source will consist of a windmill and water trough mounted on extended legs, with suitable perches. The provision of artificial permanent water sources will ensure that a water source is accessible within 400 m from any location within the offset area.</p>

Justification	Proposed action
Management Action 5 - Fire management	
<p>Inappropriate fire regimes that lead to infrequent hot dry fires threaten roost resource availability for the bare-rumped sheathtail bat and increase the risk of uncontrolled wildfires that are a threat to the koala, bare-rumped sheathtail bat and southern black-throated finch.</p> <p>NRA (2018) suggested that historical fire regimes on LRSA are likely to be unfavourable for southern black-throated finch. The historical fire regime has probably contributed to the proliferation of certain weedy grasses and forbs that are unfavourable for southern black-throated finch (NRA 2018). The National Recovery Plan has identified the alteration of habitat by changes in fire regime as a major threat to southern black-throated finch.</p> <p>Fire has been infrequent in the south of the LRSA (0 to 1 fire since 2000). In other areas of the LRSA fire has been more frequent, whereby predominantly occurring during periods of relatively low rainfall and warm or hot weather (NRA 2018). Fires that occur at times of low soil moisture disadvantage native grasses and favour forbs (NRA 2018). Additionally, hot fires coinciding with these conditions can result in temporary broad-scale loss of plant biomass, thereby creating conditions favourable for weed ingress and homogenising grass flowering/seeding timeframes (NRA 2018). When repeated over the medium to long term, these conditions will likely disadvantage southern black-throated finch (NRA 2018).</p> <p>Stylosanthes* (an introduced pasture legume) which was commonly observed within the ground layer of the offset area, can out compete potential southern black-throated finch foraging grasses. Fire has been recommended to maintain the balance between Stylosanthes* and palatable grass species in improved pastures (Partridge et al. 1996).</p> <p>Consideration should also be given to where grader grass* and thatch grass* is present. Both species can expand rapidly in response to ground disturbance caused by fire (NRA 2018).</p> <p>Management should aim to prevent extensive and uncontrolled fires. This is especially an issue in areas that have high fuel loads, such as lands not grazed by cattle (NRA 2011).</p> <p>Recommendations for managing southern black-throated finch habitats with fire are listed in the Habitat Management Guidelines (NRA 2011) and include:</p> <ul style="list-style-type: none"> – Maintain landscapes that have variety in burning regimes, e.g. variety in the timing and intensity of fires and the areas burnt each year. This can be achieved by adopting a fire regime that involves burning fire breaks earlier in the season then following up with early dry season (May to July) patch burns (cool burns) in discrete areas (i.e. don't burn entire landscapes at once). Areas should be left unburnt for 5 or more years apart from fire breaks which may require more frequent treatment. – Southern black-throated finch will most likely benefit from landscapes that have a mosaic of fire histories (spatially and temporally). 	<p>Within 12 months of Project approval, a Bushfire Management Plan will be developed and implemented. A review of historical fire management efforts and fire history will be undertaken for the proposed offset areas and surrounds. Fire management actions will be planned and implemented with the aim of protecting the offset area and southern black-throated finch habitat values and resources.</p> <p>The Queensland Herbarium (2021b) provides fire management guidelines for each of the Queensland Regional Ecosystems that occur within the offset area and are described in Table 7.4.</p> <p>Although the Queensland Herbarium (2021b) guidelines are developed for the general maintenance of a regional ecosystem and needs to be considered, they are not tailored to promote and maintain suitable foraging grasses for southern black-throated finch. Fire management should therefore aim to meet the Habitat Management Guidelines (NRA 2011) performance indicators for managing fire for southern black-throated finch habitat.</p> <p>A fire management strategy including a program of actions will be developed. Fire risks to the southern black-throated finch population will be managed through the implementation of the following key components:</p> <ul style="list-style-type: none"> – Identification and maintenance of fire breaks using existing fence-lines and track networks, widening fire breaks up to a width of 10 m if necessary. – Scheduled, periodic fuel management via hazard reduction burning. These will be developed and implemented in consultation with DES and Queensland Rural Fire Service with prescribed burns undertaken by suitably qualified and experienced practitioners. <p>Management of vegetation will be generally consistent with guidelines for the local regional ecosystem, with prescribed post wet (May – June) burns at low intensity at intervals of between 2 and 7 years, with the aim to burn at no greater than 20% percent of stands in any one year. This will reduce the potential for uncontrolled high intensity fires that have the capacity to burn out habitat across the entire offset area.</p> <p>Fire management actions will be reviewed every five years, at a minimum, in consultation with local Fire Management Authorities and including the DES and Qld Rural Fire Service.</p>

Justification	Proposed action
<ul style="list-style-type: none"> – Protect dry season southern black-throated finch habitat, especially grasslands near to water, from late dry season fires. This is particularly important during dry years. Also protect grasslands near water sources during the southern black-throated finch breeding season when there is no alternative water or habitat nearby. – Burn when there is good soil moisture. Spell grasslands after fire to reduce woody vegetation thickening and assist in the recovery of native perennial grasses. – Wet season fires (January to March) should be avoided due to impacts on Cockatoo grass. – A fire regime recommended by the Queensland Herbarium (2021b) for REs 11.3.12, 11.3.25 and 11.3.35 is suitable for most southern black-throated finch habitats on LRSA. Igniting fires under appropriate weather conditions is essential for achieving these outcomes. 	
Management Action 6 – Control of feral animals	
<p>The National Recovery Plan has identified following as major threats to southern black-throated finch:</p> <ul style="list-style-type: none"> – Degradation of habitat by domestic stock and rabbits, including alterations to fuel load, vegetation structure and wet season food availability. – Predation by introduced predators. <p>Feral animals that pose a threat to southern black-throated finch include feral pigs (<i>Sus scrofa</i>), feral rabbits/hares (<i>Oryctolagus cuniculus</i> / <i>Lepus europaeus</i>) and feral cats (<i>Felis catus</i>) (NRA 2018). The feral animal species feral pigs* (<i>Sus scrofa</i>) and wild dogs (<i>Canis familiaris</i>) are considered common within the LSRA, where feral pigs* have a potential material impact on southern black-throated finch's habitat. While rabbits (<i>Oryctolagus cuniculus</i>) are considered uncommon within the LSRA (NRA 2018; Pers comm. Bradley Drinkwater (Ross River Dam Ranger)), the species can substantially degrade habitat for the southern black-throated finch and may degrade the quality of habitats at the offset area if left unchecked. Each year TCC conduct an aerial shooting program where they control approximately 30 wild dogs* and 220 wild pigs* per year (Pers comm. Bradley Drinkwater (Ross River Dam Ranger)).</p> <p>Southern black-throated finch require viable habitat which is made up of seeding grasses available all year round, in order to sufficiently support life, recruitment and genetic diversity (NRA 2018). Feral pigs can reduce of seedling grasses, such as Cockatoo Grass (<i>Alloterois semialata</i>), essential for southern black-throated finch and act as vector for the spreading and establishment of weed species. Feral pigs are known to remove Cockatoo Grass by digging up the plants to feed on the tubers (NRA 2011), thereby reducing the abundance of resources for southern black-throated finch.</p> <p>Feral cats also pose a threat to southern black-throated finch when drinking, where they have been observed attacking birds including finches at cattle troughs (NRA</p>	<p>Baseline pest monitoring will be undertaken to identify evidence of feral or unwanted pests and development of a property wide feral animal management program specifying techniques (trapping, baiting, shooting) to be utilised will be completed within 12 months of commencement of the action. Key priorities will be monitoring and management of cats, rabbits, wild dogs and pigs.</p> <p>Annual pest monitoring by a suitably qualified pest management contractor, with evidence of pest animals GPS recorded. Where there is evidence of pest animals, targeted trapping, baiting and/or shooting programs will be implemented by an independent suitably qualified pest management contractor. Where annual monitoring does not identify any feral or pest species monitoring will be reduced to 2 yearly.</p> <p>Where practical and appropriate, participate cooperatively in pest management planning and implementation with local land managers (government departments, local governments and utility providers) to ensure effective pest management in the locality of the offset area.</p> <p>As discussed in Management Action 4 (water source management), permanent water sources will be provided within LRSA. The permanent water source will consist of a bore and windmill and water trough mounted on extended legs, with suitable perches. The trough mounted on extended legs will prevent predation by cats and will prevent other feral animals from utilising the water source.</p>

Justification	Proposed action
<p>2011). Predators, such as feral cats, may occur in higher numbers in areas closer to water sources (Landsberg et al. 1997).</p> <p>Feral animals including the wild dog are common in the proposed offset area and have the potential to impose negative pressures on the koala, with dogs representing a key mortality threat to koalas (DAWE 2022A).</p>	
Management Action 7 – Reduction in cattle densities	
<p>The offset area has been subject to varying levels of cattle grazing. This has degraded understorey vegetation, with reduced extent and quality of foraging habitat for the southern black-throated finch within the offset area particularly notable. Reduction of cattle densities and reinstatement of native grassy ground layer will increase food availability for the southern black-throated finch.</p>	<p>Cattle densities will be reduced from the offset area and fencing will be secured where required to prevent cattle entering the offset area from adjoining properties.</p> <p>Areas with high localised grazing impacts will be rehabilitated to re-establish native food grasses for the southern black-throated finch, and reinstatement of the native ground layer will require a holistic management combining management of weeds, fire and existing pasture grasses.</p>

Fire management guidelines for each of the REs that occur within the offset area and are described in Table 7.4.

Table 7.4 Queensland Herbarium (2021b) fire management guidelines for each of the Queensland Regional Ecosystems in the offset area

RE code	Short description	DES Fire Management Guidelines
11.3.12	<i>Melaleuca viridiflora</i> , <i>M. argentea</i> +/- <i>M. dealbata</i> woodland on alluvial plains	<p>SEASON: Mid-dry season.</p> <p>INTENSITY: Low to moderate.</p> <p>INTERVAL: Occasional fires, typically every 5 - 10 years.</p> <p>STRATEGY: Use occasional burning to promote herbs and shrubs and reduce excessive fuel build up that can cause high intensity fires.</p> <p>ISSUES: The coastal north Queensland populations of <i>Grevillea pteridifolia</i> are fire-killed obligate seeders with fire promoted germination. Many herbs are promoted by fire, such as ground orchids. Conversely, terrestrial orchids can be killed by fires that are intense enough to scorch them in the canopy and therefore they provide a useful indicator of past fire intensities. Ensure maintenance of a diverse ground and shrub layer. Where <i>Grevillea pteridifolia</i> or other fire-killed shrubs are present, wait until subsequent post-fire seedlings have matured before burning again.</p>
11.3.25b	<i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i> , <i>Nauclea orientalis</i> open forest	<p>SEASON: Primarily early dry season.</p> <p>INTENSITY: Low.</p> <p>INTERVAL: 3 - 5 years.</p> <p>STRATEGY: Protection relies on broad-scale management of surrounding country with numerous small fires throughout the year so that wildfires will be very limited in extent. c-g: Depending on position in the landscape, protection depends on broad-scale management of surrounding country, with numerous small fires throughout the year so that wildfires will be very limited in extent.</p> <p>ISSUES: Fringing communities are critical habitat. In some situations it may be best not to burn. Intense and extensive fires degrade vegetation structure and destroy fauna habitats. Restrict the extent and intensity of fires. Hollow trees are critical habitat. Green panic may be an issue and an intensive grazing regime for very short periods, may be necessary to limit potential of wildfire. If riparian areas need to be burnt to reduce fuel loads then burning should occur when there is good soil moisture and active growth.</p>
11.3.35	<i>Eucalyptus platyphylla</i> , <i>Corymbia clarksoniana</i> woodland on alluvial plains	<p>SEASON: Early dry season when there is good soil moisture, with some later fires in the early storm season or after good spring rains.</p> <p>INTENSITY: Primarily low to moderate, with occasional high intensity fires.</p> <p>INTERVAL: Typically 2 - 7 years, with some areas longer unburnt.</p> <p>STRATEGY: A predominance of early dry season fires is recommended, although there is value in occasional late dry season fires, or storm burns, over small areas. Burning should begin very soon after the wet season, to secure boundaries and adjacent fire-sensitive vegetation. Subsequent repeat ignitions can be used within the same section of land weeks or months after the boundaries have been secured by early burning, to produce a mixture of burnt areas with multiple ignition dates. Use topographical features to ignite areas as soon as they dry out. This will create a mosaic of areas that were burnt at different dates and unburnt sections within the same area of woodland. Burn away from riparian communities, which can be critical habitat for some species. Approximately 25% of the grassy woodlands within a landscape should receive patchy fires in most years.</p> <p>ISSUES: These woodlands have a diverse native grass and herb layer that is maintained and promoted by regular fire. Burning that starts immediately after the wet season, with follow up small fires ignited progressively over multiple dates can increase the availability of grass and herb seed, which is a critical food source for many birds and small mammals. Recently burnt grass clumps tend to produce more seed than unburnt clumps and the earlier burnt grass usually seeds earlier than later burnt grass. Maintaining a fire mosaic will help ensure protection of habitat and mitigate against wildfires. Low to moderate intensity burns with good soil moisture minimise the risk of losing hollow trees. An occasional late season burn will promote grasses and legumes. Ensure a diverse grass layer; maintain hollow-bearing trees and vegetation structure.</p>

7.3 Completion criteria and corrective actions

Completion criteria have been derived from the site habitat quality to demonstrate the improvement in the quality of habitat in the offset area over a 20-year period (Table 7.6). These have been broadly categorised to align with the ecological outcomes detailed in Section 6.4 herein. Additionally, interim milestones that set targets at 5-yearly intervals for progress towards achieving these offset completion criteria have been developed (Table 7.6).

Monitoring results will be used to determine if the interim milestones are being achieved. These interim milestones provide an indication of the success of the management measures being implemented for southern black-throated finch, bare-rumped sheath-tail bat and koala habitat and serve as trigger values where failure to achieve these will result in the implementation of corrective actions. Accordingly, corrective actions are detailed in Table 7.5.

Table 7.5 Interim milestones, completion criteria and corrective actions

Ecological outcome	Year 1 performance indicator	Year 5 performance indicator	Year 10 performance indicator	Year 15 performance indicator	Completion criteria	Corrective actions
Increase the area and quality of habitat for the relevant MNES species.	<ul style="list-style-type: none"> At least 90 percent survival of planted tubestock is observed. At least 70 percent germination of seeds is observed. Natural regeneration of key flora species from all vegetation strata is observed in regrowth areas. 	<ul style="list-style-type: none"> Regeneration and establishment of native plant communities is recorded. No notable areas of dieback are recorded. Net increase in canopy cover is recorded. Increase in habitat scores is recorded as per 5 year milestones in Table 7.6. 	<ul style="list-style-type: none"> Net increase in canopy cover is maintained. Recruitment and regeneration of native plants is maintained. Increase in habitat condition scores is recorded as per 10 year milestones in Table 7.6 . 	<ul style="list-style-type: none"> Net increase in canopy cover is maintained. Recruitment and regeneration of native plants is maintained. Increase in habitat condition scores is recorded as per 15 year milestones in Table 7.6. 	<ul style="list-style-type: none"> Restore the RE vegetation across non-remnant and regrowth areas to achieve floristics comparable to that of the relevant RE benchmarks. Achieve required point increase in habitat condition scores. 	Review potential reasons, such as seasonal or climatic conditions or surveying variation, and/or undertake additional management (e.g. watering; active planting of tubestock and/or seeding).
Increase species richness of canopy and shrub level vegetation.	<ul style="list-style-type: none"> At least 90 percent survival of planted tubestock is recorded. 	<ul style="list-style-type: none"> Net increase in canopy and shrub species diversity is recorded. 	<ul style="list-style-type: none"> Net increase in canopy and shrub species diversity is maintained. 	<ul style="list-style-type: none"> Maintain the net increase in canopy and shrub species diversity 	<ul style="list-style-type: none"> Species richness of canopy layer meets or exceeds RE benchmark. 	Active planting of tubestock.
Increase the cover and diversity of native grass species for southern black-throated finch.	<ul style="list-style-type: none"> At least 70 percent germination of seeds is observed. 	<ul style="list-style-type: none"> Net increase in cover and diversity of target native grass is recorded. 	<ul style="list-style-type: none"> Net increase in cover and diversity of target native grass is maintained. 	<ul style="list-style-type: none"> Net increase in cover and diversity of target native grass is maintained. 	<ul style="list-style-type: none"> Diversity and cover of native grasses is comparable to that of the relevant RE benchmarks. 	Seeding with southern black-throated finch food species.
Reduce weed density	<ul style="list-style-type: none"> Program for weed management has been developed and commenced to reduce the presence of weeds. 	<ul style="list-style-type: none"> Weed management has reduced the density and extent of existing weed infestations. No new weed infestations have established. 	<ul style="list-style-type: none"> No net increase in weed cover is recorded. 	<ul style="list-style-type: none"> No net increase in weed cover is recorded. 	<ul style="list-style-type: none"> Density and extent of shrubby weeds and grassy weeds within the offset area reduced to 70% of baseline level. 	Review and update the weed management program, and implement necessary actions.
Provide artificial permanent water sources	<ul style="list-style-type: none"> Establish artificial permanent water source. 	<ul style="list-style-type: none"> Quality and functionality of artificial permanent water 	<ul style="list-style-type: none"> Quality and functionality of artificial permanent water 	<ul style="list-style-type: none"> Quality and functionality of artificial permanent water 	<ul style="list-style-type: none"> Artificial permanent water source provides suitable quality 	Repair or modify artificial water source.

Ecological outcome	Year 1 performance indicator	Year 5 performance indicator	Year 10 performance indicator	Year 15 performance indicator	Completion criteria	Corrective actions
		source is maintained.	source is maintained.	source is maintained.	and quantity of water.	
No uncontrolled bushfires that burn more than 50% of the offset area	– A fire management strategy has been developed for the offset area and commenced.	– No uncontrolled bushfires that burn more than 50% of the offset area have occurred.	– No uncontrolled bushfires that burn more than 50% of the offset area have occurred.	– No uncontrolled bushfires that burn more than 50% of the offset area have occurred.	– No uncontrolled bushfires that burn more than 50% of the offset area have occurred.	Review Bushfire Management Plan and implement necessary actions.
Reduce feral animal density (pigs and dogs)	– Program for the control of feral animals has been developed and commenced to reduce the presence of pigs and dogs.	– Feral animal density is lower than that of the baseline. – No areas of notable habitat damage by feral animals are recorded.	– No net increase in feral animal density is recorded. – No areas of notable habitat damage by feral animals are recorded.	– No net increase in feral animal density is recorded. – No areas of notable habitat damage by feral animals are recorded.	– Feral animal densities have been reduced to prevent the degradation of habitat by pigs and prevent koala injury by dogs.	Review and update the feral animal management program, and implement necessary actions.

Table 7.6 *Habitat quality scores at completion and 5-yearly interim milestones*

Assessment unit	Starting habitat quality	Year 5 target (+/- 0.3)	Year 10 target (+/- 0.3)	Year 15 target (+/- 0.3)	Year 20 (Final completion)
Bare-rumped sheathtail bat					
AU2 Remnant 11.3.25b	5.71	6.13	6.55	6.97	7.39
AU3 Remnant 11.3.35	6.19	6.49	6.79	7.09	7.39
AU5 Regrowth 11.3.35	6.07	6.47	6.86	7.25	7.65
AU7 Non remnant 11.3.25b	5.13	5.71	6.28	6.86	7.43
AU8 Non remnant 11.3.35	5.13	5.74	6.34	6.95	7.55
Total	5.75	6.19	6.63	7.06	7.50
Southern black-throated finch					
AU1 Remnant 11.3.12	6.07	6.41	6.74	7.08	7.41
AU2 Remnant 11.3.25b	4.93	5.32	5.71	6.1	6.49
AU3 Remnant 11.3.35	5.5	5.82	6.13	6.45	6.76
AU4 Regrowth 11.3.12	5.41	5.76	6.11	6.45	6.8
AU5 Regrowth 11.3.35	5.28	5.64	5.99	6.35	6.7
AU6 Non remnant 11.3.12	4.38	4.77	5.16	5.54	5.93
AU7 Non remnant 11.3.25b	4.32	4.76	5.21	5.65	6.09
AU8 Non remnant 11.3.35	4.33	4.75	5.17	5.58	6.0
Total	5.05	5.41	5.78	6.14	6.50
Koala					
AU2 Remnant 11.3.25b	4.65	4.91	5.16	5.42	5.67
AU3 Remnant 11.3.35	4.78	5.02	5.27	5.51	5.75
AU5 Regrowth 11.3.35	4.86	5.13	5.4	5.67	5.94
AU7 Non remnant 11.3.25b	4.02	4.48	4.94	5.39	5.85
AU8 Non remnant 11.3.35	3.72	4.14	4.57	4.99	5.41
Total	4.41	4.73	5.04	5.36	5.67

7.4 Monitoring commitments

Monitoring will be undertaken to evaluate the effectiveness of management actions and assess whether interim milestones are being met. Proposed monitoring is detailed in Table 7.7, including the frequency and method of monitoring for each aspect.

Table 7.7 *Monitoring commitments*

Monitoring aspect	Monitoring frequency	Method
Baseline survey event	The condition surveys that have been undertaken to inform preparation of this OAMP will form the baseline data.	N/A
Revegetation	<ul style="list-style-type: none"> – Weekly during the establishment phase (typically 12 weeks). – Every 3 months for the first year after initial revegetation, then every six months in years 2 and 3 after initial treatment. 	<ul style="list-style-type: none"> – Assess plant health and mortality.

Monitoring aspect	Monitoring frequency	Method
Weed infestations	<ul style="list-style-type: none"> – Every 3 months for the first year after initial treatment, then every six months in years 2 and 3 after initial treatment. – Scheduled inspection and follow-up treatments once in years 4 and 5 after initial treatment. 	<ul style="list-style-type: none"> – Assess density and extent of weed infestations.
Habitat condition and photographs	<ul style="list-style-type: none"> – The condition plots will be assessed at Years 5, 10, 15 and 20 after the baseline survey. – The timing of ongoing monitoring is to correspond to that of baseline surveys. 	<ul style="list-style-type: none"> – Condition monitoring will be undertaken at the plots assessed during baseline surveys. – Assessment within these plots will be undertaken in accordance with <i>Guide to Determining Terrestrial Habitat Quality</i> (DES 2020). – Locations and photographs of any disturbances or areas requiring maintenance or removal will be recorded as part of these surveys, including evidence of past fires, artificial water sources, access tracks, fences, dumped waste, internal external firebreaks, hazard fuel loads and erosion.
Feral animals	<ul style="list-style-type: none"> – Years 1, 3 and 5 after baseline survey. – Timing of ongoing monitoring to correspond to that of baseline surveys. 	To be determined as part of developing the feral animal management program (e.g. ground-based camera trapping, spotlighting transects).
MNES fauna species*	<ul style="list-style-type: none"> – Surveys of southern black-throated finch and bare-rumped sheath-tail bat to determine species usage of the offset site 	<p>In accordance with the relevant survey guidelines (DEWHA 2009a,b; DSWEPaC 2011), including:</p> <ul style="list-style-type: none"> – Bare-rumped sheath-tail bat: dusk roost watches, Anabat detector – Southern black-throated finch: area searches around waterbodies for nests and birds; waterbody watches; vigilant bird surveys

*Given that the presence of koala has not been confirmed at the impact site, no monitoring to determine koala presence at the offset site has been proposed, i.e. the offset aims to achieve a 'like for like' replacement as required under the offsets framework

7.5 Adaptive management

An adaptive implementation program will be used to ensure uncertainty is reduced over time, and that completion criteria are attained and maintained over the period of approval. As more information becomes available following ongoing performance monitoring, the management and monitoring regime will be reviewed and revised to maximise the likelihood of attaining and maintaining the outcomes to be achieved by implementing the OAMP. Any updates to the OAMP which do not result in a material change to the environmental outcomes, performance and completion criteria will be made by TCC without the requirement of informing the DCCEE. If material amendments likely to alter the environmental outcomes, or performance and completion criteria are proposed to the OAMP, the amendments and justification for the contingency measures will be provided to the DCCEE in writing.

Adaptive management will be used to incorporate changes in any of the following areas:

- Assimilation of new data or information - such as, updates to conservation advice or new threat abatement plans relevant to the southern black-throated finch, bare-rumped sheath-tail bat and koala.
- Project coordination and scheduling – to manage unforeseen disruptions to schedule such as inclement weather on contractor works for management actions and environmental consultant monitoring events.

- Annual review of risks – to refresh the mitigation measures should new threats be identified or stochastic events such as unplanned fires or floods occur.
- Annual review of management measure effectiveness – to increase the frequency or change the method of management actions where monitoring performance criteria are not met.
- Contingency for unplanned incidents – such as stochastic events including unplanned fires or floods.

7.6 Reporting

7.6.1 Auditing and review

The OAMP will be reviewed as part of the compliance reporting process following monitoring events scheduled at Years 1, 3 and 5.

Any relevant changes to the timeframes to achieve the performance criteria will be formally submitted to DCCEEW for approval.

Independent audits will be undertaken upon request by DCCEEW in accordance with the Conditions of Approval.

7.6.2 Monitoring reporting

A monitoring report will be prepared after each monitoring event. Reporting will summarise methods and field data results, providing comparison against baseline and previous years and evaluating progress towards the performance or completion criteria.

The results of monitoring will be summarised or included in the annual compliance report, as relevant to that year.

7.6.3 Compliance reporting

7.6.3.1 Annual compliance report

An Annual Compliance Report will be prepared, as relevant to that year, in accordance with the relevant EPBC approval condition and the DCCEEW's Annual Compliance Report Guidelines (2014). The compliance report will include:

- Details of compliance, incidents and non-compliance.
- Management actions undertaken within the offset areas and as part of control programs (with associated documentation attached).
- Remediation measures to be implemented where monitoring of the performance criteria indicates failure to achieve required outcomes.
- Progress towards and achievement of the ecological outcomes and completion criteria outlined in Table 7.5.

The results of monitoring surveys will be included in the annual compliance reports, as relevant to that year. Baseline data will be compared with monitoring data to demonstrate changes in offset area habitat quality scores and for identifying progress of management actions against the performance indicators and completion criteria. Remedial action or adaptive management will be provided based on monitoring results.

Results of the weed control program and planting/regeneration program will be included in the annual compliance report, as relevant, including inspections, control and maintenance activities undertaken on-site and follow-up treatments/monitoring conducted.

7.6.3.2 Reporting non-compliance

Notification in writing to DCCEEW must be made for any incident, non-compliance with the conditions, or non-compliance with the management action commitments made in this OAMP, in accordance with relevant conditions of the EPBC approval.

Notification must be made as soon as possible and no later than thirty business days after becoming aware of the incident or non-compliance.

8. Compliance with EPBC Act Policies

8.1 EPBC Act Environmental Offsets Policy

The proposed offset has been developed in accordance with the overarching principles and aims of the EPBC Act and EPBC Act Environmental Offsets Policy (DSEWPaC 2012a), as outlined in Table 8.1.

Table 8.1 EPBC Act Environmental Offsets Policy Principles

Policy Principle	Compliance
1. Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matters.	The proposed offset area will be legally secured and contain suitable habitat for the bare-rumped sheathtail bat, southern black-throated finch and koala that will be maintained through removal or management of major threats (i.e. weeds), including at a property-scale for some aspects, improved the quality and extent of foraging and sheltering habitat for both species and regular monitoring and reporting of the existing populations and habitat characteristics, which will provide data for the ongoing successful management of the populations to maintain their viability. The proposed offset areas will increase connectivity to the adjacent surrounding LRSA.
2. Suitable offsets must be built around direct offsets but may include other compensatory measures.	The proposed offset area achieves 153.60% of the direct offset requirement for the bare-rumped sheathtail bat, 163.96% of the direct offset requirement for the southern black-throated finch and 103.79% of the direct offset requirement for the koala.
3. Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter.	The offset proposal has been defined based on the EPBC Act <i>Offsets Assessment Guide</i> (DSEWPaC 2012b) and therefore is considered consistent with the statutory protection that applies to the bare-rumped sheathtail bat, southern black-throated finch and koala.
4. Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter.	The offset proposal has been defined based on the EPBC Act <i>Offsets Assessment Guide</i> (DSEWPaC 2012b) and therefore is considered to be of a size and scale proportionate to the residual impacts on the bare-rumped sheathtail bat, southern black-throated finch and koala.
5. Suitable offsets must effectively account for and manage the risks of the offset not succeeding.	<p>The offset area contains suitable habitat for the bare-rumped sheathtail bat, southern black-throated finch and koala, is currently owned/in the process of being acquired by the proponent, and will be legally secured prior to the impacts occurring through Voluntary Declaration process and hence protected from clearing or other major disturbances and undergo management of the bare-rumped sheathtail bat, southern black-throated finch and koala populations and existing threats such as weed infestation and bushfire.</p> <p>Risks of the offset not succeeding are managed through the management actions to be implemented, monitoring and timeframes, and performance indicators and ecological outcomes to be achieved. Management measures will include revegetation, weed management, water source management, feral animal management, fire management, reduction of cattle densities, and maintenance as appropriate.</p> <p>The risk assessment for existing and future threats is provided in Section 9. The residual risk ratings for impacts to the offset area were reduced sufficiently through proposed management, monitoring and corrective action, to result in low to medium risk of the offset not succeeding.</p>
6. Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs.	<p>The offset area is not otherwise protected or managed as habitat for the bare-rumped sheathtail bat, southern black-throated finch and koala. The offset area is located on freehold tenured land owned/in the process of being acquired by the proponent, but will be further protected through the Voluntary Declaration process to become a Category A area regulated under the VM Act. This will be substantial additional protection to the existing status of Least Concern remnant vegetation (Category B).</p> <p>The proposed management of the offset areas will be additional to requirements and enforcement under law or planning regulations, such as the <i>Biosecurity Act 2014</i>.</p> <p>The Queensland Environmental Offsets Policy recognises that requirements for offsets for MNES under the EPBC Act do not need to be duplicated where the same impact</p>

Policy Principle	Compliance
	and prescribed matter have been subject to assessment under the EPBC Act as a controlled action. The proposed rehabilitation areas which is part of the wider LRSA, will improve connectivity and quality of habitats within the refuge.
7. Suitable offsets must be efficient, timely, transparent, scientifically robust and reasonable.	The proposed delivery of the offset has been based on established and standard scientific survey and management methods and will be commenced within six months of Project approval by DCCEEW for the impacts occurring to the MNES. Assessments and monitoring and management programs proposed are based on documented management strategies and land management techniques that have been adapted to the locations and site characteristics, with input from species experts and other suitably qualified persons, and reference to priority management actions and species profile information, recovery plans and threat abatement plans.
8. Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	The offset proposal includes responsible parties, management actions, timeframes, baseline survey and monitoring programs, review processes, reporting, and remedial action triggers and measures. Compliance reporting and non-compliance notification to DCCEEW is included.

8.2 EPBC Act Environmental Management Plan Guidelines

The proposed offsets have been developed in accordance with the overarching principles and aims of the EPBC Act Environmental Management Plan Guidelines (Commonwealth of Australia 2014), as outlined in Table 8.2.

Table 8.2 Offset compliance with EMP guidelines

Relevant EMP Guideline section	Compliance
2.1 Key principles	This offset proposal meets the key principles of an EMP, as relevant, including: <ul style="list-style-type: none"> – Being balanced, objective and concise. – Stating the purpose of the use of the document and any assumptions made. – Identifying gaps in information requiring further detail (such as information to be updated following monitoring events). – Using adaptive management strategies. – Being clearly presented and written. – Identifying roles and responsibilities for the commitments made.
2.2 Including commitments in management plans	Commitments in the offset proposal are specific and measurable with clear timeframes. The offset management and monitoring program will be submitted to DoR as part of approval of the VDec legally securing process.
3. Content of the EMP	The offset proposal is structured appropriately for its purpose as a guide to the delivery of the offsets. This includes: <ul style="list-style-type: none"> – Project description, purpose, roles and responsibilities, report structure and limitations sections. – Reporting of monitoring surveys and other management requirements. – Management measures that describe the activities and control programs to be designed and undertaken at the offset sites, including timeframes and measurable performance indicators and completions criteria. – Site maps are included. – Monitoring programs are described, including triggers for remedial actions and reporting processes. – Audit and review processes.
4. Evaluating risk	A risk assessment has been prepared with regard to the EMP Guidelines risk assessment method. This is presented in Section 9.

9. Risk assessment

This OAMP has considered the risks that may inhibit achieving the completion criteria for the offset site, including risks that may be wholly outside the approval holder’s control. The risks have been assessed against the Risk Matrix in Table 9.1, supplied by DCCEE. The risk analysis:

- Identifies events and threats that will, may, or are likely to impact the attainment of the completion criteria.
- Assesses the likelihood and consequences of those events and threats eventuating, both before and after risk controls are applied, and assesses residual risk levels.
- Identifies levels of uncertainty in mitigating the risks, with appropriate corrective actions and associated trigger criteria should risks and threats eventuate.

Assessment of risks on the local bare-rumped sheath-tail bat, southern black-throated finch and koala populations and without the Project are detailed in Table 9.2 to Table 9.4.

Table 9.1 Risk matrix

RISK MATRIX						
Likelihood (L): A qualitative measure of likelihood how likely is it that this event/circumstances will occur both before and after management activities are implemented						
Highly likely	Is expected to occur in most circumstances.					
Likely	Will probably occur during the life of the Project.					
Possible	Might occur during the life of the Project.					
Unlikely	Could occur but considered unlikely or doubtful.					
Rare	May occur in exceptional circumstances.					
Consequence (C): Qualitative measure of what will be the consequence/result if the issue does occur						
Minor	Minor incident of environmental damage that can be reversed. <i>(e.g. short-term delays to achieving strategy objectives, implementing low-cost, well-characterised corrective actions)</i>					
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts. <i>(e.g. short-term delays to achieving strategy objectives, implementing well-characterised, high cost/effort corrective actions)</i>					
High	Substantial instances of environmental damage that could be reversed with intensive efforts. <i>(e.g. medium-long term delays to achieving objectives, implementing uncertain, high-cost/effort corrective actions)</i>					
Major	Major loss of environmental amenity and real danger of continuing. <i>(e.g. strategy objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies)</i>					
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage. <i>(e.g. strategy objectives are unable to be achieved, with no evidenced mitigation strategies)</i>					
Final Risk Rating (R): A function of multiplying Likelihood (L) and Consequence (C)						
		Consequence				
		Minor	Moderate	High	Major	Critical
Likelihood	Highly Likely	Medium	High	High	Severe	Severe
	Likely	Low	Medium	High	High	Severe
	Possible	Low	Medium	Medium	High	Severe
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

Table 9.2 Assessment of risks on the local bare-rumped sheathtail bat population with and without the Project

Risk Event	Risk Description	Initial Risk Rating*			Management Measures / Actions	Residual Risk Rating*			Performance Criteria	Corrective Action Triggers	Corrective Actions	Monitoring Mechanism
		L	C	R		L	C	R				
Force Majeure Events												
Climate change	Degradation of habitat and food availability as a result of climate change	Likely	Moderate	Medium	No management actions are likely to prevent impact	Likely	Moderate	Medium	N/A	N/A	N/A	Independent assessment by suitably qualified ecologists annually for ten years.
Cyclones/ Severe tropical lows / flooding	Catastrophic damaging storm event	Likely	Moderate	Medium	No management actions are likely to prevent impact	Likely	Moderate	Low	N/A	N/A	N/A	Independent assessment by suitably qualified ecologists annually for ten years.
Catastrophic Bushfire	Extensive bushfire event destroying the impact and offset area	Possible	Critical	Severe	Implementation of fire breaks and controlled burns under a fire management strategy across the whole property developed in consultation with local fire authorities.	Unlikely	Major	High	Development of Fire Management Strategy for the property by relevant expert in fire ecology. No uncontrolled bushfire events	Any uncontrolled bushfire event	Report to DCCEEW. Independent expert review of Fire Management Strategy with proposed remedial actions reported to DCCEEW.	Independent assessment by suitably qualified ecologists annually for ten years.
Project Risks												
The offset failing (regardless of cause)		Possible	Critical	Severe	TCC will commit to finding an alternative offset in the unlikely event the offset fails due to unforeseen reasons.	Rare	Critical	High	Offset area not legally secured	Identify alternative offset proposal	Inform DCCEEW. Investigate new offset in consultation with bat expert and offset facilitation specialist	Independent assessment by suitably qualified ecologists annually for ten years.
Offset Funding Shortfall		Possible	Critical	Severe	Offset funding will be estimated and allocated prior to commencement	Unlikely	Critical	High	N/A	N/A	N/A	N/A
Management of Project impacts on the population												
Injury/ mortality of bare-rumped sheathtail bat during clearing	Clearing of Disturbance footprint	Possible	Major	High	Limit clearing to outside bare-rumped sheathtail bat breeding season. High-risk SMP implemented. Temporary exclusion measures around active work areas during clearing. Clearing supervised by a suitably qualified and experienced fauna spotter-catcher. Restrict movements of heavy vehicles to daylight hours and to 10 km/hr speeds.	Rare	Major	Medium	No injury or mortality of bare-rumped sheathtail bat during clearing or operation	Any injury or mortality of bare-rumped sheathtail bat bats will trigger remedial action	Stop work immediately. Report incident to DCCEEW. Investigate cause and review and update operational procedures. Incident report to be submitted to DCCEEW with remedial action and work only to recommence upon receipt of written Commonwealth approval. Investigation and incident report to be developed in consultation with a relevant bat expert. Remedial actions could include review and update of site exclusion fencing, roost detection or spotter-catching protocols or worker inductions and no-go area signage.	Daily inspections of the work area during clearing and pre-clearance surveys by fauna spotter-catchers. Reporting on any animal injuries to Qld DES as part of High Risk SMP and Damage Mitigation Permits for the Project. BSB bat presence to be monitored annually for ten years.
Injury/ mortality of bare-rumped sheathtail bat by vehicle travel	Possible deaths if 24 hr operation was permitted	Possible	Major	High	Operations limited to daylight hours. Enforcement of 10 km/hr speed limits within the Project area	Rare	Moderate	Low	No injury or mortality of bare-rumped sheathtail bat during clearing or operation	Any injury or mortality of bare-rumped sheathtail bats will trigger remedial action	Stop work immediately. Report incident to DCCEEW. Investigate cause and review and update operational procedures. Incident report to be submitted to DCCEEW with remedial action and work only to recommence upon receipt of written Commonwealth approval. Investigation and incident report to be developed in consultation with a relevant bat expert. Remedial	Daily inspection of the access road network during clearing by fauna spotter-catchers. Independent monitoring of overall population annually for ten years.

Risk Event	Risk Description	Initial Risk Rating*			Management Measures / Actions	Residual Risk Rating*			Performance Criteria	Corrective Action Triggers	Corrective Actions	Monitoring Mechanism
		L	C	R		L	C	R				
											actions could include updates to traffic plan, site speed limits, worker inductions or hours of operation.	
Disturbance by light	Possible if 24 hr operation permitted	Possible	Moderate	Medium	Operation limited to daylight hours. Only emergency lighting around active works hours permitted for safety purposes, with any lighting positioned and planned to reduce light spill into adjacent woodland areas.	Rare	Moderate	Low	No omnidirectional light sources within 100 m of potential roost sites.	Installation or operation of any omnidirectional artificial light source within 100 m of potential roost sites.	Report to DCCEEW and notify TCC of non-compliance.	Independent supervision of clearing by spotter-catchers. Independent monitoring of bare-rumped sheath-tail bat annually for ten years.
Disturbance by noise	Noise disturbance possible if high impact methods used	Likely	Moderate	Medium	Low noise options utilised. Broadband reversing alarms rather than beepers during construction and operation. Maintain plant and equipment to keep noise within acceptable operating levels. Implement and monitor noise thresholds.	Likely	Minor	Low	Limit noise to below a set threshold during clearing and operation. Inclusion of vehicle/plant maintenance schedules and compliance within monitoring documentation	Exceedance of set noise threshold at sensitive receptor	Stop work and investigate cause of noise exceedance. Report to DCCEEW with proposed corrective action (i.e. equipment maintenance or replacement)	Deployment of noise monitoring devices at the work area. Independent monitoring of bare-rumped sheath-tail bat annually for ten years.
Decline in bare-rumped sheath-tail bat abundance	Decline in bare-rumped sheath-tail bat population due to indirect impacts and habitat degradation without mitigation	Likely	Major	High	Implementation of above mitigation measures to reduce impacts to bare-rumped sheath-tail bats from noise, lighting, or injury and mortality risks	Unlikely	Major	Medium	No decline in bare-rumped sheath-tail bat abundance from baseline levels	Any significant decline in bare-rumped sheath-tail bat abundance	Stop work. Report to DCCEEW. Investigative study to establish potential causes and identify remedial actions. Adverse outcome report to be submitted to DCCEEW with remedial actions and work only to recommence upon receipt of written Commonwealth approval.	Independent assessment by suitably qualified ecologists annually for ten years.
Management of existing impacts on the population												
Degradation of foraging habitat by shrubby weed infestation	No active weed management across the Project area and existing high-levels of invasive weeds including Chinese apple, Lantana and Townsville wattle	Highly Likely	Major	Severe	Implementation of staged weed management and monitoring over a ten-year period. Rehabilitation to reinstate the vegetation cover at canopy, shrub and ground layers, monitored over a ten year period.	Rare	Major	Medium	Decrease in weed extent and density by 70% in ten years.	Any weed outbreak resulting in more than 5% cover in any area.	Report to DCCEEW. Advise DCCEEW on remedial actions. Incident report submitted to DCCEEW with remedial action and work only to recommence upon receipt of written Commonwealth approval.	Independent assessment of population and habitat by suitably qualified ecologists annually for ten years.
Management of the offset area												
Legal securing is inadequate protection for the offset area	Additional disturbances occur to the offset area through other land uses or activities	Possible	Moderate	Medium	Offset management and protection will be provided in accordance with the management plan approved for the VDec.	Unlikely	Minor	Low	Maintain bare-rumped sheath-tail bat population, increase in habitat quality score	Evidence of bare-rumped sheath-tail bat injury or mortality, additional or new disturbance observed	Review land access and maintenance protocols. Report incident to DCCEEW.	Independent assessment of population and habitat by suitably qualified ecologists annually for ten years.

Risk Event	Risk Description	Initial Risk Rating*			Management Measures / Actions	Residual Risk Rating*			Performance Criteria	Corrective Action Triggers	Corrective Actions	Monitoring Mechanism
		L	C	R		L	C	R				
										in offset area		
Failure of weed control / rehabilitation	Failure of rehabilitation and weed management due to hydrological or other chronic source of ongoing disturbance	Possible	Major	High	Review of weed management and rehabilitation protocols.	Rare	Major	Medium	Development of weed management plan in consultation with experts.	Any increase in weed extent that exceeds 20% coverage.	Report to DCCEEW. Independent expert review and update of weed management program. Advise DCCEEW on remedial actions. Incident report submitted to DCCEEW with remedial action and work only to recommence upon receipt of written Commonwealth approval.	Independent assessment by suitably qualified ecologists annually for ten years
Uncontrolled bushfire destroying bare-rumped sheath-tail bat habitat and killing individuals	Mismanagement of fire hazards allows an uncontrolled bushfire to occur (e.g. controlled burn becomes uncontrolled; increased fire hazard unaccounted for in planning)	Possible	Critical	Severe	Undertake review of fire management efforts historically, known fire history, and fire management requirements for vegetation types and the regional/climatic conditions. Fire management strategy with controlled burns, fire breaks to reduce the likelihood and severity of unplanned fire events and reduce the risk of uncontrolled bushfire events, fire management lines, fuel hazard reduction, particularly around potential roost sites, and ongoing monitoring and review of the strategy – applied across the whole property.	Unlikely	Major	High	Fire Management Strategy is developed and implemented for the property, strategy is reviewed every 5 years at a minimum	Any uncontrolled bushfire event	Report incident to DCCEEW. Independent expert review of Fire Management Strategy with proposed remedial actions reported to DCCEEW. Incident report submitted to DCCEEW with remedial actions and work only to recommence upon receipt of written Commonwealth approval. Possible remedial actions could include update to fire risk management protocols, firebreaks/ operation limits in high fire risk period and ignition risk management.	Independent assessment of population and habitat by suitably qualified ecologists annually for ten years.

Table 9.3 Assessment of risks on the local southern black-throated finch population with and without the Project

Risk Event	Risk Description	Initial Risk Rating*			Management Measures / Actions	Residual Risk Rating*			Performance Criteria	Corrective Action Triggers	Corrective Actions	Monitoring Mechanism
		L	C	R		L	C	R				
Force Majeure Events												
Climate change	Degradation of habitat and food availability as a result of climate change	Likely	Moderate	Medium	No management actions are likely to prevent impact	Likely	Moderate	Medium	N/A	N/A	N/A	Independent assessment by suitably qualified ecologists annually for ten years.
Cyclones/ Severe tropical lows / flooding	Catastrophic damaging storm event	Likely	Moderate	Medium	No management actions are likely to prevent impact	Likely	Moderate	Low	N/A	N/A	N/A	Independent assessment by suitably qualified ecologists annually for ten years.
Catastrophic Bushfire	Extensive bushfire event destroying the impact and offset area	Possible	Critical	Severe	Implementation of fire breaks and controlled burns under a fire management strategy across the whole property developed in consultation with local fire authorities.	Unlikely	Major	High	Development of Fire Management Strategy for the property by relevant expert in fire ecology. No uncontrolled bushfire events	Any uncontrolled bushfire event	Report to DCCEEW. Independent expert review of Fire Management Strategy with proposed remedial actions reported to DCCEEW.	Independent assessment by suitably qualified ecologists annually for ten years.
Project Risks												
The offset failing (regardless of cause)		Possible	Critical	Severe	TCC will commit to finding an alternative offset in the unlikely event the offset fails due to unforeseen reasons.	Rare	Critical	High	Offset area not legally secured	Identify alternative offset proposal	Inform DCCEEW. Investigate new offset in consultation with suitably qualified ecologist and offset facilitation specialist	Independent assessment by suitably qualified ecologists annually for ten years.
Offset Funding Shortfall		Possible	Critical	Severe	Offset funding will be estimated and allocated prior to commencement	Unlikely	Critical	High	N/A	N/A	N/A	N/A
Management of Project impacts on the population												
Injury/ mortality of southern black-throated finch during clearing	Clearing of Disturbance footprint	Unlikely	Major	High	Limit clearing to outside southern black-throated finch breeding season. High-risk SMP implemented. Temporary exclusion measures around active work areas during clearing. Clearing supervised by a suitably qualified and experienced fauna spotter-catcher. Restrict movements of heavy vehicles to daylight hours and to 10 km/hr speeds.	Rare	Major	Medium	No injury or mortality of southern black-throated finch during clearing or operation	Any injury or mortality of southern black-throated finch will trigger remedial action	Stop work immediately. Report incident to DCCEEW. Investigate cause and review and update operational procedures. Incident report to be submitted to DCCEEW with remedial action and work only to recommence upon receipt of written Commonwealth approval. Investigation and incident report to be developed in consultation with a relevant expert. Remedial actions could include review and update of site exclusion fencing, nest detection or spotter-catching protocols or worker inductions and no-go area signage.	Daily inspections of the work area during clearing and pre-clearance surveys by fauna spotter-catchers. Reporting on any animal injuries to Qld DES as part of High Risk SMP and Damage Mitigation Permits for the Project.
Injury/ mortality of southern black-throated finch by vehicle travel	Possible deaths if vehicle movements allowed in woodland areas off designated access tracks. Risk is	Unlikely	High	Medium	Restrict vehicle movements to designated access routes for construction. Enforcement of 10 km/hr speed limits within the Project area	Rare	High	Low	No injury or mortality of southern black-throated finch during clearing or operation	Any injury or mortality of southern black-throated finch will trigger	Stop work immediately. Report incident to DCCEEW. Investigate cause and review and update operational procedures. Incident report	Daily inspection of the access road network during clearing by fauna spotter-catchers. Reporting on any

Risk Event	Risk Description	Initial Risk Rating*			Management Measures / Actions	Residual Risk Rating*			Performance Criteria	Corrective Action Triggers	Corrective Actions	Monitoring Mechanism
		L	C	R		L	C	R				
	unlikely given low values.									remedial action	to be submitted to DCCEEW with remedial action and work only to recommence upon receipt of written Commonwealth approval. Investigation and incident report to be developed in consultation with a relevant expert. Remedial actions could include updates to traffic plan, site speed limits, worker inductions or locations of operation.	animal injuries to Qld DES as part of High Risk SMP and Damage Mitigation Permits for the Project
Disturbance by light	Possible if 24 hr operation permitted	Possible	Moderate	Medium	Operation limited to daylight hours. Only emergency lighting around active works hours permitted for safety purposes, with any lighting positioned and planned to reduce light spill into adjacent woodland areas.	Rare	Moderate	Low	No omnidirectional light sources within 100 m of potential habitat.	Installation or operation of any omnidirectional artificial light source within 100 m of potential habitat areas.	Report to DCCEEW and notify TCC of non-compliance.	Independent supervision of clearing by spotter-catchers. Weekly inspection of work area by site environmental officer.
Disturbance by noise	Noise disturbance possible if high impact methods used	Likely	Moderate	Medium	Low noise options utilised. Broadband reversing alarms rather than beepers during construction and operation. Maintain plant and equipment to keep noise within acceptable operating levels. Implement and monitor noise thresholds.	Likely	Minor	Low	Limit noise to below a set threshold during clearing and operation. Inclusion of vehicle/plant maintenance schedules and compliance within monitoring documentation	Exceedance of set noise threshold at sensitive receptor	Stop work and investigate cause of noise exceedance. Report to DCCEEW with proposed corrective action (i.e. equipment maintenance or replacement)	Deployment of noise monitoring devices at the work area.
Loss of habitat and resources	Loss of habitat from within the Disturbance footprint	Likely	Minor	Low	Rehabilitation and ongoing management of land	Likely	Minor	Low	Increase in availability of foraging habitat and potential nesting habitat.	Any net loss of foraging or potential nesting habitat.	Commit to immediate rehabilitation measures to compensate for the net loss	Independent assessment by suitably qualified ecologists annually for ten years.
Decline in southern black-throated finch abundance	Decline in southern black-throated finch population due to indirect impacts and habitat degradation without mitigation. This has reduced consequence given the low initial abundance.	Unlikely	High	Medium	Implementation of above mitigation measures to reduce impacts to southern black-throated finch from noise, lighting, or injury and mortality risks	Rare	High	Low	No decline in southern black-throated finch abundance from baseline levels	Any significant decline in southern black-throated finch abundance	Stop work. Report to DCCEEW. Investigative study to establish potential causes and identify remedial actions. Adverse outcome report to be submitted to DCCEEW with remedial actions and work only to recommence upon receipt of written Commonwealth approval.	Independent assessment by suitably qualified ecologists annually for ten years.
Management of existing impacts on the population												
Degradation of foraging habitat by shrubby weed infestation	No active weed management across the Project area and existing high-levels of invasive shrubby weeds including Chinese apple, Lantana and Townsville wattle	Highly Likely	Major	Severe	Implementation of staged weed management and monitoring over a ten-year period. Rehabilitation to reinstate the vegetation cover at canopy, shrub and ground layers, monitored over a ten year period.	Rare	Major	Medium	Decrease in weed extent and density by 70% in ten years.	Any weed outbreak resulting in more than 5% cover in any area.	Report to DCCEEW. Advise DCCEEW on remedial actions. Incident report submitted to DCCEEW with remedial action and work only to recommence upon receipt of written Commonwealth approval.	Independent assessment of population and habitat by suitably qualified ecologists annually for ten years.

Risk Event	Risk Description	Initial Risk Rating*			Management Measures / Actions	Residual Risk Rating*			Performance Criteria	Corrective Action Triggers	Corrective Actions	Monitoring Mechanism
		L	C	R		L	C	R				
Management of the offset area												
Legal securing is inadequate protection for the offset area	Additional disturbances occur to the offset area through other land uses or activities	Possible	Moderate	Medium	Offset management and protection will be provided in accordance with the management plan approved for the VDec. Land use and activities will be restricted in and around offset and 3 km buffer area.	Unlikely	Minor	Low	Maintain southern black-throated finch, increase in habitat quality score	Evidence of southern black-throated finch injury or mortality, additional or new disturbance observed in offset area	Review land access and maintenance protocols. Report incident to DCCEEW.	Independent assessment of population and habitat by suitably qualified ecologists annually for ten years.
Failure of weed control / rehabilitation	Failure of rehabilitation and weed management due to hydrological or other chronic source of ongoing disturbance	Possible	Major	High	Review of weed management and rehabilitation protocols.	Rare	Major	Medium	Development of weed management plan in consultation with experts.	Any increase in weed extent that exceeds 20% coverage.	Report to DCCEEW. Independent expert review and update of weed management program. Advise DCCEEW on remedial actions. Incident report submitted to DCCEEW with remedial action and work only to recommence upon receipt of written Commonwealth approval.	Independent assessment by suitably qualified ecologists annually for ten years
Uncontrolled bushfire destroying southern black-throated finch habitat and killing individuals	Mismanagement of fire hazards allows an uncontrolled bushfire to occur (e.g. controlled burn becomes uncontrolled; increased fire hazard unaccounted for in planning)	Possible	Critical	Severe	Undertake review of fire management efforts historically, known fire history, and fire management requirements for vegetation types and the regional/climatic conditions. Fire management strategy with controlled burns, fire breaks to reduce the likelihood and severity of unplanned fire events and reduce the risk of uncontrolled bushfire events, fire management lines, fuel hazard reduction, particularly around potential roost sites, and ongoing monitoring and review of the strategy – applied across the whole property.	Unlikely	Major	High	Fire Management Strategy is developed and implemented for the property, strategy is reviewed every 5 years at a minimum	Any uncontrolled bushfire event	Report incident to DCCEEW. Independent expert review of Fire Management Strategy with proposed remedial actions reported to DCCEEW. Incident report submitted to DCCEEW with remedial actions and work only to recommence upon receipt of written Commonwealth approval. Possible remedial actions could include update to fire risk management protocols, firebreaks/ operation limits in high fire risk period and ignition risk management.	Independent assessment of population and habitat by suitably qualified ecologists annually for ten years.

Table 9.4 Assessment of risks on the local koala population with and without the Project

Risk Event	Risk Description	Initial Risk Rating*			Management Measures / Actions	Residual Risk Rating*			Performance Criteria	Corrective Action Triggers	Corrective Actions	Monitoring Mechanism
		L	C	R		L	C	R				
Force Majeure Events												
Climate change	Degradation of habitat and food availability as a result of climate change	Likely	Moderate	Medium	No management actions are likely to prevent impact	Likely	Moderate	Medium	N/A	N/A	N/A	Independent assessment by suitably qualified ecologists annually for ten years.
Cyclones/ Severe tropical lows / flooding	Catastrophic damaging storm event	Likely	Moderate	Medium	No management actions are likely to prevent impact	Likely	Moderate	Low	N/A	N/A	N/A	Independent assessment by suitably qualified ecologists annually for ten years.
Catastrophic Bushfire	Extensive bushfire event destroying the impact and offset area	Possible	Critical	Severe	Implementation of fire breaks and controlled burns under a fire management strategy across the whole property developed in consultation with local fire authorities.	Unlikely	Major	High	Development of Fire Management Strategy for the property by relevant expert in fire ecology. No uncontrolled bushfire events	Any uncontrolled bushfire event	Report to DCCEEW. Independent expert review of Fire Management Strategy with proposed remedial actions reported to DCCEEW.	Independent assessment by suitably qualified ecologists annually for ten years.
Project Risks												
The offset failing (regardless of cause)		Possible	Critical	Severe	TCC will commit to finding an alternative offset in the unlikely event the offset fails due to unforeseen reasons.	Rare	Critical	High	Offset area not legally secured	Identify alternative offset proposal	Inform DCCEEW. Investigate new offset in consultation with expert and offset facilitation specialist	Independent assessment by suitably qualified ecologists annually for ten years.
Offset Funding Shortfall		Possible	Critical	Severe	Offset funding will be estimated and allocated prior to commencement	Unlikely	Critical	High	N/A	N/A	N/A	N/A
Management of Project impacts on the population												
Injury/ mortality of koala during clearing	Clearing of Disturbance footprint	Possible	Major	High	Temporary exclusion measures around active work areas during clearing. Clearing supervised by a suitably qualified and experienced fauna spotter-catcher. Restrict movements of heavy vehicles to daylight hours and to 10 km/hr speeds.	Rare	Major	Medium	No injury or mortality of koala during clearing or operation	Any injury or mortality of koala will trigger remedial action	Stop work immediately. Report incident to DCCEEW. Investigate cause and review and update operational procedures. Incident report to be submitted to DCCEEW with remedial action and work only to recommence upon receipt of written Commonwealth approval. Investigation and incident report to be developed in consultation with a relevant expert. Remedial actions could include review and update of site exclusion fencing, or spotter-catching protocols or worker inductions and no-go area signage.	Daily inspections of the work area during clearing and pre-clearance surveys by fauna spotter-catchers. Reporting on any animal injuries to Qld DES. Koala presence to be monitored annually for ten years.
Injury/ mortality of koala by vehicle travel	Possible deaths if 24 hr operation was permitted	Possible	Major	High	Operations limited to daylight hours. Enforcement of 10 km/hr speed limits within the Project area	Rare	Moderate	Low	No injury or mortality of koala during clearing or operation	Any injury or mortality of koalas will trigger remedial action	Stop work immediately. Report incident to DCCEEW. Investigate cause and review and update operational	Daily inspection of the access road network during clearing by fauna spotter-catchers.

Risk Event	Risk Description	Initial Risk Rating*			Management Measures / Actions	Residual Risk Rating*			Performance Criteria	Corrective Action Triggers	Corrective Actions	Monitoring Mechanism
		L	C	R		L	C	R				
Disturbance by light	Possible if 24 hr operation permitted	Possible	Moderate	Medium	Operation limited to daylight hours. Only emergency lighting around active works hours permitted for safety purposes, with any lighting positioned and planned to reduce light spill into adjacent woodland areas.	Rare	Moderate	Low	No omnidirectional light sources within 100 m of potential habitat.	Installation or operation of any omnidirectional artificial light source within 100 m of potential habitat areas.	Report to DCCEEW and notify TCC of non-compliance.	Independent supervision of clearing by spotter-catchers. Independent monitoring of koala annually for ten years.
Disturbance by noise	Noise disturbance possible if high impact methods used	Likely	Moderate	Medium	Low noise options utilised. Broadband reversing alarms rather than beepers during construction and operation. Maintain plant and equipment to keep noise within acceptable operating levels. Implement and monitor noise thresholds.	Likely	Minor	Low	Limit noise to below a set threshold during clearing and operation. Inclusion of vehicle/plant maintenance schedules and compliance within monitoring documentation	Exceedance of set noise threshold at sensitive receptor	Stop work and investigate cause of noise exceedance. Report to DCCEEW with proposed corrective action (i.e. equipment maintenance or replacement)	Deployment of noise monitoring devices at the work area. Independent monitoring of koala annually for ten years.
Loss of habitat	Loss of 134.2 ha of habitat from within the Disturbance footprint	Likely	Moderate	Medium	Rehabilitation and ongoing management of land	Unlikely	Moderate	Low	Increase in availability of habitat.	Any net loss of habitat.	Commit to immediate rehabilitation measures to compensate for the net loss	Independent assessment by suitably qualified ecologists annually for ten years.
Decline in koala abundance	Decline in koala population due to indirect impacts and habitat degradation without mitigation	Likely	Major	High	Implementation of above mitigation measures to reduce impacts to koalas from noise, lighting, or injury and mortality risks	Unlikely	Major	Medium	No decline in koala abundance from baseline levels	Any significant decline in koala abundance	Stop work. Report to DCCEEW. Investigative study to establish potential causes and identify remedial actions. Adverse outcome report to be submitted to DCCEEW with remedial actions and work only to recommence upon receipt of written Commonwealth approval.	Independent assessment by suitably qualified ecologists annually for ten years.
Management of existing impacts on the population												
Degradation of habitat by shrubby weed infestation	No active weed management across the Project area and existing high-levels of	Highly Likely	Major	Severe	Implementation of staged weed management and monitoring over a ten-year period. Rehabilitation to	Rare	Major	Medium	Decrease in weed extent and density by 70% in ten years.	Any weed outbreak resulting	Report to DCCEEW. Advise DCCEEW on remedial actions. Incident report	Independent assessment of population and habitat by suitably

Risk Event	Risk Description	Initial Risk Rating*			Management Measures / Actions	Residual Risk Rating*			Performance Criteria	Corrective Action Triggers	Corrective Actions	Monitoring Mechanism
		L	C	R		L	C	R				
	invasive weeds including Chinesee apple, Lantana and Townsville wattle				reinstate the vegetation cover at canopy, shrub and ground layers, monitored over a ten year period.					in more than 5% cover in any area.	submitted to DCCEEW with remedial action and work only to recommence upon receipt of written Commonwealth approval.	qualified ecologists annually for ten years.
Management of the offset area												
Legal securing is inadequate protection for the offset area	Additional disturbances occur to the offset area through other land uses or activities	Possible	Moderate	Medium	Offset management and protection will be provided in accordance with the management plan approved for the VDec. Land use and activities will be restricted in and around offset and 3 km buffer area.	Unlikely	Minor	Low	Maintain koala population, increase in habitat quality score	Evidence of koala injury or mortality, additional or new disturbance observed in offset area	Review land access and maintenance protocols. Report incident to DCCEEW.	Independent assessment of population and habitat by suitably qualified ecologists annually for ten years.
Failure of weed control / rehabilitation	Failure of rehabilitation and weed management due to hydrological or other chronic source of ongoing disturbance	Possible	Major	High	Review of weed management and rehabilitation protocols.	Rare	Major	Medium	Development of weed management plan in consultation with experts.	Any increase in weed extent that exceeds 20% coverage.	Report to DCCEEW. Independent expert review and update of weed management program. Advise DCCEEW on remedial actions. Incident report submitted to DCCEEW with remedial action and work only to recommence upon receipt of written Commonwealth approval.	Independent assessment by suitably qualified ecologists annually for ten years
Uncontrolled bushfire destroying koala habitat and killing individuals	Mismanagement of fire hazards allows an uncontrolled bushfire to occur (e.g. controlled burn becomes uncontrolled; increased fire hazard unaccounted for in planning)	Possible	Critical	Severe	Undertake review of fire management efforts historically, known fire history, and fire management requirements for vegetation types and the regional/climatic conditions. Fire management strategy with controlled burns, fire breaks to reduce the likelihood and severity of unplanned fire events and reduce the risk of uncontrolled bushfire events, fire management lines, fuel hazard reduction, particularly around potential habitat, and ongoing monitoring and review of the strategy – applied across the whole property.	Unlikely	Major	High	Fire Management Strategy is developed and implemented for the property, strategy is reviewed every 5 years at a minimum	Any uncontrolled bushfire event	Report incident to DCCEEW. Independent expert review of Fire Management Strategy with proposed remedial actions reported to DCCEEW. Incident report submitted to DCCEEW with remedial actions and work only to recommence upon receipt of written Commonwealth approval. Possible remedial actions could include update to fire risk management protocols, firebreaks/ operation limits in high fire risk period and ignition risk management.	Independent assessment of population and habitat by suitably qualified ecologists annually for ten years.

10. References

- Black-throated Finch Recovery Team 2007, National recovery plan for the black-throated finch southern subspecies *Poephila cincta cincta*. Report to the Department of the Environment and Water Resources. Australian Government, Canberra.
- Biodiversity Australia 2022a, Rapid habitat assessment black throated finch. Prepared by Biodiversity Australia for GHD Pty Ltd.
- Biodiversity Australia 2022b, Offset area investigation. Prepared by Biodiversity Australia for GHD Pty Ltd.
- Biodiversity Australia 2022c, Haughton area investigation. Prepared by Biodiversity Australia for GHD Pty Ltd.
- Briscoe, N.J., Krockenberger, A., Handasyde, K.A., Kearney, M.R. 2015, Bergmann meets Scholander: geographical variation in body size and insulation in the koala is related to climate. *Journal of Biogeography* 42(4): 791–802.
- Buosi, P. 2011, Management guidelines: How to look after the black-throated finch. NRA Environmental Consultants and Black-throated Finch Recovery Team.
- Churchill, S.K 1998, Australian bats. Sydney: Reed New Holland.
- Compton, A. and P.M. Johnson, 1983, Observations of the sheath-tailed bat: *Taphozous saccolaimus* Temminck (Chiroptera: Emballonuridae), in the Townsville region of Queensland. *Australian Mammalogy* 6: 83-87.
- Crowther, M.S., Lunney, D., Lemon, J., Stalenberg, E., Wheeler, R., Madani, G., Ross, K.A., Ellis, M. 2014, Climate-mediated habitat selection in an arboreal folivore. *Ecography* 37: 336–343.
- Davies, N., Gramotnev, G., Seabrook, L., Bradley, A., Baxter, G., Rhodes, J., Lunney, D. and McAlpine, C. 2013, Movement patterns of an arboreal marsupial at the edge of its range: a case study of the Koala. *Movement Ecology* 1(1): 8.
- Dennis, A.J. 2012, Bare-rumped Sheath-tail Bat. In: Curtis, L.K., A.J. Dennis, K.R. McDonald, P.M. Kyne & S.J.S. Debus, eds. *Queensland's Threatened Animals*. CSIRO Publishing.
- Department of Agriculture, Water and the Environment (DAWE) 2022a, Species profile and threats database. Department of Agriculture, Water and the Environment, retrieved September 1, 2022, from <http://www.environment.gov.au/cgibin/sprat/public/sprat.pl>
- Department of Agriculture, Water and the Environment (DAWE) 2022b, Conservation advice for *Phascolarctos cinereus* (koala) combined populations of Queensland, New South Wales and the Australian Capital Territory.
- Department of Agriculture, Water and the Environment (DAWE) 2022c, National recovery plan for the koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory)
- Department of Environment (DoE) 2014, Environmental management plan guidelines. Australian Government, Canberra.
- Department of the Environment (DoE) 2013, Matters of national environmental significance. Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999. Australian Government, Canberra.
- Department of Environment and Science (DES) 2020, Guide to determining terrestrial habitat quality (version 1.3: Feb 2020) - Methods for assessing habitat quality under the Queensland Environmental Offsets Policy.
- Department of the Environment, Water, Heritage and the Arts (DEWHA) 2009, Significant impact guidelines for the endangered black-throated finch (southern) (*Poephila cincta cincta*) – Background paper to the EPBC Act policy statement 3.13, retrieved September 1, 2022 from www.awe.gov.au/sites/default/files/documents/black-throated-finch.pdf.
- Department of the Environment, Water, Heritage and the Arts (DEWHA) 2009a, Survey guidelines for Australia's threatened birds. Australian Government, Canberra

- Department of the Environment, Water, Heritage and the Arts (DEWHA) 2009b, Survey guidelines for Australia's threatened bats. Australian Government, Canberra
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) 2011, Survey guidelines for Australia's threatened mammals. Australian Government, Canberra
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) 2012a, Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) 2012b, Offsets Assessment Guide.
- Dique, D.S., Thompson, J., Preece, H.J., de Villiers, D.L. and Carrick, F.N. 2003 Dispersal patterns in a regional Koala population in south-east Queensland. *Wildlife Research* 30(3): 281–290.
- Duncan, A., Baker, G.B. and Montgomery, N. 1999, The action plan for Australian bats. Environment Australia, Canberra.
- Ecological Interpretation 2022, GHD Haughton Pipeline 2 biocondition survey. Prepared by Ecological Interpretation for GHD Pty Ltd.
- Ellis, W., Hale, P.T. and Carrick, F. (2002) Breeding dynamics of Koalas in open woodlands. *Wildlife Research* 29(1): 19.
- Eyre, T.J., Kelly, A.L., Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. 2015, BioCondition: A condition assessment framework for terrestrial biodiversity in Queensland. Assessment manual. Version 2.2.
- Goldingay, R.L. and Dobner, B. 2014, Home range areas of koalas in an urban area of north-east New South Wales. *Australian Mammalogy* 36(1): 74–80.
- Landsberg, J., James, C.D., Morton, S.R., Hobbs, T.J. Stol, J., Drew, A. and Tongway, H. 1997, The effects of artificial sources of water on rangeland biodiversity. Final report to the Biodiversity Convention and Strategy Section of the Biodiversity Group, Environment Australia by CSIRO Division of Wildlife and Ecology.
- Mackowski, C.M. 1984, The ontogeny of hollows in Blackbutt (*Eucalyptus pilularis*) and its relevance to the management of forests for possums and gliders. Australian Mammal Society, Sydney. pp 553-67.
- Martin, R. and Handasyde, K. 1999, The koala: Natural history, conservation and management.
- Maseyk, F., Evans, M. and Maron, M. 2017, *Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act*. Threatened Species Recovery Hub.
- McKean, J.L., Friend, G. and Hertog, A.L. 1981, Occurrence of the sheath-tailed bat *Taphozous saccolaimus* in the Northern Territory. *Northern Territory Naturalist* 4: 20.
- Menkorst, P.W. 1984, Use of nest boxes by forest vertebrates in Gippsland: Acceptance, preference and demand. *Australian Wildlife Research* 11: 255-264.
- Milne, D. J., Jackling, F. C., Sidhu, M., and Appleton, B.J. 2009, Shedding new light on old species identifications: morphological and genetic evidence suggest a need for conservation status review of the critically endangered bat *Saccolaimus saccolaimus*. *Wildlife Research* 36: 496-508.
- Mitchell, D.F. 1996, Foraging ecology of the black-throated finch *Poephila cincta cincta*. MSc thesis, James Cook University, Townsville.
- Moore, B.D. and Foley, W.J. 2000, A review of feeding and diet selection in koalas (*Phascolarctos cinereus*). *Australian Journal of Zoology* 48: 317-333
- Mula Laguna, J., Reside, A.E., Kutt, A, Grice, A.C., Buosi, P, Vanderduys, E.P., Taylor, M. & Schwarzkopf, L. 2019, Conserving the endangered black-throated finch southern subspecies: what do we need to know? *Emu - Austral Ornithology* 119(4): 331-345.
- Munks, S. A., R. Corkrey, and Foley, W.J. 1996, Characteristics of arbo-real marsupial habitat in the semi-arid woodlands of northern Queensland. *Wildlife Research* 23:185–195.

- Murphy, S. 2002, Observations of the 'critically endangered' bare-rumped sheath-tail bat *Saccolaimus saccolaimus* Temminck (Chiroptera: Emballonuridae) on Cape York Peninsula, Queensland. *Australian Mammalogy* 23:185-187.
- Natural Resource Assessment Environmental Consultants (NRA) 2007, Survey and assessment of the black-throated finch (*Poephila cincta cincta*) at the Chisholm Trail Rural Residential Development, Townsville. Unpublished report prepared for the Department of Environment and Water Resources.
- Natural Resource Assessment Environmental Consultants (NRA) 2011, Habitat management guidelines for the black-throated finch (*Poephila cincta cincta*) in the Brigalow Belt North Bioregion. NQ Dry Tropics and the Black-throated Finch Trust, Townsville.
- Natural Resource Assessment Environmental Consultants (NRA) 2018, Management plan for black-throated finch (*Poephila cincta cincta*) habitat at Lake Ross Storage Area, Townsville, prepared by NRA Environmental Consultants for the Townsville City Council.
- Natural Resource Assessment Environmental Consultants (NRA) 2021, Houghton Pipeline Stage 2 Project Environmental Analysis Report. Prepared by Natural Resource Assessments Pty Ltd for GHD Pty Ltd, 27 August 2021.
- Partridge, I., Middleton, C. and Shaw, K. 1996, Stylos for better beef Department of Primary industries, Queensland.
- Pollock, A.B. (ed.) 2018, Technical descriptions of regional ecosystems of the Brigalow Belt North. Queensland Herbarium, Department of Environment and Science: Brisbane.
- Queensland Herbarium 2021a, BioCondition benchmark database. Version 3.2, December 2021.
- Queensland Herbarium 2021b, Regional ecosystem fire guidelines. December 2021.
- Reardon, T.B., Robson, S.K.A., Parsons, J.G. and Inkster, T. 2010, Review of the threatened status of microchiropteran bat species on Cape York Peninsula.
- Rechetelo, J. 2015, Movement, habitat requirements, nesting and foraging site selection: a case study of an endangered granivorous bird, the Black-throated finch. PhD thesis, James Cook University, Townsville.
- Reside, A.E., Beher, J., Cosgrove, A.J., Evans, M.C., Seabrook, L., Silcock, J.L and Maron, M. 2017, Ecological consequences of land clearing and policy reform in Queensland. *Pacific Conservation Biology* 23(3): 219. doi:10.1071/pc17001
- Rus, A.I., McArthur, C., Mella, V.S., and Crowther, M.S. 2020, Habitat fragmentation affects movement and space use of a specialist folivore, the koala. *Animal Conservation* 24: 26-37.
- Schulz, M. and Thomson, B. 2007, National recovery plan for the bare-rumped sheath-tail bat *Saccolaimus saccolaimus nudicluniatus*, Australian Government, Canberra
- Scotts, D.J. 1991, Old-growth forests: their ecological characteristics and value to forest-dependent vertebrate fauna of south-east Australia, Conservation of Australia's Forest Fauna, Lunney, D. (ed.), *The Royal Zoological Society of New South Wales*, Sydney. pp 147-159.
- Specht, R.L. 1970, Vegetation. Pp. 44-67 in G.W. Leeper (ed.), *The Australian Environment*. Fourth edition. CSIRO/Melbourne University Press, Melbourne.
- Threatened Species Scientific Committee (TSSC) 2016, Conservation advice *Saccolaimus saccolaimus nudicluniatus* bare-rumped sheath-tail bat. Canberra: Department of the Environment and Energy.
- Townsville City Council (TCC) 2020, Townsville City Biosecurity Plan 2020 – 2024, September 2020.
- White, N.A. 1999, Ecology of the koala (*Phascolarctos cinereus*) in rural south-east Queensland, Australia. *Wildlife Research* 26: 731–744.
- Williams, P., McMahon, K., Collins, E., Grice, T., Mack, A., Marshall, L. and Owbridge, E. 2020, Black-throated Finch habitat values promoted by patchy fire. *North Queensland Naturalist* 50: 38-43.
- Youngentob, K, Lindenmayer, D, Ford, K et al. 2021, Food intake: an overlooked driver of climate change casualties? *Trends in Ecology and Evolution* 36(8): 676-678.

Appendix A

Habitat scoring parameters for each species

Attribute	Scoring system				
	5 (2)	10 (4)	15 (6)	20 (8)	25 (10)
Bare-rumped sheathtail bat					
Quality and availability of food and habitat for foraging					
Presence of remnant vegetation within known range	Absent	No remnant on or adjacent to site	Adjacent to site only	Remnant vegetation in which suitable old growth trees are a component	Undisturbed old growth remnant dominated by suitable trees
Quality and availability of habitat for shelter and breeding					
Presence of preferred tree species (<i>E.platyphylla</i> or <i>M.leucadendra</i>)	Absent	Low (1 – 2 per plot)	Moderate (3 – 4 per plot)	High (5 – 8 per plot)	Very high (>8 per plot)
Presence of deep hollows in preferred species	Absent	Low (1)	Moderate (2)	High (3 – 4)	Very high (5+)
Quality and availability of habitat for mobility					
Connectivity between suitable habitats	Absent	Low	Moderate	High	Very high
Absence of threats*					
Introduction of exotic weeds	Absent	Low	Medium	High	Very high
Southern black-throated finch					
Quality and availability of food and foraging habitat					
Abundance of preferable grass species	None present	Preferred grass present but cover <10% of plots	Preferred grass cover 10 - 25% of plots	Preferred grass cover 25 – 75% of plots	Preferred grass cover > 75% of plots
Species richness of food grasses	Absent	1 -2 spp present	3 – 4 spp present	5+ spp present with annuals only	5+ spp present with annuals and perennials
Mosaic of bare patches and grass	No bare ground / 100% weed cover	< 5% or >85% bare ground	5 – 15 % or 70 – 85% bare ground	15 – 20% or 60 – 70% bare ground	20 – 60% bare ground
Quality and availability of habitat for shelter and breeding					
Availability of nesting site with known tree species	Absent	<i>E.platyphylla</i> cover 0 – 5%, <i>M.viridiflora</i> canopy < 3 m	<i>E.platyphylla</i> cover 5 – 15% or > 50%, <i>M.viridiflora</i> canopy 3 - 5 m	<i>E.platyphylla</i> cover 15 – 20% or 30 - 50%, <i>M.viridiflora</i> canopy 5 - 6 m	Numerous 20 – 30% with hollows, and/or mature <i>M.viridiflora</i> canopy (>6 m) present
Distance to water	Over 1.5 km	1 – 1.5 km	400 m – 1 km of a breeding season water source	200 m – 400 m of a breeding season water source	Within 200 m of a breeding season water source
Quality and availability of habitat for mobility					
Presence of shrubs (including invasive species)	Very high (over 70% abundance)	Mid-dense – High (50 – 70%)	Mid-dense – Low (30 – 50%)	Sparse (10 – 30%)	Very sparse (< 10%)

Attribute	Scoring system				
	5 (2)	10 (4)	15 (6)	20 (8)	25 (10)
Presence of suitable open grassy woodland	Absent	Present but both understorey and tree canopy degraded	Suitable grassland species present but tree species absent or degraded / regrowth	Open woodland with vegetation thickening and/or low grass species diversity	High quality open woodland with low shrub density
Absence of threats*					
Reduction in the availability of water	Absent	Low	Medium	High	Very high
Inappropriate grazing regimes	Absent	Low	Medium	High	Very high
Inappropriate fire regimes	Absent	Low	Medium	High	Very high
Introduction of exotic weeds	Absent	Low	Medium	High	Very high
Koala					
Quality and availability of food and habitat for foraging					
Species richness of locally important food trees	Absent	1	2	3	4+
Abundance of non-juvenile locally important food trees in 50 m x 100 m plot	Absent	1 - 25	26 - 50	51 - 75	>75
Quality and availability of habitat for shelter and breeding					
Species richness of ancillary habitat trees	Absent	1	2	3	4+
Abundance of non-juvenile ancillary habitat trees in 50 m x 100 m plot	Absent	1 - 25	26 - 50	51 – 75	>75
Quality and availability of habitat for mobility					
Connectivity between suitable habitats	Absent	Low	Medium	High	Very high
Absence of threats*					
Dog attack	Absent	Low	Medium	High	Very high
Vehicle strike	Absent	Low	Medium	High	Very high
Uncontrolled wildfire	Absent	Low	Medium	High	Very high
Drought	Absent	Low	Medium	High	Very high

*Scope and severity of threat scored using the risk matrix in the Guide to Determining Terrestrial Habitat Quality (DES 2020)

Appendix B

DCCEEW Modified QLD Habitat Quality spreadsheet for current values of the impact area and offset area

IMPACT AREA - Southern Black Wooded Peck

Table with 34 columns representing different assessment metrics (A1 to A34) and rows for various categories like Wetland, Forest, and other environmental metrics.

Specialty Checklist (see 2015) table with columns for 'Score' and 'Yes/No' for various items like 'Presence of rare or adjacent to site (weighting properly with connectivity included)', 'Presence of rare (habitat type & endorsed range)', etc.

Site Supplementary Table with columns for 'Score' and 'Yes/No' for items like 'Rare species population for breeding', 'Rare species population for dispersal', etc.

Final habitat quality score (weighted) table with columns for 'A1' through 'A34' and a 'Weighted Habitat Quality Score' column.

DP127 AREA CURRENT - Southern Black-breasted Noddy

Site Release	AES 16.3.32 Placement											AES 16.3.33 Placement											AES 16.3.34 Placement											AES 16.3.35 Placement											AES 16.3.36 Placement											Total Average	Total Average																																	
	Benchmarks					Actuals					Benchmarks					Actuals					Benchmarks					Actuals					Benchmarks					Actuals																																																						
	Area	Species	Count	%	Avg	Area	Species	Count	%	Avg	Area	Species	Count	%	Avg	Area	Species	Count	%	Avg	Area	Species	Count	%	Avg	Area	Species	Count	%	Avg	Area	Species	Count	%	Avg	Area	Species	Count	%	Avg																																																		
Site Conditions																																																																																										
Mean density of colony personnel species in ECL																																																																																										
Natural plant species richness - trees																																																																																										
Natural plant species richness - shrubs																																																																																										
Natural plant species richness - grasses																																																																																										
Natural plant species richness - forbs																																																																																										
Natural plant species richness - ferns																																																																																										
Tree canopy cover (average of emergent, canopy, sub-canopy)																																																																																										
Shrub canopy cover																																																																																										
Natural grass cover																																																																																										
Open water																																																																																										
Large trees (over 10m-tall)																																																																																										
Large shrubs (over 5m-tall)																																																																																										
Non-native plant cover																																																																																										
Quality and availability of food and foraging habitat																																																																																										
Quality and availability of shelter																																																																																										
Site Condition Score																																																																																										
MAX Site Condition Score																																																																																										
Site Quality Score - out of 5																																																																																										
Site Condition																																																																																										
Tree cover																																																																																										
Shrub cover																																																																																										
Grass cover																																																																																										
Open water																																																																																										
Large trees																																																																																										
Large shrubs																																																																																										
Non-native plant cover																																																																																										
Food availability																																																																																										
Shelter availability																																																																																										
MAX Site Condition Score																																																																																										
Site Quality Score - out of 5																																																																																										

Species Shading Data Table

Presence checked in all relevant to site (background property with surrounding habitat)

Yes - on site

Species	Count	%	Avg
Non - Dispersal	10	10	10
Dispersal	4	4	4
Foraging	2	2	2
Breeding	2	2	2

Risk Supplementary Table

Yes - source population for breeding

Yes - source population for dispersal

Necessary for maintaining genetic diversity

Near the limit of the species range

Yes	10
Yes	4
Yes	2
Yes	2

Final Habitat Quality Assessment

Site	Area	Score	Weighted
Site Condition Score (out of 5)	1.64	1.64	1.64
Site Quality Score (out of 5)	2.24	2.24	2.24
Species Shading Score (out of 5)	2.29	2.29	2.29
Habitat Quality Score (out of 5)	4.07	4.07	4.07
Assessment Unit Area (ha)	27.03	28.38	27.03
Total effort area (ha) for this assessment	625.18	625.18	625.18
Site Weighting	0.06	0.05	0.05
Weighted Habitat Quality Score	0.38	0.37	0.38

Appendix C

DCCEEW Modified QLD Habitat Quality spreadsheet future forecast values of the offset area

OFFSET AREA - FUTURE FORECAST - Koala

Assessment Unit - Regional Ecosystems. Table with columns for Benchmark 11.3.25b, AU3 - RE 11.3.35 Remnant, AU3 - RE 11.3.35 Regrowth, AU7 - RE 11.3.25b Non-remnant, and AU8 - RE 11.3.35 Non-remnant. Rows include Site Condition, Site Context, and various ecological metrics.

Species Stocking Rate (SSR) table. Includes criteria like 'Presence detected on or adjacent to site', 'Species usage of the site', and 'Role/importance of species population on site'.

SSR Supplementary Table. Includes criteria like '*Key source population for breeding', '*Key source population for dispersal', and '*Near the limit of the species range'.

Final habitat quality score (weighted) table. Columns include AU2, AU3, AU5, AU7, AU8, and AU9. Rows include Site Condition Score, Site Context Score, Species Stocking Rate Score, Habitat Quality Score, Assessment Unit area, Total offset area, and Size Weighting.

Appendix D

EPBC Act Offset Assessment Guide

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Bare-rumped sheath-tail bat
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Loss of bare-rumped sheath-tail bat habitat	Area	92.23	Hectares	Based on four targeted ecological surveys of the impact area by NRA (2021), GHD (November 2021, August 2022), Ecological Interpretations (March 2022) with 21 BioCondition and habitat assessment sites
			Quality	6	Scale 0-10	
			Total quantum of impact	55.34	Adjusted hectares	
<i>Threatened species</i>						
Birth rate e.g. Change in nest success						
Mortality rate e.g. Change in number of road kills per year						
Number of individuals e.g. Individual plants/animals						

Offset calculator																																	
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source													
<i>Ecological Communities</i>																																	
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset	Future area with offset (adjusted hectares)	0.0																					
																						Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)								
<i>Threatened species habitat</i>																																	
Area of habitat	Yes	55.34	Adjusted hectares	Land based offset of 551.79 ha of land at Lake Ross on land owned by Townsville City Council	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	551.79	Risk of loss (%) without offset	0%	Risk of loss (%) with offset	0%	0.28	100%	0.28	0.27	85.00	153.60%	Yes														
																						Time until ecological benefit	20	Start quality (scale of 0-10)	6	Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	8	2.00	80%	1.60	1.54
<i>Threatened species</i>																																	
Birth rate e.g. Change in nest success																																	
Mortality rate e.g. Change in number of road kills per year																																	
Number of individuals e.g. Individual plants/animals																																	



ghd.com

→ **The Power of Commitment**