



Lansdown
Eco-Industrial Precinct



Lansdown Eco-Industrial Precinct Enabling Infrastructure

**Preliminary Documentation Under the Environmental Protection
and Biodiversity Conservation Act 1999 (EPBC Act) - FINAL**
EPBC 2022/09383

October 2023



Executive Summary

Townsville City Council (TCC) is delivering the Lansdown Eco-Industrial Precinct (LEIP) Project, Northern Australia's first environmentally sustainable advanced manufacturing, technology, and processing hub. The LEIP is located approximately 38 km south of Townsville, adjacent and west of Flinders Highway. The LEIP will realise the objectives of the Townsville City Deal (a tri-partisan agreement spanning 15 years and all levels of government) to activate industry and export growth for Townsville and its regional partners as the Industry Powerhouse of the North. The LEIP is located on approximately 2,200 hectares (ha) of freehold land owned by TCC. The action which is subject to this referral, is the early enabling works of the water infrastructure pipeline (including pump stations and site laydown areas) and upgrading and constructing roads (including Flinders Highway, Woodstock Giru Road, Major Creek Road, Jones Road, Woodstock Avenue, Old Flinders Highway, No Name Road, Unnamed Road, Ghost Gum Road and Bidwilli Road) that will facilitate the LEIP.

Essential early enabling infrastructure works to service the LEIP involve road access at the northern and southern section of the site and a raw water network (including external pipeline, storage dam, internal pump station and internal pipeline) to service the initial proponents (the Project). The enabling infrastructure is contained within the LEIP site and numerous existing road reserves including Flinders Highway, Woodstock Giru Road, Major Creek Road, Jones Road, Woodstock Avenue, Old Flinders Highway, No Name Road, Unnamed Road, Ghost Gum Road and Bidwilli Road. Following a referral for the Project under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2022/09383) which was accepted on 23 November 2022 with a controlled action decision on 23 December 2022, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) submitted a Request For Information (RFI) to TCC describing the technical and non-technical information required in the preliminary documentation and the general structure, style and format of the required response.

A desktop assessment and field assessments have been undertaken to establish the existing ecological values of the Project area and determine the level of likely impact upon them from the Project. Five ecological surveys have been conducted by Evolve Environmental Solutions Pty Ltd across the Project area and surrounds, including:

- 28 March to 1 April 2022. This survey was focused on the water infrastructure network, water storage dam, Jones Road and No Name Road (north and south);
- 22 and 27 May 2022 . This survey was focused on the water infrastructure network, water storage dam, Jones Road and No Name Road (north and south);
- 12 to 16 September 2022. This survey was focussed on the greater LEIP Masterplan area (separate project), however additional survey was undertaken for additional roads;
- 10 to 14 October 2022. This survey was also focussed on the greater LEIP Masterplan area (separate project), however additional survey was undertaken for additional roads, including assessment of the Unnamed Road; and
- 6 to 10 February 2023. This survey was focused on targeted fauna surveys, onsite flora assessments for Matters of National Environmental Significance (MNES) species and onsite fauna habitat assessments within the entire Project area.

The ecological values of the Project area and surrounds have been extensively surveyed recently in 2022 and 2023. Ground-truthing surveys of the Project area evaluated the Project area to consist of a high proportion of exotic grassy and herbaceous species, which are reflective of the disturbed state of vegetation within the majority of the surveyed area. Ecological values pertaining to grassland and wetland species including the Double-barred finch (*Taeniopygia bichenovii*) (least concern (NC Act), not listed (EPBC Act)) which was observed on site, the Black-throated finch (southern) (endangered (EPBC Act, NC Act)), and Squatter pigeon (southern) (*Geophaps scripta scripta*) (vulnerable (NC Act, EPBC Act)) are present, though reduced due to altered species composition of the ground layer reducing seed availability. Habitat for small mammals within the access road reserve is sparse and is only provided through fallen woody debris and ground litter. No gilgai or soil cracks are present for small ground-dwelling fauna.

No EPBC Act listed flora species, or threatened ecological communities were observed within the Project footprint itself during the field assessments. Evidence of EPBC Act listed fauna species was identified, including:

- Black-throated finch (southern) (*Poephila cincta cincta*);
- Squatter pigeon (southern) (*Geophaps scripta scripta*); and
- Bare-rumped sheath-tail bat (*Saccolaimus saccolaimus nudicluniatatus*).

The White-throated needletail (*Hirundapus caudacutus*) and Australian painted snipe (*Rostratula australis*) was also determined likely to occur based on close proximity of records for these species. The presence of EPBC Act listed migratory species were also recorded.

It was determined that the Project has the potential to result in residual significant impacts to the Black-throated finch (southern). The clearing of vegetation and habitat for the Black-throated finch (southern) is expected to result in the loss of habitat. With the mitigation measures proposed, the Project is likely to result in a significant residual impact and as such, environmental offsets are required.

The design and mitigation measures proposed will minimise additional indirect impacts to terrestrial fauna and flora communities within and surrounding the Project area from construction and operational activities. These measures include minimising fauna interactions and weed spread during the Project construction and rehabilitation phases, are all incorporated within the Construction Environmental Management Plan, Weed and Pest Management Plan and the Matters of National Environmental Significance Environmental Management Plan. With control measures in place indirect impacts to fauna and flora additional to those previously described are not expected to be significant.

In recognition of the LEIP's economic and social significance, on 7 March 2023 the LEIP was declared a 'prescribed project' under section 76E of the State Development and Public Works Organisation Act 1971 by the Queensland State Government. The LEIP is projected to deliver a local jobs boom, supporting more than 5,000 during construction and an estimated 1,600 direct and 9,100 indirect jobs once fully developed. Specific workforce numbers related to the Project are expected to range up to 190 personnel. An assessment of the socio-economic impacts of the Project indicates there will be positive impact on the regional economy due to the economic stimulus provided by the Project's construction, operation and future development and industry uses. This will also result in positive impacts to the regional supply chain and employment opportunities. Adverse impacts from the Project are minor and generally related to a loss of ecosystem services from clearing of remnant vegetation.

The following timeline explains the key events in the approval process to this point in time:

- On 25 March 2022, TCC formally endorsed the infrastructure masterplan for the LEIP;
- On 8 April 2022, a pre-lodgement meeting was held with the Queensland State Assessment and Referral Agency (SARA). Approvals and permits will be obtained as required and in accordance with this advice;
- On 15 September 2022, a pre-referral meeting was held with the DCCEEW to discuss the Project and the referral process;
- On 14 October 2022, a referral was started for the Project;
- On 23 November 2022, the referral was accepted by the DCCEEW and underwent invitation for public comment on the referral;
- On 1 December 2022, a variation request was submitted to DCCEEW for Project design refinement;
- On 13 December 2022, response to the preferred process for variation was submitted to DCCEEW;
- On 22 December 2022, additional comments regarding the Project referral were received from DCCEEW and responded to and a follow-up meeting was held;
- On 23 December 2022, DCCEEW concluded the proposed action is a controlled action under the EPBC Act, and requested preliminary documentation to be prepared for the Project;
- On 20 January 2023, DCCEEW provided the Proponent with a Request for Information (RFI);

- On 23 February 2023, a meeting was held with DCCEEW to discuss the Project area;
- On 28 February 2023, a meeting was held with DCCEEW to discuss the Project and Preliminary Documentation, including minor amendments to the Project area;
- On 19 June 2023, DCCEEW issued additional comments on the Preliminary Documentation,
- On 26 June 2023, a meeting was held with DCCEEW to discuss the Project status and updates to the Preliminary Documentation,
- On 1 August 2023, DCCEEW issued follow up minor comments on the Preliminary Documentation,
- On 8 August 2023, a further meeting was held with DCCEEW to clarify the minor comments on the Preliminary Documentation,
- On 18 August 2023, DCCEEW issued comments on the Offset Management Plan; and
- On 22 August 2023, a meeting was held with DCCEEW to clarify comments on the Offset Management Plan.
- On 4th of October, after direction from DCCEEW, the Preliminary documentation was put on public display
- On 17th October, the 10 BD for public display period ended
- On the 19th of October the proponent notified DCCEEW that no comments were received and therefore no further updates are required to the Preliminary Documentation and the documentation can be considered final for the purposes of the final assessment stages.

Calibre Professional Group Pty Ltd (Calibre) has been assisting the TCC with the engineering design works for the LEIP Enabling Infrastructure and CDM Smith Australia Pty Ltd (CDM Smith) has been engaged to provide environmental and approvals support.

Table of Contents

Executive Summary	ii
Acronyms and Abbreviations	xiii
Section 1 Introduction	1
1.1 Background	1
1.1.1 Timeline	5
1.2 Purpose and Scope	5
1.3 Project Overview	6
1.4 Compliance Table	8
1.4.1 Information Request	8
1.5 Project Area and Locality	16
1.5.1 Existing Environment	16
1.6 Statutory Considerations	21
1.6.1 Commonwealth Legislation	21
1.6.2 State and Local Legislation	22
Section 2 Description of the Action	26
2.1 Project Infrastructure	26
2.1.1 Access Roads	26
2.1.2 Water Infrastructure Network	28
2.2 Layout Plan	29
2.3 Disturbance Footprints	31
2.4 Project Design and Impact Avoidance	33
2.5 Project Timing	33
2.6 Project Construction	35
2.6.1 Workforce and Hours	36
2.6.2 Plant and Equipment	36
2.6.3 Construction Methodology	37
2.7 Traffic	44
2.8 Commissioning	44
2.9 Operation and Maintenance	44
2.10 Future Works	45
Section 3 Habitat Assessment	48
3.1 Methodology	48
3.1.1 Desktop Review	48
3.1.2 Field Surveys	48
3.1.3 Habitat Mapping Approach	53
3.1.4 Habitat Quality Assessment	54
3.1.5 Impact Assessment	60
3.2 Description of the Environment	63

3.2.1	Regional Ecosystems.....	63
3.2.2	Habitat Quality	67
3.2.3	Watercourses and Waterways	68
3.2.4	Wetlands	68
3.2.5	Protected Plants Flora Survey Trigger Map	72
3.2.6	Terrestrial Flora	72
3.2.7	Fauna Habitats.....	75
3.2.8	Fauna Species	75
3.3	Matters of National Environmental Significance	90
3.3.1	MNES Threatened Ecological Communities.....	90
3.3.2	MNES Threatened Fauna Species – Likely or Known to Occur	91
3.3.3	MNES Threatened Fauna Species – Identified in the DCCEEW RFI but Determined Moderately Likely or Unlikely to Occur	108
3.3.4	MNES Migratory Species	129
3.3.5	Adequacy of Surveys.....	134
Section 4 Impact Assessment.....		142
4.1	Potential Impacts to MNES	142
4.1.1	Habitat Clearing and Connectivity	143
4.1.2	Direct Fauna Mortality.....	144
4.1.3	Pests and Weeds	145
4.1.4	Air Quality and Dust.....	145
4.1.5	Noise.....	145
4.1.6	Accidental Release of Pollutants	146
4.1.7	Fire.....	146
4.2	Significant Impact Criteria Assessment - Threatened Species	146
4.2.1	Black-throated finch (southern) (Endangered).....	147
4.2.2	Bare-rumped sheathtail bat (Vulnerable).....	150
4.2.3	Squatter pigeon (southern) (Vulnerable).....	153
4.2.4	White-throated needletail (Vulnerable, Marine, Migratory).....	154
4.2.5	Australian painted snipe (Endangered)	156
4.2.6	Masked owl (northern) (Vulnerable)	157
4.2.7	Grey falcon (Vulnerable).....	158
4.2.8	Greater sand plover (Critically Endangered, Marine, Migratory)	159
4.2.9	Curlew sandpiper (Critically Endangered, Marine, Migratory)	160
4.2.10	Eastern curlew (Critically Endangered, Marine, Migratory)	163
4.2.11	Northern quoll (Endangered)	164
4.2.12	McDonald’s frog (Critically Endangered)	165
4.2.13	Ghost bat (Vulnerable)	166
4.2.14	Semon’s leaf-nosed bat (Vulnerable)	167
4.2.15	Koala (Endangered)	168
4.2.16	Greater glider (northern) (Vulnerable)	170
4.2.17	Greater glider (southern and central) (Endangered)	171
4.3	Impacts to Breeding and Migration Season as a Result of Project Construction	173
4.4	Overall MNES Risk Assessment	176
4.4.1	Risk Assessment Methodology	176
4.4.2	Probability Assessment.....	177
4.4.3	Consequence Assessment	177

4.4.4	Risk Matrix.....	179
4.4.5	Potential Facilitated Impacts.....	185
4.5	Potential Residual Impacts and Offsets.....	187
Section 5 Avoidance, Mitigation and Management Measures		188
5.1	Relevant Guidance Material.....	188
5.2	Mitigation Measures and Sub Plans.....	188
5.2.1	Land.....	190
5.2.2	Water.....	200
5.2.3	Habitat Clearing and Connectivity.....	210
5.2.4	Direct Fauna Mortality.....	215
5.2.5	Weeds and Pests.....	220
5.2.6	Air Quality and Dust.....	224
5.2.7	Noise.....	229
5.2.8	Accidental Release of Pollutants.....	233
5.2.9	Fire.....	235
5.2.10	Matters of National Environmental Significance.....	238
5.3	Pre-clearance and Clearance Procedures.....	242
5.3.1	Pre-clearing.....	242
5.3.2	Clearing.....	242
5.4	Summary of Permanent and Temporary Impacts.....	243
5.4.1	Construction Phase.....	243
5.4.2	Operational Phase.....	244
5.4.3	Maintenance.....	245
Section 6 Rehabilitation Requirements		246
6.1	Rehabilitation Activities.....	246
6.1.2	Fencing.....	249
6.1.3	Revegetation.....	249
6.2	Rehabilitation Timing.....	251
6.3	Rehabilitation Monitoring.....	251
6.4	Acceptance Criteria and Corrective Actions.....	252
6.5	Rehabilitation Works Completion.....	254
Section 7 Offsets		255
7.1	Background.....	255
7.2	EPBC Act Environmental Offsets Policy.....	255
7.3	Project Offset Requirements.....	257
7.3.1	Black-throated finch (southern).....	257
7.3.2	Habitat Calculation Method.....	257
7.3.3	Required Offsets.....	258
7.3.4	Estimate of Required Offset Area.....	258
7.4	Offset Site Options.....	259
7.5	Offset Site Habitat Quality Assessment.....	261
7.5.1	Desktop Assessment.....	261

7.5.2	Field Survey	261
7.5.3	Reporting and Scoring	261
7.5.4	Offset Site Habitat Quality Results	261
7.6	Offset Management Strategy	262
7.6.1	Offset Management Plan.....	262
7.6.2	Mechanism to Legally Secure Offsets.....	263
Section 8 Ecologically Sustainable Development		265
Section 9 Economic and Social Matters		268
9.1	Economic and Social Costs and Benefits	268
9.2	Public Stakeholder Consultation	269
9.3	Indigenous Stakeholder Consultation	270
Section 10 Environmental Record of the Person Proposing to take the Action		272
Section 11 Conclusion.....		273
Section 12 References		274

Figures

Figure 1-1	Project Location and Project Components.....	3
Figure 1-2	Future Development Staging.....	4
Figure 1-3	Geology	18
Figure 1-4	Landscape Units	19
Figure 1-5	Project Area Soil Mapping	20
Figure 2-1	Layout Plan.....	30
Figure 2-2	EPBC 2022-09281 Project Area.....	32
Figure 2-3	Typical Construction Corridor.....	42
Figure 2-4	Constrained Preliminary Aspirational Master Plan (Calibre Professional Services Pty Ltd, 2022).....	47
Figure 3-1	Waterways Assessment Locations	62
Figure 3-2	Ground-truthed Habitat Mapping – Assessment Units	64
Figure 3-3	Regional Ecosystems (Biodiversity)	65
Figure 3-4	Regional Ecosystems (<i>Vegetation Management Act</i>).....	66
Figure 3-5	Known Species Records within 100 km	79
Figure 3-6	Species Sightings at Project Level (recorded locations only)	80
Figure 3-7	Surrounding Black-throated Finch (southern) Habitat	96
Figure 3-8	Black-throated Finch (southern) Field Sightings.....	97
Figure 4-1	LEIP Developable Areas	186
Figure 6-1	Rehabilitation areas.....	247
Figure 7-1	Potential Offset Site	260

Plates

Plate 3-1	Black-throated finch (southern) observed foraging adjacent to the railway corridor (source: Evolve 2023).....	92
Plate 3-2	Disused finch nests found within the survey area (source: Evolve 2022a).....	92
Plate 4-1	Approach to Considering Significance of Impacts Accounting for Probability of Consequence (DSEWPaC, 2012b) ..	176

Tables

Table 1-1	Summary of project components forming LEIP's enabling infrastructure.....	6
Table 1-2	Preliminary Documentation – Request for Information.....	8
Table 1-3	Detailed Surface Geology.....	16
Table 1-4	Mapped Landscape Units.....	16
Table 2-1	Project Disturbance Footprints.....	31
Table 2-2	Project Timing.....	35
Table 2-3	Communications.....	36
Table 3-1	Evolve Ecology Survey Coverage*.....	49
Table 3-2	Assessment Units for MHQA.....	55
Table 3-3	Threat Assessment Matrix (DES, 2020).....	55
Table 3-4	BioCondition Assessment Results for the Project Site Summarised by Assessment Unit.....	67
Table 3-5	Wetland of High Ecological Significance.....	70
Table 3-6	Likelihood of Occurrence of Conservation Significant Flora.....	73
Table 3-7	Summary of all Conservation significant and migratory fauna detected (sightings, calls or traces) during field surveys.....	77
Table 3-8	Likelihood of Occurrence of Conservation Significant and Migratory Fauna Within the LEIP.....	81
Table 3-9	Introduced Fauna Species Known within the Project Area and Surrounds.....	90
Table 3-10	Key Data on Black-throated Finch (Southern).....	91
Table 3-11	Relevant Black-throated finch (southern) food species in and surrounding the Project area.....	93
Table 3-12	MHQA for the Black-throated finch (southern) summarised by assessment unit.....	94
Table 3-13	Key Data on Bare-rumped sheathtail bat.....	98
Table 3-14	MHQA for the Bare-rumped sheathtail bat summarised by assessment unit.....	99
Table 3-15	Key Data on Squatter pigeon (southern).....	101
Table 3-16	MHQA for the Squatter pigeon (southern) summarised by assessment unit.....	103
Table 3-17	Key Data on White-throated needletail.....	104
Table 3-18	Key Data on Australian painted snipe (<i>Rostratula australis</i>).....	106
Table 3-19	MHQA for the Australian painted snipe summarised by assessment unit.....	107
Table 3-20	Key Data on Curlew sandpiper.....	108
Table 3-21	Key Data on Northern quoll.....	110
Table 3-22	Key Data on Masked owl (northern).....	112
Table 3-23	Key Data on Grey falcon.....	114
Table 3-24	Key Data on Greater sand plover.....	116
Table 3-25	Key Data on Eastern curlew.....	118
Table 3-26	Key Data on McDonald's frog.....	119
Table 3-27	Key Data on Ghost bat.....	120
Table 3-28	Key Data on Semon's leaf-nosed bat.....	122
Table 3-29	Key Data on Koala.....	123
Table 3-30	MHQA for the Koala summarised by assessment unit.....	124
Table 3-31	Key Data on Greater glider (northern).....	126
Table 3-32	Key Data on Greater glider (southern and central).....	128
Table 3-33	Important Habitat Assessment – Migratory Species.....	131
Table 3-34	Assessment Against Significant Impact Criteria: Migratory Species.....	134
Table 3-35	Field survey adequacy assessment.....	135
Table 4-1	Summary of Potential Impacts to MNES.....	142
Table 4-2	Estimated Clearance of National Environmental Significance Habitat.....	144
Table 4-3	Assessment Against Significant Impact Criteria: Black-throated finch (southern).....	147
Table 4-4	Assessment Against Significant Impact Criteria: Bare-rumped sheathtail bat.....	150

Table 4-5	Assessment Against Significant Impact Criteria: Squatter pigeon (southern)	153
Table 4-6	Assessment Against Significant Impact Criteria: White-throated Needletail	155
Table 4-7	Assessment Against Significant Impact Criteria: Australian painted snipe.....	156
Table 4-8	Assessment Against Significant Impact Criteria: Masked owl (northern).....	157
Table 4-9	Assessment Against Significant Impact Criteria: Grey falcon	159
Table 4-10	Assessment Against Significant Impact Criteria: Greater sand plover.....	160
Table 4-11	Assessment Against Significant Impact Criteria: Curlew sandpiper.....	161
Table 4-12	Assessment Against Significant Impact Criteria: Eastern curlew	163
Table 4-13	Assessment Against Significant Impact Criteria: Northern quoll	164
Table 4-14	Assessment Against Significant Impact Criteria: McDonald’s frog	165
Table 4-15	Assessment Against Significant Impact Criteria: Ghost bat.....	166
Table 4-16	Assessment Against Significant Impact Criteria: Semon’s leaf-nosed bat	167
Table 4-17	Assessment Against Significant Impact Criteria: Koala.....	169
Table 4-18	Assessment Against Significant Impact Criteria: Greater glider (northern).....	170
Table 4-19	Assessment Against Significant Impact Criteria: Greater glider (southern and central)	171
Table 4-20	Species Breeding Season and Project Construction Timeframes	173
Table 4-21	Definitions for Assessment of Hazard and Risk	177
Table 4-22	Ratings for Probability of Occurrence	177
Table 4-23	Consequence Ratings	178
Table 4-24	Risk Assessment Matrix.....	179
Table 4-25	Qualitative Risk Assessment of Potential Impacts to MNES.....	181
Table 5-1	Land Objectives and Management Measures	190
Table 5-2	Waterway Objectives and Management Measures	201
Table 5-3	Habitat Clearing and Connectivity Objectives and Management Measures	211
Table 5-4	Direct Fauna Mortality Objectives and Management Measures.....	216
Table 5-5	Pests and Weeds Objectives and Management Measures.....	221
Table 5-6	Air Objectives and Management Measures	225
Table 5-7	Noise Objectives and Management Measures.....	229
Table 5-8	Accidental Release of Pollutants Objectives and Management Measures.....	233
Table 5-9	Fire Objectives and Management Measures.....	235
Table 5-10	Mitigation Measures to Manage Threats to MNES	238
Table 5-11	Summary of impacts and mitigation measures as a result of Project construction	243
Table 5-12	Summary of impacts and mitigation measures as a result of Project operation.....	244
Table 5-13	Summary of impacts and mitigation measures as a result of Project maintenance	245
Table 6-1	Assessment of Rehabilitation Activity Predicted Effectiveness.....	246
Table 6-2	Hydromulch mix endemic grass species.....	250
Table 6-3	Suitable Flora Species for Listed Threatened Fauna.....	250
Table 6-4	Acceptance Criteria and Corrective Actions	253
Table 7-1	Summary of habitat loss representing a significant residual impact.....	255
Table 7-2	EPBC Act Offset Principles	256
Table 7-3	Final Habitat Quality Impact Site – Black-throated finch.....	258
Table 7-4	Impact Calculation Values	259
Table 7-5	Potential Offset Site Options.....	259
Table 7-6	Overview of Offset Management Zone	262
Table 7-7	Legally Binding Mechanisms to Secure Offset Areas.....	263
Table 8-1	Core Objectives and Guiding Principles of ESD Addressed.....	265
Table 10-1	Proponent Details.....	272

Appendices

Appendix A State Assessment and Referral Agency Meeting Minutes	279
Appendix B DCCEEW Referral Decision and Request for Information	280
Appendix C Waterway and Wetland Crossing Design Plans	281
Appendix D Evolve Ecology Report 1	282
Appendix E Evolve Ecology Report 2	283
Appendix F Evolve Ecology Report 3	284
Appendix G Evolve Ecology Report 4	285
Appendix H Survey Effort Locations	286
Appendix I Waterway Assessments	287
Appendix J PMST Report and WildNet Species List	288
Appendix K Habitat Mapping	289
Appendix L Species Conservation Advice	290
Appendix M Construction Environmental Management Plan	291
Appendix N Weed and Pest Management Plan	292
Appendix O Bushfire Management Plan	293
Appendix P Matters of National Environmental Significance Management Plan	294
Appendix Q Offset Management Plan	295

Document history & status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
Draft	24/02/2023	SM	SM	26/02/2023	Draft (Initial Revision)
Draft	08/03/2023	JH	SM	08/03/2023	Rev A
Rev 0	13/03/2023	SM	SM	14/03/2023	Rev 0
Rev 1	28/04/2023	SM	SM	28/04/2023	Rev 1
Rev 2	29/06/2023	SG	DT	29/06/2023	Rev 2
Rev 3	05/07/2023	SG	SG	05/07/2023	Rev 3
Rev 4	10/08/2023	SG	DT	10/08/2023	Rev 4
Rev 5	01/09/2023	SG	DT	01/09/2023	Rev 5

Distribution of copies

Version	Date issued	Quantity	Format	Issued to
Draft Rev A	08/03/2023	1	Word / PDF	Townsville City Council
Rev 0	14/03/2023	1	PDF	Townsville City Council
Rev 1	28/04/2023	1	PDF	Townsville City Council
Rev 2	30/06/2023	1	PDF	Townsville City Council DCCEEW
Rev 3	05/07/2023	1	PDF	Townsville City Council DCCEEW
Rev 4	10/08/2023	1	PDF	Townsville City Council DCCEEW
Rev 5	September 2023	Multiple	PDF/Print	Townsville City Council DCCEEW General Public
Final	October 2023	Multiple	PDF/Print	Townsville City Council DCCEEW General Public

Last Saved:	20 October 2023
File Name:	LEIP_Preliminary Documentation_Final
Author:	SVM, AB, SS, SM, SG
Project Manager:	SM, DT
Client:	Townsville City Council
Document Title:	Lansdown Eco-Industrial Precinct – Enabling Infrastructure: EPBC Act Final Preliminary Documentation
Document Version:	Final
Project Number:	1001483

Acronyms and Abbreviations

Acronym	Definition
ACHA	<i>Aboriginal Cultural Heritage Act 2003</i>
ACM	Asbestos Containing Material
AHD	Australian Height Datum
ALA	Atlas of Living Australia
AquaBAMM	Aquatic Biodiversity Assessment Mapping Method
AU	Assessment Unit
BAR	Basic Right-turn Treatment
Biosecurity Act	<i>Biosecurity Act 2014</i>
BMP	Bushfire Management Plan
CEMP	Construction Environmental Management Plan
CHMA	Cultural Heritage Management Agreement
COP	Core Operating Procedure
DAF	Department of Agriculture and Fisheries
DAWE	Department of Agriculture, Water and the Environment ¹
DBH	Diameter at Breast Height
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DES	Department of Environment and Science
DICL	Ductile Iron Cement Lined
DMP	Damage Mitigation Permit
DN	Diameter Nominal
DRDMW	Queensland Department of Regional Development, Manufacturing and Water
DSDSATSIP	Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships
EMM	EMM Consulting
EO Act	<i>Environmental Offsets Act 2014</i>
EP Act	<i>Environmental Protection Act 1994</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESCP	Erosion Sediment Control Plan
ESD	Ecologically Sustainable Development
EV	Environmental Values
GBO	General Biosecurity Obligation
GPS	Global Positioning System
GRP	Glass Reinforced Polymer

¹ Department of Agriculture, Water and the Environment (DAWE) has been superseded, however is retained in this Preliminary Documentation for historical references.

Acronym	Definition
Ha	Hectare
HDPE	High Density Polyethylene
HES	High Ecological Significance
HVR	High Value Regrowth
KTP	Key Threatening Process
kW	Kilowatt
LEIP	Lansdown Eco-Industrial Precinct
LGA	Local Government Area
ML	Megalitre
MLES	Matters of Local Environment Significance
MNES	Matters of National Environmental Significance
MNESMP	Matters of National Environmental Significance Management Plan
MP	Management Plan
MSCL	Mild Steel Cement Lined
MSES	Matters of State Environmental Significance
NC Act	<i>Nature Conservation Act 1992</i>
NSESD	National Strategy for Ecologically Sustainable Development
NSW	New South Wales
OC	Of concern
Planning Act	<i>Planning Act 2016</i>
PMST	Protected Matters Search Tool
Q	Quaternary Observation Point
QLD	Queensland
QR	Queensland Rail
REs	Regional Ecosystems
RFI	Request for Further Information
RVM	Regulated Vegetation Mapping
SARA	State Assessment and Referral Agency
SPRAT	Species Profile and Threats
SVL	Snout to Vent Length
TCC	Townsville City Council
TEC	Threatened Ecological Community
TMR	Queensland Department of Transport and Main Roads
VM Act	<i>Vegetation Management Act 1999</i>
W	Watt
WoNS	Weeds of National Significance
WPMP	Weed and Pest Management Plan

Section 1 Introduction

1.1 Background

Townsville City Council (TCC) is delivering the Lansdown Eco-Industrial Precinct (LEIP) Project, Northern Australia's first environmentally sustainable advanced manufacturing, technology, and processing hub. The LEIP will realise the objectives of the Townsville City Deal (a tri-partisan agreement spanning 15 years and all levels of government) to activate industry and export growth for Townsville and its regional partners as the Industry Powerhouse of the North.

The LEIP is located on approximately 2,200 hectares (ha) of freehold land owned by TCC.

Five initial proponents have been conditionally allocated land in the precinct following tender processes conducted by TCC. These proponents are:

- Queensland Pacific Metals;
- Edify Energy;
- Origin Energy Future Fuels Pty Ltd;
- Solquartz Pty Ltd; and
- North Queensland Gas Pipeline.

A tract of Sport & Recreation zoned land directly adjacent the LEIP was leased to DriveIT NQ in 2016 for the creation of a multi-use motorsport facility. Construction commenced in 2021 with the main track recently completed.

On 25 March 2022, TCC formally endorsed the infrastructure masterplan for the LEIP. Under the masterplan, over the next 15 – 20 years the LEIP will be developed in the following stages (as shown on Figure 1-2):

- **Stage 0** Enabling Infrastructure (2022-2025) – essential early enabling infrastructure works (as shown on Figure 1-1) to service the LEIP that primarily involves road access at the northern and southern section of the LEIP and a raw water network (including external pipeline, storage dam, internal pump station and internal pipeline) to service the initial proponents ;
- **Stage 1** (2022 – 2025) – Initial proponents obtain all various approvals and commence construction of their facilities;
- **Stage 2** (2026-2030) – Initial proponents move into full and expanded operations. Expansion to the south, with provision of necessary infrastructure to service other proponents; and
- **Stages 3 & 4** (2031-2041) – Final expansion and infill of infrastructure to service those areas remaining. Proponents' operations continue to grow. Enhancement of infrastructure as the LEIP continues to be further developed.

Stage 0 (Enabling Infrastructure) is the action that is the subject of the EPBC referral (2022/09383) and this Preliminary Documentation. Therefore, only the water infrastructure network and access roads shown in Figure 1-1 are considered under this Preliminary Documentation. Further information on the Project's enabling infrastructure is detailed in Section 1.3.

Development of the various land parcels within the LEIP (ie Stages 1 to 4) will be undertaken by the various proponents, with separate EPBC Act processes where applicable. Other future infrastructure to support future proponents would also be subject to separate EPBC Act processes.

While future projects within the LEIP project boundary will be subject to future EPBC Act processes, an overarching constraints analysis assessment was undertaken as part of the Master Planning process which included identifying environmentally sensitive areas (refer to the TCC LEIP Master Plan 2022). As a result of this assessment, mapped

regional ecosystems (up to 308 ha), which have the potential to provide suitable habitat for EPBC listed species, have been classified as moderate to highly constrained areas. Therefore, of the total LEIP Project area of 2,056.5 ha, it is considered that only 1,627.6 ha is developable land.

Future projects will need to carry out detailed assessment before development can proceed. The mapped regional ecosystems and environmentally sensitive areas require ground truthing to understand the condition and suitability of habitat for EPBC listed species. Two proponents (Drive-it NQ and QPM) have carried site specific environmental investigations, including EPBC referrals/self-assessment, for sections of the developable land within the precinct, therefore a total of 1,459.8 ha of land remains, of which 1,161.6 ha is considered developable. Further details regarding facilitated impacts and future development can be found in Section 4.4.5

Calibre Professional Group Pty Ltd (Calibre) has been assisting the TCC with the engineering design works for the LEIP Enabling Infrastructure and CDM Smith Australia Pty Ltd (CDM Smith) has been engaged to provide environmental and approvals support.

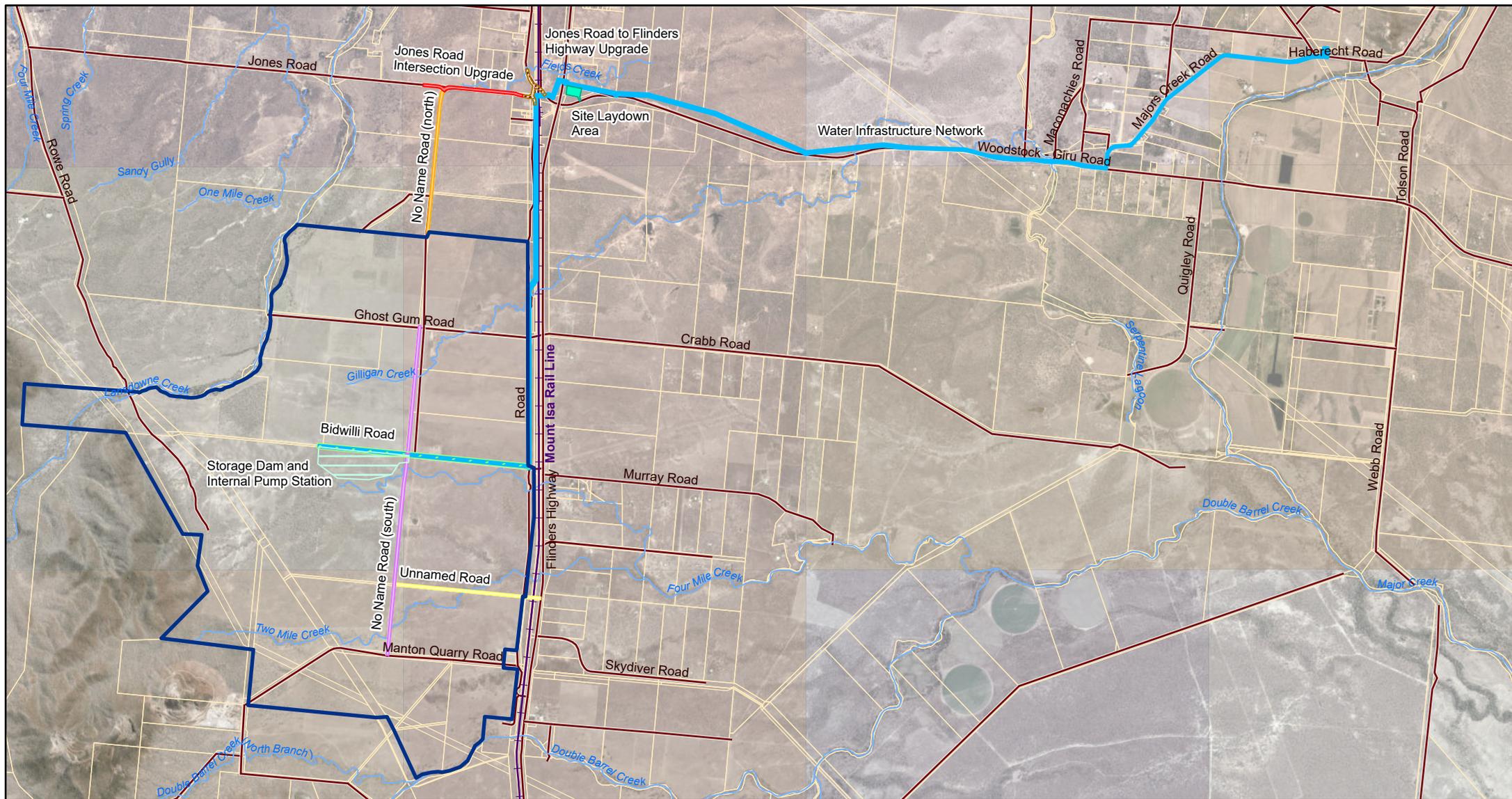
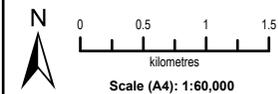


Figure 1-1 Project Location and Project Components

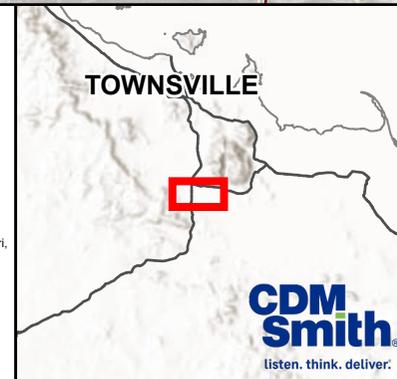
LEGEND

- | | | |
|--|---------------------------------------|-----------------|
| LEIP Precinct Boundary | Bidwilli Road | Rail Network |
| Jones Road Intersection Upgrade | Unnamed Road | Existing Roads |
| Jones Road to Flinders Highway Upgrade | Water Infrastructure Network | Watercourse |
| No Name Road (north) | Storage Dam and Internal Pump Station | Cadastre (DCDB) |
| No Name Road (south) | Site Laydown Area | |



User: ZURAWSIKO 9/08/2023
 Project: Figure1_PublicExhibition.aprx
 Client: 1001483 TCC - LEIP Prelim Documentation
 Projection: GDA 1994 MGA Zone 55

Esri, Geoscience Australia, NASA, NGA, USGS, Esri, USGS
 Imagery: Queensland Satellite Data QSat 2017.
 DISCLAIMER
 CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



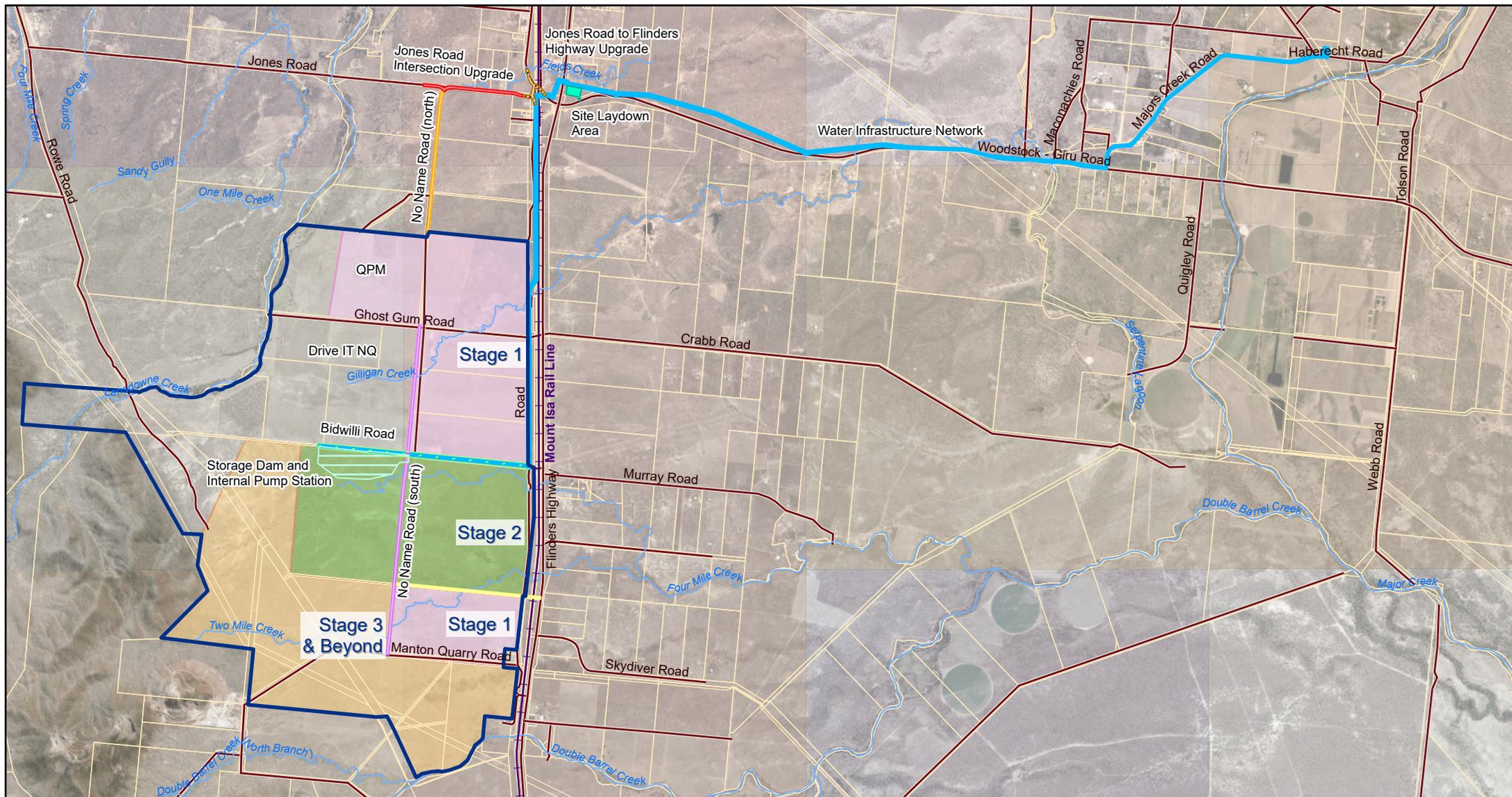
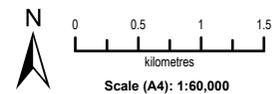


Figure 1-2 Future Development Staging

LEGEND

- | | | |
|--|---------------------------------------|------------------|
| LEIP Precinct Boundary | Unnamed Road | Watercourse |
| Jones Road Intersection Upgrade | Water Infrastructure Network | Cadastre (DCDB) |
| Jones Road to Flinders Highway Upgrade | Storage Dam and Internal Pump Station | Stage |
| No Name Road (north) | Site Laydown Area | Stage 1 |
| No Name Road (south) | Rail Network | Stage 2 |
| Bidwilli Road | Existing Roads | Stage 3 & Beyond |



User: ZURAWSIKO 10/08/2023
 Project: Figure1_2_PublicExhibition2.aprx
 Client: 1001483 TCC - LEIP Prelim Documentation

Esri, Geoscience Australia, NASA, NGA, USGS, Esri, USGS
 Imagery: Queensland Satellite Data QSat 2017.
 DISCLAIMER
 CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



1.1.1 Timeline

The following timeline explains the key events in the referral process to this point in time:

- On 25 March 2022, TCC formally endorsed the infrastructure masterplan for the LEIP;
- On 8 April 2022, a pre-lodgement meeting was held with the Queensland State Assessment and Referral Agency (SARA), refer to Appendix A for the pre-lodgement minutes. Approvals and permits will be obtained as required and in accordance with this advice.
- On 15 September 2022, a pre-referral meeting was held with the Department of Climate Change, Energy, the Environment and Water (DCCEEW) to discuss the Project and the referral process;
- On 14 October 2022, a referral was started for the Project.
- On 23 November 2022, the referral was accepted by the DCCEEW and underwent invitation for public comment on the referral;
- On 1 December 2022, a variation request was submitted to DCCEEW for Project design refinement;
- On 13 December 2022, response to the preferred process for variation was submitted to DCCEEW;
- On 22 December 2022, additional comments regarding the Project referral were received from DCCEEW and responded to and a follow-up meeting was held;
- On 23 December 2022, DCCEEW concluded the proposed action is a controlled action under the EPBC Act, and requested preliminary documentation to be prepared for the Project;
- On 20 January 2023, DCCEEW provided the Proponent with a Request for Information (RFI);
- On 23 February 2023, a meeting was held with DCCEEW to discuss the Project area;
- On 28 February 2023, a meeting was held with DCCEEW to discuss the Project and Preliminary Documentation, including minor amendments to the Project area;
- On 19 June 2023, DCCEEW issued additional comments on the Preliminary Documentation; and
- On 26 June 2023, a meeting was held with DCCEEW to discuss the Project status and updates to the Preliminary Documentation.
- On 1 August 2023, DCCEEW issued follow up minor comments on the Preliminary Documentation; and
- On 8 August 2023, a further meeting was held with DCCEEW to clarify the minor comments on the Preliminary Documentation.
- On 18 August 2023, DCCEEW issued comments on the Offset Management Plan; and
- On 22 August 2023, a meeting was held with DCCEEW to clarify comments on the Offset Management Plan.

1.2 Purpose and Scope

Following the referral (EPBC 2022/09383) which was accepted on 23 November 2022 with a controlled action decision on 23 December 2022, the DCCEEW submitted a RFI to the Proponent describing the technical and non-technical information required in the preliminary documentation and the general structure, style and format of the required response (refer to Appendix B).

The Preliminary Documentation request by DCCEEW listed the following specific additional content:

- Description of the action;
- Habitat assessment;

- Impact assessment;
- Avoidance, mitigation and management measures;
- Rehabilitation measures;
- Offsets;
- Ecologically sustainable development;
- Economic and social matters; and
- Environmental record of the person proposing to take the action.

To address the specific additional information requested by DCCEEW, this document provides a detailed compilation of existing information from the original referral which is supplemented by additional information gathered in response to the RFI. A RFI compliance table is provided in Section 1.4. While the scope of this documentation is focused on providing the information necessary to address the RFI, the Preliminary Documentation is also required to be 'standalone' and therefore, a range of additional information has been included to provide the reader with a comprehensive document (e.g., locational information, relevant legislation, environmental permits and local development approvals process etc.).

1.3 Project Overview

The LEIP has been formed to foster Australia's first environmentally sustainable, advanced manufacturing, technology, and processing hub which will result in significant economic benefit to the local, regional and State economy. The LEIP is located approximately 38 km south of Townsville, adjacent and west of Flinders Highway. The enabling infrastructure is contained within the LEIP site and numerous existing road reserves including Flinders Highway, Woodstock Giru Road, Major Creek Road, Jones Road, Woodstock Avenue, Old Flinders Highway, No Name Road, Unnamed Road, Ghost Gum Road and Bidwilli Road. The LEIP location and its components are provided in Figure 1-1. To facilitate the development of the LEIP, enabling infrastructure is required and a summary of project components is outlined in Table 1-1, further detail is provided in Section 2.1.

Table 1-1 Summary of project components forming LEIP's enabling infrastructure

Project Component	Description Summary
Water Infrastructure	
External Pipeline	<ul style="list-style-type: none"> ▪ Extends from Ross River Dam Pipeline, connecting existing water supply network to LEIP; ▪ Connection occurs adjacent to three intersection junctions at Majors Creek; ▪ Total length of 16.25 km, within a 20 m construction corridor; ▪ Located 4.5 m from the nearest property boundary; ▪ Constructed using DN900 glass reinforced polymer (GRP) pipe; and ▪ Pipeline protection, erosion control and scour prevention materials used.
Internal Pipeline	<ul style="list-style-type: none"> ▪ Installed within the No Name Road existing and new road reserve from Ghost Gum Rd to Manton Quarry Rd; and ▪ Various diameters including DN250 to DN500.
Storage Dam	<ul style="list-style-type: none"> ▪ Proposed immediately south of Bidwilli Road at the termination of the external pipeline; ▪ Occupies an area of approximately 26 ha; ▪ Storage capacity of approximately 437 ML; and ▪ Access via Bidwilli Road.
Internal Pump Station	<ul style="list-style-type: none"> ▪ New pump station east of the storage dam; ▪ Connects storage dam and internal pipeline; and ▪ Access via Bidwilli Road.

Project Component	Description Summary
Site Laydown Area	<ul style="list-style-type: none"> Approximately 1.7 ha in area, north east of Flinders Highway and Woodstock Giru Road intersection.
Access Roads	
Jones Road to Flinders Highway Upgrade	<ul style="list-style-type: none"> Modifications to existing roads and intersections required; and All roads are existing sealed roads within road reserves.
Jones Road Intersection Upgrade	<ul style="list-style-type: none"> Existing road; Connection to No Name Road (north) via a new intersection; and Upgraded for approximately 900 m in length to connect to Old Flinders Highway.
Closure of Existing Level Crossing	<ul style="list-style-type: none"> Two existing level crossings will be closed; and No change to land tenure, road reserves or road infrastructure.
No Name Road (north) Upgrade	<ul style="list-style-type: none"> Extends 1.7 km from northern LEIP boundary to Jones Road; New road, 10 m wide road drainage easement, plus an existing 20 m road reserve; and Designed to accommodate heavy vehicles.
No Name Road (south) Upgrade	<ul style="list-style-type: none"> New, 10 m wide road pavement within a new 30 m road reserve; and Extends approximately 2.2 km from Bidwilli Road to Manton Quarry Road.
Bidwilli Road	<ul style="list-style-type: none"> Minor modifications required to connect to No Name Road (south) and provide access to internal pump station and storage dam.
Unnamed Road	<ul style="list-style-type: none"> East-West road north of Manton Quarry Road. Road corridor to be 30 m wide. New, 10 m wide road pavement easement plus existing 20 m road reserve; and Extends approximately 1.7 km from No Name road (south) to Flinders Highway
Flinders Highway Upgrade	<ul style="list-style-type: none"> Shoulder widening required. The shoulder widening works are contained within the existing Flinders Highway road reserve
Creation of Easements	<ul style="list-style-type: none"> A 45 m wide easement on western side of No Name Road (south); A 10m wide easement on the northern side of Unnamed Road; and A 20m wide easement within the southern side of the existing Ghost Gum road reserve.

1.4 Compliance Table

1.4.1 Information Request

Table 1-2 provides a cross-reference providing evidence of compliance with the DCCEEW information request (in Appendix B) that has been included in this Preliminary Documentation.

Table 1-2 Preliminary Documentation – Request for Information

Item	Request	Relevant Section of this document
1. Description of the Action		
1.1	The location, boundaries and size (in hectares) of the disturbance footprint and of any adjoining areas which may be indirectly impacted by the proposal, including nearby vegetation. Include mapping and coordinates.	Section 2.3.
1.2	A description of all components of the action, including the anticipated timing and duration (including start and completion dates) of each component of the project. In addition, any components which were included in the referral material, but are no longer part of the proposed action or were previously referred must be clearly identified.	Section 1.1.1; Section 1.3; Section 2.1 and Section 2.5
1.3	A description of the operational requirements of the action including any anticipated maintenance works.	Section 2.9
1.4	A description of the surrounding land uses.	Section 1.5.1.2
1.5	An indicative layout plan for the proposed action area, including the location and type of land use, key infrastructure, and the number and location of rehabilitation areas, dwellings, and associated infrastructure. Include mapping and coordinates for each of the above.	Section 2.2; Figure 2-1
1.6	Provide a description of any approval that has been obtained from a State or Commonwealth agency or authority, including any conditions that apply to the action. Include a statement identifying any additional approval that is required.	Section 1.6.2.11.
1.7	To the extent reasonably practicable, provide a description of any future works that will be enabled due to the construction of this project. This includes projects that will and will not be referred by the proponent (or on their behalf).	Section 2.10

Item	Request	Relevant Section of this document
2. Habitat Assessment		
2.1 Species General Information		
2.1.1	Provide a habitat assessment for relevant listed threatened species and communities. Include information on habitat located within, adjacent to and downstream of the project area, include habitat patch size in hectares. Include references to updated advice from the SPRAT Database.	Black-throated finch (southern) – Section 3.3.2.1.4 Bare-rumped sheath-tail bat – Section 3.3.2.2.4 Squatter pigeon (southern) – Section 3.3.2.3.4 White-throated needletail – Section 3.3.2.4.4 Australian painted snipe – Section 3.3.2.5.4 Curlew sandpiper – Section 3.3.3.1.4 Northern quoll – Section 3.3.3.2.4 Masked owl (northern) – Section 3.3.3.3
2.1.2	Identify and describe known historical records of the listed threatened species and ecological communities in the broader region. All known records must be supported by an appropriate source (i.e., Commonwealth and State databases, published research, publicly available survey reports, etc.), the year of the record and a description of the habitat in which the record was identified.	Black-throated finch (southern) – Section 3.3.2.1.2 Bare-rumped sheath-tail bat – Section 3.3.2.2.2 Squatter pigeon (southern) – Section 3.3.2.3.2 White-throated needletail – Section 3.3.2.4.2 Australian painted snipe – Section 3.3.2.5.2 Curlew sandpiper – Section 3.3.3.1.2 Northern quoll – Section 3.3.3.2.2 Masked owl (northern) – Section 3.3.3.3.2 Grey falcon – Section 3.3.3.4.2 Greater sand plover – Section 3.3.3.5.2 Eastern curlew – Section 3.3.3.6.2 McDonald’s frog – Section 3.3.3.7.2 Ghost bat – Section 3.3.3.8.2 Semon’s leaf-nosed frog – Section 3.3.3.9.2 Koala – Section 3.3.3.10.2 Greater glider (northern) – Section 3.3.3.11.2 Greater glider (southern and central) – Section 3.3.3.12.2

Item	Request	Relevant Section of this document
2.1.3	<p>Provide detailed mapping of suitable habitat (within, adjacent to and downstream of the project site, where relevant) for all listed threatened species and communities, which:</p> <ul style="list-style-type: none"> ▪ Is specific to the habitat assessment undertaken for each listed threatened species and ecological community (i.e., does not only illustrate relevant Queensland Regional Ecosystems); ▪ Includes an overlay of the project disturbance footprint; ▪ Includes known records of individuals derived from desktop analysis and field surveys; and ▪ Is provided separately as attachments in JPEG format. 	<p>Black-throated finch (southern) – pg. 1-3 of Appendix K Squatter pigeon (southern) – pg. 4-6 of Appendix K Koala – pg. 7-9 of Appendix K Oriental cuckoo – pg. 10-12 of Appendix K Northern quoll – pg. 13 of Appendix K Australian painted snipe – pg. 14 of Appendix K Curlew sandpiper – pg. 15 of Appendix K Bare-rumped sheathtail bat – pg. 16-18 of Appendix K Glossy ibis – pg. 19 of Appendix K Black-faced monarch – pg. 20-22 of Appendix K</p>
2.1.4	<p>Include an assessment of the adequacy of any surveys undertaken (including survey effort and timing). In particular, the extent to which these surveys were appropriate for the listed species or community and undertaken in accordance with relevant departmental survey guidelines.</p>	Section 3.3.5
2.1.5	<p>Attach all relevant ecological surveys referenced in the referral and preliminary documentation as supporting documents to the preliminary documentation.</p>	Appendix D; Appendix E; Appendix F; Appendix G; Appendix H
2.2 Species Specific Information		
Black-throated Finch (Southern) (<i>Poephila cincta cincta</i>) – endangered		
2.2.1	<p>Include mapping of located individuals from surveys. Include in this mapping the location of breeding and foraging habitat within and surrounding the project area as well as any notable evidence of individuals such as nests.</p>	Section 3.3.2.1 and page 1-3 of Appendix K
2.2.2	<p>Identification of relevant food species in and surrounding the project area.</p>	Section 3.3.2.1
Bare-rumped Sheathtail Bat (<i>Saccolaimus saccolaimus nudicluniatu</i>s) - vulnerable		
2.2.3	<p>Include mapping of suitable roosting and foraging habitat and locations of survey effort. This should include areas within and surrounding the project area that are suitable foraging and roosting habitat.</p>	<p>Section 3.3.2.2.4; Appendix H and page 16-18 of Appendix K Survey effort is found in Appendix H, with suitable hollow records on page 19 of Appendix H</p>

Item	Request	Relevant Section of this document
Squatter Pigeon (southern) (<i>Geophaps scripta scripta</i>) – vulnerable		
2.2.4	A discussion of vegetation composition and structure on relevant land zones (i.e., specific tree and grass species).	Section 3.3.2.3.4
2.2.5	A discussion of breeding, foraging and dispersal habitat requirements as defined by relevant statutory documentation.	Section 3.3.2.3.4
2.2.6	The total area (in hectares) of each breeding, foraging and dispersal habitat type, including consideration of disturbed (non-remnant vegetation) areas.	Section 3.3.2.3.4
Australian Painted Snipe (<i>Rostratula australis</i>) – endangered		
2.2.7	A discussion of vegetation composition and structure (i.e., shallow wetlands with a good cover of grasses, rushes and reeds).	Section 3.3.2.5.4
2.2.8	A discussion of habitat use requirements (e.g., breeding, foraging, dispersal, etc.).	Section 3.3.5.2.4
2.2.9	The total area (in hectares) of each identified habitat type (e.g., breeding, foraging, dispersal, etc.)	Section 3.3.5.2.4
3. Impact Assessment		
3.1.1	An assessment of the likely impacts associated with the construction and operation of the proposed action, including vegetation, maintenance, increased traffic, and increased activity in the general area.	Section 4
3.1.2	Include the direct and indirect loss and/or disturbance of protected matters and their habitat as a result of the proposed action. This must include the area (in hectares) and quality of the habitat to be impacted and quantification of the individuals to be impacted (where applicable).	Section 4.1.1
3.1.3	An assessment of the impacts of habitat fragmentation in the project area and surrounding areas, including consideration of species' movement patterns.	Section 4.1.1
3.1.4	An assessment of the likely duration of impacts to protected matters as a result of the proposed action.	Section 4.4; Table 4-25
3.1.5	A discussion of whether the impacts are likely to be repeated, for example as part of maintenance.	Table 4-25
3.1.6	A discussion of whether any impacts are likely to be unknown, unpredictable or irreversible.	Section 4.1
3.1.7	Justify, with supporting evidence, how the proposed action will not be inconsistent with: <ul style="list-style-type: none"> ▪ Australia's obligations under the Biodiversity Convention, the Convention on Conservation of Nature in the South Pacific (Apia Convention), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); and ▪ A recovery plan or threat abatement plan. 	Table 4-3 to Table 4-19

Item	Request	Relevant Section of this document
3.1.8	Assess the likelihood and give a description of all potential facilitated impacts to listed threatened species from future actions that have been enabled by this proposed action.	Table 4-25
4. Avoidance, Mitigation and Management Measures		
4.1	<p>Include the following management plans (in approved or draft format) as appendices to the preliminary documentation:</p> <ul style="list-style-type: none"> ▪ Construction Environmental Management Plan; ▪ Weed and Pest Animal Management Plan; and ▪ Bushfire Management Plan. 	<ul style="list-style-type: none"> • Construction Environmental Management Plan – Appendix M; • Weed and Pest Animal Management Plan – Appendix N; and • Bushfire Management Plan – Appendix O.
4.2	<p>A detailed summary of measures proposed to be undertaken by the proponent to avoid, mitigate and manage relevant impacts of the proposed action on relevant protected matters (including any measures required through other Commonwealth, State and/or local government approvals).</p> <p>Proposed measures must be based on best available practices, appropriate standards, evidence of success for other similar actions and supported by published scientific evidence. All commitments must be drafted using committal language (e.g., ‘will’ and ‘must’) when describing the proposed measures.</p> <p>All proposed measures must also be drafted to meet the ‘S.M.A.R.T’ principle:</p> <ul style="list-style-type: none"> • S – Specific (what and how); • M – Measurable (baseline information, number/value, auditable); • A – Achievable (timeframe, money, personnel); • R – Relevant (conservation advices, recovery plans, threat abatement plans); and • T – Time-bound (specific timeframe to complete). 	<p>Section 5 Section 5.2 Appendix M, N, and O</p>
4.2	Information on the timing, frequency and duration of the proposed avoidance, mitigation and management measures to be implemented.	Section 5.2 in Table 5-1; Table 5-2; Table 5-3; Table 5-4; Table 5-5; Table 5-6; Table 5-7; Table 5-8; Table 5-9
4.3	Details of specific and measurable environmental outcomes to be achieved for relevant protected matters, including an assessment of the expected or predicted effectiveness of the proposed measures.	Section 5.2 in Table 5-1; Table 5-2; Table 5-3; Table 5-4; Table 5-5; Table 5-6; Table 5-7; Table 5-8; Table 5-9
4.4	Any statutory or policy basis for the proposed measures, including reference to the SPRAT Database and relevant approved conservation advice, recovery plan or threat abatement plan, and a discussion on how the proposed measures are consistent with relevant plans.	Table 5-10
4.5	Details of ongoing management and monitoring programs, including timing, to validate the effectiveness of proposed measures and demonstrate that environmental outcomes will be, or have been, achieved.	Section 5.2 in Table 5-1; Table 5-2; Table 5-3; Table 5-4; Table 5-5; Table 5-6; Table 5-7; Table 5-8; Table 5-9

Item	Request	Relevant Section of this document
4.6	Details of tangible, on-ground corrective actions that will be implemented, including timing, in the event that monitoring programs indicate that the environmental outcomes have not been, or will not be, achieved.	Section 6.4
5. Rehabilitation Requirements		
5.1	The details of any rehabilitation activities proposed to be undertaken, including any activities required through other Commonwealth, State and/or local government approvals. All commitments must be drafted using committal language (e.g., 'will' and 'must') when describing the proposed activities.	Section 6.1
5.2	The proposed final landform, including rehabilitation completion criteria, and its relation to the pre-disturbance vegetation community. Include an assessment of the expected or predicted effectiveness of the proposed rehabilitation activities.	Predicted effectiveness of the proposed rehabilitation activities – Table 6-1 Final landform and rehabilitation completion criteria – Table 6-4
5.3	Provide detailed mapping of the project site that clearly identifies areas to be rehabilitated.	Figure 6-1
5.4	Information on the timing, frequency and duration of proposed rehabilitation activities to be implemented, including anticipated time to completion.	Section 6.2
5.5	Details of ongoing management and monitoring programs, including timing, to validate the effectiveness of proposed rehabilitation activities and demonstrate that completion criteria will be, or have been, achieved.	Section 6; Table 6-1
5.6	Details of tangible, on-ground corrective actions that will be implemented, including timing, in the event that monitoring programs indicate that the completion criteria have not been, or will not be, achieved.	Section 6; Table 6-1
5.7	Details on consideration of flora species that may be relevant to listed threatened species present in the region such as Southern Black-throated Finch.	Table 6-2 and Table 6-3
6. Offsets		
6.1	An assessment of the likelihood of residual significant impacts occurring on relevant protected matters, after avoidance, mitigation and management measures have been applied.	Table 4-25
6.2	A summary of the proposed environmental offset, if required in accordance with the assessment of significant residual impact, and key commitments to achieve a conservation gain for each protected matter.	Section 7
6.3	If an offset area has not been nominated, include a draft OS as an appendix to the preliminary documentation. The draft OS must meet the information requirements set out in Appendix B.1.	Section 7

Item	Request	Relevant Section of this document
6.4	Where offset area/s have been nominated, include a draft OMP as an appendix to the preliminary documentation. The draft OMP must meet the information requirements set out in Appendix B.2, and must be prepared by a suitably qualified ecologist and in accordance with the department's Environmental Management Plan Guidelines (2014), available at: www.environment.gov.au/epbc/publications/environmental-management-plan-guidelines	Section 7
7. Ecologically Sustainable Development (ESD)		
7.1	<p>A description of how the proposed action meets the principles of ESD, as defined in section 3A of the EPBC Act. The following principles are principles of ecologically sustainable development:</p> <p>decision making processes should effectively integrate both long term and short term economic, environmental, social and equitable considerations;</p> <ul style="list-style-type: none"> ▪ If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation; ▪ The principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations; ▪ The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making; ▪ Improved valuation, pricing and incentive mechanisms should be promoted. 	Section 8
8. Economic and Social Matters		
8.1	An analysis of the economic and social impacts of the action, both positive and negative.	Section 9.1
8.2	Details of any public consultation activities undertaken and their outcomes.	Section 9.2

Item	Request	Relevant Section of this document
8.3	<p>Details of any consultation with Indigenous stakeholders.</p> <p>Indigenous engagement</p> <p>Identify existing or potential native title rights and interests, including any areas and objects that are of particular significance to Indigenous peoples and communities, possibly impacted by the proposed action and the potential for managing those impacts.</p> <p>Describe any Indigenous consultation that has been undertaken, or will be undertaken, in relation to the proposed action and their outcomes.</p> <p>The department considers that best practice consultation, in accordance with the Guidance for proponents on best practice Indigenous engagement for environmental assessments under the EPBC Act (2016) includes:</p> <ul style="list-style-type: none"> ▪ Identifying and acknowledging all relevant affected Indigenous peoples and communities; ▪ Committing to early engagement; ▪ Building trust through early and ongoing communication for the duration of the project, including approvals, implementation and future management; ▪ Setting appropriate timeframes for consultation; and ▪ Demonstrating cultural awareness. <p>Describe any state requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action with regards to Indigenous peoples and communities.</p>	Section 9.3
8.4	Projected economic costs and benefits of the project, including the basis for their estimate through cost/benefit analysis or similar studies.	Section 9.1
8.5	Employment opportunities expected to be generated by the project (including construction and operational phases).	Section 9.1; Table 8-1
9. Environmental Record of the Person Proposing to take the action		
9.1	<p>Include details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:</p> <ul style="list-style-type: none"> ▪ The person proposing to take the action; ▪ For an action for which a person has applied for a permit, the person making the application; ▪ If the person is a body corporate—the history of its executive officers in relation to environmental matters; and ▪ If the person is a body corporate that is a subsidiary of another body or company (the parent body)—the history in relation to environmental matters of the parent body and its executive officers. 	Section 10

1.5 Project Area and Locality

1.5.1 Existing Environment

The Project is wholly located within the TCC local government area (LGA) and is mapped within the rural zone, adjacent to community facilities, high impact industry and recreation and open space zoning under the Townsville City Plan (Planning Scheme), October 2014.

1.5.1.1 Topography

The site is generally flat with elevation ranging from 45 m Australian Height Datum (AHD) to the northeast, to 89 m AHD at its highest point to the southwest.

1.5.1.2 Land Use

The project is situated within land that has been historically cleared for agricultural and cattle grazing purposes.

Enabling infrastructure is primarily within existing road reserves.

Within the broader region (within 10 km of the Project area), land uses predominantly include grazing, however, also include other agricultural activities, mining, forestry, industry and housing.

1.5.1.3 Geology

The Project area is in the Burdekin River Regional Mapping Extent. The detailed surface geology of the Project area is summarised in Table 1-3, as well as Figure 1-3 and Figure 1-4.

Table 1-3 Detailed Surface Geology

Rock-Unit Name	Lithological Summary	Dominant Rock	Rock Type	Age
Qa	Clay, silt, sand and gravel; flood plain alluvium	Alluvium	Stratified unit (including volcanic and metamorphic)	Quaternary
Qr	Clay, silt, sand, gravel and soil; colluvial and residual deposits	Colluvium	Stratified unit (including volcanic and metamorphic)	Quaternary
Qas	Sand and silt; abandoned levee, channel and outwash deposits; sandy rises in alluvial plains	Alluvium	Stratified unit (including volcanic and metamorphic)	Quaternary

1.5.1.4 Soils

An assessment of publicly available soil mapping data provides an indication of relevant soil types across and surrounding the Project area. Results from the desktop assessment as they relate to soils and landforms show the majority of the Project area is mapped as the landscape units VA76 (Isbell 2002) and Si10 (refer to Table 1-4).

Table 1-4 Mapped Landscape Units

Code	Description	Soil Description
VA76	Alluvial plains with some low stream levees and relic infilled stream channels	Hard pedal mottled-yellow duplex soils
SI10	Level alluvial plains	Hard pedal yellow duplex soils

Code	Description	Soil Description
MT13	Gently undulating lands	Grey massive earths
SI15	Level alluvial plains with slightly elevated old levees and shallow prior and present stream channels	Hard pedal yellow duplex soils
MU15	Level alluvial plains with numerous old meander channels and terraces	Red massive earths
MK1	Alluvial delta plains with a complex pattern of present and prior stream channels and levees	Brown or mottled-red massive earths

The predominant soil type mapped across the Project area (see Figure 1-5) are sodosols. Sodosol are soils with a clear or abrupt textural B horizon and in which a major part of the upper 0.2 m of the B2 horizon (or a major part of the entire B2 horizon if it is less than 0.2m thick) is sodic and not strongly acid. Hydrosols and soils with strongly sub-plastic upper B2 horizons are excluded.

No acid sulphate soils are mapped in the area. Based on laboratory aggressivity testing results undertaken for the Project, the soils tested and expected groundwater conditions would mostly result in a “non-aggressive” exposure classification above groundwater level and “mild” classification would apply to sand layers below groundwater level.

Based on preliminary geotechnical investigations, the indication is that the 2 to 3m deep excavations for the pipeline are likely to predominantly comprise sands to the east of Serpentine Lagoon and predominantly clays to the west and south of this point. The shallowest bedrock was encountered at 5.2m depth and therefore considered unlikely in the trench excavations.

1.5.1.5 Surface Water and Groundwater

The Project area is located within the Haughton Basin, which flows from Mingela in the west and enters the Great Barrier Reef World Heritage Area between Townsville and Ayr (GBRMPA 2013). The major waterways in the Haughton Basin are the Haughton River and Barratta Creek. The Haughton River in the north of the Haughton basin runs from the hill slopes in the upper basin in the north, across an extensive floodplain landscape into wide tidal delta made up of extensive areas of saltmarsh, saltpan and mangrove forests. This delta flows into Bowling Green Bay. Two relatively natural tributaries – Reid River and Major Creek flow into the Haughton River in the Upper part of the basin.

To the west, the Haughton Basin is elevated land with relatively intact vegetation. To the east, the Haughton basin is an old alluvial floodplain with river systems flowing into coastal estuaries (GBRMPA 2013).

A search of the Queensland (QLD) Department of Regional Development, Manufacturing and Water (DRDMW) for the region indicates that groundwater is encountered at depths of between 2.5 m and 12 m below ground level.

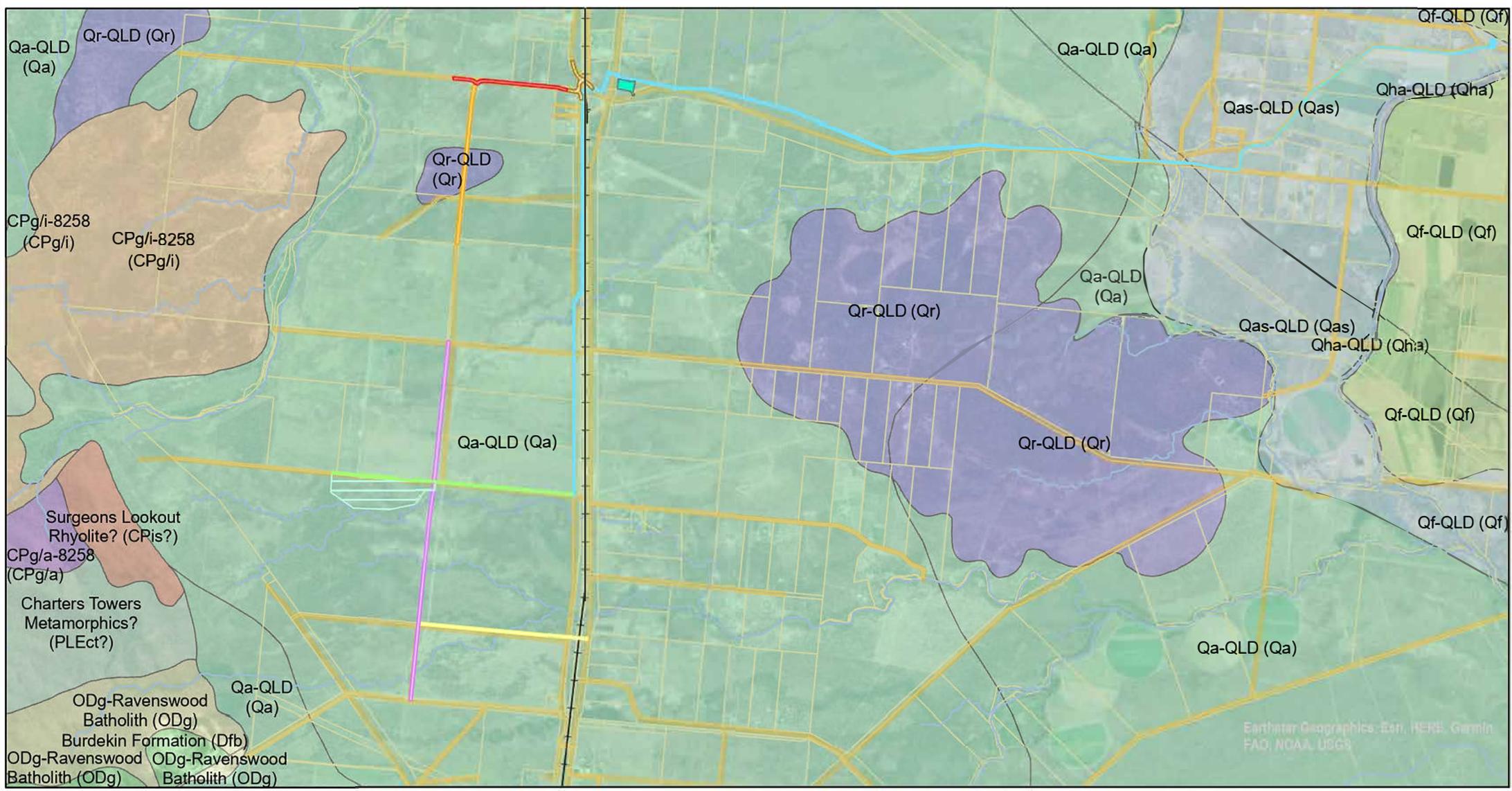
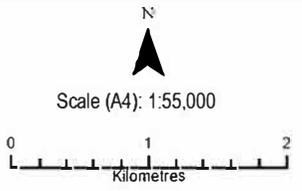


Figure 1-3 Geology

- Legend
- Jones Road Intersection Upgrade
 - Jones Road to Flinders Highway Upgrade
 - No Name Road (north)
 - No Name Road (south)
 - Bidwilli Road
 - Unnamed Road
 - Water Infrastructure Network
 - Storage Dam and Internal Pump Station
 - Site Laydown Area
 - Rail Network
 - Existing Roads
 - Watercourse
 - Cadastre (DCDB)

- Detailed Surface Geology
- Burdekin Formation (Dfb)
 - CPg/a-8258 (CPg/a)
 - CPg/i-8258 (CPg/i)
 - Charters Towers Metamorphics? (PLEct?)
 - ODg-Ravenswood Batholith (ODg)

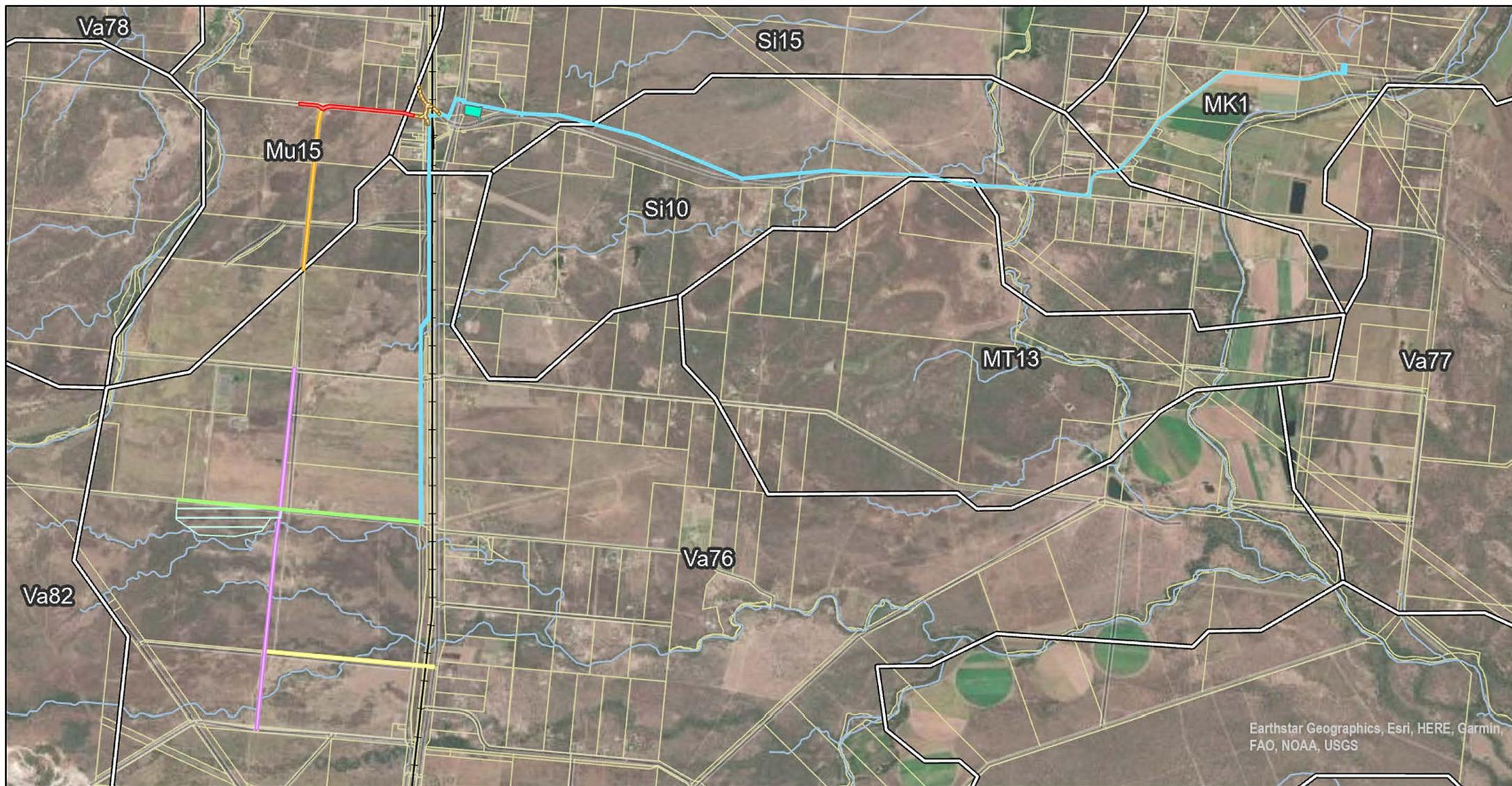
- Qa-QLD (Qa)
- Qas-QLD (Qas)
- Qf-QLD (Qf)
- Qha-QLD (Qha)
- Qr-QLD (Qr)
- Surgeons Lookout Rhyolite? (CPis?)



Date: 6/03/2023
Author: EMH



DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

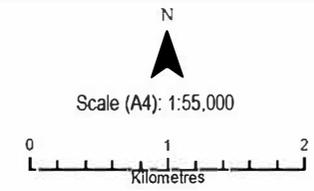


Earthstar Geographics, Esri, HERE, Garmin, FAO, NOAA, USGS

Figure 1-4 Landscape Units

Legend

- | | | |
|--|---------------------------------------|---|
| Jones Road Intersection Upgrade | Bidwilli Road | Rail Network |
| Jones Road to Flinders Highway Upgrade | Unnamed Road | Existing Roads |
| No Name Road (north) | Water Infrastructure Network | Watercourse |
| No Name Road (south) | Storage Dam and Internal Pump Station | Cadastre (DCDB) |
| | Site Laydown Area | Atlas of Australian soils Queensland 2M |



Date: 6/03/2023
 Author: EMH
 DISCLAIMER
 CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

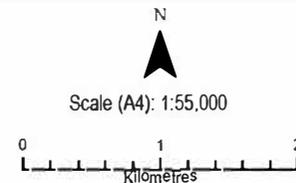




Figure 1-5 Project Area Soils Mapping

Legend

- | | | |
|--|---------------------------------------|-----------------|
| Jones Road Intersection Upgrade | Bidwilli Road | Rail Network |
| Jones Road to Flinders Highway Upgrade | Unnamed Road | Existing Roads |
| No Name Road (north) | Water Infrastructure Network | Watercourse |
| No Name Road (south) | Storage Dam and Internal Pump Station | Cadastre (DCDB) |
| Site Laydown Area | SODOSOLS | |



Date: 6/03/2023
 Author: EMH
 DISCLAIMER
 CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



1.6 Statutory Considerations

The following legislation, both Commonwealth and State level, is relevant to the regulatory approval of the Project. On 7 March 2023, the LEIP was declared a prescribed project by the Minister for State Development, Infrastructure, Local Government and Planning. Such declaration will provide TCC with additional State Government support in the delivery of the LEIP.

1.6.1 Commonwealth Legislation

1.6.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined in the EPBC Act as matters of national environmental significance (MNES).

Protected matters under the EPBC Act are:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (Ramsar wetlands);
- Nationally threatened species and ecological communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas;
- Great Barrier Reef Marine Park;
- Nuclear actions; and
- A water resource in relation to coal seam gas and large coal mining development.

Proponents may refer projects to the Australian Government Minister for the Environment (the Minister) for a determination on whether their project is a controlled action or not a controlled action. If the action described in the referral is deemed to be a controlled action, then it is likely to have the potential for a significant impact on MNES and an assessment process must be undertaken in accordance with the decision from the Minister.

Where significant impacts to MNES are deemed likely to occur and are unavoidable, a project proponent may be required to compensate by providing environmental offsets in accordance with the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012a).

The EPBC referral was submitted to DCCEEW on 23 November 2022. On 22 December 2022, a delegate of the Minister for the Environment determined the Project a controlled action under the EPBC Act and will be assessed by Preliminary Documentation (EPBC 2022/09383). The controlling provisions were determined to be listed threatened species and communities (sections 18 and 18A).

1.6.1.2 Matters of National Environmental Significance: Significant Impact Guidelines 1.1 – EPBC Act

The Significant Impact Guidelines 1.1 are provided under the EPBC Act and are required where an action has, will have, or is likely to have a significant impact on a matter of national environmental significance. The Significant Impact Guidelines 1.1 provide a 'self-assessment' process using detailed criteria for conservation categories (i.e., Endangered/Critically Endangered and Vulnerable species and Threatened Ecological Communities) to assist in determining whether a referral is required to be submitted to the Australian Government Department of the Environment (DoE) for a decision by the Minister on whether assessment and approval is required under the EPBC Act.

1.6.1.3 Native Title Act 1993

The Commonwealth *Native Title Act 1993* (NT Act) recognises the rights and interests of Indigenous peoples in respect of land on which they historically resided and regulates the conduct of ‘future acts’, including development. The Commonwealth NT Act includes requirements for native title party notification and consultation, where a proponent seeks to undertake a ‘future act’.

1.6.2 State and Local Legislation

1.6.2.1 Aboriginal Cultural Heritage Act 2003

The *Aboriginal Cultural Heritage Act 2003* (ACHA) is the primary piece of legislating governing the protection of Aboriginal Cultural Heritage in Queensland. The ACHA requires developers to identify reasonable and practicable measures for ensuring the activities are managed to avoid or minimise harm to Aboriginal cultural heritage in a way that meets the duty of care requirements under Section 23 of the ACHA.

The Cultural Heritage Duty of Care Guidelines (the Guidelines) provide guidance in determining whether a person or activity complies with the cultural heritage duty of care. The Guidelines recognise that it is unlikely that Aboriginal cultural heritage will be harmed where:

- The current or proposed activity in an area is in an areas previously subjected to significant ground disturbance and the activity will impact only on the area subject to the previous ground disturbance; or
- The impact of the current or proposed activity is unlikely to cause any additional harm to Aboriginal cultural heritage than has already occurred.

1.6.2.2 Biosecurity Act 2014

The *Biosecurity Act 2014* (Biosecurity Act) provides legislative measures to manage pests and weeds, diseases, and environmental contaminants, and to address the impacts they have on the economy, environment, agriculture, tourism, and society.

The Act provides statutory powers to prohibit or restrict the introduction and spread of plant and animal pests to and within Queensland. Restricted matter is listed in the Act and includes a range of invasive plants that are present in Queensland. These invasive plants are having significant adverse impacts in Queensland, and it is desirable to manage them and prevent their spread, thereby protecting un-infested parts of the State. The Act requires everyone to take all reasonable and practical measures to minimise the biosecurity risks associated with invasive plants and animals under their control. This is called a general biosecurity obligation (GBO).

Weeds and pests pose one of the most significant threats to environmental values and agriculture within the Project area and broader region. Accordingly, appropriate management measures will be implemented to restrict the introduction and/or spread of weed species as a means of protecting the values of the surrounding country.

1.6.2.3 Environmental Offsets Act 2014

The *Environmental Offsets Act 2014* (EO Act) (QLD), Environmental Offsets Regulation 2014 and the Queensland Government Environmental Offsets Policy 2014 provides a streamlined framework for environmental offset requirements. Offsets are required where there is an unavoidable impact on significant Environmental Values (EVs). In addition, an environmental offset can only be required if impacts from a prescribed activity constitutes a significant residual impact as identified through the following guidelines:

- The State guideline that provides guidance on what constitutes a significant residual impact of Matters of State Environmental Significance (MSES);
- The Commonwealth Significant Impact Guidelines for what constitutes a significant residual impact on MNES; and
- Any relevant local government significant impact guidelines for Matters of Local Environment Significance (MLES).

To avoid duplication with offsets required under the Commonwealth's EPBC Act Environmental Offsets Policy 2012, the policy provides that the administering agency must consider other relevant offset conditions which apply for the same, or substantially the same prescribed impact. If duplicate conditions are imposed, it allows the proponent to remove the duplication.

To determine ether the Project will result in a significant impact to flora and fauna species, residual impacts to MSES have been assessed and are discussed in Table 4-25 and Section 4.4.5.

1.6.2.4 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) provides the key legislative framework for environmental management and protection in Queensland. The objective of the EP Act is to: 'Protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains ecological processes on which life depends' (s 3.) Under the EP Act, every person must comply with the general environmental duty that stipulates: 'A person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm (the general environmental duty)' (s 319). The Act also obliges the duty of persons to notify the administering authority where they suspect an event has happened that causes or threatens serious or material environmental harm.

Desktop and field assessments have validated the presence and extent of Regional Ecosystems (REs) present within the Project area, presence of listed threatened flora and fauna species under the *Nature Conservation Act 1999* and suitable habitats. The assessments identified numerous waterways for waterway barrier works (WWBW) intersect the Project area, particularly along No Name Road (south) and the water infrastructure alignment. Management measures have been constructed to minimise the impacts to intersected WWBW and listed threatened species.

1.6.2.5 Fisheries Act 1994

The *Fisheries Act 1994* (Fisheries Act) provides for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to:

- Apply and balance the principles of ecologically sustainable development; and
- Promote ecologically sustainable development.

The Fisheries Act provides a framework for the sustainable management and conservation of Queensland's fisheries resources, recognising the importance of these resources to the state's economy and environment and further seeks to ensure their long-term viability for the benefit of all stakeholders.

1.6.2.6 Nature Conservation Act 1992

The objective of the *Nature Conservation Act 1992* (NC Act) is the conservation of nature while allowing for the involvement of indigenous people in the management of protected areas in which they have an interest under Aboriginal tradition or island custom.

In the context of the Project the NC Act provides for protection and management of native wildlife and habitat that supports native species with particular regard to:

- Administering the clearing of plants protected under the NC Act;
- Managing activities that may cause disturbance (that is tamper, damage, destroy, mark, move or dig up) to animal breeding places; and
- Managing the taking of native flora and fauna.

Subordinate regulation lists protected species and areas to which the regulatory provisions of the NC Act apply, namely the Nature Conservation (Animals) Regulation 2020: this regulation lists terrestrial and aquatic plant and animal species presumed extinct, endangered, vulnerable, near threatened, least concern, international or prohibited. It recommends management objectives or the protection and maintenance if these species in Queensland, as appropriate.

The field surveys conducted for the Project have included habitat assessments and identification of flora and fauna. Information gathered during the surveys has been used to determine species likelihood of occurrence within the Project area and habitat mapping assessments have been prepared to understand the potential impact to fauna foraging, breeding and roosting places within the Project area.

1.6.2.7 Planning Act 2016

The *Planning Act 2016* (Planning Act) is Queensland's principal planning legislation and comprises three main elements: plan making, development assessment and dispute resolution. The aim of the Planning Act is to provide a planning system that enables responsible development and delivers prosperity, sustainability and liveability.

The State Planning Policy (SPP) is a statutory instrument prepared under the Planning Act that relates to matters of State interest. The SPP applies to a range of circumstances under the Planning Act, including for development assessment and when proposed new planning schemes are made or amended. The SPP is applicable to assessable development within Queensland. The provisions of the SPP may also be considered under the standard criteria of the EP Act which includes ecological MSES including Biodiversity – Matters of State Environmental Significance (MSES) - Regulated vegetation and Regulated vegetation (intersecting a watercourse) and waterway barriers.

1.6.2.8 Queensland Heritage Act 1992

The Queensland Heritage Act 1992 (QLD Heritage Act) provides for the identification, protection and conservation of places and objects of cultural significance in Queensland. The QLD Heritage Act aims to ensure that Queensland's cultural heritage resources are preserved for future generations including the protection and management of heritage places and objects. Under the QLD Heritage Act, approval is required when alteration or demolition of a heritage place is proposed.

Desktop and field assessments have been undertaken to identify the potential presence of QLD heritage places within the Project area.

1.6.2.9 Vegetation Management Act 1999

The Vegetation Management Act 1999 (VM Act) regulates the conservation and management of vegetation communities, providing protection for the following:

- Regional Ecosystems (REs) classified as 'endangered' or 'of concern' (including remnant and high-value regrowth);
- REs classified as 'least concern' associated with mapped waterways;
- Management of category, A, B, C, R and X areas;
- Mapped 'essential habitat' for threatened flora and fauna species listed under the NC Act; and
- Specific wetlands as mapped under the VM Act.

A Relevant Purpose determination under Section 22A of the *Vegetation Management Act 1999* has been submitted for the clearing of native vegetation within the Project area.

1.6.2.10 Water Act 2000

The *Water Act 2000* provides a framework for the planning and regulation of the use and control of water in Queensland, including regulating both major water impoundments (i.e., dams, weirs, and barrages) and extraction by pumping for irrigation and other uses. This Act provides a wide range of tools for the regulation of in-stream (i.e., watercourses, lakes, and springs) and overland water flow and groundwater within the context of "sustainable management and efficient use" of water. The Act provides for Water Resource Plans, generally on a catchment-by-catchment basis, to be prepared through a consultative process. These plans are meant to balance water allocations (i.e., human use) with environmental flows (i.e., leaving water in a watercourse to maintain natural processes) (s46).

Water Use Plans may be prepared for areas at risk of land or water degradation, e.g., due to rising underground water levels, salinisation, deteriorating water quality, water logging of soils, destabilisation of the bed and banks of watercourses, damage to the riverine environment, or increasing soil erosion (s60). Land and Water Management Plans may also be submitted by individual landowners applying to irrigate their land (s73).

1.6.2.11 State Government Approvals

The Proponent and its design engineers has been in consultation with TMR and QR to obtain approval for relevant crossings and interactions.

A pre-lodgement meeting was held with SARA, refer to Appendix A for the pre-lodgement minutes. Approvals and permits will be obtained as required and in accordance with this advice.

Under Schedule 6, Part 3, Item 8 of the Queensland Planning Regulation 2017, operational work under a local categorising instrument is exempt if the work is undertaken by or for a public sector entity. As such operational work approvals for the roads and water infrastructure network under a local categorising instrument (planning scheme, temporary local planning instrument or a variation approval) will not be required as Council are considered a public sector entity.

TCC has submitted a relevant purpose determination application for clearing associated with the water infrastructure network (i.e., pipeline, pump station, raw water storage dam and onsite storage area). A relevant purpose determination is required before submitting a development application for operational works which involve clearing native vegetation.

Final designs are currently being reviewed to consider other potential approvals, including:

- Operational Works development approval for waterway barrier works (*Fisheries Act 1994*);
- Operational Works for the Taking or Interfering with Water (Water Licence) (*Water Act 2000* and the *Planning Act 2016*);
- Operational Work in a Wetland Protection Area (*Environmental Protection Act 1994* and *Planning Regulation 2017*); and
- Operational Work that is the Construction of a Dam (*Water Supply (Safety and Reliability) Act 2011* and *Planning Act 2016*).

Section 2 Description of the Action

2.1 Project Infrastructure

The Project design is at various stages of development, but the extent of works will be within the Project area, as shown in Figure 1-2 and other report figures. Information on the Project infrastructure is provided below.

PLEASE NOTE – Some minor amendment to Project design has occurred as part of the detailed design process, which has resulted in a very minor increase to the disturbance area, changing from 87.12 ha to now 87.58 ha. These minor amendments have been included as part of the Preliminary Documentation that was not previously included in the Referral area. These changes were discussed with DCCEEW officers who were notified of the minor amendments on 28/02/2023 who advised of its inclusion in the Action area for this preliminary documentation. These changes primarily involved:

- Minor increase related to the laydown area;
- Some minor realignments of the external pipeline;
- Amendment to Jones Road to Flinders Highway upgrade to better align with existing rail infrastructure;
- Minor increase related to the storage dam;
- Minor realignment of the No Name Road (South) Upgrade; and
- Decrease in width from 30 m to 20 m of the Bidwill Road and No Name Road (South) Upgrade.

2.1.1 Access Roads

2.1.1.1 Jones Road, to Flinders Highway Upgrade

Connecting Jones Road to Flinders Highway requires some modifications to existing roads and intersections with Old Flinders Highway, Glenn Road and Woodstock Avenue to accommodate heavy vehicle movements. These road alignments are located within existing road reserves that are subject to previous disturbance and ongoing road reserve maintenance activities such as slashing. The connection of Jones Rd to Flinders Highway will also traverse an existing level crossing for the Mt Isa Railway.

2.1.1.2 Jones Road Intersection Upgrade

The Jones Road Intersection with No Name Road (north) will be modified to facilitate heavy vehicle movements and change the priority of movements to No Name Road (north). This upgraded intersection will slightly extend beyond the eastern edge of No Name Road (north) road reserve. Jones Road will be upgraded to a 10 m wide pavement within the existing 30 m wide road reserve for an approximate length of 900 m to connect to Old Flinders Highway to accommodate heavy vehicle movements.

2.1.1.3 Closure of Existing Level Crossing

The proposed closure of the level crossings at Ghost Gum Road, Bidwilli Road and Manton Quarry Road are currently in discussion between the Queensland Department of Transport and Main Roads (TMR) and Queensland Rail (QR). The closure of these level crossings will be confirmed prior to commencement of nearby enabling infrastructure works. As part of the enabling infrastructure works there will be no change to land tenure, road reserves or road infrastructure directly adjacent the level crossings.

2.1.1.4 No Name Road (North) Upgrade

This section of No Name Road is approximately 1.7km in length, with a new 10 m wide pavement being constructed within an existing 20 m wide road reserve, designed to accommodate heavy vehicles. The road reserve for No Name

Road will be expanded to 30 m in width, with a 10 m wide land resumption of the western side of the existing road corridor to allow for drainage and other future essential services. The eastern side of the road corridor is proposed to have no formed drains allowing continuation of the existing overland flow over the existing land and crossing the new road via a series of culverts. The average annual daily traffic along Jones Road and No Name Road is forecast to ultimately be 2,340 vehicles per day, with 35% heavy vehicle usage. The design vehicle of this road is a Type 2 road train. Usage of the road has a growth rate of 1.4% linear as per the Queensland TMR advice.

2.1.1.5 No Name Road (South) Upgrade

No Name Road (south) runs between Ghost Gum Road and Manton Quarry Road. For the enabling infrastructure, No Name Road (south) will extend approximately 2.2 km from Bidwilli Road to Manton Quarry Road. The design for No Name Road (south) is not yet complete, however, this road will adopt the same cross section and details to the No Name Road (north) design discussed above. This road will be a new 10m wide road pavement designed to accommodate heavy vehicles within a new 30m road reserve.

2.1.1.6 Bidwilli Road

For the enabling infrastructure works some minor modifications for a short section of the existing unsealed road will be made to provide access to the internal pump station and storage dam and connect to No Name Road (south). The existing Bidwilli Road reserve is 20 m wide. The raw water pipeline aspect of the water infrastructure network will be installed within the Bidwilli Road reserve on the southern side. The northern side of the Bidwilli Road reserve will allow for a 4.25 m service corridor for future gas, water, telecommunications, shared electricity and an exclusion zone.

2.1.1.7 Unnamed Road

The Unnamed Road (the East-West road corridor north of Manton Quarry Road) is an existing road reserve of 20 m width. The design for Unnamed Road is not yet complete, however, this road will adopt the same cross section and details to the No Name Road design discussed above. The road will be a new 10 m wide road pavement designed to accommodate heavy vehicles. A 10 m wide easement will be added to the northern boundary of Unnamed Road to allow for drainage and other future essential services.

2.1.1.8 Flinders Highway Upgrade

Some shoulder widening of Flinders Highway is required to provide for extensions of acceleration and deceleration lanes and accommodate the turning movements for the predicted increase in heavy vehicles at the existing Glenn Rd / Flinders Highway / Woodstock Giru Road intersection. The shoulder widening works are contained within the existing Flinders Highway road reserve.

2.1.1.9 Creation of Easements

As part of the land allocation process to suit enabling infrastructure works, various additional easements will be created to accommodate future infrastructure in the following locations:

- A 45m wide easement on the western side of No Name Road (south) for future overhead power by others;
- A 10m wide easement on the northern side of Unnamed Road provides a 30 m wide road reserve for the second access road to LEIP; and
- A 20m wide easement within the southern side of the existing Ghost Gum Road reserve for future gas main by others.

2.1.2 Water Infrastructure Network

2.1.2.1 External Water Pipeline

Detailed design of the LEIP raw water supply pipeline is well progressed, having been issued for the purposes of a competitive tender process.

The proposed DN900 raw water pipeline will support the known and future proponents of the planned LEIP development with an ultimate design flow of approximately 950 litres per second.

The proposed water infrastructure network will connect to the existing Houghton pump station to Ross River Dam DN900 mild steel cement lined (MSCL) pipeline at the Major Creek Road and Haberecht Road intersection. The connection to the existing Ross River Dam pipeline occurs adjacent the Major Creek Road / Mountview Road / Haberec Road junction at Majors Creek. The pipeline travels west via the road reserves of Major Creek Road and into Woodstock Giru Road. The pipeline continues west along Woodstock Giru Road reserve, crossing the Flinders Highway and Mt Isa Railway at Woodstock, before continuing south along Woodstock Avenue road reserve until it reaches Bidwilli Road. The external pipeline then continues west along Bidwilli Road within the existing road reserve, terminating at the proposed storage dam where raw water is to be stored before supply through the internal water pipeline. A short portion of the water main is located within private land holdings and will require an easement.

The total length of the external water main is approximately 16.25 km, within a nominal 20 m construction corridor, with the pipeline typically 4.5 m from the nearest property boundary. The pipe material is predominantly DN900 GRP pipes and MSCL pipes for critical locations like the Flinders Highway and Mt Is Railway trenchless crossings. Reno mattresses for pipeline protection, erosion control and scour prevention are provided at various waterway crossing points along the external pipeline. Air, scour, pressure release and stop valves (including associated concrete structures) are provided at various locations along the external pipeline. Reinforced concrete thrust and anchor blocks with associated pads and pile footings will be installed at bends, valves and other select locations to restrain the pipeline from moving due to internal pressures.

2.1.2.2 Internal Water Pipeline

Once the raw water has been supplied to the storage dam, it will be supplied to all internal industrial proponents through a 3.8 km Ductile Iron Cement Lined (DACL) pipeline. The internal pipeline will be of various diameters, ranging from DN250 to DN500 to suit the water demand of each individual proponent. For the enabling infrastructure, the internal pipeline will be installed within the No Name Road existing and new road reserve from Ghost Gum Rd to Manton Quarry Rd. Design is currently at 70% detailed design status.

2.1.2.3 Storage Dam

The purpose of the raw water storage dam is to facilitate an uninterrupted supply of raw water to all industrial proponents within the LEIP development. The dam will be created with a 437 ML capacity to provide for the 14 days' supply, allowing Sunwater to undertake maintenance on their canals and waterways that provide the water supply to LEIP. This dam is being designed in accordance with the requirements for Queensland referable structures. The raw water storage dam is proposed immediately south of Bidwilli Road at the termination of the external pipeline, occupying a site area of approximately 26 ha. The dam will be excavated to provide a finished level approximately 6 m below the natural surface and an embankment of around 8 m above the natural surface level. The embankments are intended to be constructed using the excavated spoil (as far as practicable).

The storage dam will be of earth construction and will contain appropriate internal liners to prevent seepage. The design includes a geosynthetic liner system (i.e., a floating cover overlying a High Density Polyethylene (HDPE) primary liner which then overlies a conductive geotextile and cushion). The proposed design also incorporates a groundwater depressurization system and a spillway with greater than 100-year average rainfall recurrence interval capacity.

The external pipeline will fill the dam, with the pipeline discharging at a high level near the crest of the dam. Service vehicles will be able to travel around the complete perimeter of the dam at the crest, accessible by a ramp. The external

batters of the embankments will be topsoiled and grassed. The storage dam includes a security fence around the perimeter of the dam with the internal pump station within the same compound. Access to the storage dam will be via Bidwilli Road. Design is currently at 50% detailed design status.

2.1.2.4 Internal Pump Station

A new pump station is proposed immediately east of the storage dam, connecting the storage dam to the internal pipeline that will distribute the raw water to the various individual proponents within the LEIP. The pump station will be located adjacent to the storage dam on Lot 87 on plan RP911426, on the southern side of Bidwill Rd. The building structure will be a basic blockwork building with access provided from Bidwilli Rd.

The pump station design includes, inter alia, electrical supply to site for the pump sets, switchboard, lighting and onsite generator. The building will be supplied with an electrical ventilation system and air-conditioned room for the switchboard and electrical gear. The design has reached 30% detailed design status.

2.1.2.5 Site Laydown Area

An area of approximately 1.7 ha immediately north-east of the Flinders Highway and Woodstock Giru Road intersection (on Lot 130 on plan EP1764 (Reserve)) has been set aside for temporary use for contractor(s) site office and the temporary storage of pipe during construction.

At construction completion, all temporary infrastructure created during the enabling infrastructure works will be removed from the Site Laydown Area and the site will be rehabilitated.

2.2 Layout Plan

Key features of the Project are represented in Figure 2-1, including pipeline alignment and associating pump stations, access roads and the site laydown area.

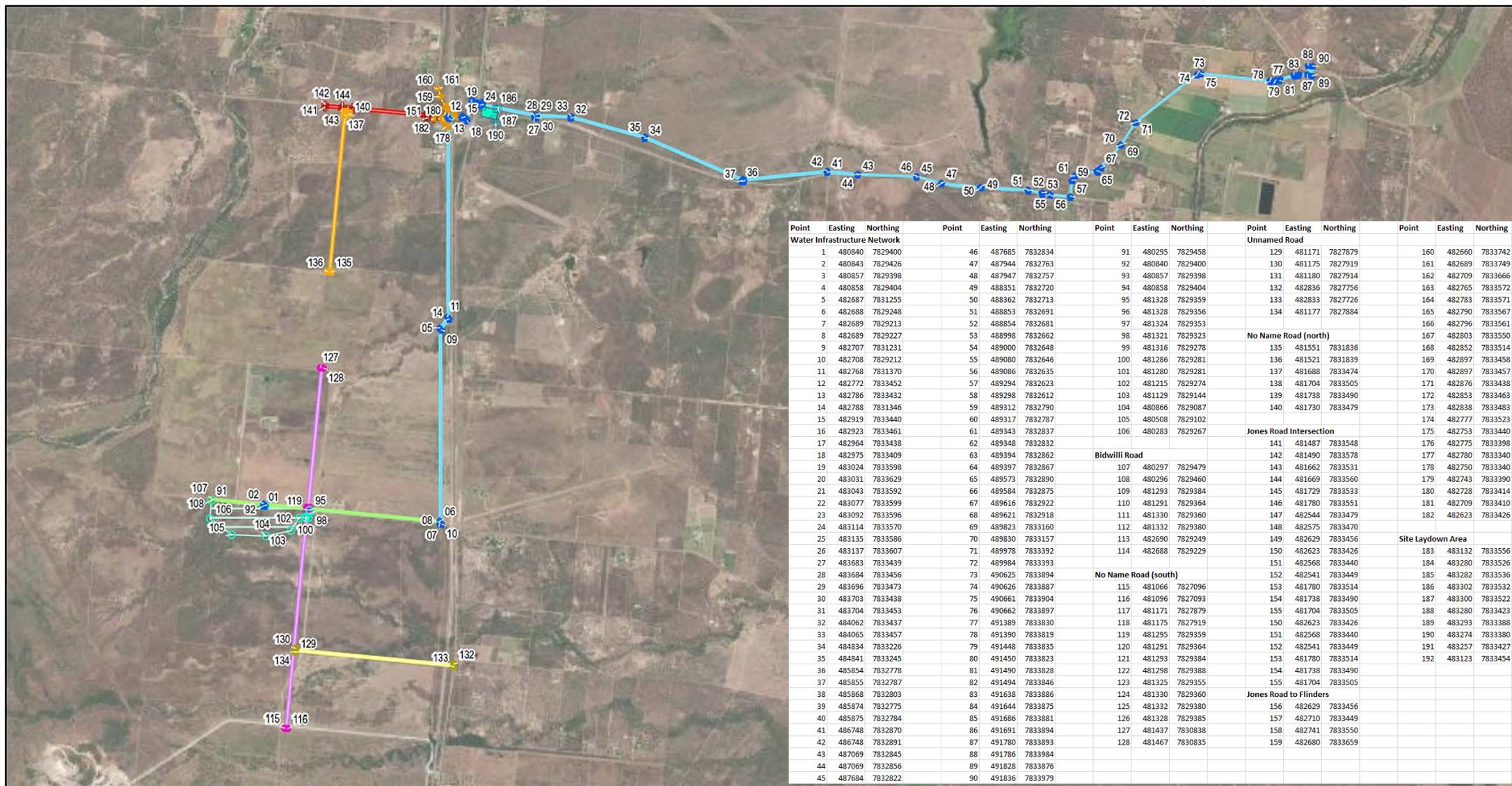


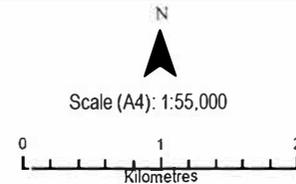
Figure 2-1 Layout Plan

Legend

- Jones Road Intersection Upgrade
- Unnamed Road
- Jones Road to Flinders Highway Upgrade
- Water Infrastructure Network
- No Name Road (north)
- Storage Dam and Internal Pump Station
- No Name Road (south)
- Site Laydown Area
- Bidwilli Road

XY Points

- ◆ Jones Road Intersection Upgrade
- Jones Road to Flinders Highway Upgrade
- No Name Road (north)
- No Name Road (south)
- ▲ Bidwilli Road
- Unnamed Road
- Storage Dam and Internal Pump Station
- Site Laydown Area



GDA 1994 MGA Zone 55



Date: 14/03/2023
Author: EMH

DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



2.3 Disturbance Footprints

The disturbance footprints are calculated as per Table 2-1. Disturbance footprints are the maximum expected clearing extent for the Project, which will total 87.58 ha. This is the disturbance required for the construction of the Project.

It is important to note that a temporary access road which was approved under EPBC 2022-09281 has been constructed. This overlaps with the Project area at Jones Road and No Name Road (north). As such the habitat mapping areas for species has not included the area for the temporary access road (EPBC 2022-09281) which totals approximately 3.88 ha. The project area for EPBC 2022-09281 is shown in Figure 2-2 below.

Table 2-1 Project Disturbance Footprints

Type of Area	Project Extent / Disturbance Area (ha)	Final Built Footprint (ha)
Water Infrastructure Network	27.05	0 ha
Storage Dam and Internal Pump Station	26.88	26.88
Site Laydown Area	1.78	0
Jones Road Intersection Upgrade	3.55	3.55
Bidwilli Road	4.80	4.80
No Name Road (north)	5.07	5.07
No Name Road (south)	11.23	11.23
Jones Road to Flinders Highway Upgrade	2.21	2.21
Unnamed Road	5.01	5.01
Total	87.58	58.75



Figure 2-2 EPBC 2022-09281 Project Area

2.4 Project Design and Impact Avoidance

The Project is a critical component to allow proponents in the precinct to have the confidence to invest, develop their own projects and commence construction and operate. Alternative project alignments and locations were considered during the project concept design phase. The current alignments were considered the most feasible (and only) options because:

- The majority of the disturbance footprint is located in previously disturbed existing formed road reserves or in gazetted road reserves;
- The Project will tie in with works in the Flinders Highway proposed to be completed by the TMR;
- The Project will allow future connection with the nearby Houghton pipeline project;
- There are various fixed constraints on the design due to other key infrastructure, such as necessary connection to the Ross River Dam pipeline, presence of Flinders Highway and Mt Isa Railway; and
- Other entrances/exits located off the Flinders Highway into the LEIP pose significant manoeuvrability and safety constraints for larger vehicles.

Attempts to avoid areas of ecological significance along Woodstock-Giru Road were made during detailed design. This included attempting to avoid areas of mapped vegetation and the Serpentine Lagoon by moving pipeline of the water infrastructure network closer to Woodstock-Giru Road. However, at the direction of TMR, the preference was for the alignment to remain in its current location, due to the potential for future road upgrades. This meant that the alignment could not be moved closer to the Woodstock-Giru road and could not reduce fragmentation associated with clearing of remnant vegetation and with Serpentine Lagoon.

As part of a referral variation request submitted to DCCEEW on 1 December 2022 and on 13 December 2022, the Project footprint as part of design refinements was updated to avoid disturbance to a farm dam located at the Jones Road Intersection Upgrade. This amendment is expected to avoid potential impacts to MNES threatened species. The existing farm dam provides habitat for some threatened species which have been recorded at this location. The removal of the exaggerated 'curve' as part of the previous design and the straightening of the intersection as well as the decreased width of the road alignment lessens environmental impacts including, directly reducing impacts on threatened species habitat and associated impacts such as clearing vegetation.

2.5 Project Timing

The Project lifecycle consists of clearing and establishment works, construction, initial rehabilitation, commissioning, operation and final rehabilitation. Initial rehabilitation of works of a temporary nature will occur as sections are completed while final rehabilitation will occur once operational (refer to Section 6.1 for the rehabilitation activities).

The operation and maintenance period will be ongoing for the life of the infrastructure.

The Project timeframes related to the initial stages of the Project are presented in

Section 2 Description of the Action

Table 2-2. The operations period for the Project is for a proposed +50 years.

The indicative construction start and end dates below are subject to timely EPBC approval, with an estimated completion date of all enabling infrastructure works by mid-December 2024.

Table 2-2 Project Timing

Phase	Indicative Construction Start	Indicative Construction End	Estimated Direct Full Time Equivalent (FTE) Jobs
Access Roads			
Jones Road to Flinders Highway Upgrade	March 2024	November 2024	30 FTE
Jones Road Intersection Upgrade	March 2024	November 2024	30 FTE
No Name Road (North) Upgrade (<i>previously approved</i>)	November 2022	June 2023	20 FTE
No Name Road (South) Upgrade	April 2024	December 2024	50 FTE
Bidwilli Road – included in Water Infrastructure Works	N/A	N/A	N/A
Unnamed Road	April 2024	December 2024	50 FTE
Flinders Highway Upgrade	September 2023	February 2024	30 FTE
Water Infrastructure Works			
External water pipeline	November 2023	December 2024	190 FTE
Internal water pipeline	February 2024	September 2024	40 FTE
Storage dam	November 2023	December 2024	60 FTE
Internal pump station	April 2024	November 2024	10 FTE
Site Laydown Area	November 2023	February 2024	10 FTE

2.6 Project Construction

The construction of the Project will involve the following key steps:

- Site Preparation, clearing and grubbing of vegetation, and grading of the Project area to prepare a construction working area for the site laydown area, pipelines, access roads, pump station and storage dam;
- Separating and stockpiling topsoil and subsoil to protect and preserve for later reuse;
- Excavation of a trench for the pipelines using trenching machines and conventional open cut trench methods;
- Trenchless installation of pipeline by pipe ramming or micro-tunnelling will be used underneath the rail corridor and State-controlled roads;
- Lowering the pipeline into the trench and backfilling with excavated material and replacing topsoil;
- Typical road works construction for all access roads, including subgrade preparation, earthworks, drainage, pavement construction, sealing, line-marking and road furniture as required;
- Testing and commissioning of new infrastructure; and
- Decommissioning of the construction site including rehabilitation of non-operational areas including the infrastructure network and laydown area.

TCC has awarded a construction contract to perform special field tasks including ground soil testing, construction and restoration of the construction site. Construction of the Project is expected to commence by mid-August 2023 and is estimated to be completed by mid-December 2024.

2.6.1 Workforce and Hours

The actual construction workforce will be defined by the various construction contractors. The works are expected to occur six days a week during daylight hours.

The following meeting schedule (Table 2-3) has been developed to ensure clear and regular communication between all Project stakeholders and key subcontractors.

Table 2-3 Communications

Meeting	Interval	Typical Agenda	Attendees
Coordination Meeting (CM)	Daily	Activities including: <ul style="list-style-type: none"> ▪ Access; ▪ Interfaces; ▪ Deliveries; and ▪ Induction requirements. 	Project engineers, site engineers and supervisors
Team Meeting (TM)	Weekly – Tuesdays	Activities including: <ul style="list-style-type: none"> ▪ Contract deliveries; ▪ Procurement; ▪ Major subcontractors; ▪ Program: 4 week lookahead program; and ▪ Resources including plant, materials and labour. 	Project manager, Project engineers, site engineers and supervisors
Safety Meeting (SM)	Weekly – Tuesdays	Activities including: <ul style="list-style-type: none"> ▪ Results of audits and inspections; ▪ Tool box talks; ▪ Recent incidents; ▪ Training; ▪ Upcoming work tasks – safety planning; ▪ Upcoming audits; and ▪ Stakeholder issues. 	Project manager, Project engineers, site engineers, supervisors, safety officer and key subcontractor representatives

2.6.2 Plant and Equipment

The Project will require a number of specialist plant and equipment, which will be mobilised to site, including:

- Backhoe;
- Bobcat;
- Body truck;
- Bulldozer;
- Compactors/Rollers (appropriately sized);
- Concrete mixer truck;
- Dump truck;
- Excavator;
- Front loader;
- Grader;
- Asphalt / bitumen paver;
- Specialised pie jacking or micro-tunnelling equipment;

- Stabiliser (for insitu lime stabilisation); and
- Water truck.

Based on the conditions encountered in the bores and pits along the pipeline, it is estimated that bulk excavation of the clays and sands may be undertaken by medium-sized excavators, such as 16 tonne or 20 tonne (or larger). With respect to the cobble-rich soils encountered within the storage dam and western borrow area, for preliminary information only, it is likely that ripping by D8 or larger dozer would be required.

The construction contractors will implement a plant and equipment management core operating procedure (COP) to ensure that all mobile powered plant and equipment used on the Project are to undergo the following inspections and tests:

- Plant risks assessment prior to mobilisation on site;
- Plant daily inspection prior to commencement of work each shift;
- Manufacturers or suppliers requirements;
- Health and safety inspections on audit requirements; and
- Daily, weekly and monthly plant and equipment inspections.

Plant that has exceeded its service or maintenance schedules will be stood down until service and maintenance requirements have been met. Pre-site plant inspections will be conducted prior to any plant arriving on site. The project representative will undertake regular checks to verify that these procedures are occurring correctly. All owners and operators of plant used on the site are required to conduct a daily pre-start inspection.

Any issues identified in the plant inspections must be rectified as soon as practicable.

2.6.3 Construction Methodology

2.6.3.1 Site Laydown Area

The site laydown area will need to be cleared of hazardous combustible vegetation and/or appropriate measures shall be undertaken by the contractor to minimise the risk of fire damage. The site needs to be made sufficiently level to ensure pipes can be safely stacked, avoiding rolling or pipe displacement due to uneven terrain. Other requirements will be made as per the following management plans:

- Construction Environmental Management Plan (CEMP) (provided in Appendix M);
- Weed and Pest Management Plan (WPMP) (provided in Appendix N);
- Bushfire Management Plan (BMP) (provided in Appendix O); and
- Matters of National Environmental Significance Management Plan (MNESMP) (provided in Appendix P).

To facilitate construction, pipes will be strung along the pipeline trench, stored at least 2 m away from the side of a trench.

2.6.3.2 Road Construction

Various access roads will need to be constructed and/or upgraded to facilitate access to the LEIP. Construction methodologies for all access roads are as follows:

- Road construction for the LEIP is predominantly located within road reserves;
- The construction contractor will engage a licenced surveyor to carry out field surveys as soon as the possession of the site is granted;
- Resident access surrounding the site boundary will be maintained, and traffic will be able to travel Jones Rd at all times and a shuttle flow will be maintained when working on Jones Road;

- The construction contractor will address any requirement of tree protection zones for retained trees and the protection zone will be established for the duration of the Project;
- Site clearing for road construction will be restricted to the work area only and any green vegetation cleared is to be disposed off-site. Care will be taken to ensure that no damage is caused to any tree trunks, roots, canopy or branches during construction;
- All earthworks will be conducted in accordance with relevant standards;
- All drainage works will commence after insitu lime stabilisations and embankment works are completed. All concrete base slabs and end structures will be built to TMR standard drawing requirements;
- Roadworks / pavement layer construction will be conducted in accordance with relevant standards;
- Manual traffic controllers will be engaged whilst line marking is conducted, and street furniture on post will be installed as required;
- Handover documentation and asset capturing processes will be conducted by a licenced surveyor and will be provided to TCC. During this process, the construction contractor will collate and ensure that an up to date 'as constructed' record of the works during construction is progressively prepared and maintained. As constructed' survey data is to include:
 - All subbase base layers;
 - Roads;
 - Culverts;
 - Electrical conduits;
 - Pits;
 - Footings;
 - Structural details;
 - Landscaping;
 - Pathways;
 - Drainage structures; and
 - Stormwater drains.

2.6.3.3 Transfer and Distribution Mains Construction

2.6.3.3.1 Clearing and Site Preparation

The clearing of the Project site will be limited to the areas required within the construction corridor to minimise disturbance to the surrounding environment. The site preparation including clearing, and grubbing is to be completed in accordance with the TMR Road Technical Specification MRTS04.

Construction contractors will engage a licenced surveyor to carry out field surveys as soon as possession of the site is granted to provide demarcation of the construction site and no-go zones.

2.6.3.3.2 Excavation Method

From commencement of excavation, trenches shall be maintained in stable condition with shoring boxes or stepped excavations to prevent movement or collapse of side walls. The length of trench open at any one time shall be minimised. All pipe embedment material will be imported and wrapped in geotextile material, with spoil disposed offsite to an approved landfill site, identified by the contractor. Geotechnical inspections will be undertaken during construction to confirm the applicability of batter slope angles, trench and bedding conditions.

Where required, excavations shall be dewatered and kept free of water to maintain the stability of the surrounding soil and to provide suitable working conditions until the pipeline has been installed and embedment and fill materials placed and compacted to a sufficient height, to prevent flotation of the pipeline. Groundwater shall be kept below the bottom of the cut to prevent wash-out or sloughing of exposed walls. Where sloughing occurs, the resulting loose materials shall be removed so that it cannot interfere with the placement and compaction process. Water removed by the dewatering process shall be disposed of in accordance with the relevant environmental protection requirements as stated in the CEMP (Appendix M).

Additional excavation shall be undertaken for:

- Thrust and anchor blocks, to longitudinally restrain pressure pipelines from internal pressure thrust;
- Bulkheads, to longitudinally restrain pipelines from slippage on steep slopes; and
- Concrete pads, to support heavier structures such as valves.

2.6.3.3.3 Water Pipeline Construction Corridor

It is anticipated that all construction activities will be undertaken in road reserves in rural locations during daytime hours. Typical mitigation methods for noise, vibration and air quality will need to be implemented during construction. Where possible, construction will be contained to public property and road reserve, however, the external watermain will have construction within private property and allocation of an easement of the transfer main in sections. Due to the majority of alignment works falling within road reserves, traffic impacts will need to be managed in conjunction with TMR and TCC as required. Where possible given the rural location, single lane access with traffic control adjacent to work sites should be provided as a worst case to maintain vehicle and emergency service access.

2.6.3.3.4 Waterway Crossing Methods

Open excavation will be used for waterway crossings. Temporary water diversion may be required, and water will have to be pumped out of the trench. Reno mattresses are to be installed to protect the pipe, reinstate the natural surface over the excavated and backfilled pipe trench, handle higher water velocities and scour protection along water bodies.

The external water pipeline will be crossing waterbodies along the following chainages:

- Between CH 3770 and CH 3800 – Refer to drawing 2372 of Appendix C;
- Between CH 6020 and CH 6100 – Refer to drawing 2373 of Appendix C;
- Between CH 6200 and CH 6320 – Refer to drawing 2374 of Appendix C;
- Between CH 8560 and CH 8680 – Refer to drawing 2375 of Appendix C;
- Between CH 8920 and CH 9020 – Refer to drawing 2376 of Appendix C;
- Between CH 10480 and CH 10580 – Refer to drawing 2377 of Appendix C; and
- Between CH 12280 and CH 12340 – Refer to drawing 2378 of Appendix C.

2.6.3.3.5 Road and Rail Crossing

The pipeline crossing of Flinders Highway will be by trenchless means, proposed to be micro-tunnelling or pipe ramming if feasible. The TMR's Technical Note 163 guidelines, and specifically Section 5.4 of the document, are adopted. A welded mild steel enveloper with wall thickness to be confirmed by the tunnelling contractor will be installed with a minimum cover of 1200 mm relative to the edge of the pavement. In addition to the abovementioned document, reference is also made to TMR's MRTS141 Micro-tunnelling and Pipe Jacking document. Backfill of the launch and receival pits will be in uniform layers of 150mm of compacted earth to a level of 150mm below surface with the top 150mm filled with topsoil.

The pipelines crossing of the QR railway will be by trenchless means. QR's MD-20-173 Specification (replacing CIVIL-SR-016) are adopted. The pipeline will be installed in a MSCL enveloper pipe and pass through the QR reserve in a straight line at 90 degrees (+5 degrees). As the carrier pipe is greater than 450mm, pipe ramming of the pipeline will be

undertaken. The steel carrier pipe shall be protected against corrosion in accordance with AS 2885.1 or AS 4645.2, as applicable. Alternatively, a GRP carrier pipe will be considered.

The minimum cover over the enveloper pipe exceeds 2m, designed in accordance with AS5100.

Consultation has been conducted and is continuing with TMR and QR to obtain approval for the relevant crossings.

2.6.3.3.6 Wetland Construction Methods

Open trenching of Serpentine Lagoon is proposed as illustrated by the following drawings:

- Drawing 2310 of Appendix C;
- Drawing 2360 of Appendix C; and
- Drawing 2372 of Appendix C.

The CEMP includes further measures regarding construction in the Serpentine Lagoon, refer to Appendix M.

The construction corridor across Serpentine Lagoon will be from the fence line to the headwall along Woodstock Giru Road. Two boreholes were drilled, one on each side of the wetland in the verge of Woodstock Giru Rd, i.e., BH107 and BH108. Firmer stronger clay to 2 m depth over hard residual borderline sandy clay / clayey sand to depths of 7 m and 5.2 m respectively were encountered.

A Fauna and Flora spotter will inspect the area to identify any habitat of concern and recommend mitigation measures to be undertaken to minimise the ecological impact. The pipeline will have a minimum of 1m cover under the bed.

The pipeline embedment material will be wrapped in geotextile material, with the pipeline protected against flowing water and erosion by the inclusion of a reno mattress of 300 mm thickness, anchored into the soil at a minimum of 1.5 m. A 300 mm thick overlay of native topsoil will be spread over the reno mattress to allow natural establishment of the wetland. No bends will be installed under the crossing to avoid construction of concrete thrust and anchor blocks.

Construction vehicle movement (Right of Way or ROW) will be limited, and all waste and spoil will be discarded away from the wetland. The disturbance level will be kept to a minimum with construction ROW limited between the property fence line to the road.

ROW clearance and operation:

- Limit the reno mattress to the area as shown on the design drawings;
- Limit construction equipment operating in wetland areas to that needed to clear the construction right of way (refer to Figure 2-3), dig the trench, install the pipeline, backfill the trench, and restore the construction right of-way;
- Cut vegetation just above ground level, leaving existing root systems in place, and remove cuts from the wetland for disposal;
- Do not use rock or soil imported from outside the wetland, other than that needed for the embedment material and reno mattress construction;
- If standing water or saturated soils are present, or if construction equipment causes ruts or mixing of the topsoil and subsoil in wetlands, use low-ground-weight construction equipment, or operate normal equipment on prefabricated equipment mats, or terra mats;
- Do not cut trees outside of the approved construction work area to obtain timber for riprap or equipment mats;
- Remove all project-related material used to support equipment on the construction right of way upon completion of construction;
- Return all wetland banks to preconstruction contours or to a stable angle of repose as approved by the geotechnical engineer.

Section 2 Description of the Action

Temporary Sediment Control:

- Install sediment barriers across the entire construction right of way at all wetland crossings where necessary to prevent sediment flow into the wetland. Removable sediment barriers can be removed during actual construction, but must be re-installed after construction has stopped for the day and/or when heavy precipitation is imminent;
- Where wetlands are adjacent to the construction ROW and the ROW slopes toward the wetland, install sediment barriers along the edge of the ROW as necessary to contain spoil and prevent sediment flow into the wetland. These sediment barriers should be removed during the ROW clean-up following pipeline installation.

Trench Dewatering:

- Temporary groundwater monitoring bores were installed to 6m depth, with respective groundwater depths measured at 4.91 m and 5.18 m. With Serpentine Lagoon and other waterway works scheduled to be constructed during the dry season, groundwater pumping is not anticipated.
- If required, any flowing water will be collected in temporary berms and diverted around the construction area.
- Dewater the trench (either on or off the construction right of way) in a manner that does not cause erosion and does not result in heavily silt laden water flowing into any wetland. Remove the dewatering structures as soon as possible after the completion of dewatering activities.

Timeline

The works at Serpentine Lagoon will comprise of installing a water pipeline. The total estimated disturbance timeframe to complete this section of the pipeline is approximately 2 – 3 weeks, after which, the watercourse will be re-instated to natural water levels and there will be no ongoing impoundment or diversions. More specifically, the excavation, laying of the pipe and backfill activities are estimated to take 7 days. Similarly, it is estimated that the laying of reno mattresses, topsoil and revegetation activities will also take 7 days.

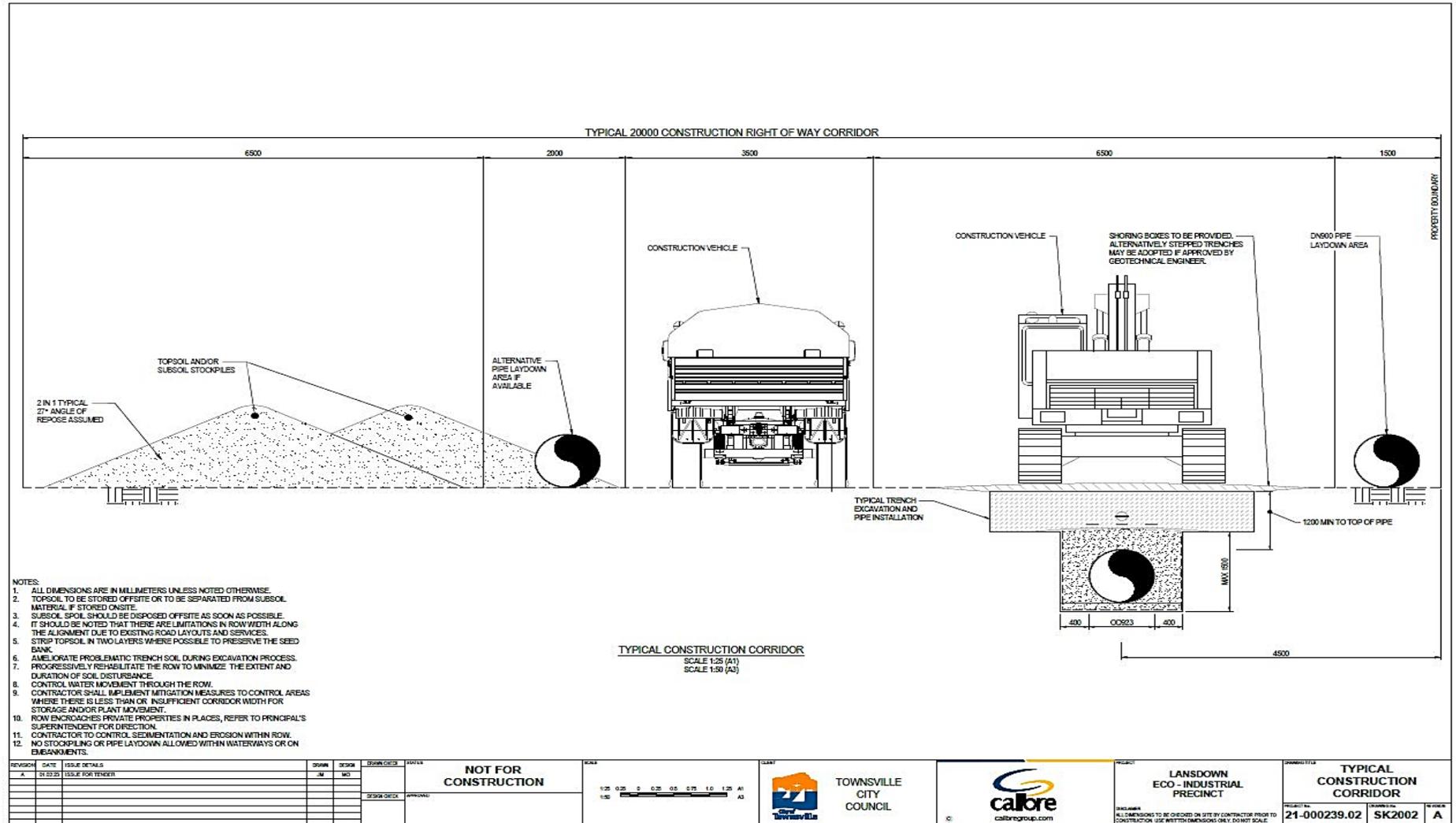


Figure 2-3 Typical Construction Corridor

2.6.3.4 Storage Dam Construction

A carriageway of 3 m width will be constructed around the entire perimeter of the storage dam. A grass blend mixture will be applied to external batters and the like.

Stormwater discharge from the external batters of the storage dam will flow naturally to the environment or existing watercourses (minor shaping of the subgrade up to a maximum of 5 m from the toe of the external batter shall occur so that water does not pond near the external embankment toe).

Geotechnical Slope Stability – An appropriate factor of safety will need to be achieved for all batters, principally against slope and foundation failure plus differential settlement.

- Earthworks cut batters 1V:3H.
- Earthworks fill batters 1V:3H.
- Bulk earthworks for the storage dam involve the following as a minimum:
 - Clearing and grubbing vegetation to waste (long term storage on site);
 - Stripping topsoil (assumed depth 150 mm) to temporary on-site stockpile for later re-use;
 - Cutting unsuitable material from the footprint of the storage dam and filling at a long-term onsite storage area or disposing off-site to an approved landfill site;
 - Cutting, filling and shaping the subgrade to achieve design levels and crossfalls followed by proof rolling to ensure that there are no soft spots;
- Constructing perimeter embankments comprised of general fill;
- Undertaking minor earthworks for contractor construction access involving constructing ramps and the like to enable vehicular access to the storage dam excavation;
- Undertaking earthworks to construct a long-term access ramp to the storage dam with gradient 1V:15H;
- Sourcing suitable clay materials from on-site or other embankment lining materials and using this material to construct a secondary liner;
- Using suitable clay materials to construct a key at the interface of natural soil and embankment fill placed to construct the perimeter embankments;
- Excavating and constructing anchor trenches in the crest of the storage dam;
- Shaping the subgrade around the perimeter of the storage dam to limit stormwater overland flows from accessing the cell during construction;
- Shaping the subgrade around the perimeter of the storage dam to ensure in the long term that stormwater and runoff from the external batters always flow away from the storage dam;
- Minor earthworks including cutting, filling, and shaping for the spillway and stilling basin; and
- Placing stored topsoil from temporary stockpile over external batters and disturbed areas prior to grassing.

2.6.3.5 Internal Pump Station Construction

The LEIP internal pump station will be constructed on already disturbed land as a result of the storage dam bulk earthworks. Unsuitable material from onsite cut and fill activities will be carted off site to an approved landfill site. A short bitumen access road from Bidwilli Rd to the pump station will be provided.

Detailed electrical, control and instrumentation design of the internal pump station is yet to be finalised. Telemetry and SCADA will be updated to provide communication between the LEIP internal pump station, storage dam, the existing Houghton pump station and TCC control room.

2.7 Traffic

The construction traffic associated with the Project is expected as follows:

- 478 vehicles/day (two-way movements). Vehicles predominantly originate from Townsville (North of the site) with materials being transported to site from the Port of Townsville;
- 175 vehicles/day during the AM Peak to the Project from Townsville;
- 163 vehicles/day of construction workers. Workers are anticipated to reside locally or in Townsville. Workers will either drive own vehicles to site with the potential to be transported by construction contractor buses.
- Construction vehicle sizes/types, expected to include:
 - B-double (26 m);
 - Semi-trailer (19 m);
 - MRV truck (12.5 m); and
 - Ute / van (5.2 m).

There is expected to be few operational vehicle movements to service the Project.

At the completion of enabling infrastructure works and completion of development by the initial proponents the LEIP is expected to generate 2,340 vehicles/day in 2025.

2.8 Commissioning

Following completion of site works all construction equipment will be demobilised. The Project infrastructure will undergo a testing and commissioning process.

Testing and commissioning of the pipeline shall be in accordance with AS/NZS 2566.2. Water used for flushing of the pipeline to remove debris and other contaminants shall be disposed of in accordance with the relevant environmental protection requirements.

2.9 Operation and Maintenance

Operation and maintenance requirements are expected to be minimal, and generally in accordance with TCC maintenance requirements and scheduling. When problems arise, corrective actions will be taken in accordance with TCC procedures.

Maintenance on pipelines will generally be required at air, scour, control and stop valve structures, and therefore needs to be inspected as part of an O&M program. Potential water infiltration into chambers due to rain and storm events needs to be pumped out manually at regular intervals. Any exposed pipework should be inspected and maintained against potential corrosion.

The operational and maintenance requirements for the Project is unlikely to generate an average of more than 2 vehicle movements per week.

The design life of the assets is +50 years. During this time, it is anticipated that a range of maintenance activities will be required at varying intervals. These maintenance activities include:

- Pump station maintenance will be typical of mechanical and electrical equipment and include:
 - Replacement of wearing parts; and
 - Preventative maintenance and routine statutory maintenance of electrical switchboards and cabling systems.

- Hardstands and access roads and tracks are provided at the pump stations for maintenance activities including removal of pump sets, motors and heavy items of plant using mobile cranes;
- Periodic cleaning of the river intake screens may be required to remove accumulated debris such as after seasonal flooding events;
- Maintenance activities for the pipeline may include the following:
 - Replacement of valves;
 - Maintenance of any access roads;
 - Operation of valves; and
 - General condition inspections.
- Maintenance of the access roads may include the following:
 - Regular slashing and weeding activities as required.
- Maintenance of the storage dam may include the following:
 - Regular inspection of fencing throughout the construction and operation phases, to check for any damage; and
 - If damage to fencing is observed, this is to be fixed by a suitably qualified person.

All operational and maintenance-based activities will be subject to a maintenance plan developed by TCC, typical of local authority water supply assets.

2.10 Future Works

Future works within the vicinity of the LEIP have been identified for future industrial development including Townsville Port and Townsville State Development Area. These areas are together referred to as the Townsville Southern Industrial Corridor. The Project will enable future development associated with the LEIP.

An Infrastructure Master Plan and Asset Infrastructure Plan has been prepared for the LEIP with the purpose of defining a pathway to enable the controlled and sustainable development. A copy of the Infrastructure Master Plan is available on TCC's website (<https://www.townsville.qld.gov.au/lansdown>).

The total potentially developable area of the LEIP is estimated at 1,627.6 ha as per the Infrastructure Master Plan. TCC is in discussions with a number of proponents including those mentioned in Section 1.1. The LEIP is located within the Townsville LGA which is regulated by the Townsville City Plan which sets out a vision for how Townsville should grow. The LEIP is partly located in the Lansdown high impact industry precinct which is a precinct which is included in the High Impact Industry Zone.

As part of the Master Plan, a preliminary aspiration master plan was done to address the physical constraints of the LEIP study area. The plan provides for the general layout of the LEIP showing the delineation of sub precincts and higher order elements. These sub-precincts are flexible and subject to the needs of industry as the LEIP expands. A copy of the aspiration master plan is shown in Figure 2-4 and provides an understanding of what types of uses may be undertaken in future years.

Known future works of other proponents within the area are as follows:

- Creation of overhead power, gas and other services in the easements;
- A possible second storage dam immediately adjacent the Enabling Works storage dam, subject to the water demands for future proponents;
- Future upgrades or extension of access roads to service future proponents; and

Section 2 Description of the Action

- Future upgrades of extension of internal water pipelines to service future proponents.

A staging plan for the LEIP has also been identified which will progress as the demand for future development by proponents progresses over the next 15 – 20 years. The stages are currently proposed, as per Section 1.1. As the staging and future development is occurring over such a long timeframe, the impacts on MNES and habitats from other proponents is unable to be accurately defined at this point in time. Such future development will need to consider impacts to MNES on a case-by-case basis with the support by TCC.

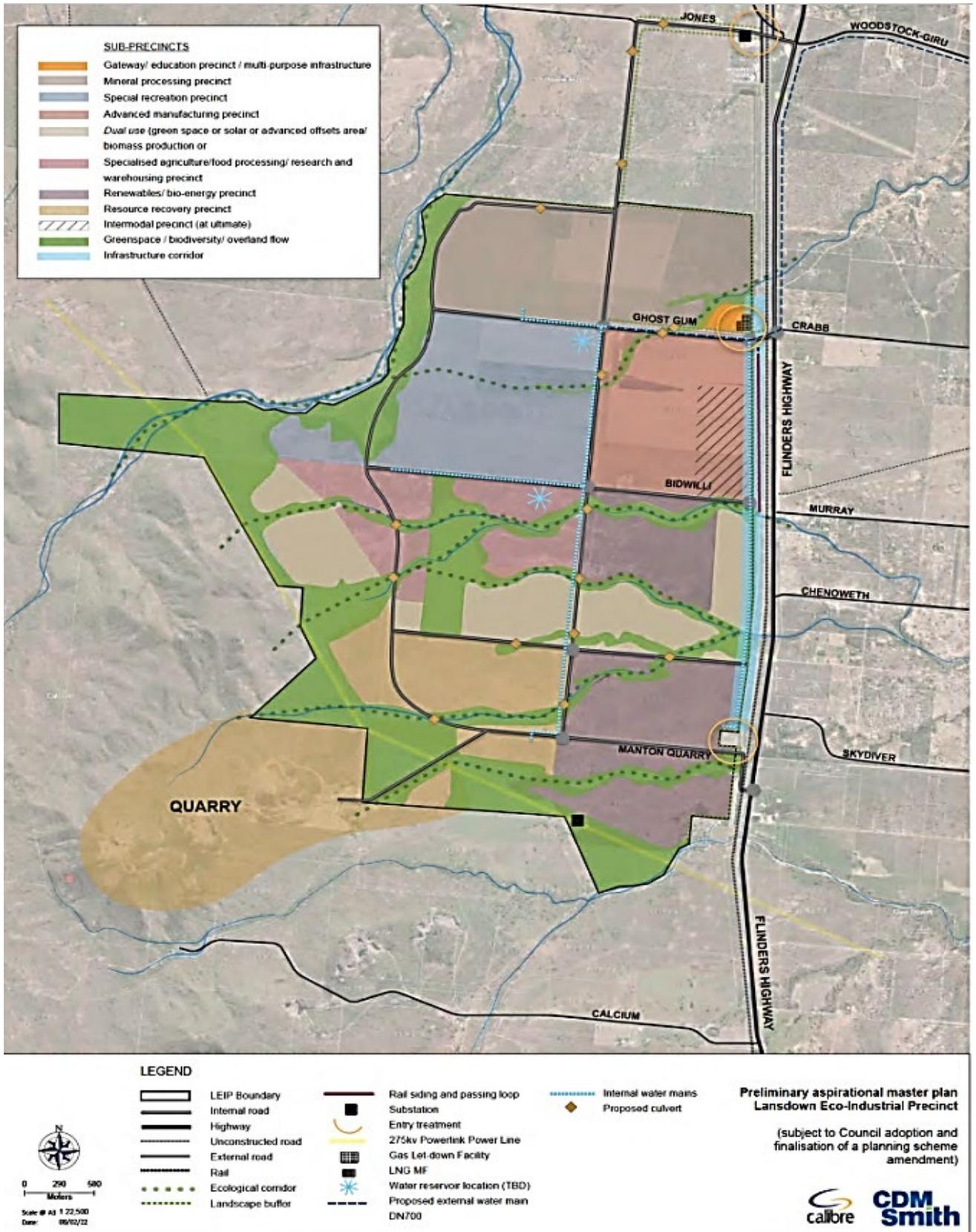


Figure 2-4 Constrained Preliminary Aspirational Master Plan (Calibre Professional Services Pty Ltd, 2022)

Section 3 Habitat Assessment

3.1 Methodology

3.1.1 Desktop Review

Desktop studies were undertaken prior to field assessments. The desktop review was used to obtain background information relating to the potential presence and distribution of species and ecological communities, specifically those listed under the VM Act, NC Act and EPBC Act. The desktop assessment was completed through evaluation of a range of information sources including:

- Commonwealth EPBC Act Protected Matters Search Tool (PMST);
- Commonwealth Species Profile and Threats Database (SPRAT) and associated conservation advice;
- Department of Environment and Science (DES) WildNet (Wildlife Online) database search results; and
- Atlas of Living Australia (ALA) database search results.

The EPBC Act PMST, while based on some species records, primarily relies on modelling of suitable habitats (with mapped boundary constraints accounted for) and is largely a predictive tool with associated caveats.

Wildlife Online database records are based on records of species from a wide variety of observers and although the records are generally accurate in terms of spatial location, not all records have been verified. The report area for the WildNet species list was a specified point at -19.605S, 146.85E, with a 100 km search radius to obtain conservation significant records within the broader region. All conservation significant species, all historical records and all record types were retrieved.

3.1.2 Field Surveys

Surveys for the Enabling Infrastructure were carried out by Evolve Environmental Solutions Pty Ltd (Evolve) which have been supplemented by surveys undertaken by EMM Consulting (EMM) as part of other nearby projects (refer to Appendix H for survey locations). This referral has primarily utilised survey and information from the Evolve surveys (refer to Section 3.1.2.1, Appendix D, Appendix E, Appendix F and Appendix G). Information from the EMM Survey was completed for the Access Road referral (EPBC 2022/09281) which overlaps with part of the Project.

3.1.2.1 Enabling Infrastructure Project Surveys (Evolve)

Five ecological surveys have been conducted by Evolve across the Project area and surrounds, including:

- From 28 March to 1 April 2022 (ecological survey findings on page 19 of Appendix D) (Evolve 2022a). This survey was focused on the water infrastructure network, water storage dam, Jones Road and No Name Road (north and south);
- From 22 to 27 May 2022 (ecological survey findings on page 16 of Appendix E) (Evolve 2022b). This survey was focused on the water infrastructure network, water storage dam, Jones Road and No Name Road (north and south);
- From 12 to 16 September 2022 (ecological survey findings on page 15 of Appendix F) (Evolve 2022c). This survey was focussed on the greater LEIP Masterplan area (separate project), however additional survey was undertaken for additional roads;
- From 10 to 14 October 2022 (ecological survey findings on page 15 of Appendix F) (Evolve 2022c). This survey was also focussed on the greater LEIP Masterplan area (separate project), however additional survey was undertaken for additional roads, including assessment of the Unnamed Road; and

- From 6 to 10 February 2023 (ecological survey findings on page 20 of Appendix G). This survey was focused on targeted fauna surveys, onsite flora assessments for MNES species and onsite fauna habitat assessments within the entire Project area.

A summary of project components and surveys undertaken by Evolve is provided in Table 3-1.

Table 3-1 Evolve Ecology Survey Coverage*

Component	28 March to 1 April 2022	22 and 27 May 2022	12 to 16 September 2022	10 to 14 October 2022	6 to 10 February 2023
Water Infrastructure Network					
Water Pipeline (including pump station)	Surveyed	Surveyed	Not Surveyed	Not Surveyed	Surveyed
Water Dam	Surveyed	Surveyed	Not Surveyed	Not Surveyed	Surveyed
Site Laydown Area	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed	Surveyed
Access Roads					
Jones Road, including Jones Road no named road	Surveyed	Surveyed	Surveyed	Not Surveyed	Surveyed
Jones Road to Flinders Highway Upgrade	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed	Surveyed
No Name Road (north) Upgrade	Surveyed	Surveyed	Not Surveyed	Not Surveyed	Surveyed
No Name Road (south) Upgrade	Not Surveyed	Surveyed	Surveyed	Surveyed	Surveyed
Bidwilli Road	Surveyed	Surveyed	Surveyed	Surveyed	Surveyed
Unnamed Road	Not Surveyed	Not Surveyed	Not Surveyed	Surveyed	Surveyed
Flinders Highway Upgrade	Not Surveyed	Not Surveyed	Not Surveyed	Surveyed	Surveyed

* Table Note. Closure of level crossing and creation of easements has been removed.

Field survey methods included secondary, and quaternary vegetation surveys, camera trapping, audio logging, scat and sign searches, diurnal bird surveys, and spotlighting. Waterway and wetland assessments were also conducted. Field survey methods are described in detail in the following subsections and in Appendix D, Appendix E, Appendix F and Appendix G.

Note that the onsite storage area was not specifically surveyed; however, this location is immediately adjacent to the water infrastructure network and displays similar characteristics to surrounding areas which were surveyed.

3.1.2.2 Flora Assessment

Floral assessments were carried out as per guidelines published in *Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland*, Version 6. (Neldner et al., 2022) with the following notable deviation:

- Queensland Herbarium Monitoring site tags or other permanent site tags were not placed at sampling locations.

Refer to Appendix H for floral assessment survey locations.

3.1.2.2.1 Secondary Vegetation Surveys

Secondary vegetation surveys were conducted within a 50 m by 10 m survey plot, unless otherwise stated. The following vegetation characteristics were recorded for each survey plot:

- Canopy cover;

- Median canopy height;
- Maximum Diameter at Breast Height (DBH);
- Shrub canopy cover (is present as a distinct ecological layer);
- Shrub canopy height;
- Stem count of each woody species present within the plot;
- Percentage cover of each ground layer species;
- Percentage cover of organic litter; bare ground; and rock as applicable; and
- Cardinal coordinate (North, South, East, West) photos were taken at each end of the transect.

Canopy cover and shrub cover were assessed using the line intercept method and recorded as a percentage. Shrub canopy ≥ 2 m is recorded as a separate value where a distinct shrub layer is present.

Woody specimens < 2 m in height were excluded from the woody species stem count.

Ground layer species and cover assessments were conducted within five 1 m x 2 m sample plots per sample site. Sample plots were located 0 m, 10 m, 20 m, 30 m and 40 m on alternating sides of the plot centre line. Germinating tree and shrub specimens were included within the ground layer cover where specimens were ≤ 1 m.

3.1.2.2 Quaternary Vegetation Surveys

Quaternary vegetation surveys were conducted as a point assessment with the following recorded for each point:

- The survey point as a Global Positioning System (GPS) coordinate;
- All species present at the sample point for each ecological layer;
- Dominant species and the height of the ecologically dominant layer; and
- Photos facing in each of the four cardinal directions; North, South, East and West.

3.1.2.3 Fauna Assessment

Fauna assessments were carried out as per survey guidelines published in *Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland* (Eyre et. al. 2018) and *Significant impact guidelines for the endangered black-throated finch (southern)(*Poephila cincta cincta*)* (DEWHA, 2009a).

Refer to Appendix H for survey locations.

3.1.2.3.1 Camera Trapping

Seven motion sensor cameras were deployed over four nights between 28 March to 1 April 2022, 17 were deployed over four nights between 23 May and 27 May 2022. A total of twenty-two motion sensor cameras were deployed for four nights during either the September or October survey weeks. A further two motion sensor cameras were deployed over four nights between 6 and 10 February 2023. The following methodology was applied to motion sensor cameras during all deployments:

- Installed in key locations on site;
- Securely attached 10 – 50 cm from the ground on a tree or post;
- Not baited; and
- Set on the burst function of three photos per trigger.

3.1.2.3.2 Audio Logging

AudioMoth ecological recording devices are open source full-spectrum acoustic loggers with the ability to detect sound both at audible and ultrasonic frequencies. These devices are commonly used during field surveys to detect species calls, allowing records of species that may otherwise not be visible or physically active during the surveys. AudioMoth devices can detect species calls from up to 500 m of the recording location. Any recorded calls were played back to identify the species.

AudioMoth ecological recording devices were deployed over four nights from 28 March to 1 April 2022 and 6 to 10 February 2023:

- Sampling cycle was set to record for 15 seconds in every minute between dusk and dawn;
- Sample rate was 256 kHz; and
- Gain median.

3.1.2.3.3 Anabat Passive Bat Detectors

Three Anabat passive bat detectors were deployed over four nights from 6 to 10 February 2023 in locations where bats were previously observed or where potential for roosting habitat (tree hollows and/or shedding bark) was previously recorded. Anabat devices were deployed using the following methodology:

- Audio recordings were taken for the duration of the night survey;
- Volume and frequency thresholds were set to reduce non-bat recording;
- Volume was set in-situ based on background noise;
- Frequency set to 12,000 KHz; and
- Data was analysed by spectrograph using Anabat insight Program.

3.1.2.3.4 Scat and Sign Search

These searches were conducted incidentally throughout the entire survey to coincide with systematic surveys and other on-site activities. Traces were documented with use of a camera for later confirmation of identification. No samples were removed from site.

3.1.2.3.5 Diurnal Bird Surveys

Based on site conditions, wet season surveys for the Black-throated finch (southern) (*Poephila cincta cincta*) were conducted. Surveys were inclusive of both targeted searches and water source observations. Each observer carried a pair of hand-held binoculars to assist with species identification consistent with the species Significant Impact Guidelines.

Targeted Surveys

Targeted searches included:

- One hour/ha within 600 m radius of a water source;
- Specific effort devoted to searching grassland areas representing key habitat;
- Searching of trees, shrubs, mistletoes, raptor nests and tree hollows for nests;
- Call detection; and
- Examination of flocks of co-occurring finch species, small granivorous doves and Black-faced wood swallows (*Artamus cinereus*).

Water Source Observations

Water source observations were conducted for six (6) observer-hours a day for two days per each water source. Observations were conducted for a period of three hours following first light. Observers were positioned within view of the water's edge.

3.1.2.4 Spotlighting

3.1.2.4.1 Amphibian Spotlighting

Waterbody surveys were conducted searching for frogs, tadpoles and egg masses and listening for calling adult males. Spotlighting surveys were conducted on foot. Each observer utilised a 30 Watt (W) hand-held spotlight and hand-held recording devices were carried to assist in call identification.

3.1.2.4.2 Arboreal Mammal Spotlighting

Spotlighting surveys were conducted on foot, within the 100 x 100 m generic survey site for 30-person minutes by two ecologists. Tree canopies were inspected for arboreal mammals and perching birds. Binoculars were used to assist with species identification. Each observer utilised a 30 W hand-held spotlight.

3.1.2.5 Waterway and Wetland Assessment

3.1.2.5.1 Waterways

Waterways and drainage features were walked and captured by GPS. Photo points and aquatic features were noted at certain points along and near the crossing points, additional crossing sections were noted that were not mapped as fisheries waterways but still would meet the definition under the Queensland Department of Agriculture and Fisheries (DAF) definition as exhibiting at least one of the following attributes:

- Defined bed and banks – The bed and banks need to be continuous upstream and downstream of the site rather than isolated and broken sections of a depression;
- An extended, if non-permanent, period of flow – Flow must continue beyond the duration of a rain event and have some reliability attached to rainfall. There is a need to distinguish between channels that funnel immediate localised rainfall, and waterways where flow has arisen from an upstream catchment;
- Flow adequacy – The flow needs to be sufficient to sustain basic ecological processes and habitats, and to maintain biodiversity within or across the feature. The adequacy of the flow depends on the ecological function of the channel e.g., waterways that connect to fish habitat like a wetland or waterhole may only need infrequent and short duration flows to provide connectivity for fish; and
- Fish habitat at, or upstream of, the site – Most instream features provide habitat for fish under adequate flow conditions or, in the case of pools, during dry periods. Therefore, it is important to have some knowledge of the fish species for the site and their habitat use, particularly in headwater streams. Periodic connectivity to upstream and off stream fish habitats are also considered fish habitat.

Assessment of thirty-seven (37) waterway locations within the Project area were conducted using the four criteria above along with any other distinguishable features. Waterway assessment locations are shown in Figure 3-1.

3.1.2.5.2 Wetlands

The Queensland Wetland Definition and Delineation Guideline Part A: A guide to existing wetland definitions and the application of the Queensland Wetlands Program definition is used to identify whether a site should be considered wetland according to the definition. The Guideline provides a four-step process for applying the Program's Wetland Definition. This process involves:

1. Knowing and understanding the definition;

2. Planning the investigation of a potential features;
3. Conducting the investigation and recording information; and
4. Applying the wetland decision tree.

Four factors are considered in defining what is and is not a wetland; hydrology, flora and fauna, soils, and non-biotic features. In order to be considered a wetland under the definition the water body must meet criteria for the hydrology factor and at least one of the other factors.

The Aquatic Biodiversity Assessment Mapping Method (AquaBAMM) is a decision support tool that is predominantly used to compare sites within a catchment or geographic area using four measure categories – low, medium, high or very high. Assessment is carried out using a mix of diagnostic assessment (field surveys, broadscale mapping, etc.) and expert opinion. An assessment was carried out against key criterion using values identified through site specific surveys and review of publicly available information. Based on the data and interpretation from experienced scientists a measurement of low, medium, high and very high has been attributed for each of the criteria. An overall assessment has been provided using an average of all of the criteria.

Refer to Appendix H for survey locations.

3.1.2.6 BioCondition Assessment

BioCondition assessments were undertaken as per the methodology outlined in the BioCondition Manual (Eyre et al., 2015) and in accordance with BioCondition sampling effort recommendations published in Table 2-1 of 'Guide to Determining Terrestrial Habitat Quality version 1.3' (DES, 2020).

3.1.3 Habitat Mapping Approach

Habitat was mapped for ten (10) conservation significant species (threatened and migratory species) including:

- Black-throated finch (southern);
- Bare-rumped sheathtail bat;
- Squatter pigeon (southern);
- Koala;
- Oriental cuckoo;
- Northern quoll;
- Australian painted snipe;
- Curlew sandpiper;
- Glossy ibis; and
- Black-faced monarch.

Habitat mapping was undertaken through the use of spatially available desktop data, ground-truthed data from all ecological surveys undertaken at the Project area and habitats were mapped as per species preferable habitats outlined in each species conservation advice.

Black-throated finch (southern)

Habitat for the Black-throated finch (southern) was mapped including any seeding grass within 5 km of a permanent water source as this is considered habitat in the species model distribution.

Squatter pigeon (southern)

Habitat for the Squatter pigeon (southern) was mapped based on the following habitats:

- Breeding habitat (i.e., remnant/regrowth open forest to sparse open woodland within 1km of suitable permanent waterbody (Stream order 3 to 5 and perennial watercourses have been considered);
- Foraging habitat (i.e., remnant/regrowth open forest to sparse open woodland within 3km of suitable seasonal or permanent waterbody); and
- Dispersal habitat: any forest or woodland occurring between breeding and foraging habitat, or pasture with scattered trees < 100 m apart.

Bare-rumped sheathtail bat

Habitat for the Bare-rumped sheathtail bat was mapped to include woodland/forest canopy, open areas and tree hollows.

Koala

Koala habitat in the mapping consists of native Australian woodland that contains a variety of Koala habitat and food trees.

Habitat mapping for each species is further identified in their respective sections in Section 3.3.

3.1.4 Habitat Quality Assessment

A habitat quality assessment was undertaken for MNES species which are known or likely to occur as identified in Section 3.2.8. In addition to this, a habitat quality assessment was also undertaken for the Koala. A description on the Habitat Quality Assessment methodology is provided below, refer to Appendix G for additional information.

Fauna species habitat quality was assessed in accordance with Chapter 2.4 of “*Guide to determining terrestrial habitat quality – Methods for assessing habitat quality under the Queensland environmental Offsets Policy version 1.3*” and “*BioCondition – A Condition Assessment Framework for Terrestrial Biodiversity in Queensland Assessment Manual, Queensland Herbarium version 2.2*”.

Habitat quality was assessed for the species considered known or likely to occur within the area, including:

- Black-throated finch (southern);
- Bare-rumped sheathtail bat;
- Squatter pigeon (southern);
- Australian painted snipe; and
- Koala.

The habitat quality for each of the listed species above was scored using a weighted table of five habitat quality criteria calculated from measured site attributes, thirteen site reference criteria and four site context criteria in accordance with the BioCondition methodology previously adopted. Habitat quality criteria used in the assessment included:

- Availability for food and foraging habitat;
- Quality and availability of shelter and breeding habitat;
- Role of site location to overall population in Queensland;
- Threats to the species; and
- Support for mobility of surrounding habitat.

In locations where surveys have previously been conducted to obtain BioCondition or secondary vegetation data, only additional data required to meet the Habitat Quality Assessment Standard Guidelines was collected during the 2023 field survey.

Forty-one Modified Habitat Quality Assessment (MHQA) transects were conducted during the February 2023 survey (refer to Appendix G). For the purposes of the MHQA, assessment units were defined using REs and vegetation condition, as shown in Table 3-2.

Table 3-2 Assessment Units for MHQA

Assessment Unit	Description	Sample Units
AU1	RE 11.3.30 Remnant	BIOA, BIOC, T8, T9, T10, T14, T15, T16, H1, H3 and H10
AU2	RE 11.3.30 Non-Remnant	BIOB, BIOD, BIO1, BIO2, BIO3, BIO4, BIO5 BIO07, BIO8, T17, H13, H14, H16, H17, H18 and H20
AU3	RE 11.3.35 Remnant	BIO6, T11, T22, H2, H9, H11
AU4	RE 11.3.35 Non-Remnant	H5, H6, H15 and H19
AU5	RE 11.3.27e Remnant	H7
AU6	RE 11.3.25b Remnant	T12 and H12
AU7	RE 11.3.12 Remnant	T13

Scoring of threats to each species was determined using a threat matrix in accordance with “*Guide to Determining Terrestrial Habitat Quality*” (DES, 2020). A score out of 25 was given for each species absence of threat (refer to Table 3-3), with the final score being the lowest possible score for an individual identified threat.

Table 3-3 Threat Assessment Matrix (DES, 2020)

Threat Matrix			Severity				
			Very High	High	Medium	Low	Very Low
			1	2	3	4	5
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

3.1.4.1.1 Black-throated finch (southern) (Endangered)

Quality and Availability of Food and Foraging Habitat

A habitat score relating to the quality and availability of food and foraging habitat for the Black-throated finch (southern) was based on the following attributes:

- **Abundance of food grasses** – The coverage of preferred food grasses across 5 areas of 1 x 1 metre BioCondition quadrats was assessed. With the species being primarily granivorous, grass seed availability is an indicator of foraging habitat quality and 25% cover is considered favourable (NRA, 2011);
- **Mosaic of bare patches and grasses** – The average cover of bare ground across 5 areas of 1 x 1 metre BioCondition quadrats was assessed. Black-throated finch (southern) require bare ground patches to access seed banks, with areas of 40.59% ± 19.28% bare ground cover with a maximum of 85% are preferred by the subspecies (Rechetelo, 2015); and
- **Species richness of food grasses** – The overall number of the species preferred grass feed species is an indicator of foraging habitat quality as higher species diversity and a mixture of annuals and perennial species allows for a broader time period which seed production occurs. Sufficient habitat for the species is defined when six or more

species of food grasses are present within a plot (NRA, 2011), with favourable grass species including: *U. mosambicensis*, Crabgrass (*Digitaria ciliaris*), Red natal grass (*Melinis repens*), Curly windmill grass (*Enteropogon acicularis*), Native millet (*Panicum decompositum*), Hairy panic (*Panicum effusum*), Bluegrass (*Dichanthium sericeum*), Cockatoo grass (*Alloteropsis semialata*), Woodland lovegrass (*Eragrostis sororia*), Kangaroo grass (*Themeda triandra*) and Purple-top chloris (*Chloris inflata*) (Mitchell, 1996; NRA, 2007). It should be noted that Crabgrass, Red natal grass and Purple-top chloris are listed as environmental weeds in Queensland, however, are not Weeds of National Significance (WoNS). Although these weeds are favourable food sources for the Black-throated finch (southern), these species, or any weeds in general, will not be used during the Project rehabilitation phase.

Quality and Availability of Shelter and Breeding Habitat

The quality and availability of breeding habitat for each species was scored a rating out of 25, as per a species by species basis to indicate the overall quality shelter and breeding habitat within the Project area.

A habitat score relating to the quality and availability of shelter and breeding habitat for the Black-throated finch (southern) was based on the following attributes:

- Abundance of preferable nesting tree species – Suitable nesting species include *E. platyphylla*, *Melaleuca viridiflora*, *C. tessellaris* and *C. dallachiana* (Rechetelo, 2015); and
- Distance to water – A desktop assessment was conducted to determine the distance to a permanent water source for each habitat assessment. As the Black-throated finch (southern) is an obligate drinker, the species requires habitats with availability to a constant water source. Nesting habitats are typically found within 200 m to a permanent water source and not more than 400 m from the water source (NRA, 2011).

Threats to the species

Threats identified as a potential significance to the Black-throated finch include:

- Reduction in water availability – The reduction in availability to permanent water sources (e.g., through drought events) can significantly impact the species to utilise a particular habitat (DEWHA, 2009b);
- Intensive grazing regimes – Overgrazing of habitat resulting in seed depletion can reduce the capacity of habitat suitable for the black-throated finch to occupy (DEWHA, 2009b);
- Risk of fire – Fire during the species' breeding season can cause disturbance to nesting habitat and failure of breeding (DEWHA, 2009b); and
- Exotic weed dominance – Exotic weeds can reduce the availability of quality habitat and food grasses to the species (DEWHA, 2009b).

Species Mobility Capacity

Species mobility capacity for the Black-throated finch (southern) were assessed using the following criteria:

- Coverage of shrub species, including native and introduced species – This was measured using an intersection with a 100 m transect. Flocks of the subspecies are negatively associated with excessive shrub cover (Rechetelo, 2015); and
- Presence of open grassy woodland vegetation structure – Vegetation was assessed for quality and connectivity of open woodland structure using 100 x 50 m BioCondition plots.

3.1.4.1.2 Bare-rumped sheathtail bat

Quality and Availability of Food and Foraging Habitat

Food and foraging habitat quality for the Bare-rumped sheathtail bat was indicated by the presence of mature remnant woodland. The species is known to forage in a wide variety of habitats, particularly those near coastal eucalypt forests and woodlands (TSSC, 2016).

Quality and Availability of Shelter and Breeding Habitat

A habitat score relating to the quality and availability of shelter and breeding habitat for the Bare-rumped sheathtail bat was based on the following attributes:

- Abundance of preferred tree species: The species is likely to roost in hollows of mature Eucalyptus or Melaleuca species (Schulz and Thomson, 2007). Stems of mature preferred species were counted within a 50 x 100m plot; and
- Presence of deep hollows: 100 x 50 m BioCondition plots were used to count and identify potentially deep hollows that the species requires to nest in (Milne et al., 2009). These are generally in mature Eucalyptus or Melaleuca species (Schulz and Thomson, 2007).

Threats to the species

The Bare-rumped sheathtail bat is significantly affected by an increased abundance of exotic weeds to species roosting habitat (Schulz and Thomson, 2007).

Other threats identified as a potential significance to the Bare-rumped sheathtail include:

- Habitat loss and fragmentation: The species preferred habitat is subject to developments for horticulture and/or urban development.;
- Competition for tree hollows by native bees, non-native and native birds: The spread of the Asian honeybee (*Apis cerana*) will increase the competition for roosting hollows (Hyatt, 2012). However, this has not been demonstrated, but is possible (Schulz and Thomson, 2007);
- Disease: The species may be impacted by the Australian bat Lyssavirus; however, this has not been demonstrated, but is possible (Schulz and Thomson, 2007); and
- Too frequent burning: Too frequent burning may result in impacts to the availability and quality of roosting hollows. Again, this has not been demonstrated but is considered possible.

Species Mobility Capacity

Species mobility capacity for the Bare-rumped sheathtail bat was assessed by the connectivity between suitable habitats. Availability of mature woodland habitat in the surrounding landscape was used as an indicator of mobility (Schulz & Thomson 2007; Reardon et al., 2010; Dennis, 2012). Scoring of connectivity was assigned using the following scores:

- Five (5) – totally isolated;
- Ten (10) – partially isolated;
- Fifteen (15) – periodically isolated;
- Twenty (20) – major connectivity; and
- Twenty-five (25) – totally connected.

3.1.4.1.3 Squatter pigeon (southern) (Vulnerable)

Quality and Availability of Food and Foraging Habitat

An abundance of food grasses within the Project area was used as the site attribute to indicate food and habitat quality for the Squatter pigeon (southern). The average coverage of preferred food grasses across 5 areas of 1 x 1 metre BioCondition quadrats was assessed. The Squatter pigeon (southern) is predominantly granivorous, with approximately 95% of its diet consisting of seeds (Chrome, 1976).

Quality and Availability of Shelter and Breeding Habitat

A habitat score relating to the quality and availability of shelter and breeding habitat for the Squatter pigeon (southern) was based on the following attributes:

- Mosaic of bare ground and grass cover – The Squatter pigeon (southern) nests in scraped depressions in dirt that are sheltered by organic matter (Lord, 1956). Vegetation cover in these areas are typically a mix of perennial tussock grasses with/without low shrubs and/or forbs; and
- Distance to water – The subspecies is likely to be sedentary where reliable water sources are available throughout the year (Squatter Pigeon Workshop 2011).

Threats to the species

Threats identified as a potential significance to the Squatter pigeon (southern) include:

- Attack by predatory animals – Research shows a decline of subpopulations of the subspecies can be linked to high fox abundance (Garnett & Crowley, 2000);
- Exotic weeds – Exotic weed species have the potential to degrade species habitat (Squatter Pigeon Workshop, 2011);
- Habitat Loss and Fragmentation – Clearing of habitat for agricultural purposes is a known and significant threat to the species (Squatter Pigeon Workshop, 2011); and
- Overgrazing – Overgrazing activities with livestock has the potential to degrade habitat suitable to the Squatter pigeon (southern) (Squatter Pigeon Workshop, 2011).

Species Mobility Capacity

The species mobility capacity of the habitat for Squatter Pigeon (southern) was assessed as the connectivity between suitable habitats as dispersal habitat for the species can be any forest or woodland habitat with sufficient water available that occurs between foraging or breeding habitat (Squatter Pigeon Workshop, 2011).

3.1.4.1.4 Australian painted snipe (Endangered)

Quality and Availability of Food and Foraging Habitat

A habitat score relating to the quality and availability of food and foraging habitat for the Australian painted snipe was based on the following attributes:

- Abundance of food grasses – The average coverage of preferred food grasses across 5 areas of 1 x 1 metre BioCondition quadrats; and
- Coverage of seasonal wetlands – The coverage of seasonal wetland for each plot was measured by intersection with the transect and was expressed as a percentage of coverage.

Quality and Availability of Shelter and Breeding Habitat

A habitat score relating to the quality and availability of shelter and breeding habitat for the Australian painted snipe was based on the following attribute:

- Coverage of seasonal wetland: Seasonal wetland areas intersecting the 100 m transect were recorded. Wetland should be shallow with exposed mud to be suitable for the species (Rogers et al., 2005).

Threats to the species

The Australian painted snipe is commonly threatened by the reduction of water quality as a result of increased nutrient and saline content (Rogers et al., 2005).

Species Mobility Capacity

Species mobility capacity for the Australian painted snipe was assessed by the connectivity of suitable habitats. As the species is a highly mobile bird, regardless of the landscape, the determining factor of suitable habitat is the presence of wetland areas (Marchant & Higgins, 1993). As such, species mobility capacity was scored based on the percentage land cover of suitable seasonal wetland within 1 km of the assessment location.

3.1.4.1.5 Koala (Endangered)

Quality and Availability of Food and Foraging Habitat

A habitat score relating to the quality and availability of food and foraging habitat for the Koala was based on the following attributes:

- Species richness of locally preferred food trees – Koalas are known to occur in higher density ecosystems with high food tree species richness (Munks et al., 1996); and
- Abundance of locally preferred food trees – Locally important food tree species that met the non-juvenile habitat tree status (Youngentob et al., 2021b) were assessed within a 50 x 100 m BioCondition plot.

Quality and Availability of Shelter and Breeding Habitat

A habitat score relating to the quality and availability of shelter and breeding habitat for the Koala was based on the following attributes:

- Species richness of non-juvenile koala habitat trees – Species richness of non-juvenile koala habitat trees as defined in the QLD Offsets Policy was assessed in 100 x 50 m BioCondition plots. Species richness of habitat trees is seen as a significant indicator of shelter habitat quality (Youngentob et al. 2021b); and
- Abundance of non-juvenile koala habitat trees – The abundance of non-juvenile koala habitat trees as defined in the QLD Offsets Policy was assessed using 100 x 50 m BioCondition plots by stem count. This methodology allows for the measurement of the quantity of shelter resources available in the habitat (Youngentob et al. 2021b).

Threats to the species

Threats identified as a potential significance to the Koala include:

- Attack – A known threat to the species is attack from domestic and wild dogs and dingos as the Koala traverses the landscape;
- Vehicle strike – Vehicle collisions are known to be a threat to Koalas whilst crossing roads, particularly in urban and peri-urban areas;
- Bushfire – Uncontrolled bushfires are a threat to the species as they are slow moving. Altered and inappropriate fire regimes, as well as increased fuel loads are influencing this threat to the species; and
- Drought – Extreme drought can reduce food and shelter availability for the Koala.

Species Mobility Capacity

Species mobility capacity for the Koala was assessed by connectivity between suitable habitats. This was scored using the following criteria:

- Five (5) – totally isolated;
- Ten (10) – partially isolated;
- Fifteen (15) – periodically isolated;
- Twenty (20) – major connectivity; and
- Twenty-five (25) – totally connected.

3.1.4.2 Access Road Survey – EPBC 2022/09281 (EMM)

Two ecological surveys conducted by EMM in July 2021 and March 2022 were undertaken to identify potential MNES within the existing road reserve ‘Access Road’ which runs from Jones Road to the northern extent of the LEIP, in support of a separate referral (EPBC 2022 / 09281). Habitat records obtained by EMM have been included on Figures in Section 3.2.8. This report has not been appended to this report; however, it can be found via the online referral portal for EPBC 2022 / 09281. Information and conclusions have been used to support this Project and report.

- Field survey methods included:
- Deployment of Anabat Detectors;
- Diurnal bird surveys;
- Habitat assessments;
- Active searches;
- Verification of vegetation community mapping by ground-truthing Regional Ecosystem (REs); and
- Records taken of incidental observations during surveys.

3.1.5 Impact Assessment

3.1.5.1 Likelihood of Occurrence Assessment

An assessment was conducted to attribute a ‘likelihood of occurrence’ to TECs and species that are MNES, which have been previously recorded or were predicted to occur within the desktop search extent. The likelihood of occurrence assessment was based on a review of species distributions and habitat requirements, historical records for the region, and the results of habitat assessments and field surveys conducted within the Project area. Refer to Section 3.2.6 and Section 3.2.8 for these assessments.

The likelihood of occurrence ranking was based on the following framework:

- **Known:** Species recorded during the field survey. Species within this category were subject to further impact assessment (refer to Section 3.1.5.2).
- **Likely:** Species has been recorded in the desktop search extent and suitable habitat is present in the Project area. Species within this category were subject to further impact assessment (refer to Section 3.1.5.2).
- **Moderate:** Species’ distribution incorporates the Project area but only habitat of poor quality and/or very limited extent is present or the species has not been recorded in the desktop extent. Species within this category were not subject to further impact assessment.
- **Unlikely:** Species has not been previously recorded in the desktop search extent and/or the current known distribution does not encompass Project area or habitat is lacking from the Project area. Species within this category were not subject to further impact assessment.

3.1.5.2 Significant Impact Criteria Assessment

A significant impact assessment was undertaken on the Project's potential impacts on the species that are MNES that have been confirmed known or are considered likely to occur within the Project area. The assessment was made against the Commonwealth Significant impact guidelines (DoE 2013) (and where available, species-specific guidelines). Refer to Section 4.2 for this assessment.

Species which had the potential to be impacted significantly by the proposed action (i.e., Black-throated finch (southern)) underwent a further assessment as per Section 3.1.5.3.

3.1.5.3 Risk Assessment

A MNES risk assessment was undertaken for species which had the potential to be significantly impacted and to understand if there is any significant residual impact. This assessment is provided in Section 4.4 with further information on the process provided in that section.

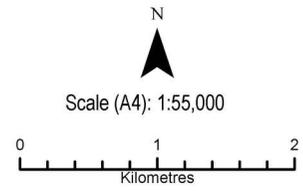


Earthstar Geographics, Esri, HERE, Garmin, FAO, NOAA, USGS

Figure 3-1 Waterways Assessment Locations

Legend

-  Waterway ID
-  Watercourse
-  Jones Road Intersection Upgrade
-  Jones Road to Flinders Highway Upgrade
-  No Name Road (north)
-  No Name Road (south)
-  Bidwilli Road
-  Unnamed Road
-  Water Infrastructure Network
-  Storage Dam and Internal Pump Station
-  Site Laydown Area
-  Rail Network
-  Existing Roads
-  Cadastre (DCDB)
-  Serpentine Lagoon Nature Refuge



Date: 26/06/2023
 Author: EMH
 DISCLAIMER
 CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



3.2 Description of the Environment

3.2.1 Regional Ecosystems

Ground-truthed vegetation mapping has been undertaken during field surveys and is illustrated in Figure 3-2. Vegetation across the Project area is generally RE 11.3.30 (Assessment Unit (AU) 1, AU 2) and 11.3.35 (AU3) (Figure 3-3). Field-based Bio Condition transects were conducted with findings provided in Appendix F.

Field surveys determined that all four of the REs are confirmed to occur within the Project area and are classed as least concern, Category B and Category R vegetation under the VM Act (Figure 3-4).

Some mapping discrepancies appear to occur between the two dominant REs. Both RE 11.3.30 and 11.3.35 are terrestrial ecosystems. Mapping discrepancies occurring between the two REs are as follows:

- Transect one (T1) and Transect seven (T7) which were confirmed to be non-remnant vegetation appear, based on present regrowth, to be more closely aligned with RE 11.3.30 rather than their mapped pre-clearance RE of 11.3.35;
- T19 exhibits woody vegetation consistent with RE 11.3.30 rather than RE 11.3.35, indicating a mapping discrepancy of approximately 100 m;
- T9 and T20 are mapped as RE 11.3.30 but exhibit vegetation consistent with RE 11.3.35.

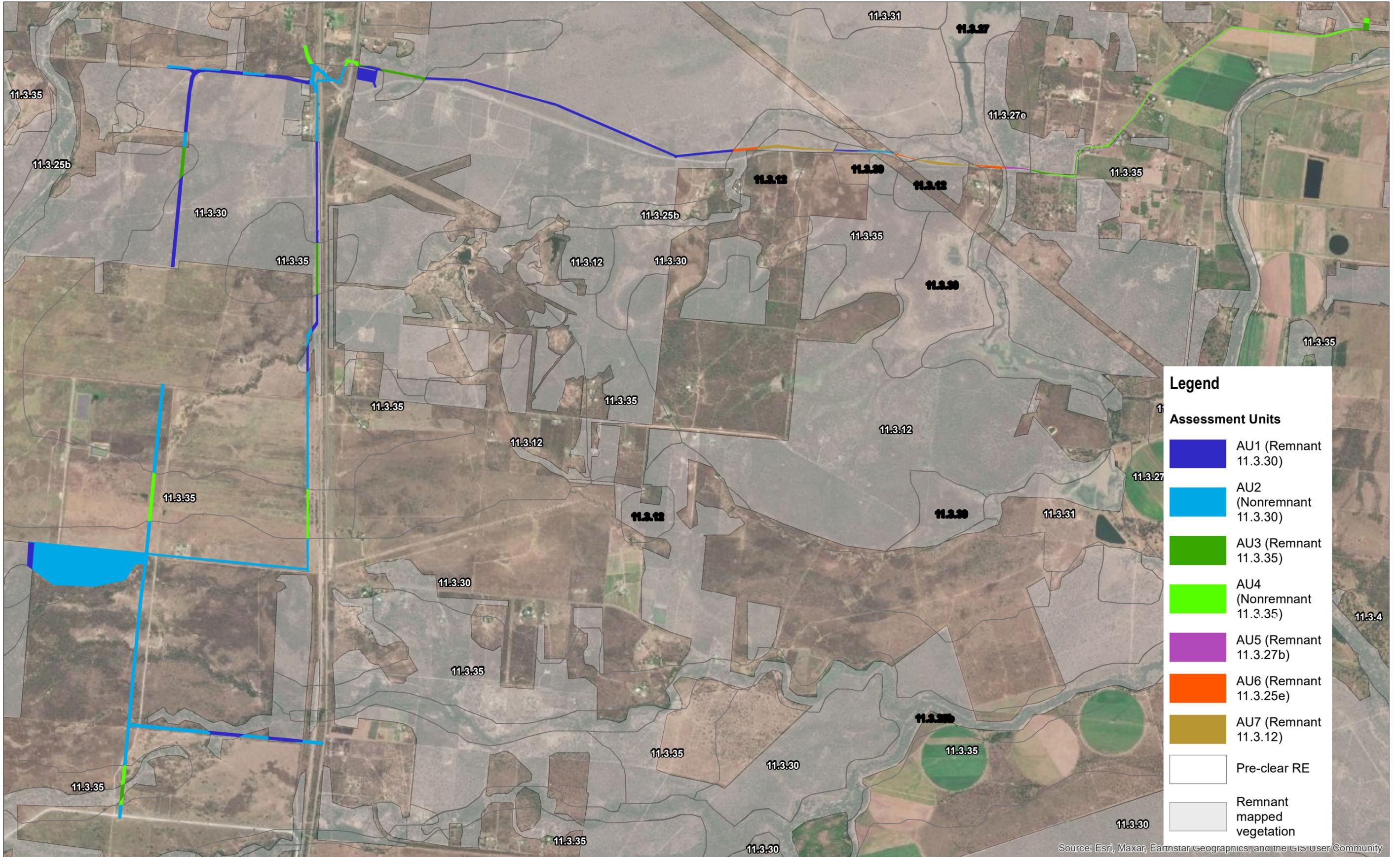
T21 is located within an area mapped as RE 11.3.27e, a Least Concern palustrine wetland. Vegetation observed within the survey plot was not consistent with these values, instead belonging to RE 11.3.35 which is mapped as occurring adjacent to the transect area.

Quaternary transects were utilised in areas lacking significant assessable woody vegetation. Of the 44 quaternary transects conducted, the following discrepancies were noted:

- Quaternary observation point (Q) 7 falls within remnant mapping but was found to be cleared vegetation, the assessment point occurs at the edge of the remnant mapping and represents a discrepancy in the mapped boundary or the remnant vegetation which includes the adjacent roadway;
- Q40 falls within remnant mapping but occurs within a cleared area associated with a dirt access road;
- Q41 is mapped as non-remnant 11.3.30, however extant woody vegetation in the vicinity is consistent with RE 11.3.35;
- Q42 is mapped as remnant 11.3.35 however woody vegetation is absent from the survey location, indicating that the area is non-remnant
- Q52S, Q54S, Q47S and Q49S were found to belong to different regional ecosystems than their mapped values.
- These survey points are located near a mapped change in regional ecosystem suggesting a mapping discrepancy with regards to the change of regional ecosystem;
- Q58S to Q61S and Q64S to Q66S lacked canopy vegetation cover and therefore were unable to be accurately classified by regional ecosystem based on on-ground values, and further are not considered to meet remnant status; and

Q62S, Q63S, QAV and QAY were found to belong to different regional ecosystems than the values mapped.

Plan 4: Assessment Units

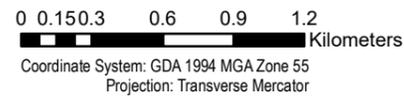
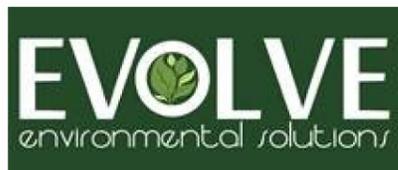


Legend

Assessment Units

- AU1 (Remnant 11.3.30)
- AU2 (Nonremnant 11.3.30)
- AU3 (Remnant 11.3.35)
- AU4 (Nonremnant 11.3.35)
- AU5 (Remnant 11.3.27b)
- AU6 (Remnant 11.3.25e)
- AU7 (Remnant 11.3.12)
- Pre-clear RE
- Remnant mapped vegetation

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

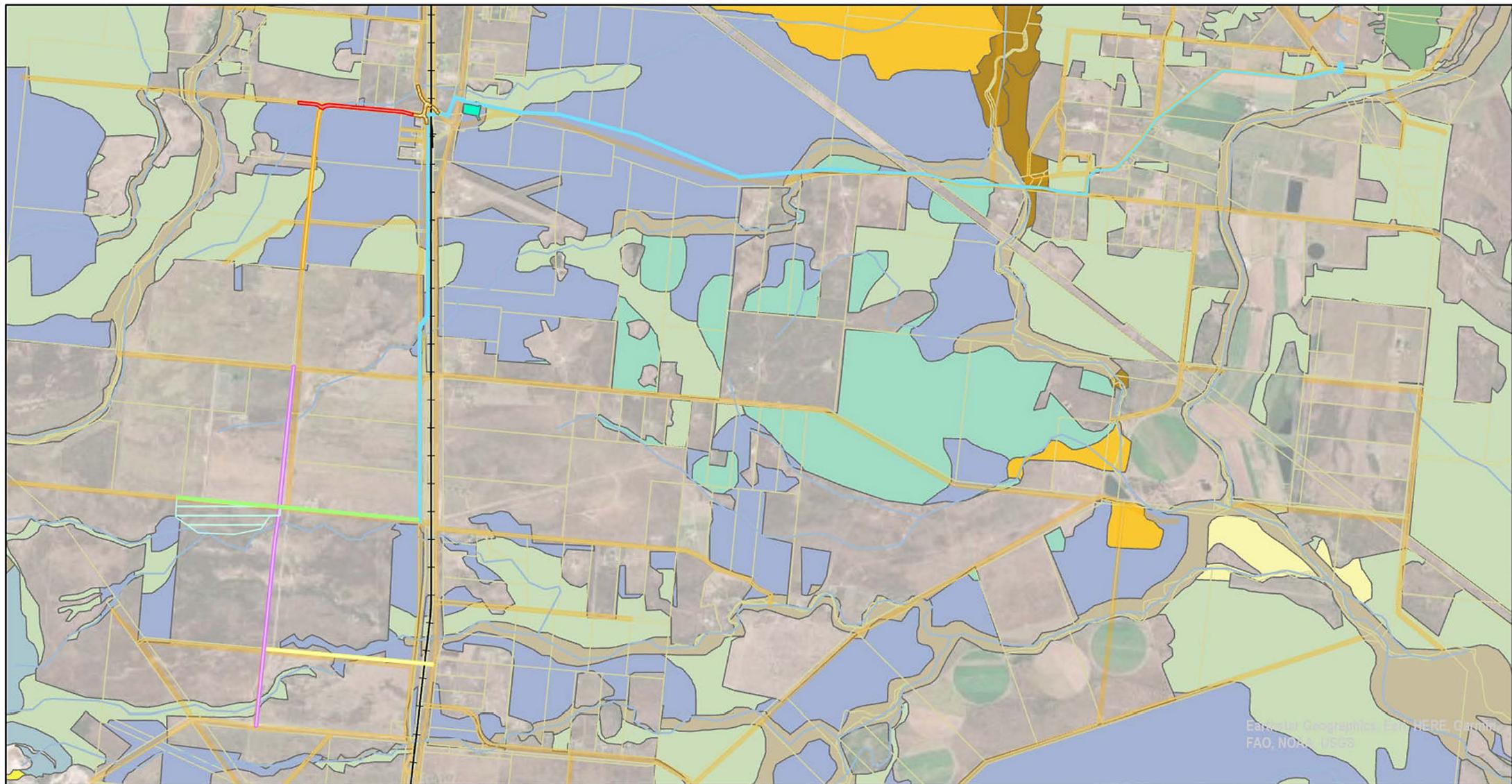


Issue	Date	Description	Drawn	Checked
A	14/03/2023	Preliminary	RH	AH

Lansdown Eco-Industrial Precinct

Date: 14/03/2023
Plan 4 Assessment Units A

Figure 3-2 Ground Truthed Habitat Mapping - Assessment Units



ES: 11.02 Geographical Data HERE, Credits: FAO, NOAA, USGS

Figure 3-3 Mapped Regional Ecosystems (Biodiversity)

Legend

Regional Ecosystem

- 11.11.15
- 11.12.9
- 11.3.12
- 11.3.30
- 11.3.35
- 9.12.22

Remnant

- 11.3.25
- 11.3.27
- 11.3.31
- 11.3.4
- 9.11.8

- Jones Road Intersection Upgrade
- Jones Road to Flinders Highway Upgrade
- No Name Road (north)
- No Name Road (south)
- Bidwilli Road
- Unnamed Road
- Water Infrastructure Network

- Storage Dam and Internal Pump Station
- Site Laydown Area
- Rail Network
- Existing Roads
- Watercourse
- Cadastre (DCDB)

N

Scale (A4): 1:55,000



Date: 6/03/2023
Author: EMH

DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



3.2.2 Habitat Quality

Habitat quality within the Project area was assessed and is shown in Table 3-4. The methodology is provided in Section 3.1.2.6 and Appendix G. As seen in the table below, the total BioCondition scores for all assessment units were low to intermediate, ranging from 4.00 to 52.00 of the maximum score (80). All assessment units scored below 1. The assessment units and the associated ground-truthed regional ecosystems are shown on Table 3-4.

The Project area contains two REs, remnant and non-remnant RE 11.3.30 and RE 11.3.35. The overall condition of both remnant and non-remnant RE 11.3.35 in assessment unit (AU) 3 and AU4 respectively, appeared the lowest among other vegetation groups identified at the Project area. A maximum vegetation quality score of 28% was identified in AU3 and 5% in AU4.

Both AU5 (remnant RE 11.3.27e) and AU7 (remnant RE 11.3.12) occur in their respective REs without benchmark values assigned, therefore, due to small size and degraded ecological value of the AUs, a rapid assessment method was used to assume a score of 70% for attributes that could not be assessed against a guideline in accordance with “*Guide to Determining Terrestrial Habitat Quality version 1.3*”. However, non-native plant cover was excluded from this rapid assessment method as its attribute is always zero (0), therefore, this was calculated using the BioCondition methodology.

Table 3-4 BioCondition Assessment Results for the Project Site Summarised by Assessment Unit

Assessment Unit	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Regional Ecosystem	Remnant 11.3.30	Non-Remnant 11.3.30	Remnant 11.3.35	Non-remnant 11.3.35	Remnant 11.3.27e	Remnant 11.3.25b	Remnant 11.3.12
Recruitment	0.00	0.19	0.50	0.00	3.50	0.00	3.50
Native plant species richness - trees	3.41	3.13	2.50	0.63	3.50	2.50	3.50
Native plant species richness - shrubs	2.73	0.47	2.08	0.00	3.50	2.50	3.50
Native plant species richness - grasses	1.36	1.56	2.08	0.63	3.50	5.00	3.50
Native plant species richness - forbs	1.36	0.78	0.42	0.00	3.50	2.50	3.50
Tree canopy height (average of emergent, canopy and sub canopy)	4.55	3.69	3.83	1.25	3.50	5.00	3.50
Tree canopy cover (average of emergent, canopy and sub canopy)	2.18	1.13	2.17	0.00	3.50	2.50	3.50
Shrub canopy cover	1.82	1.06	1.67	0.00	3.50	1.50	3.50
Native perennial grass cover	1.09	1.38	1.00	0.25	3.50	1.00	3.50
Organic litter	3.73	3.13	2.67	1.25	3.50	4.00	3.50
Large trees	2.27	2.19	0.83	0.00	10.50	2.50	10.50
Coarse woody debris	0.36	0.50	1.33	0.00	3.50	3.50	3.50
Non-native plant cover	3.36	2.06	1.50	0.00	0.00	4.00	3.00
Total (out of 80)	28.23	21.25	22.58	4.00	49.00	36.50	52.00
Score (out of 1)	0.35	0.27	0.28	0.05	0.61	0.46	0.65

3.2.3 Watercourses and Waterways

A number of mapped waterways intercept the Project area (refer to Figure 3-1). These waterways were investigated as part of the ecology surveys and are described with photos provided in Table 3 of Appendix I.

The survey methodology used during the waterway assessments are as follows:

- Waterways and drainage features were walked and captured by GPS;
- Photo points and aquatic features were noted at certain points along and near the crossing points.
- Additional crossing sections were noted that were not mapped as fisheries waterways but still would meet the definition under the Queensland Department of Agriculture and Fisheries (DAF) definition as exhibiting at least one of the following attributes:
 - Defined bed and banks – The bed and banks need to be continuous upstream and downstream of the site rather than isolated and broken sections of a depression;
 - An extended, if non-permanent, period of flow – Flow must continue beyond the duration of a rain event and have some reliability attached to rainfall. There is a need to distinguish between channels that funnel immediate localised rainfall, and waterways where flow has arisen from an upstream catchment;
 - Flow adequacy – The flow needs to be sufficient to sustain basic ecological processes and habitats, and to maintain biodiversity within or across the feature. The adequacy of the flow depends on the ecological function of the channel e.g., waterways that connect to fish habitat like a wetland or waterhole may only need infrequent and short duration flows to provide connectivity for fish; and
 - Fish habitat at, or upstream of, the site – Most instream features provide habitat for fish under adequate flow conditions or, in the case of pools, during dry periods. Therefore, it is important to have some knowledge of the fish species for the site and their habitat use, particularly in headwater streams. Periodic connectivity to upstream and off stream fish habitats are also considered fish habitat.

Appendix I provides an overview of all mapped and ground-truthed waterways within the Project area, including the Serpentine Lagoon wetland. A total of thirty-seven (37) waterway locations were assessed using the above methodology / criteria and are further described in Appendix I, including the GPS locations, Water Act classification (i.e., unmapped / drainage feature), distinguishable features, photos and a field assessment summary against the above four criteria. Appendix I further outlines the existing environment (i.e., flora species) within the waterways and the construction methodology for the clearing and construction works that intercept waterway locations (also referred to in 2.6.3 of this PD). The appendix specifies management measures and restoration activities to be used where the water infrastructure network intercepts the identified waterways.

3.2.4 Wetlands

The pipeline aspect of the water infrastructure network crosses areas mapped as high ecological significance (HES) wetlands, associated with the Serpentine Lagoon. Assessment of the accessible wetland areas has been broken down into four assessment criteria:

- Hydrology;
- Flora and fauna;
- Soils; and
- Non-biotic features.

From the assessment of the four factors in determining a wetland, the subject area matches the characteristics and description of a wetland as stated in the *Queensland Wetland Definition and Delineation Guideline Part A*. The Serpentine Lagoon is best described from the current survey as an ephemeral palustrine wetland located in the Great

Barrier Reef Catchment. Observations made on Lot 1 RP726632 confirming the wetland status as mapped under the MSES HES Wetlands Mapping are outlined in Table 3-5.

Serpentine Lagoon intersects with Gilligan Creek approximately 450 m upstream of the Project area. State mapping (QGlobe) does not specify any further upstream creeks connecting to Serpentine Lagoon. Downstream of the wetland, Serpentine Lagoon connects to Major Creek through an unnamed stream, approximately 2 km south-east of the Project area. Direct and indirect impacts to the waterways both upstream and downstream of the lagoon are expected to be temporary during clearing and construction works, through the potential interruption of the wetland hydrological regime and flow from upstream waterbodies and into downstream waterbodies. Impacts relating to erosion and sedimentation may have a temporary indirect impact in downstream waterbodies. Increased turbidity and alteration of flow during construction may temporarily impact the availability of food, such as invertebrates and foraging opportunities for MNES wetland species but this will be short term and localised. Due to the short term nature of these impacts and through the implementation of best practice environmental management and mitigation measures it is thought direct and indirect impacts to MNES species will be minimised (refer to Section 5).

Table 3-5 Wetland of High Ecological Significance

Name	Hydrology	Flora and Fauna	Soils	Non-biotic
<p>Wetland (Serpentine Lagoon) on Lot 1 RP726632</p>	<p>At the time of survey, the area was inundated by water to a depth of approximately 40cm.</p> <p>Observations of the adjacent land parcel made between the 28th March and 1st April during an atypically dry period gave no indication of above ground water presence, as such the wetland may not be permanent but qualifies for a hydrological ranking of ephemeral based upon present conditions following a period of high rainfall.</p> <p>Rating = Medium</p>	<p>Floral composition of the wetland area match that expected to be typically found in wetland (both permanent and ephemeral) environments and along fringing area of wetlands.</p> <p>The upper canopy was dominated by <i>Melaleuca viridiflora</i> and <i>Lophostemon grandiflorus</i>, with the occasional <i>Corymbia tessellaris</i>. Mid canopy was largely void and ground cover was dominated by <i>Leersia hexandra</i>. These are considered to be wetland indicator species.</p> <p>Wetland associated fauna species identified within the wetland area included: <i>Threskiornis molucca</i>, <i>Threskiornis spinicollis</i>, <i>Litoria fallax</i>, <i>Litoria rubella</i>, <i>Ardea intermedia</i>, <i>Nycticorax caledonicus</i>, <i>Egretta novaehollandiae</i> and <i>Todiramphus macleayii</i>.</p> <p>Rating = High (Flora) Rating = High (Fauna)</p>	<p>Erosion of uplands and deposition of sediments (sand, silt, clay, gravels) by alluvial processes in relatively low areas have formed alluvial landforms. When flow exceeds the ability of the stream channels to carry the throughput, overbank flow carries sediment away from the channel until the velocity is such that the suspended load is deposited, forming alluvial landforms such as levees or alluvial plains.</p> <p>This description of an alluvial plain best describes the wetland area and surrounding environment.</p> <p>Rating = Medium.</p>	<p>Wetland assessment site was considered slightly lower in elevation when compared to its surrounds, facilitating pooling during periods of rain.</p> <p>Little non-biotic features of any great value were noted.</p> <p>Rating = Low</p>

Name	Hydrology	Flora and Fauna	Soils	Non-biotic
Wetland Photos – Serpentine Lagoon				
 <p>(refer to page 8 of Appendix H for survey / photo locations).</p>				

3.2.5 Protected Plants Flora Survey Trigger Map

The Project does not intersect any areas mapped under the Protected Plants Flora Survey Trigger Map administered by DES.

3.2.6 Terrestrial Flora

A PMST database identified seven conservation significant flora species as known or predicted to occur within a 20 km buffer (refer to Appendix J), whilst a Wildlife Online database search identified a total of 656 flora species within 20 km of the Project area (refer to Appendix J). A 20 km buffer area for flora was applied (as opposed to the 100 km buffer for fauna species) as flora are non-mobile and less likely to spontaneously occur within the Project area. Table 3-6 outlines the relevant conservation significant species and their likelihood of occurring on site based on the presence of suitable habitat on site and historical records.

One hundred and twelve (112) flora species were identified during field surveys. Thirty-one (31) of the recorded species were native and woody species represented twenty-three (23) of the recorded species. The high proportion of exotic grassy and herbaceous species recorded is reflective of the disturbed state of vegetation within the majority of the surveyed area. None of the recorded flora species were listed as being of conservation significance under the EPBC Act or NC Act. A desktop threatened flora likelihood of occurrence assessment was undertaken which found only two species with a low likelihood to occur: Bluegrass (*Dichanthium setosum*); and Black ironbox (*Eucalyptus raveretiana*).

Table 3-6 Likelihood of Occurrence of Conservation Significant Flora

Species	Status		Description of Habitat	Potential to Occur	Source
	EPBC Act	NC Act			
Miniature moss orchid (<i>Bulbophyllum globuliforme</i>)	Vulnerable	Near Threatened	Erect perennial grass to about 70 cm tall. Occurs in heavy soils (predominantly cracking clays or alluvium, often in gilgai) in woodland or open woodland usually dominated by Acacia (brigalow) and/or Eucalyptus species.	Unlikely. Species was not recorded during field surveys. No ALA records occur within 100 km of the Project area.	PMST ALA Field surveys
Bluegrass (<i>Dichanthium setosum</i>)	Vulnerable	Least Concern	Bluegrass (<i>Dichanthium setosum</i>) is associated with heavy basaltic black soils and red-brown loams with clay subsoil. The species is found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture.	Unlikely. Species was not recorded during field surveys. No ALA records occur within 100 km of the Project area.	PMST ALA Field surveys
Mount Stuart ironbark (<i>Eucalyptus paedoglauca</i>)	Vulnerable	Vulnerable	Mount Stuart ironbark (<i>Eucalyptus paedoglauca</i>) occurs only in the Townsville area. Occurs on ridges or hill slopes on shallow sandy-loam soil. All populations occur in areas of remnant vegetation.	Unlikely. Species was not recorded during field surveys.	PMST ALA Field surveys
Black ironbox (<i>Eucalyptus raveretiana</i>)	Vulnerable	Least Concern	Black Ironbox (<i>Eucalyptus raveretiana</i>) occurs on the banks of rivers, creeks and other watercourses, on clayey or loamy soil.	Unlikely. Species was not recorded during field surveys. Twelve ALA records of the species exist within 100 km of the Project site, with the closest 25 km south of the Project area.	PMST ALA Field surveys
<i>Leichhardtia brevifolia</i>	Vulnerable	Vulnerable	At Hidden Valley near Paluma, plants grow in woodland on granite soils and on Magnetic Island the species occurs in open forest on dark acid agglomerate soils (Forster, 1995).	Unlikely. Species was not recorded during field surveys.	PMST ALA Field surveys

Section 3 Habitat Assessment

Species	Status		Description of Habitat	Potential to Occur	Source
	EPBC Act	NC Act			
<i>Omphalea celata</i>	Vulnerable	Vulnerable	<i>Omphalea celata</i> is known from three sites in central east Queensland, including Hazelwood Gorge, near Eungella; Gloucester Island, near Bowen; and Cooper Creek in the Homevale Station area, north-west of Nebo.	Unlikely. Species was not recorded during field surveys. No ALA records.	PMST ALA Field surveys
<i>Tephrosia leveillei</i>	Vulnerable	Least Concern	One collection exists near Ravenswood growing along a railway track. Typically grows on alluvial plains in Cullen's ironbark (<i>Eucalyptus cullenii</i>) woodland with Red bloodwood (<i>Corymbia erythrophloia</i>), Cooktown ironwood (<i>Erythrophleum chlorostachys</i>) and Bushman's clothes peg (<i>Grevillea glauca</i>), and in tall open forest of Eucalyptus and Corymbia species over dense <i>Heteropogon contortus</i> on red sand.	Unlikely. Species was not recorded during field surveys. No ALA records.	PMST ALA Field surveys

3.2.6.1 Weed Species

Eighty one (81) introduced flora species were identified within the Project area during field surveys. Field surveys identified sections of the pipeline and road alignment to fall within areas of agricultural grazing use as reflected by a high proportion of pastural grass and legume species such as Shrubby stylo (*Stylosanthes scabra*). Road reserves surveyed contain species reflective of the agricultural use of the wider region and weed species typical of disturbed sites such as grader grass (*Themeda quadrivalvis*) and Leucaena (*Leucaena leucocephala*).

The field surveys further noted the access road corridor to be very weed-dense, with open (non-remnant) areas dominated by herbaceous weeds, primarily Hyptis (*Hyptis sp.*), Joyweed (*Alternanthera sessilis*), Sicklepod (*Senna obtusifolia*), Chinese apple, Rubber vine and Siratro (*Macrosptilium atropurpureum*) and some grasses including Signal grass (*Urochloa decumbens*) and *Chloris spp.* (EMM, 2022). Chinese apple, Rubber vine and Sicklepod are listed as 'Category 3 restricted matters' under Biosecurity Act 2014.

Chinese apple and Rubber vine are also Weeds of National Significance (WoNS) at Commonwealth level.

3.2.7 Fauna Habitats

The majority of the Project area is of reduced ecological value due to the extent of grazing and historical clearing. Ecological values pertaining to grassland and wetland species including the Double-barred finch (*Taeniopygia bichenovii*) (least concern (NC Act), not listed (EPBC Act)) which was observed on site, the Black-throated finch (southern) (endangered (EPBC Act, NC Act)), and Squatter pigeon (southern) (*Geophaps scripta scripta*) (vulnerable (NC Act, EPBC Act)) are present though reduced due to altered species composition of the ground layer reducing seed availability.

Habitat for small mammals within the access road reserve is sparse, only provided through fallen woody debris and ground litter. No gilgai or soil cracks are present for small ground-dwelling fauna (EMM, 2022).

Four hollow-bearing trees are located within the No Name Road reserve (EMM, 2022) and are a valuable habitat features for hollow-dependent species. Notably, the Bare-rumped sheath-tail bat (*Saccolaimus saccolaimus nudicluniatu*) (endangered (NC Act), vulnerable (EPBC Act)) roosts and rears young in tree hollows (Churchill, 2008) and the Northern quoll (*Dasyurus hallucatus*) (least concern (NC Act), endangered (EPBC Act)) will den in tree hollows and are the most arboreal quoll species (DCCEEW, 2022c).

The extent of potential habitat for water-source dependent granivorous species, including the Squatter pigeon (southern) and southern black-throated finch is considered to include the entirety of the proposed impact area on the basis that:

- All areas fall within 5 km of permanent water sources; and
- A total of 96.97 % of vegetation sampling points contain foraging opportunities for granivorous species in the form of seed producing grasses.

Although undergoing seasonal variation in abundance, seeding grass species, including introduced species were recorded from all 12 BioCondition vegetation surveys associated with the road alignments conducted between 12 September and 14 October, 40 out of 42 of quaternary vegetation surveys conducted during the same period recorded the presence of seeding grass species.

Abandoned finch nests from unknown species were located on site during the September surveys (refer to page 20 of Appendix G).

3.2.8 Fauna Species

A search of the PMST database identified 60 threatened fauna species as known or predicted to occur within a 20 km buffer (refer to Appendix J), whilst a search of the Wildlife Online database identified a total of 444 fauna species as known to occur within a 20 km of the Project area (refer to Appendix J). Of the 60 conservation significant fauna listed in the PMST report, a total of 19 bird species are listed as Migratory species under the EPBC Act and are predicted to occur in the Project area. A likelihood of assessment has been undertaken for species that have the potential to occur

within the Project area, these are further classified into four categories (known, likely, moderate and unlikely) based on the presence of suitable habitat on site and historical records, as shown in Table 3-7.

In the RFI on 23 December 2022, DCCEEW provided a list of 12 species as potentially impacted by the Project and have therefore been incorporated into the likelihood of assessment. These species include:

- Masked owl (northern) (*Tyto novaehollandiae kimberli*);
- Grey falcon (*Falco hypoleucos*);
- Greater sand plover (*Charadrius leschenaultii*);
- Curlew sandpiper (*Calidris ferruginea*);
- Eastern curlew (*Numenius madagascariensis*);
- Australian painted snipe (*Rostratula australis*);
- Northern quoll (*Dasyurus hallucatus*);
- McDonalds frog (*Cophixalus mcdonaldi*);
- Ghost bat (*Macroderma gigas*);
- Semon's leaf-nosed bat (*Hipposideros semoni*);
- Koala (*Phascolarctos cinerus*); and
- Greater glider (northern) (*Petauroides minor*).

Records of the previously listed species and MNES species considered known or likely to occur within the Project area were obtained from WildNet and Atlas of Living Australia (ALA) databases to identify species records within the broader region (100 km) and are provided as points in Figure 3-5.

A total of 91 fauna species were recorded during field survey efforts, excluding domestic livestock. Eighty-five (85) of the detected species were native, with the majority being avian species. A full list of species is provided on page 31 of Appendix D, page 27-29 of Appendix E, page 24 of Appendix F and page 67-69 of Appendix G. During the survey events, the following number of species were recorded:

- From 28 March to 1 April 2022 Survey – 40 fauna species, 36 of these being native and one conservation significant species was detected, the Koala, listed as endangered under the EPBC Act and NC Act;
- From 22 to 27 May 2022 – 92 fauna species were recorded during the field survey effort, eighty-five (85) of the detected species were native, with 75 being avian species. Of the 92 species detected, three were conservation significant including: Koala, Squatter pigeon (southern) and potential Black-throated finch (southern)² and two were migratory species, the Barn swallow and Glossy ibis;
- From 12 to 16 September 2022 and 10 to 14 October 2022 – 88 fauna species were recorded during the field survey effort within 1 km of the road alignments including domestic species, 72 of the detected species were native, with the majority 69 being avian species. Two migratory species were detected, the Barn swallow and Black-faced monarch; and
- From 6 to 10 February 2023 – 93 fauna species were recorded during the field survey effort within 1 km of road alignment, including domestic species. Of the 93, 77 were native species, with 70 being avian species. The field survey identified three least concern microbat species (Hoary wattled bat (*Chalinolobus nigrogriseus*); Large bent-

² Due to visual similarities and range overlap, it was difficult to determine if they recorded Black-throated finch individual belonged to the endangered white-rumped sub-species (*Poephila cincta cincta*) or the least concern northern subs-species (*Poephila cincta atropygialis*). A WildNet search returned 21 records for *Poephila cincta cincta* and 0 records for *Poephila cincta atropygialis*.

winged bat (*Miniopterus orianae oceanensis*) and Eastern forest bat (*Vespadelus pumilus*) and one reptile species (Open-litter rainbow skink (*Carlia pectoralis*) listed as least concern).

All conservation significant and migratory fauna with a known occurrence presence within the broader region have been analysed via desktop databases and are presented in Figure 3-5

All conservation significant fauna species recorded onsite by either EMM or Evolve during the above field surveys are presented in Table 3-7 The conservation significant and migratory species that had recorded sightings and locations onsite within the project area via on ground surveys are presented in Figure 3-6.

Table 3-7 Summary of all Conservation significant and migratory fauna detected (sightings, calls or traces) during field surveys

MNES Species	Consultancy	Survey Date	Number of Observations and method/type	Location
Koala	Evolve	Between 28/03/2022 and 01/04/2022	No sighting but traces found	Not specified in ecology report
Bare-rumped sheath-tail bat	EMM	July 2021	8 individuals	2 Locations along No Name Road (north) 1 – 2 calls per detector night Lansdowne Creek South-east and south-west of No Name Road (north)
Black-throated finch (southern)	Evolve	Between 22/05/2022 and 27/05/2022	1 – unconfirmed subspecies	Along No Name Road (north)
		Between 06/02/2023 and 10/02/2023	2 individuals	Along railway corridor
Squatter pigeon (southern)	EMM	July 2021	5 individuals	50 m east of No Name Road (north)
			7 individuals	Dam
		March 2022	2 individuals	50 m east of No Name Road (north)
	Evolve	Between 22/05/2022 and 27/05/2022	Not specified in ecology report	Not specified in ecology report
		October 2022	2 individuals	South of Bidwilli Road
		Between 06/02/2023 and 10/02/2023	3 individuals	Not specified in ecology report
Barn swallow	Evolve	Between 22/05/2022 and 27/05/2022	Not specified in ecology report	Not specified in ecology report
		Between 12/09/2022 and 14/10/2022	Not specified in ecology report	Not specified in ecology report
		Between 06/02/2023 and 10/02/2023	Not specified in ecology report	Not specified in ecology report
Glossy ibis	Evolve	Between 22/05/2022 and 27/05/2022	“Multiple”	In vicinity of Serpentine Lagoon
Black-faced monarch	EMM	July 2021	1 individual	Lansdowne Creek
	Evolve	September 2022	1 individual	“In riparian vegetation”

Section 3 Habitat Assessment

MNES Species	Consultancy	Survey Date	Number of Observations and method/type	Location
		February 2023	1 individual	"In riparian vegetation"
Fork-tailed swift	EMM	March 2021	1 Individual	Adjacent to the QPM site
Spectacled monarch	EMM	July 2021	2 individuals	Lansdowne Creek
Rufous fantail	EMM	July 2021	4 individuals	Lansdowne Creek
Oriental cuckoo	EMM	July 2021	1 individual	Lansdowne Creek

Legend

Evolve Survey Data

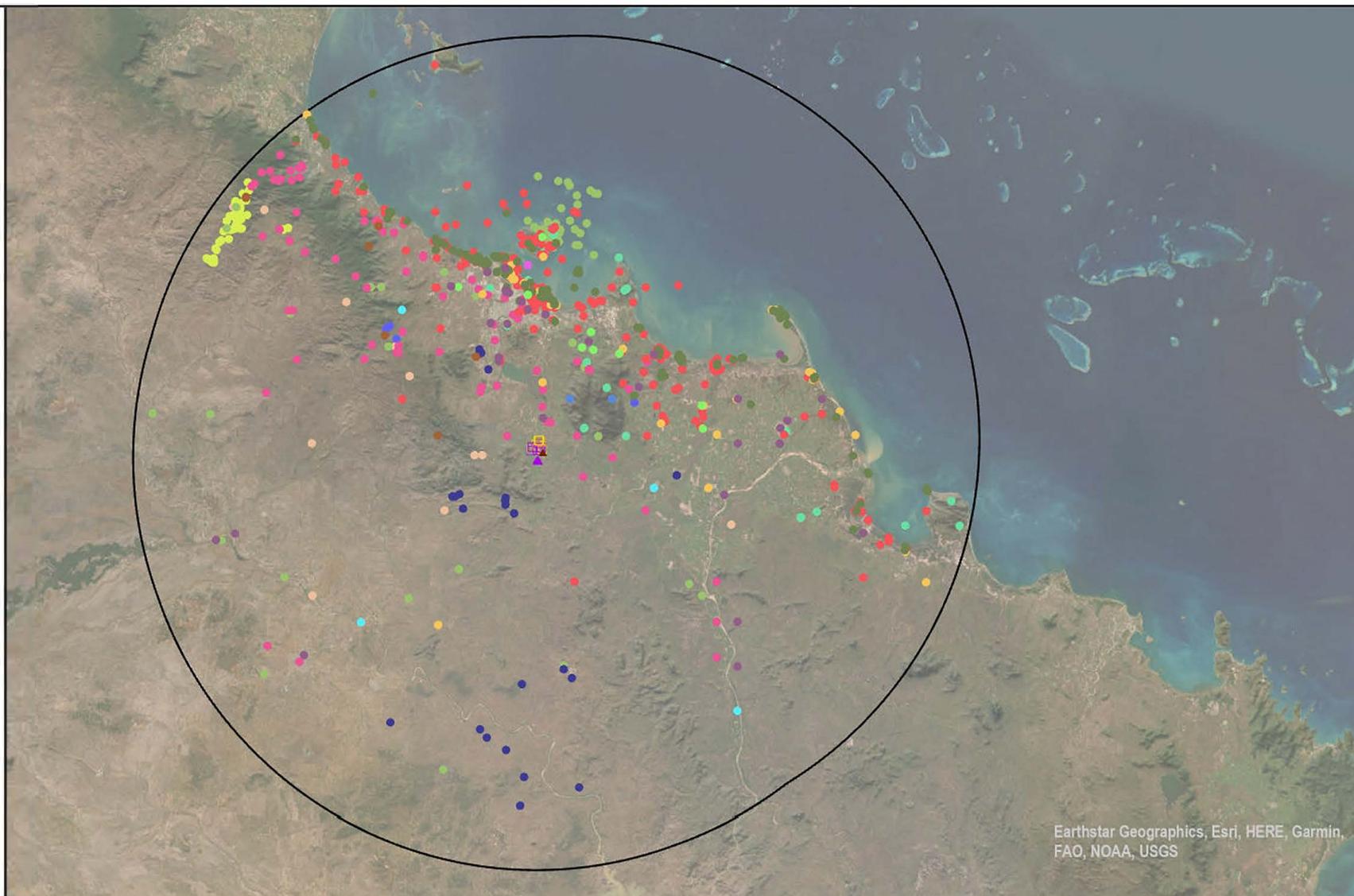
- ▲ Squatter Pigeon
- ▲ Black-throated Finch

EMM Survey Data

- Bare-rumped Sheathtail Bat
- Black-faced Monarch
- Black-throated Finch (unconfirmed)
- Oriental Cuckoo
- Rufous Fantail
- Spectacled Monarch
- Squatter Pigeon

ALA Records

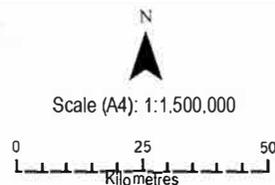
- Australian Painted Snipe
- Bare-rumped Sheathtail Bat
- Grey Falcon
- Black-throated Finch (Southern)
- Masked Owl (Northern)
- Greater Sand Plover
- Curlew Sandpiper
- Eastern Curlew
- Squatter Pigeon (Southern)
- White-throated Needletail
- McDonald's Frog
- Northern Quoll
- Koala
- Semon's Leaf-nosed Bat
- Ghost Bat
- Greater Glider (Northern)
- Greater Glider (Central and Southern)



Earthstar Geographics, Esri, HERE, Garmin, FAO, NOAA, USGS

Figure 3-5 Known Species Records within 100km
Legend

□ Project Area 100km Buffer



GDA 1994 MGA Zone 55



Date: 7/03/2023
Author: EMH

DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



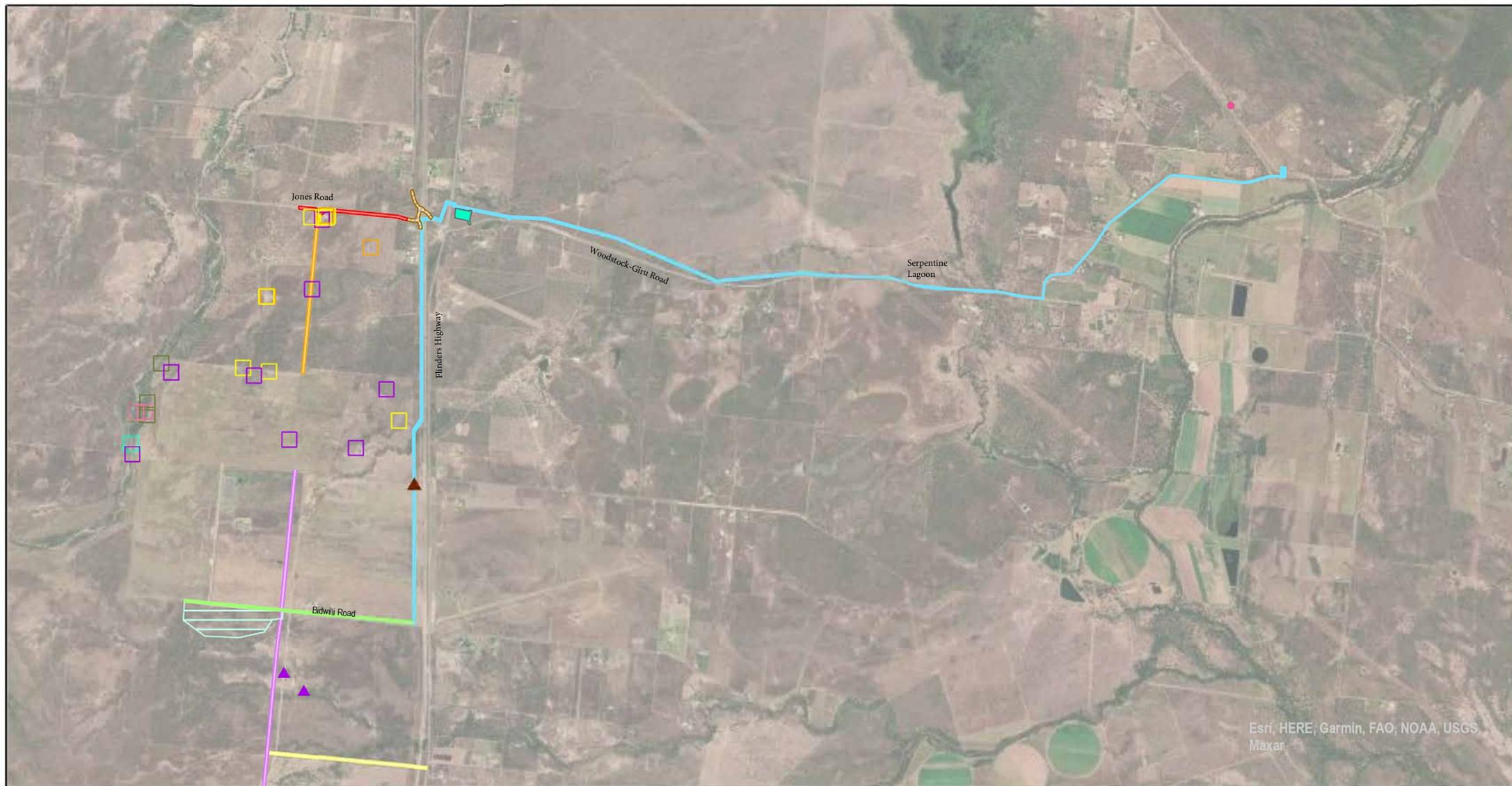
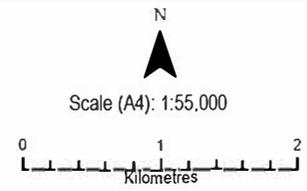


Figure 3-6 Species Sightings at Project Level (recorded locations only)



GDA 1994 MGA Zone 55



Date: 7/03/2023
 Author: EMH

DISCLAIMER
 CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



Table 3-8 Likelihood of Occurrence of Conservation Significant and Migratory Fauna Within the LEIP

Species	Status		Habitat Preference	Likelihood of Occurrence
	EPBC Act	NC Act		
Curlew sandpiper (<i>Calidris ferruginea</i>)	Critically Endangered	Critically Endangered	Curlew sandpiper mainly occurs on intertidal mudflats in sheltered coastal areas (i.e., estuaries, bays, inlets, lagoons). They also occur inland around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in brackish and fresh waters.	Moderate. Species previously recorded within the locality, however not within or adjacent to the Project area. Potential habitat (wetland) is present within the subject area. Potential foraging habitat does exist around the Serpentine Lagoon (1.19 ha).
Greater sand plover (<i>Charadrius leschenaultii</i>)	Vulnerable, Migratory	Vulnerable	In the non-breeding grounds in Australasia, the species is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches, large intertidal mudflats, sandbanks, salt marshes, estuaries, coral reefs, rocky islands rock platforms, tidal lagoons and dunes near the coast (Marchant & Higgins, 1993).	Unlikely. Species has not been previously recorded within 20 km of the Project area (based on desktop assessments).
Red goshawk (<i>Erythrotriorchis radiatus</i>)	Vulnerable	Endangered	The species inhabits tall open forests and woodlands, tropical savannas traversed by rivers, and the edges of rainforests, usually on fertile soils in coastal and subcoastal regions (Marchant & Higgins, 1993).	Unlikely. Species has not been previously recorded within the Project area (based on desktop assessments).
Grey falcon (<i>Falco hypoleucos</i>)	Vulnerable	Vulnerable	The Grey falcon occurs at low densities across inland Australia (Birdlife International, 2019). The species frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses. The species has also been observed hunting in treeless areas and frequents tussock grassland and open woodland, particularly in winter.	Unlikely. Species has not been recorded within 40 km of the Project area (based on desktop assessments).

Species	Status		Habitat Preference	Likelihood of Occurrence
	EPBC Act	NC Act		
Squatter pigeon (southern) (<i>Geophaps scripta scripta</i>)	Vulnerable	Vulnerable	This species inhabits open grasslands and woodlands typically with a native understorey although may occur in artificial pastures.	<p>Known.</p> <p>Previously recorded within the locality and habitat values occur within the proposed impact area. Species was sighted during the second targeted survey by Evolve adjacent to Majors Creek Road in open eucalypt woodland.</p> <p>Species was additionally sighted twice by Evolve during October surveys on lot 87 RP911426 within 200 m of a permanent farm dam (Evolve 2022c).</p> <p>A habitat mapping exercise has noted the following habitat is suitable for the Squatter pigeon (southern):</p> <ul style="list-style-type: none"> - Breeding habitat: 17.87 ha; - Foraging habitat: 25.58 ha; and <p>Dispersal habitat: 2.64 ha.</p>
White-throated needletail (<i>Hirundapus caudacutus</i>)	Vulnerable, Migratory	Vulnerable	<p>A regular summer non-breeding migrant to eastern Australia, the White-throated needletail is a highly aerial species that forages in the airspace over most habitats.</p> <p>However, the shows some preference for forested hilly areas and coastal ranges. Its roosting habits are poorly known but it has been recorded roosting in woodlands, high amongst the foliage of large Eucalypt species (Pizzey et al. 2012).</p>	<p>Likely.</p> <p>Multiple records of this species are represented within the study area. The species habitat preferences indicate that it could occur in any airspace over the entire road reserve. Therefore, this species is considered likely to occur.</p>
Star finch (eastern) (<i>Neochmia ruficauda ruficauda</i>)	Endangered	Endangered	The Star finch (eastern) occurs within damp grasslands, sedgelands or grassy woodlands near permanent water or areas of regular inundation. Occasionally, individuals have been reported in disturbed habitat and suburban areas.	<p>Unlikely.</p> <p>Species has not been previously recorded within the Project area (based on desktop assessments).</p>
Eastern curlew (<i>Numenius madagascariensis</i>)	Critically Endangered, Migratory	Endangered	During the non-breeding season in Australia, the Eastern curlew is most commonly associated with estuaries, bays, harbours, inlets and coastal lagoons, containing large intertidal mudflats or sandflats, often with beds of seagrass.	<p>Unlikely.</p> <p>Species has not been previously recorded within 20 km of the Project area (based on desktop assessments).</p>

Species	Status		Habitat Preference	Likelihood of Occurrence
	EPBC Act	NC Act		
Black-throated finch (southern) (<i>Poephila cincta cincta</i>)	Endangered	Endangered	The Black-throated finch (southern) occurs mainly in grassy, open woodlands and forests, typically dominated by Eucalyptus, Corymbia and Melaleuca, and occasionally in tussock grasslands or other habits (for example freshwater wetlands), often along or near watercourses, or in the vicinity of water.	<p>Known.</p> <p>Species recorded as part of surveys. Species habitat values including essential habitat values occur within the proposed impact area.</p> <p>The fourth detailed survey by Evolve recorded two individuals at one location, located close to the rail line.</p> <p>Habitat mapping identified 29.76 ha was deemed to be foraging habitat only, whilst a further 46.08 ha was determined to provide breeding and foraging habitat,</p>
Australian painted snipe (<i>Rostratula australis</i>)	Endangered	Endangered	<p>The Australian painted snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often scattered clumps of lignum <i>Muehlenbeckia</i> or cane grass or sometimes tea-tree (<i>Melaleuca</i>).</p> <p>The Australian painted snipe utilises areas that are lined with trees or have some scattered fallen or washed-up timber.</p>	<p>Likely.</p> <p>Species previously recorded within proximity to the Project area and potential habitat (wetland) is present within the subject area.</p> <p>No individuals were located during the surveys however the site does fall into the modelled habitat areas as noted by the Queensland Department of Environment and Science. The mapping exercise has noted that there is approximately 1.19 ha that can be considered suitable habitat.</p> <p>Majority of premier habitat for the Australian painted snipe is located near Serpentine Lagoon and associated wetlands to the North of the alignment near Serpentine Lagoon.</p>
Masked owl (northern) (<i>Tyto novaehollandiae kimberli</i>)	Vulnerable	Vulnerable	Masked owl (Northern) has been recorded in riparian forest, rainforest, open forest, Melaleuca swamps and the edges of mangroves. The species has also been recorded along the margins of sugar cane fields.	<p>Unlikely.</p> <p>Species has not been previously recorded within 20 km of the Project area (based on desktop assessments).</p>

Species	Status		Habitat Preference	Likelihood of Occurrence
	EPBC Act	NC Act		
Northern quoll (<i>Dasyurus hallucatus</i>)	Endangered	-	<p>The Northern quoll occupies habitats including rocky areas, eucalypt forests and woodlands, rainforests, sandy lowlands, and beaches, shrubland, grassland and desert.</p> <p>Northern quoll habitats encompass some form of rocky area for denning purposes with surrounding vegetated habitats for foraging and dispersal. Eucalypt forest or woodland habitats usually have a high structural diversity containing large diameter trees, termite mounds or hollow logs for denning purposes. Tree hollows will also be used as den sites, as northern quolls are the most arboreal quoll species (DCCEEW, 2022c).</p>	<p>Moderate.</p> <p>Species previously recorded within proximity (8km) to the proposed impact area. The species has been found the Bowling Green Bay National Park. Foraging habitat has been mapped as areas within 4km radius of intact vegetation areas (for which multiple sightings and preferred denning habitat exists) which is approximately 4 ha of habitat within the Project area.</p>
Semon's leaf-nosed bat (<i>Hipposideros semoni</i>)	Vulnerable	Endangered	<p>Semon's leaf-nosed bat is rare even in core habitats, including rainforests, streams and rivers adjacent to rainforests (Reardon et al., 2010).</p>	<p>Unlikely</p> <p>There were no individuals recorded during the 2022 or 2023 field surveys. Based on desktop assessments, the closest individual was recorded approximately 37 km away in Townsville and there are no other records within 100 km of the Project area.</p>
Ghost bat (<i>Macroderma gigas</i>)	Vulnerable	Endangered	<p>The species is generally found in northern Australia, north of 29°S in Western Australia, Northern Territory and Queensland, where it inhabits arid Pilbara regions, tropical savanna woodlands and rainforests.</p>	<p>Unlikely</p> <p>There were no individuals recorded during the 2022 or 2023 field surveys and no suitable roosting habitat was located within the proposed impact area. The closest known record of the species was recorded in 2019, approximately 20 km northeast of the Project site.</p>
Greater glider (northern) (<i>Petauroides minor</i>)	Vulnerable	Vulnerable	<p>The species occurs in patchy, isolated populations from Townsville north to the Windsor Tablelands. The Greater glider (northern) is generally restricted to eucalypt forest and woodlands on high elevations within its range.</p>	<p>Unlikely</p> <p>There were no individuals recorded during the 2022 and 2023 field surveys and no tree hollows suitable for large animals were recorded. Although there are many records of this species within the region, all records are located within the Paluma Range National Park.</p>

Species	Status		Habitat Preference	Likelihood of Occurrence
	EPBC Act	NC Act		
Greater glider (southern and central) (<i>Petauroides volans</i>)	Endangered	Endangered	The Greater glider (southern and central) occurs at elevations between 0 – 1,200 m above sea level, in eucalypt forests and woodlands of eastern Australia, from Proserpine QLD south to Wombat State Forest in Victoria.	Unlikely There were no individuals recorded during the 2022 and 2023 field surveys and no tree hollows suitable for large animals were recorded. The closest known record of the species occurs on the north-western area of Mingela State Forest, recorded in 2000, approximately 15 km west of the Project site.
Koala (<i>Phascolarctos cinereus</i>)	Endangered	Endangered	Open forest and woodland where food trees (<i>Eucalypt spp.</i>) are present.	Unlikely. No sighting of Koalas or Koala scats have been found. No evidence of species presence during on-ground surveys, other than a potential scratch mark on a tree. Species not recorded within the locality. Potential habitat in the form of potential feed tree species is present within the Project area and the species has the potential to be present in areas adjacent to the project.
Large-eared horseshoe bat (<i>Rhinolophus robertsi</i>)	Vulnerable	-	Large-eared horseshoe bat occurs in rainforests, riparian forests, eucalypt open forests and woodlands from Cape York and south to Townsville. Rare species even within its core habitat.	Unlikely. Species has not previously been recorded in Project area or within 20 km of the Project area (based on WildNet and ALA assessments).

<p>Bare-rumped sheath-tail bat (<i>Saccolaimus nudicluniatatus</i>)</p>	<p>Vulnerable</p>	<p>Endangered</p>	<p>The species occurs in tropical woodland and tall open forests – in Queensland, mainly in Poplar Box or Darwin Stringybark savannah woodland. The species roosts and rears young in tree hollows (Churchill, 2008). The Bare-rumped sheath-tail bat has been suggested to forage over habitat edges such as the edge of rainforest and in forest clearings.</p>	<p>Known</p> <p>Records from the Townsville region (e.g., surveys for the Townsville ring road, Majors Creek solar farm). Despite there being few records of the species, it is potentially under recorded in the region. It occurs in lowland forest including gallery forest.</p> <p>As part of the EMM surveys, numerous calls recorded on Anabat devices in March 2021 (EMM, 2022). While not able to be categorically identified, they were assigned to the group <i>Saccolaimus saccolaimus</i> / <i>Taphozous troughtoni</i> / <i>Ozimops lumsdenae</i>, and it is highly likely that some of these calls belong to <i>S. saccolaimus</i> (Greg Ford, 2021). Although other calls were positively assigned to the other species (EMM, 2022). Subsequent to this, as part of the EMM July 2021 survey further Anabat™ detectors were deployed to provide further clarity on the status of the species on the road reserve (EMM, 2022). Calls from this species were confirmed from four sites sampled, with calls from a fifth site being likely from this species (EMM, 2022).</p> <p>In both the EMM and surveys conducted by Evolve no known roosts have been confirmed to date. Potential roosts are mapped however further inspection of hollows has not been undertaken and can therefore not be confirmed. Foraging habitat can be noted on the alignment as the species has a fast, direct flight and is likely to forage primarily for aerial insects over the woodland/forest canopy but may fly lower when foraging over open situations.</p> <p>Vegetation with hollows at around 200mm diameter constitute possible roosting habitat, six potential roosting hollows were recorded by Evolve during October surveys of which one is within the road alignment, this point and another hollow within the alignment recorded by EMM have been mapped as roosting habitat, totalling 0.03ha</p>
---	-------------------	-------------------	---	--

Section 3 Habitat Assessment

Species	Status		Habitat Preference	Likelihood of Occurrence
	EPBC Act	NC Act		
				<p>(Evolve, 2022c). A total of 31 potentially deep hollows suitable for Bare-rumped sheath-tail bat were observed across all field surveys (refer to page 19 of Appendix K. Noting these 31 hollows do not refer to a total number of hollow-bearing trees in the area.</p> <p>The project area is located in the modelled distribution as modelled by DCCCEEW. Further several studies in the area have located the species via the use of song meters.</p>
McDonald's frog (<i>Cophixalus mcdonaldi</i>)	Critically Endangered	Critically Endangered	Restricted to high altitude rainforest habitats on Mount Elliot, to the north-east of the Project area. Individuals have been found along rocky creek margins, in rotted tree stumps, under flat rocks and in rock cracks.	<p>Unlikely</p> <p>This species has not been recorded in the Project area. It is restricted to elevations of 900m above sea level and higher on Mount Elliot in the Bowling Green Bay National Park.</p>
Fork-tailed swift (<i>Apus pacificus</i>)	Migratory	Special Least Concern	Almost exclusively aerial and occurs mainly over inland plains. Habitats include riparian woodland, heathland and low scrub areas.	<p>Known</p> <p>Previously recorded by EMM (EMM, 2022) in the area and suitable habitat occurs anywhere over the Project area, therefore the whole Project area is considered potential foraging habitat.</p>
Latham's snipe (<i>Gallinago hardwickii</i>)	Migratory	Special Least Concern	In Australia, the species occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g., swamps, flooded grasslands or heathlands, around bogs and other water bodies).	<p>Moderate</p> <p>Species previously recorded within the locality; species habitat values are present within the Project area.</p>
Gull-billed tern (<i>Gelochelidon nilotica</i>)	Migratory	Special Least Concern	Inhabits shallow wetlands, including coastal or inland lakes, swamps and lagoons, as well as sheltered bays and estuaries, where it forages for insects and small fish.	<p>Moderate</p> <p>Species previously recorded within the locality and potential habitat is present within the Project area.</p>

Species	Status		Habitat Preference	Likelihood of Occurrence
	EPBC Act	NC Act		
Black-faced monarch (<i>Monarcha melanopsis</i>)	Migratory	Special Least Concern	Mainly occurs over rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland and warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	Known Species recorded during the September 2022 survey by Evolve (Evolve, 2022c). Species previously recorded within the locality and marginal potential foraging habitat (2.64 ha) is present within the alignment.
Spectacled monarch (<i>Symposiachrus trivirgatus</i>)	Migratory	Special Least Concern	Prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves and other densely vegetated areas.	Moderate Species previously recorded within locality; marginal habitat is present within the project area.
Glossy ibis (<i>Plegadis falcinellus</i>)	Migratory	Special Least Concern	The species preferred habitat for foraging and breeding are freshwater marshes at the edges of lakes, rivers, lagoons, floodplains, meadows, swamps reservoirs, sewage ponds, rice fields and cultivated areas under irrigation.	Known The species has previously been recorded within the Project area locality and species habitat values are present within the Project area. Recorded as part of the second survey (Evolve, 2022b) within the locality of Serpentine Lagoon. The premier habitat for the Glossy ibis is located within Serpentine Lagoon and associated wetlands to the North of the alignment near Serpentine Lagoon. Potential foraging and breeding habitat mapped within the locality of Serpentine Lagoon totals 1.19 ha of the alignment.
Pacific golden plover (<i>Pluvialis fulva</i>)	Migratory	Special Least Concern	In non-breeding grounds in Australia this species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands.	Moderate Previously recorded within the locality and marginal habitat occurs within the proposed impact area.
Rufous fantail (<i>Rhipidura rufifrons</i>)	Migratory	Special Least Concern	In east and south-east Australia, the species mainly inhabits wet sclerophyll forests, often gullies dominated by eucalypts, usually with a dense shrubby understorey often including ferns.	Known Species previously recorded within the locality and recorded on Lansdown Creek by EMM; marginal habitat is present within the Project area.

Species	Status		Habitat Preference	Likelihood of Occurrence
	EPBC Act	NC Act		
Barn swallow (<i>Hirundo rustica</i>)	Migratory	Special Least Concern	<p>The species usually occurs in northern Australia, and on the east to Fraser Island in Queensland.</p> <p>The Barn swallow is recorded in open country in coastal lowlands, often near water, towns and cities. Known to occur in freshwater wetlands.</p>	<p>Known</p> <p>Not recorded previously or as part of the PMST. Species was however recorded as part of the second survey (Evolve, 2022b). Species may occur within the locality of Serpentine Lagoon.</p>
Oriental cuckoo (<i>Cuculus optatus</i>)	Migratory	Special Least Concern	<p>This species is a summer visitor to Australia.</p> <p>It inhabits a wide range of habitats, including dense to open woodlands and forests, vine thickets monsoonal rainforest and wet sclerophyll forest. It particularly prefers the edges of riparian forests (Menkhorst et al., 2017).</p>	<p>Known</p> <p>Multiple records of this species exist within the study area and suitable habitat occurs. This species was identified adjacent to the road reserve during surveys (EMM, 2022).</p> <p>Evolve surveys did not observe the species over 4 weeks of survey. The species does not breed in Australia and can therefore be found potentially in any woodland environment, which has been mapped as 46.08 ha of the alignment.</p>

3.2.8.1 Pest Fauna Species

Wildlife Online and EPBC Act PMST searches identified seventeen (17) introduced terrestrial fauna species within a 20 km radius of the Project area. One (1) of these species are also listed as Restricted Matters under the *Biosecurity Act 2014* (DAF, 2020) (Table 3-9). Under the Act, a person who has control over a ‘Restricted Matter’ must not do the following:

- Category 3 – a person who has, or has a thing infested with, the ‘Restricted Matter’ in the person’s possession or under the person’s control must not distribute or dispose of the restricted matter unless the distribution or disposal is carried out via the methods set out in the Biosecurity Act;
- Category 4 – move the ‘Restricted Matter’, or cause or allow to be moved;
- Category 5 – keep in the person’s possession or under the person’s control; and
- Category 6 – give food to the ‘Restricted Matter’.

Of the seventeen species identified in desktop assessments, six pest fauna species were recorded during field surveys (Table 3-9).

Table 3-9 Introduced Fauna Species Known within the Project Area and Surrounds

Species Name	Common Name	Biodiversity Act Category	Identified During Field Surveys
<i>Rhinella marina</i>	Cane toad	-	✓
<i>Acridotheres tristis</i>	Common myna	-	✓
<i>Felis catus</i>	Domestic cat	-	✓
<i>Rattus sp.</i>	Rat	-	✓
<i>Sus scrofa</i>	Feral pig	Category 3, 4, and 6	✓
<i>Bos taurus</i>	European cattle	-	✓
<i>Lonchura punctulata</i>	Nutmeg mannikin	-	X
<i>Columba livia</i>	Rock dove	-	X
<i>Pavo cristatus</i>	Indian peafowl	-	X
<i>Passer domesticus</i>	House sparrow	-	X
<i>Pavo cristatus</i>	Indian peafowl	-	X
<i>Equus caballus</i>	Horse	-	X
<i>Mus musculus</i>	House mouse	-	X
<i>Oreochromis mossambica</i>	Mozambique mouthbrooder	-	X
<i>Gambusia holbrooki</i>	Mosquitofish	-	X
<i>Poecilia reticulata</i>	Guppy	-	X
<i>Hemidactylus frenatus</i>	House gecko	-	X

3.3 Matters of National Environmental Significance

3.3.1 MNES Threatened Ecological Communities

There were no Threatened Ecological Communities (TECs) were flagged as having a probability of occurrence within the Project area or buffer area by a PMST report generated for the Project. On-ground flora surveys of the Project area found no evidence of any TECs or associated Regional Ecosystems.

3.3.2 MNES Threatened Fauna Species – Likely or Known to Occur

This section includes additional information on species which are likely or known to occur as identified in Table 3-8

3.3.2.1 Black-throated finch (southern) (Endangered)

Key data for Black-throated finch (southern) is presented in Table 3-10 and a significant impact assessment is presented in Table 4-3. Mapping of known species records within the area is shown in Figure 3-5 and Figure 3-6.

Table 3-10 Key Data on Black-throated Finch (Southern)

Black-throated finch (southern) (<i>Poephila cincta cincta</i>)
Baseline Data Results
Field surveys conducted in 2022 had a potential and unverified sighting close to Serpentine Lagoon just off Woodstock Giru Road, however, due to visual similarity and range overlap it was unable to be determined whether these sightings were the endangered (NCA and EPBC Act) Black-throated finch (white-rumped southern subspecies) (<i>Poephila cincta cincta</i>), or the least concern northern subspecies Black-throated finch (northern) (<i>Poephila cincta atropygialis</i>). Two individuals were sighted at one location during adjacent to the railway corridor line.
EPBC Status
Endangered
Key Threats
Key threats to the Black-throated finch (southern) include: <ul style="list-style-type: none"> ▪ Clearance and fragmentation of woodlands, riparian habitats and wattle shrublands; ▪ 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; and ▪ Hybridisation with escapees of the northern subspecies.
Recovery Plans
The National Recovery Plan of the Black-throated finch (southern) subspecies (Black-throated Finch Recovery Team, Department of Environment and Climate Change (New South Wales (NSW)) and Queensland Parks and Wildlife Service, 2007). The Project and its associated studies has undertaken survey and monitoring and provided additional information regarding the prevalence of the species. This information will be useful to various research groups. Impacts associated with the studies are expected to provide great value. The Project is expected to be consistent with the recovery plan as outlined throughout Section 3.3.2.1.
Threat Abatement Plans
<ul style="list-style-type: none"> • Threat abatement plan to reduce the impacts on northern Australia’s biodiversity by the five listed grasses (DSEWPC, 2012): <ul style="list-style-type: none"> ▪ Addresses the key threatening process (KTP) ‘Ecosystem degradation, habitat loss and species decline due to invasion of northern Australia by introduced Gamba grass (<i>Andropogon gayanus</i>), Para grass (<i>Urochloa mutica</i>), Olive hymenachne (<i>Hymenachne amplexicaulis</i>), Mission grass (<i>Cenchrus polystachios syn. Pennisetum pedicellatum</i>)’. • Threat abatement plan for competition and land degradation by rabbits (DotEE, 2016): <ul style="list-style-type: none"> ▪ Established a national framework to guide and coordinate Australia’s response to the impacts of European rabbits on biodiversity. Identifies the research and management actions required to ensure the long-term survival of those native species and communities impacted by the presence of rabbits. Replaces the previous threat abatement plan published in 2008 (DEWHA, 2008). ▪ The Project is expected to be in accordance with the threat abatement plans listed above. The Project will implement management measures to reduce impacts from introduced grasses and is not expected to result in increase to rabbits.

3.3.2.1.1 Species Description

The Black-throated finch (southern) (*Poephila cincta cincta*) is listed as endangered under both the EPBC Act and NC Act. Black-throated finch (southern) is a small, granivorous bird approximately 120 mm in length and weighing approximately 15 grams. The species exhibits a distinctive black throat, a fawn body colouring, a white rump and pink feet. The southern black-throated finch is distributed within two general locations, including the Townsville region and scattered sites in central-eastern Queensland. The southern black throated finch inhabits woodland savannahs, areas of riverine vegetation, grassy, open woodlands and forests, typically dominated by Eucalyptus, Corymbia and Melaleuca species, often near watercourses, or in the vicinity of water. As a general rule areas of seeding grass within 5km of a permanent water source can be considered habitat in the species model distribution area.

3.3.2.1.2 Occurrence in Region

The ALA database identified four (4) known records of the species within a 100 km radius of the Project area, recorded in 1885, 1892, 2016 and 2017 within proximity to watercourses and within bushland habitats (refer to Figure 3-5). Whereas a WildNet species search returned 256 records for the southern subspecies (refer to Appendix J). The closest record on the ALA database is located approximately 23 km south-east of the Project area (refer to Figure 3-5).

3.3.2.1.3 Occurrence in Project Area

Field surveys conducted in 2022 had one (1) potential and unverified species sighting close to Serpentine Lagoon just off Woodstock Giru Road, however due to visual similarity and range overlap it was unable to be determined whether these sightings were the endangered (EPBC Act and NC Act) Black-throated finch (white-rumped southern subspecies) (*Poephila cincta cincta*), or the least concern northern subspecies Black-throated finch (northern) (*Poephila cincta atropygialis*) (Evolve, 2022b). During the February 2023 survey, a pair (2 individuals) of Black-throated finch (southern) were confirmed and observed foraging adjacent to the railway corridor (refer Plate 3-1). Refer to Figure 3-8 for all sightings of Black-throated finch (southern) within the project area. Finch nests were observed during the first ecological field surveys (refer to Plate 3-2), however due to the bottle shaped woven structure, it could not be determined if these nests belonged to the Black-throated finch ((southern), the Double-barred finch (*Taeniopygia bichenovii*), the Chestnut-breasted manikin (*Lonchura castaneothorax*) or the Zebra finch (*Taeniopygia guttata*). Locations of these nests were not specified within the ecological survey reports.



Plate 3-1 Black-throated finch (southern) observed foraging adjacent to the railway corridor (source: Evolve 2023).



Plate 3-2 Disused finch nests found within the survey area (source: Evolve 2022a)

3.3.2.1.4 Habitat Assessment in Project Area and Surrounds

The alignment of the roads and water infrastructure network crosses several drainage and creek crossings, and traverses near both natural and man-made permanent water bodies. The whole of the alignment provides either suitable foraging or breeding habitat for this species. Favourable foraging species for the Black-throated finch (southern) have been listed in Table 3-11, with an assessment of whether the flora species is native or introduced and whether or not the flora species occurs within the Project area. Vegetated areas have been noted as breeding due to the species nesting requirements, whilst grassland only areas have been noted as foraging. Regularly slashed and maintained roadsides (e.g., along Woodstock Giru Road) have been excluded from foraging habitat as this species feed on the seeds of grasses and this would be largely absent from these areas.

Habitat mapping identified 29.76 ha was deemed to be foraging habitat only, whilst a further 46.08 ha was determined to provide breeding and foraging habitat (refer to pg. 1-3 of Appendix K).

An assessment of ‘surrounding’ potential Southern black-throated finch habitat was undertaken. On review of the Significant Impact Guidelines for the endangered southern black-throated finch (*Poephila cincta cincta*), a 5 km buffer has been used which is expected to be the ‘biologically relevant’ range of the species. As stated in the EMM report (EMM, 2022), the southern black-throated finch habitat in the surrounding area within a 5 km buffer from the referral area is precautionarily defined as:

- *Marginal breeding habitat – the Significant Impact Guidelines for the endangered Black-throated Finch (southern) (Commonwealth of Australia, 2009) states that the subspecies nest in trees located within 1 km of seasonal water sources (NRA, 2007). Remnant woodland within 1 km of the farm dams adjacent to the survey area is mapped as potential breeding habitat due to the presence of suitable nesting trees and the proximity to retained areas of open grassy woodland outside the survey area – additionally areas of regrowth are also captured. However, the limiting factor of suitable foraging habitat near the potential breeding areas should be noted and the weedy nature of these areas. Therefore, it is considered unlikely that these areas support preferred breeding habitat for the subspecies in the study area but consistent with the guidelines these areas are conservatively mapped as potential.*
- *Foraging habitat – all remaining areas of grassy woodland within 3 km of potential breeding habitat consistent with Mitchell (1996) where suitable habitat factors are present (e.g., foraging grass species, bare ground on which seed can be gleaned).*

Table 3-11 Relevant Black-throated finch (southern) food species in and surrounding the Project area

Scientific Name	Common Name	Native or Introduced	Project Occurrence Records
<i>Enteropogon acicularis</i>	Curly windmill grass	Native	No
<i>Themeda triandra</i>	Kangaroo grass	Native	Yes
<i>Panicum decompositum</i>	Native millet	Native	Yes
<i>Panicum effusum</i>	Hairy panic	Native	No
<i>Dichanthium sericeum</i>	Bluegrass	Native	No
<i>Alloteropsis semialata</i>	Cockatoo grass	Native	No
<i>Eragrostis sororia</i>	Woodland lovegrass	Native	No
<i>Urochloa mosambicensis</i>	Sabi grass	Introduced environmental weed. Not to be used in rehabilitation.	No
<i>Digitaria ciliaris</i>	Summer grass	Introduced environmental weed. Not to be used in rehabilitation.	Yes

Section 3 Habitat Assessment

Scientific Name	Common Name	Native or Introduced	Project Occurrence Records
<i>Melinis repens</i>	Red natal grass	Introduced environmental weed. Not to be used in rehabilitation.	Yes
<i>Chloris inflata</i>	Purple-top chloris	Introduced environmental weed. Not to be used in rehabilitation.	No

The surrounding habitat mapping figure is provided in Figure 3-7.

Areas of existing roads, rail and built structures were excluded from the habitat mapping areas.

Using the surrounding habitat mapping, the amount of Black-throated finch (southern) habitat within the 5 km buffer area is as follows:

- Foraging habitat = 670.2 ha
 - The Project area which is 83.8 ha represents 12.50 % of the potential foraging habitat within the 5 km buffer.
- Breeding habitat = 22,549.6 ha
 - The Project area which is 83.8 ha represents 0.37 % of the potential breeding habitat within the 5 km buffer.

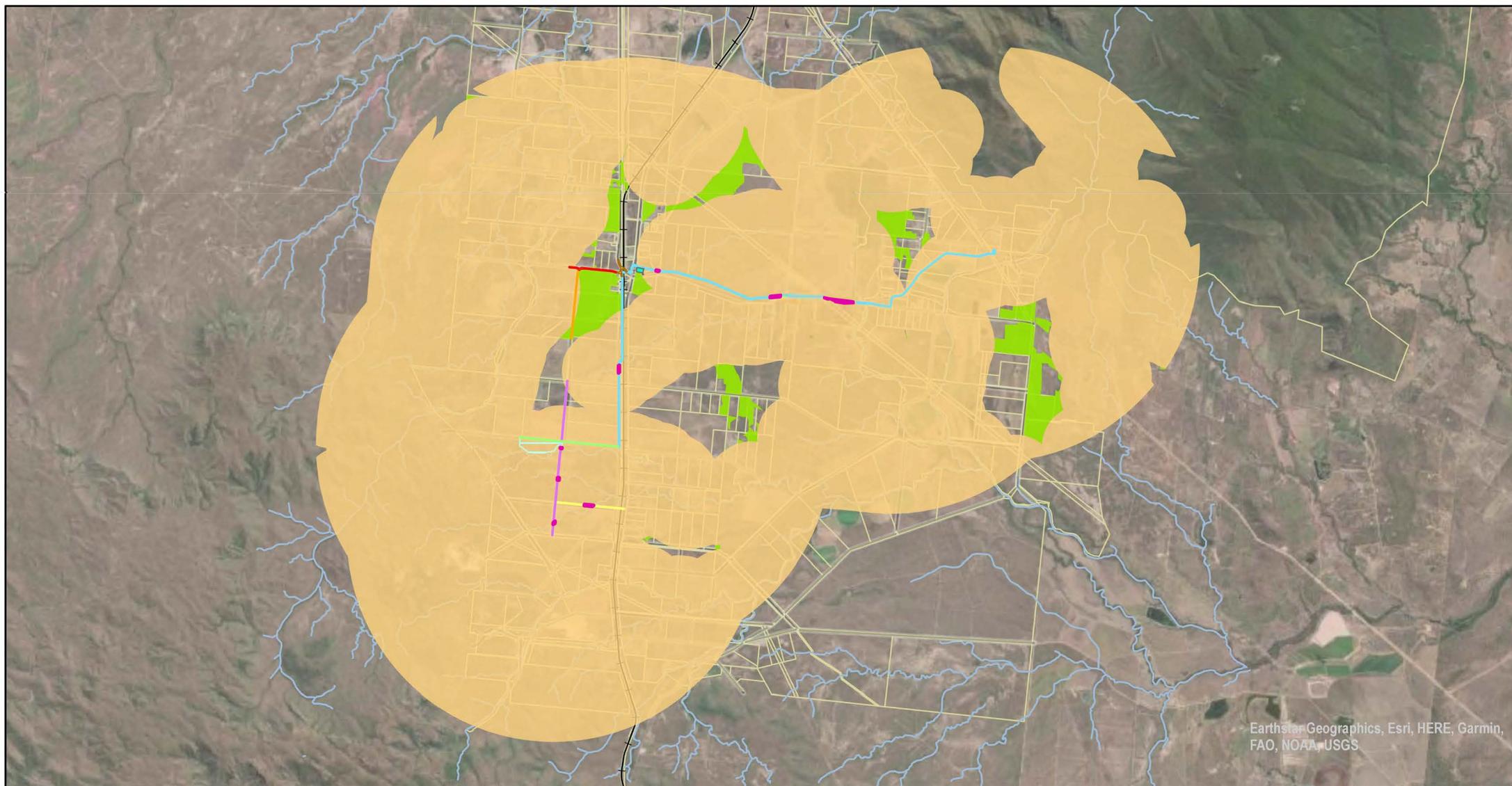
The habitat quality scores for the Black-throated finch (southern) are presented in Table 3-12, with overall habitat scores intermediate ranging from 5.19 to 6.63 out of 10.

Table 3-12 MHQA for the Black-throated finch (southern) summarised by assessment unit

Assessment unit	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Regional Ecosystem	Remnant 11.3.30	Non-Remnant 11.3.30	Remnant 11.3.35	Non-Remnant 11.3.35	Remnant 11.3.27e	Remnant 11.3.25b	Remnant 11.3.12
Foraging Habitat							
Abundance of preferable grass species	14.55	13.44	13.33	22.50	20.00	10.00	15.00
Species richness of preferable food grasses	16.82	12.19	12.50	11.25	15.00	25.00	25.00
Mosaic of bare ground and grass cover	14.55	15.00	7.50	5.00	5.00	7.50	20.00
Average Score	15.30	13.54	11.11	12.92	13.33	14.17	20.00
Breeding Habitat							
Nesting tree availability	13.64	10.74	14.17	5.00	15.00	17.50	20.00
Distance to water	17.73	21.25	21.67	17.50	25.00	25.00	20.00
Average Score	15.68	15.99	17.92	11.25	20.00	21.25	20.00
Role of site to overall population	5	5	5	5	5	5	5
Threats							
Reduction In water availability	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Intensive grazing regimes	15.45	11.25	13.33	15.00	20.00	20.00	20.00

Section 3 Habitat Assessment

Assessment unit	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Risk of fire	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Exotic weed dominance	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Lowest score	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Species Mobility							
Coverage of shrub species, including native and introduced species	24.55	25.00	25.00	25.00	25.00	20.00	25.00
Presence of open grassy woodland vegetation structure	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Average Score	19.77	20.00	20.00	20.00	20.00	17.50	20.00
Species habitat score	6.45	5.19	5.48	5.45	6.63	6.27	6.57



Earthstar Geographics, Esri, HERE, Garmin, FAO, NOAA-USGS

Figure 3-7 Surrounding Black-throated Finch (Southern) Habitat

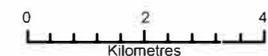
Legend

- | | | |
|---------------------------|--|---------------------------------------|
| Habitat Mapping (Evolve) | Jones Road Intersection Upgrade | Water Infrastructure Network |
| Foraging Habitat | Jones Road to Flinders Highway Upgrade | Storage Dam and Internal Pump Station |
| Marginal Breeding Habitat | No Name Road (north) | Site Laydown Area |
| | No Name Road (south) | Rail Network |
| | Bidwilli Road | Existing Roads |
| | Unnamed Road | Watercourse |
| | | Cadastre (DCDB) |

N



Scale (A4): 1:127,551

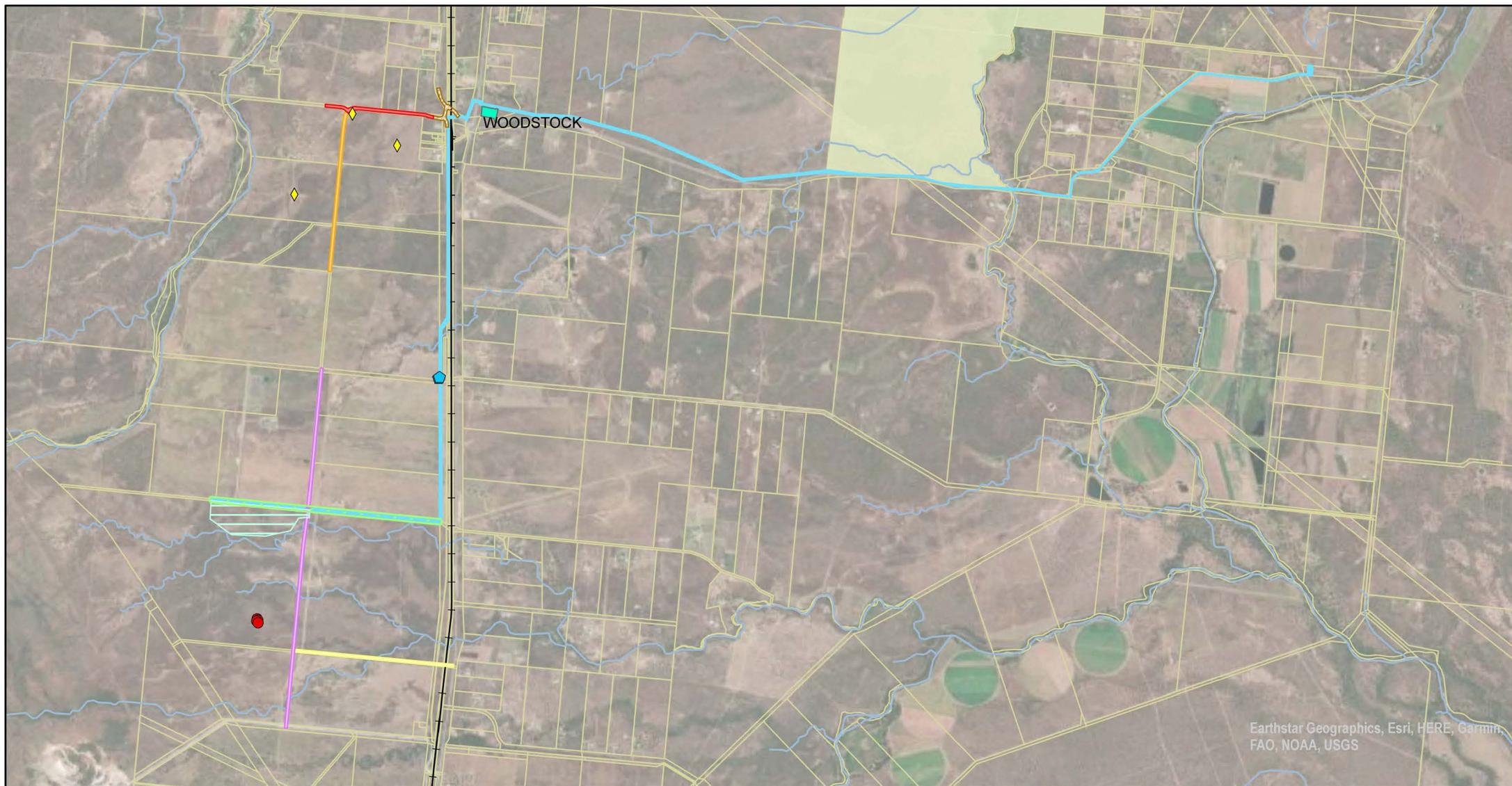


GDA 1994 MGA Zone 55



Date: 22/06/2023
 Author: EMH
 DISCLAIMER
 CDM Smith has endeavored to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



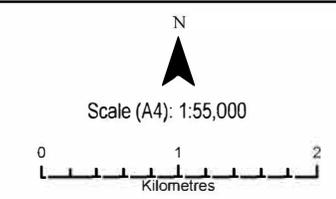


Earthstar Geographics, Esri, HERE, Garmin, FAO, NOAA, USGS

Figure 3-8 Black-throated finch (southern) field records

Legend

- | | | |
|---|---------------------------------------|---------------------------------|
| Confirmed sightings (Evolve) | No Name Road (north) | Site Laydown Area |
| Finch nests (unconfirmed inhabiting species) (Evolve) | No Name Road (south) | Rail Network |
| Unconfirmed sightings (EMM) | Bidwilli Road | Watercourse |
| Jones Road Intersection Upgrade | Unnamed Road | Cadastre (DCDB) |
| Jones Road to Flinders Highway Upgrade | Water Infrastructure Network | Serpentine Lagoon Nature Refuge |
| | Storage Dam and Internal Pump Station | |



GDA 1994 MGA Zone 55



Date: 23/06/2023
 Author: EMH
 DISCLAIMER:
 CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



3.3.2.2 Bare-rumped sheathtail bat (Vulnerable)

Key data for Bare-rumped sheathtail bat is presented in Table 3-13 and a significant impact assessment is presented in Table 4-4. Mapping of known species records within the area is shown in Figure 3-5 and Figure 3-6.

Table 3-13 Key Data on Bare-rumped sheathtail bat

Bare-rumped sheathtail bat (<i>Saccolaimus saccolaimus nudicluniatus</i>)
Baseline Data Results
According to the survey conducted in June 2022, the species was potentially located via the use of song meters. All areas of the Project area provide this foraging habitat.
EPBC Status
Vulnerable
Key Threats
Although poorly known, potential threats to the species listed in the Conservation Advice (TSSC, 2016b) include: <ul style="list-style-type: none"> ▪ Habitat loss and fragmentation; ▪ Competition for tree hollows by birds (native and non-native) and bees; and ▪ Too frequent burning, particularly with potential impacts on availability of roosting trees. Additionally, disease is cited as a possible threat given similar species are known to carry the Australian Bat Lyssavirus.
Recovery Plans
The National Recovery Plan for the Bare-rumped sheathtail bat (Shulz and Thomson, 2007). The Project and its associated studies has undertaken survey and monitoring and provided additional information regarding the potential of the species to occur. This information will be useful to various research groups. Impacts associated with the studies are expected to provide great value. The Project is expected to be consistent with the recovery plan as outlined throughout Section 3.3.2.2.
Threat Abatement Plans
No Threat Abatement Plan has been identified as being relevant for this species.

3.3.2.2.1 Species Description

Bare-rumped sheathtail bat (*Saccolaimus saccolaimus nudicluniatus*) is listed as vulnerable under the EPBC Act and endangered under the NC Act. The Bare-rumped sheathtail bat is a large, high-flying bat that is rarely caught in harp traps and forages above the canopy. Its echolocation call is hard to distinguish from other freetail bats (TSSC, 2016b). The species is mostly recorded in eucalypt forests and woodlands in near-coastal areas and is also known to be associated with low coastal lowland rainforest (e.g., Iron Range on Cape York). In Queensland, the species is known to occur from Ayr to the Iron Range with most records being near-coastal (TSSC, 2016b). The species roosts in deep tree hollows. All confirmed Australian roosting records (albeit there are few) are from deep tree hollows in Poplar Gum, Darwin Woollybutt or Darwin Stringybark (Churchill, 1998). Hollow bearing trees in the Project area have the potential to hold roosting individuals. The species forages for insects high above the canopy and has been observed over gallery forest and melaleuca swamps. Little information is available on foraging habitat due to lack of direct observations however habitat adjacent to roosting locations in the Townsville region has included Poplar Gum woodland on alluvial plains. It is likely to forage across the entire Project area. DCCEEW does not specify what constitutes an important population for bare-rumped sheathtail. There is no evidence to indicate that a population in the Project area is likely to be a key population for breeding, dispersal or maintaining genetic diversity in the species. However, the Project area is located near the edge of the species' range with known records south to Ayr (just north of Townsville) and as such any occurrence on site may be considered an important population.

3.3.2.2.2 Occurrence in Region

A WildNet species search within 100 km of the Project area returned three records for the species (refer to Appendix J); whereas, the ALA database identified eight records of the species, with the closest record approximately 26 km north-east of the Project area (refer to Figure 3-5). The species recorded on the ALA database were recorded in 1966, 1965, 1978, 1981 and 2000 within residential areas, woodlands in close proximity to residential areas, on Magnetic Island, within Bowling Green Bay National Park and within HES wetlands.

3.3.2.2.3 Occurrence in Project Area

The Bare-rumped sheath-tail bat was recorded during the EMM July 2021 surveys of No Name Road (north) (refer to pg. 2 of Appendix H for the survey effort). A total of 8 individuals were recorded to occur, with locations including along No Name Road (north), Lansdowne Creek and South-east and south-west of No Name Road (north). According to the Evolve ecology survey conducted in June 2022, the species was located via the use of song meters. No known roosts have been confirmed during the field surveys; however, potential roosting hollows were observed once during the October 2022 survey and seven times during the February 2023 survey.

3.3.2.2.4 Habitat Assessment in Project Area

Foraging habitat can be noted along Jones Road, No Name Road (north), No Name Road (south), Bidwilli Road and along the entire water infrastructure network, as the species has a fast, direct flight and is likely to forage primarily for aerial insects over the woodland/forest canopy but may fly lower when foraging over open situations. All areas of the Project area provide this foraging habitat. It is highly unlikely that roost sites are to be found unless hollows are expertly assessed, as the species remains silent at roosting sites and is only audible when disturbed. Vegetation with hollows at around 200 mm diameter constitute possible roosting habitat. Potential roosting hollows were observed once during the October 2022 survey and seven times during the February 2023 survey. Each of these and an additional hollow within the alignment have been mapped as roosting habitat and total 0.09 ha.

Thirty potential microbat roosting sites (i.e., hollows and exfoliating bark) were observed by Evolve within and adjacent to the pipeline alignment during the February 2023 survey. However, potential roosting hollows will require an expert assessment to confirm microbat usage.

Based on the above the remaining 79.71 ha (refer to pg. 16-18 in Appendix K) can be considered foraging habitat albeit the likelihood of a significant population in the alignment is low due the scarcity of the species.

The habitat quality scores for the Bare-rumped sheath-tail bat are presented in Table 3-14. The average foraging habitat scores ranged from 5.00 to 20.00 out of 25.00 across the assessment units. Average breeding habitat scores across the assessment units ranged from 5.63 to 15.00 out of 25, threat scores were 10.00 out of 10.00 and species mobility 5.00 to 25.00 out of 25.00. The overall habitat scores for Bare-rumped sheath-tail bat resulting intermediate ranging from 2.52 to 5.41 out of 10.00.

Table 3-14 MHQA for the Bare-rumped sheath-tail bat summarised by assessment unit

Assessment unit	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Regional Ecosystem	Remnant 11.3.30	Non-Remnant 11.3.30	Remnant 11.3.35	Non-Remnant 11.3.35	Remnant 11.3.27e	Remnant 11.3.25b	Remnant 11.3.12
Foraging Habitat							
Presence of mature remnant woodland	16.36	5.00	15.83	5.00	20.00	17.50	15.00
Average Score	16.36	5.00	15.83	5.00	20.00	17.50	15.00
Breeding Habitat							
Preferred tree species	6.82	5.63	10.83	5.00	10.00	17.50	25.00

Section 3 Habitat Assessment

Assessment unit	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Presence of deep hollows	7.73	9.38	14.17	6.25	15.00	10.00	5.00
Average Score	7.27	7.50	12.50	5.63	12.50	13.75	15.00
Role of site to overall population	5	5	5	5	5	5	5
Threats							
Exotic weed dominance	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Lowest score	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Species Mobility							
Connectivity of suitable habitats	21.36	5.00	16.67	5.00	25.00	25.00	25.00
Average Score	21.36	5.00	16.67	5.00	25.00	25.00	25.00
Overall species habitat score	4.74	3.22	4.60	2.52	4.59	5.41	3.88

3.3.2.3 Squatter pigeon (southern) (Vulnerable)

Key data for Squatter pigeon (southern) is presented in Table 3-15 and a significant impact assessment is presented in Table 4-5. Mapping of known species records within the area is shown in Figure 3-5 and Figure 3-6.

Table 3-15 Key Data on Squatter pigeon (southern)

Squatter pigeon (southern) (<i>Geophaps scripta scripta</i>)
Baseline Data Results
Species was sighted by Evolve during the 2022 field surveys adjacent to Majors Creek Road in open Eucalypt Woodland, approximately 400m from a permanent water source and has several ephemeral or man-made water sources close by. Species was additionally sighted twice by during the October surveys on lot 87 RP911426 within 200m of a permanent farm dam. A habitat mapping exercise noted 46.09 ha of habitat at the Project is suitable for the Squatter pigeon (southern).
EPBC Status
Vulnerable
Key Threats
Key threats to Squatter pigeon (southern) include: <ul style="list-style-type: none"> ▪ Vegetation clearing and fragmentation; ▪ Overgrazing of habitat by livestock and feral herbivores; ▪ Introduction of weeds; ▪ Inappropriate fire regimes; ▪ Thickening of understorey vegetation; ▪ Predation by feral cats and foxes; ▪ Trampling of nests by livestock; and ▪ Illegal shooting.
Recovery Plans
There is no adopted or made Recovery Plan for this species.
Threat Abatement Plans
For the Southern squatter pigeon, the following Commonwealth Threat Abatement Plans are considered relevant: <p>Threat abatement plan for predation by feral cats (DoE, 2015c):</p> <ul style="list-style-type: none"> ▪ Sets out four objectives for controlling feral cats including control in different landscapes, effectiveness of control options, alternative strategies to aid threatened species recovery and public support for cat management. <p>Threat abatement plan of competition and land degradation by rabbits (DotEE, 2016):</p> <ul style="list-style-type: none"> ▪ Establishes a national framework to guide and coordinate Australia’s response to the impacts of European rabbits on biodiversity. Identifies the research and management actions required to ensure the long-term survival of those native species and communities impacted by the presence of rabbits. Replaces the previous threat abatement plan published in 2008 (DEWHA). <p>Threat abatement plan for predation by the European Red Fox (DEWHA, 2008):</p> <ul style="list-style-type: none"> ▪ Sets out prioritising management areas including ascertain the degree of threat to the survival of threatened species and communities, the potential for recovery of threatened species and communities, threatened species likely to benefit through fox control in specific areas, and cost effectiveness of fox control in a particular area.

3.3.2.3.1 Species Description

The Squatter pigeon (southern) (*Geophaps scripta scripta*) is listed as vulnerable under both the EPBC Act and NC Act. The Squatter pigeon (southern) is largely terrestrial, foraging and breeding on the ground and is usually seen in pairs or small groups of up to 20 or more birds. The southern subspecies occurs mainly in dry grassy eucalypt woodlands and open forests (Frith 1982; Crome and Shields, 1992) but also inhabits *Callitris/Acacia sp.* woodlands and was reported from open plains in its historical southern range (Frith, 1982) and has also been found in sandy sites near permanent water (Blakers et al., 1984). Squatter pigeons dust-bathe and are often encountered on dirt tracks and in areas of bare

soil denuded of ground cover by livestock (Frith 1982; Higgins and Davies, 1996). Although they remain common in heavily grazed country in tropical Queensland, they are typically more common in un-grazed land compared to grazed land (Woinarski and Ash, 2002). This species was historically found from Cape York Peninsula in Queensland south to the Dubbo region in New South Wales. There have been no official records in New South Wales since the 1970s and the species has declined greatly in southern Queensland (Higgins and Davies, 1996). Much of the original habitat in Queensland has been replaced with pasture for livestock (Higgins and Davies, 1996). Threats to existing populations include clearing and fragmentation of habitat, overgrazing by livestock and feral herbivores, trampling of nests by livestock, predation by feral cat (*Felis catus*) and red fox (*Vulpes vulpes*), and illegal shooting.

Important populations of the Southern squatter pigeon have been identified as those isolated and sparsely distributed sub-populations that occur south of the Carnarvon Ranges in central and southern Queensland, including:

- Populations occurring in the Condamine River catchment and Darling Downs of southern Queensland;
- Populations occurring in the Warwick-Inglewood-Texas region of southern Queensland; and
- Any population that may potentially occur in New South Wales (Queensland Parks and Wildlife Service, 2011).

North of the Carnarvon Ranges the species is relatively common and is considered to be distributed as a single, continuous sub-population (Queensland Parks and Wildlife Service, 2011). As such, the population in the Project area is not considered to be an important population. Based on an evaluation of all criteria, the Project is not expected to have a significant residual impact on Southern squatter pigeon.

3.3.2.3.2 Occurrence in Region

A WildNet species search returned results for 90 records of the species as recorded within 100 km of the Project area (refer to Appendix J); whereas the ALA database identified 22 records of the species within 100 km of the Project area (refer to Figure 3-5) recorded in 1970, 1972, 1998, 2011, 2019 and 2020. Majority of ALA records were species inhabiting disturbed/cleared land, along roadsides (established roads and dirt tracks) and one record within irrigated farmland.

3.3.2.3.3 Occurrence in Project Area

Two (2) Squatter pigeon (southern) individuals were sighted by during the May 2022 field surveys adjacent to Majors Creek Road in open eucalypt woodland, approximately 400m from a permanent water source. This water source has several ephemeral or man-made water sources close by (Evolve, 2022b). Species was additionally sighted twice by during the October surveys on lot 87 RP911426 within 200m of a permanent farm dam (Evolve, 2022c). Additionally, three individuals were again sighted during the February 2023 survey (Evolve, 2023).

3.3.2.3.4 Habitat Assessment in Project Area

The Project is located within the modelled distribution of the species. Ground-truthing assessments of the Project area identified the vegetation suitable to the Squatter pigeon (southern) including a high proportion of pastoral grass and legume species, with both Native Millet (*Panicum decompositum*) and Kangaroo Grass (*Themeda triandra*) present. These two flora species are favourable for the Squatter pigeon (southern). Additional favourable flora species for the Squatter pigeon (southern) include Curly windmill grass (*Enteropogon acicularis*) Hairy panic (*Panicum effusum*) and Bluegrass (*Dichanthium sericeum*), however these were not recorded within the Project area.

Habitat mapping has been provided based on the following habitat requirements as per the species SPRAT and has been updated post the referral phase following additional survey completed in February 2023:

- Breeding habitat: remnant/regrowth open forest to sparse open woodland within 1 km of suitable permanent waterbodies (stream order 3 to 5 and perennial watercourses have been considered);
- Foraging habitat: remnant/regrowth open forest to sparse open woodland within 3 km of suitable seasonal or permanent waterbodies;
- Dispersal habitat: any forest or woodland occurring between breeding and foraging habitat, or pasture with scattered trees less than 100 m apart.

A habitat mapping exercise has noted the following habitat is suitable for the Squatter pigeon (southern) (refer to refer to page 4-6 in Appendix K):

- Breeding habitat: 17.87 ha;
- Foraging habitat: 25.58 ha; and
- Dispersal habitat: 2.64 ha.

Habitat quality scores for the Squatter pigeon (southern) including the overall species habitat score, are presented in Table 3-16. The average foraging habitat scores ranged from 10.00 to 22.50 out of 25.00 across the assessment units. Average breeding habitat scores across the assessment units ranged from 11.25 to 18.13 out of 25, the lowest threat scores were 10.00 out of 25.00 and species mobility 15.00 out of 25.00. The overall habitat scores for Squatter pigeon (southern) scored intermediate, ranging from 5.23 to 6.55 out of 10.00.

Table 3-16 MHQA for the Squatter pigeon (southern) summarised by assessment unit

Assessment unit	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Regional Ecosystem	Remnant 11.3.30	Non-Remnant 11.3.30	Remnant 11.3.35	Non-Remnant 11.3.35	Remnant 11.3.27e	Remnant 11.3.25b	Remnant 11.3.12
Foraging Habitat							
Abundance of preferrable grass species	14.55	13.44	13.33	22.50	20.00	10.00	15.00
Average Score	14.55	13.44	13.33	22.50	20.00	10.00	15.00
Breeding Habitat							
Bare ground coverage	14.55	15.00	7.50	5.00	5.00	7.50	20.00
Distance to water	17.73	21.25	21.67	17.50	25.00	25.00	20.00
Average Score	16.14	18.13	14.58	11.25	15.00	16.25	11.25
Role of site to overall population	5	5	5	5	5	5	5
Threats							
Predator attack	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Reduction in water availability	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Habitat loss and fragmentation	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Overgrazing	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Lowest score	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Species Mobility							
Connectivity of suitable habitats	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Average Score	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Species habitat score	5.58	5.72	6.02	5.23	5.91	6.55	6.02

3.3.2.4 White-throated needletail (Vulnerable, Marine, Migratory)

Key data for the White-throated needletail is presented in Table 3-17 and records of species mapping within 100km of the Project area in Figure 3-5.

Table 3-17 Key Data on White-throated needletail

White-throated needletail (<i>Hirundapus caudacutus</i>)
Baseline Data Results
There is one records of the species within the 3 km of the Project area as per the ALA database (recorded in 2015). The species was not recorded during field surveys in 2022. Potential roosting habitat is likely to be restricted to Lansdown Creek and Serpentine Lagoon.
EPBC Status
Vulnerable, Marine, Migratory
Key Threats
In Australia threats include collision with overhead wires, windows and lighthouses although this affects only a few individuals and therefore is not a threat to the species overall. Other threats may include the use of insecticides, loss of roosting sites in Australia.
Recovery Plans
There is no adopted or made Recovery Plan for this species.
Threat Abatement Plans
No Threat Abatement Plan has been identified as being relevant for this species.

3.3.2.4.1 Species Description

The White-throated needletail (*Hirundapus caudacutus*) is listed as vulnerable and migratory under the EPBC Act and vulnerable under the NC Act. The migratory bird exhibits a cigar-shaped body, stubby tail and long pointed wings, with an average body size of 20 cm and 115-120 grams in weight (TSSC, 2019). The species is known to be gregarious during the non-breeding season in Australia. White-throated needletails migrate to Australia during the non-breeding season from September to mid-March, distributing across coastal regions of eastern and south-eastern Australia. The species is considered mostly aerial, flying at heights of less than 1 m to more than 1000 m above ground, in all types of habitats, although preferring wooded forests, open forest and rainforest (TSSC, 2019). The species does not breed in Australia. In Australia, White-throated needletail are known to forage for insects including beetles, cicadas, bees, wasps, flies etc. (TSSC, 2019).

3.3.2.4.2 Occurrence in Region

Two-hundred and seven records of the species exist within the broader region (100 km) on the ALA database (refer to Figure 3-5) between 1968 and 2021. Majority of these records exist within wooded forests (both coastal and inland), coastal habitats (i.e., beaches and ocean), residential zones, on Magnetic Island and along irrigated pastures. As per the WildNet database, there are 74 records of the species within 100 km of the Project area (refer to Figure 3-5)

3.3.2.4.3 Occurrence in Project Area

There is one records of the species within the 3 km of the Project area as per the ALA database (recorded in 2015). The species was not recorded during field surveys in 2022.

3.3.2.4.4 Habitat Assessment in Project Area

There is some potential for roosting habitat in the Project area although any mature woodland could provide potential roosting habitat. Potential roosting habitat is likely to be restricted to Lansdown Creek and Serpentine Lagoon. No

Section 3 Habitat Assessment

habitat map has been prepared for this species as it is an aerial insectivore that spends most of its time aloft, and could occur anywhere over the Project area, therefore the whole Project area is considered potential foraging habitat.

3.3.2.5 Australian painted snipe (Endangered)

Key data for Australian painted snipe is presented in Table 3-18 and a significant impact assessment is presented in Table 4-7. Mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-18 Key Data on Australian painted snipe (*Rostratula australis*)

Australian painted snipe (<i>Rostratula australis</i>)
Baseline Data Results
No individuals were recorded during the 2022 field surveys. Potential wetland habitat is present on site, with suitable habitat located near Serpentine Lagoon and associated wetlands north of the Project alignment.
EPBC Status
Endangered
Key Threats
Key threats to the species include: <ul style="list-style-type: none"> ▪ Predation; ▪ Loss of wetland habitat; ▪ Degradation of habitat; ▪ Trampling of nests by livestock; and ▪ Climate change
Recovery Plans
There is no adopted or made recovery plan for this species.
Threat abatement plans
There are no threat abatement plans listed as relevant for this species.

3.3.2.5.1 Species Description

Australian painted snipe (*Rostratula australis*) is currently listed as endangered under both the EPBC Act and NC Act. The Australian Painted Snipe is a stocky wading bird with a long pink bill and is approximately 220-250 mm in length. The Australian painted snipe inhabits wetlands in all Australian states, however, is known to be most common in eastern Australia, with scattered records in Queensland, New South Wales, Victoria and South Australia. The species favours shallow freshwater environments within its range, including lakes, swamps and claypans abundant with tussock grasses, reeds and sedges. The species breeds in response to wetland conditions rather than a typical breeding season, preferring shallow wetlands with areas of bare wet mud, and both upper and canopy cover nearby. Nest records are all, or nearly all, from or near small islands in freshwater wetlands, provided that these islands are a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover.

3.3.2.5.2 Occurrence in Region

A search of ALA records identified thirty one (31) records of the species exist within a 100 km range of the Project area; recorded between 1953 and 2020, surrounding lakes, within disturbed environments, residential zones and wooded forests. Whereas a WildNet species search recorded sixteen species within 100 km of the Project area (refer to Appendix J and Figure 3-5).

3.3.2.5.3 Occurrence in Project Area

No individuals were recorded during the 2022 field surveys. The closest record of the species occurred approximately 5 km north of the Project area in 2013.

3.3.2.5.4 Habitat Assessment in Project Area

The Australian painted snipe resides in shallow brackish ephemeral and/or permanent wetlands, with a high abundance of grasses, scrubs, reeds, open timber or samphire (DSEWPC, 2013). Additionally, the species occasionally inhabits areas that are lined with trees, or that have scattered fallen or washed-up timber (Marchant & Higgins 1993). Ecological surveys undertaken for the Project determined foraging habitat for the Australian painted snipe only marginally exists.

Breeding requirements for the Australian painted snipe are more specific than foraging requirements, where for breeding, the species requires shallow wetlands with areas of bare, wet mud and an upper canopy and canopy cover nearby (DSEWPC, 2013). As per the ecological surveys undertaken for the Project, breeding habitat for the Australian painted snipe does not occur within the Project area.

The habitat mapping assessment noted that there is approximately 1.19 ha that could potentially be considered suitable foraging habitat for the species, being the swampy, *Melaleuca* area with some adjacent grassland. The majority of premier habitat for the Australian Painted Snipe is located near Serpentine Lagoon and associated wetlands to the north of the alignment near Serpentine Lagoon (refer to pg. 14 in Appendix K).

Habitat quality scores for the Australian painted snipe including the overall species habitat score, are presented in Table 3-19. The average foraging habitat scores ranged from 8.75 to 15.00 out of 25.00 across the assessment units. Average breeding habitat scores across the assessment units ranged from 5.00 to 10.00 out of 25.00, the lowest threat scores were 10.00 out of 25.00 and species mobility 5.00 to 25.00 out of 25.00. The overall habitat scores for Squatter pigeon (southern) scored intermediate, ranging from 1.53 to 3.11 out of 10.00.

Table 3-19 MHQA for the Australian painted snipe summarised by assessment unit

Assessment unit	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Regional Ecosystem	Remnant 11.3.30	Non-Remnant 11.3.30	Remnant 11.3.35	Non-Remnant 11.3.35	Remnant 11.3.27e	Remnant 11.3.25b	Remnant 11.3.12
Foraging Habitat							
Abundance of preferable grass species	14.55	13.44	13.33	22.50	20.00	10.00	15.00
Coverage of rank wetland	5.00	5.00	5.00	5.00	10.00	7.50	10.00
Average Score	9.77	9.22	9.17	13.75	15.00	8.75	12.50
Breeding Habitat							
Coverage of rank wetland	5.00	5.00	5.00	5.00	10.00	7.50	10.00
Average Score	5.00	5.00	5.00	5.00	10.00	7.50	10.00
Role of site to overall population	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Threats							
Reduction in water quality	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Lowest score	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Species Mobility							
Presence of rank wetland	21.36	5.00	16.67	5.00	25.00	25.00	25.00
Average Score	21.36	5.00	16.67	5.00	25.00	25.00	25.00
Species habitat score	3.11	1.85	2.74	1.53	2.22	2.92	2.26

3.3.3 MNES Threatened Fauna Species – Identified in the DCCEEW RFI but Determined Moderately Likely or Unlikely to Occur

This section includes additional information on species which were identified in the DCCEEW RFI but determined as unlikely to occur in Table 3-8. It should be noted that habitat mapping has not been undertaken for these species as they have been determined to be unlikely to occur.

3.3.3.1 Curlew sandpiper (Critically Endangered, Marine, Migratory)

Key data for the Curlew sandpiper is presented in Table 3-20 and mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-20 Key Data on Curlew sandpiper

Curlew sandpiper (<i>Calidris ferruginea</i>)
Baseline Data Results
Species not previously recorded within the locality. It is possible that suitable habitat for the Curlew sandpiper is present in wetlands along the enabling infrastructure, where foraging may occasionally occur. Potential habitat (wetland) is present within the subject area. Potential foraging habitat also exists around the Serpentine Lagoon (1.19 ha).
EPBC Status
Critically Endangered, Marine, Migratory
Key Threats
Threats in Australia include: <ul style="list-style-type: none"> ▪ Habitat loss and degradation, ▪ Pollution, ▪ Human disturbance of feeding and roosting habitat, ▪ Changes to water regimes, and ▪ Invasive plants species.
Recovery Plans
Recovery Plan not required, for Curlew sandpiper as the approved conservation advice for the species provides sufficient direction to implement priority actions and mitigate against key threats.
Threat Abatement Plans
No Threat Abatement Plan has been identified as being relevant for this species.

3.3.3.1.1 Species Description

The Curlew sandpiper (*Calidris ferruginea*) is a small, slim sandpiper 18–23 cm long and weighing 57 g, with a wingspan of 38–41 cm (DoE, 2015a). The legs and neck are long. The bill is also long and is decurved with a slender tip. The bill is black, sometimes with a brown or green tinge at the base. The head is small and round, and the iris is dark brown. The legs and feet are black or black grey. When at rest, the wing-tips project beyond the tip of the tail. The sexes are similar, but females have a slightly larger and longer bill and a slightly paler underbelly in breeding plumage (Higgins & Davies, 1996).

In Australia, Curlew sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. Records occur in all states during the non-breeding period, and also during the breeding season when many non-breeding one year old birds remain in Australia rather than migrating north. In Queensland, scattered records occur in the Gulf of Carpentaria, with widespread records along the coast south of Cairns. There are sparsely scattered records inland.

In Australia, Curlew sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and

sewage farms (DoE, 2015a). They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters (Higgins & Davies, 1996).

This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds. Curlew sandpipers forage on mudflats and nearby shallow water. In non-tidal wetlands, they usually wade, mostly in water 15–30 mm, but up to 60 mm deep. They forage at the edges of shallow pools and drains of intertidal mudflats and sandy shores. At high tide, they sometimes forage among low sparse emergent vegetation, such as saltmarsh, and sometimes forage in flooded paddocks or inundated salt flats. Occasionally they forage on wet mats of algae or waterweed, or on banks of beach cast seagrass or seaweed. They rarely forage on exposed reefs (Higgins & Davies, 1996). Curlew sandpipers roost in open situations with damp substrate, especially on bare shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh (Higgins & Davies, 1996).

3.3.3.1.2 Occurrence in Region

Curlew sandpipers occur along the Queensland and coastline during summer. Numerous records for the species follow the Queensland coastline, with some inland records. A search of the WildNet species list identified 175 records of the species within a 100 km radius of the Project area (refer to Appendix J), whereas the ALA database recorded 286 records within 100 km of the Project area (refer to Figure 3-5), recorded between 1926 and 2021, predominantly along the coastline, in proximity to a watercourse or within irrigated farmland. Bowling Green Bay is listed as a key site for migratory shorebirds in the East Asian-Australasian Flyway Site Network.

3.3.3.1.3 Occurrence in Project Area

It is possible that suitable habitat for the Curlew sandpiper is present in wetlands along the enabling infrastructure, where foraging may occasionally occur. Species not previously recorded within the locality, with the closest record being approximately 14 km away.

3.3.3.1.4 Habitat Assessment in Project Area

Potential habitat (wetlands) is present within the subject area. Potential foraging habitat for the Curlew sandpiper exists around the Serpentine Lagoon (1.19 ha) (refer to pg. 15 in Appendix K). A detailed habitat assessment was not conducted for this species due to the presence of high-quality preferred habitat elsewhere in the region (coastline, including Bowling Green Bay). In comparison, the potential habitat within the Project area is not preferred and used less frequently.

3.3.3.2 Northern quoll (Endangered)

Key data for the Northern quoll is presented in Table 3-21 and mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-21 Key Data on Northern quoll

Northern quoll (<i>Dasyurus hallucatus</i>)
Baseline Data Results
There were no individuals recorded during the 2022 field surveys. The closest known record of the species was recorded in 1973, approximately 5 km north of the Project site.
EPBC Status
Endangered
Key Threats
<p>Key threats to the species (as per the SPRAT database) include:</p> <ul style="list-style-type: none"> ▪ Lethal toxic ingestion caused by cane toads; ▪ Habitat loss, degradation and fragmentation; ▪ Inappropriate fire regimes; ▪ Weed invasion (e.g., Gamba grass (<i>Andropogon gayanus</i>)); ▪ Predation by feral cat (<i>Felis catus</i>) and European red fox (<i>Vulpes vulpes</i>); and ▪ Parasitism.
Recovery Plans
<p>The following recovery plan is relevant to this species:</p> <ul style="list-style-type: none"> • <i>National Recovery Plan For the Northern Quoll Dasyurus hallucatus</i> (Hill and Ward, 2010). <p>The Project and its associated studies has undertaken survey and monitoring and provided additional information regarding the potential of the species to occur. This information will be useful to various research groups. Impacts associated with the studies are expected to provide great value. The Project is expected to be consistent with the recovery plan as outlined throughout Section 3.3.3.2.</p>
Threat Abatement Plans
<p>The following threat abatement plans are relevant to this species:</p> <ul style="list-style-type: none"> ▪ Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads (DSEWPC, 2011); and ▪ Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses (DSEWPC, 2012). <p>The Project is expected to be in accordance with the threat abatement plans listed above. The Project will implement management measures to reduce impacts from introduced grasses and is not expected to result in increase to cane toads.</p>

3.3.3.2.1 Species Description

The Northern quoll (*Dasyurus hallucatus*) is currently listed as endangered under the EPBC Act. The Northern quoll is the smallest of Australia's quoll species, measuring approximately 250 – 370 mm in body length and weighing up to 1.2 kilograms. Species distribution has significantly reduced to five regional populations across Queensland, the Northern Territory and Western Australia, including offshore islands. Within Queensland, the species is found south of Gracemere and Mount Morgan, south of Rockhampton, in Weipa and west to Carnarvon Range National Park in central Queensland; however, occasional records exist in Maleny, Sunshine Coast Hinterland. The Northern quoll inhabits eucalypt forests and woodlands, rocky areas, rainforests, lowlands and beaches, shrubland, grassland and desert regions. Species' diet consists of invertebrates (e.g., beetles, grasshoppers, spiders, scorpions), fruits and nectar.

3.3.3.2.2 Occurrence in Region

A search of the ALA database identified twenty-eight records of the species within a 100 km radius of the Project area, between 1907 and 2022; recorded within woodland habitats along the coastline, within Bowling Green Bay National

Park and within residential areas; whereas the WildNet database returned no results of the species within a 100 km radius (refer to Appendix J).

3.3.3.2.3 Occurrence in Project Area

There were no individuals recorded during the 2022 field surveys. The closest known record of the species was recorded in 1973, approximately 5 km north of the Project site.

3.3.3.2.4 Habitat Assessment in Project Area

A habitat mapping exercise for habitat suitable to the Northern quoll within the Project area and within a 4 km radius of intact vegetation areas (for which multiple sightings and preferred denning habitat exists) identified approximately 4 ha of suitable habitat (refer to pg. 13 in Appendix K). The species has previously been found the Bowling Green Bay National Park. Foraging habitat has been mapped as areas within 4 km radius of intact vegetation area (for which multiple sightings and preferred denning habitat exists) which is approximately 4 ha.

A detailed habitat assessment for the Northern Quoll was not undertaken due to the absence of rocky areas, and woodlands with high structural diversity and large hollows or termite mounds for denning.

3.3.3.3 Masked owl (northern) (Vulnerable)

Key data for Masked owl (northern) is presented in Table 3-22 and mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-22 Key Data on Masked owl (northern)

Masked Owl (northern) (<i>Tyto novaehollandiae kimberli</i>)
Baseline Data Results
The Northern Masked owl was not recorded in any of the field surveys and is unlikely to occur in the Project area, due to a lack of habitat values.
EPBC Status
Vulnerable
Key Threats
<p>Key threats to the Masked owl (northern) are likely to include habitat loss and degradation due to:</p> <ul style="list-style-type: none"> ▪ Broadscale clearing, particularly of areas containing large, hollow-bearing trees; ▪ Changed fire regimes; ▪ Livestock grazing; ▪ Invasive grasses that reduce foraging efficiency; and ▪ Competition with feral predators. <p>Prey availability may be a limiting factor for this species, with any threats to small to medium mammals potentially indirectly impacting this species.</p>
Recovery Plans
Recovery Plan required, this species had a recovery plan in force at the time the legislation provided for the Minister to decide whether or not to have a recovery plan (19/2/2007). The recovery plan that was adopted for this species on 10/06/2005 ceased to be in effect from 1/10/2015. There is no current adopted or made Recovery Plan for this species.
Threat Abatement Plans
<p>The following threat abatement plans are relevant to this species:</p> <ul style="list-style-type: none"> ▪ Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses (DSEWPC, 2012). <p>The Project is expected to be in accordance with the threat abatement plans listed above. The Project will implement management measures to reduce impacts from introduced grasses.</p>

3.3.3.3.1 Species Description

The Masked owl (northern) (*Tyto novaehollandiae kimberli*) is a large owl with prominent heart-shaped facial disc, with plumage highly patterned by speckling, and generally darker on the back and paler below. Males can weigh up to 600g, whereas females can weigh up to 1 kg. The Masked owl has been recorded in riparian forest, rainforest, open forest, *Melaleuca* swamps and the edges of mangroves, as well as along the margins of sugar cane fields. It also commonly roosts in monsoon rainforests, and forages in more open vegetation types, including grasslands. Typically, individuals roost in tree hollows, but may also roost among dense foliage. Masked owls breed in large tree hollows, which usually form in large rainforest trees. It is likely that individual home ranges are large. The diet of the Northern Masked owl mostly comprises small to medium-sized mammals. The subspecies likely breeds from March to October.

3.3.3.3.2 Occurrence in Region

The species distribution in Queensland runs along the coastline from the Gulf of Carpentaria to a disputed southern limit between Mackay and Rockhampton. WildNet records are in the broader area are around Townsville with 17 records within 100 km of the Project area (refer to Appendix J), whereas the ALA database identified seven records of the species within 100 km of the Project area (refer to Figure 3-5) in 1991, 1992 and 1998. Only one record occurs south of the Project area. ALA records of the species were recorded within forest environments including Paluma Range National Park, Clemant State Forest and Paluma State Forest.

3.3.3.3 Occurrence in Project Area

No Northern masked owls were detected during field surveys. The closest records are approximately 25 km west and 26 km north-west of the Project area in 1991 and 1998 respectively.

3.3.3.4 Grey falcon (Vulnerable)

Key data for Grey falcon is presented in Table 3-23 and mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-23 Key Data on Grey falcon

Grey falcon (<i>Falco hypoleucos</i>)
Baseline Data Results
No Grey falcons were detected in ecology surveys due to the lack of suitable habitat. Habitat for the Grey falcon does not occur in the Project Area.
EPBC Status
Vulnerable
Key Threats
This species lacks focussed research; plausible threats to Grey falcon include: <ul style="list-style-type: none"> ▪ Predation by feral cats; ▪ Increased temperatures in arid and semi-arid areas due to climate change; ▪ Demographic and genetic stochastic events; ▪ Habitat loss, degradation, and fragmentation from land clearing and grazing of exotic herbivores (e.g., camels); ▪ Disturbance of nests by birdwatchers and photographers; and ▪ Mortality from collisions with vehicle, fences, and powerlines.
Recovery Plans
Recovery Plan not required, the Conservation Advice provides sufficient guidance on the recovery of the Grey falcon and a decision to have a recovery plan is unlikely to lead to substantial additional conservation benefits at this time. Consequently, the Threatened Species Scientific Committee advises that a recovery plan is not recommended (26/06/2020).
Threat Abatement Plans
No Threat Abatement Plans have been identified as being relevant for this species.

3.3.3.4.1 Species Description

The Grey falcon (*Falco hypoleucos*) is listed as vulnerable under both the EPBC Act and NC Act. The Grey falcon is elusive and the rarest of Australia’s falcons. It is a medium-sized raptor (weighing 400 – 500 grams), with females weighing approximately 30% more than males (TSSC, 2020). It is a pale grey falcon with long wings, dark wing tips, and narrow black bars across its tail. The chin, throat and cheeks are white in colour, underneath adults are pale grey with fine blackish streaks, and juveniles are white with heavy dark streaks. The eye-ring, cere and base of the bill are bright orange-yellow, and the tip of the bill black. The legs are fully feathered.

Grey falcons inhabit arid and semi-arid areas across Australia but may become more widespread during periods of drought. The species frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses, as well as treeless areas of tussock grassland and open woodland (TSSC, 2020). They feed predominately on a variety of birds. The Grey falcon nests in old nests of other birds in tall trees and telecommunications poles; breeding occurs from June to November.

3.3.3.4.2 Occurrence in Region

ALA records are sparse along the Queensland coast between Cairns and Mackay, with one record within 100 km, which was recorded above the ocean between Townsville and Magnetic Island. The majority of these records are undated. Grey falcons are thought to be typically absent east of the Great Dividing Range (TSSC, 2020) but may venture further east during periods of drought. A search of the WildNet species list identified two records of the species within 100 km of the Project area (refer to Appendix J and Figure 3-5).

3.3.3.4.3 Occurrence in Project Area

No Grey falcons were detected in ecology surveys due to the lack of suitable habitat. It is possible that Grey falcons will occasionally occur in the greater area during times of drought.

3.3.3.5 Greater sand plover (Vulnerable, Marine, Migratory)

Key data for the Greater sand plover is presented in Table 3-24 and mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-24 Key Data on Greater sand plover

Greater sand plover (<i>Charadrius leschenaultii</i>)
Baseline Data Results
Greater sand plovers inhabit areas that are closer to the coast where its feeding grounds are predominantly saline and brackish wetlands. Occurrences in freshwater wetlands is rare. No Greater Sand Plovers were detected in ecology surveys due to the lack of preferred habitat. Habitat for the Greater sand plover does not occur in the Project Area.
EPBC Status
Vulnerable, Marine, Migratory
Key Threats
In Australia, threats include: <ul style="list-style-type: none"> ▪ Habitat loss and modification from coastline developments, ▪ Pollution from industrial activities and increased silt, ▪ Disturbance from recreational activities, particularly during feeding, ▪ Habitat modification caused by invasive weeds, such as Water Hyacinth (<i>Eichhornia crassipes</i>), and ▪ Reduction of food resources due to exotic marine pests.
Recovery Plans
Recovery Plan not required, approved conservation advice provides sufficient direction to implement priority actions and mitigate against key threats. Significant management and research is being undertaken at international, national, state and local levels (2/05/2016). The <i>Wildlife Conservation Plan for Migratory Shorebirds</i> (Commonwealth of Australia, 2015) is also relevant.
Threat Abatement Plans
No Threat Abatement Plan has been identified as being relevant for this species.

3.3.3.5.1 Species Description

The Greater sand plover (*Charadrius leschenaultii*) is a small-to-medium sized shorebird (length 22–25 cm; body mass 75-100 g) with a straight long bill that bulges towards the end but has a pointed tip. The legs are long and olive-grey. In non-breeding plumage, the head, nape and upperparts are grey-brown and there are large grey-brown patches on the sides of the breast. The forehead eyebrow, chin, neck and underparts are white. As this species breeds in the northern hemisphere, it does not present in breeding plumage when in Australia. This species is present in Australia between late July and March, though is more populous in northern Australia.

Greater sand plovers often occur in large mixed flocks, particularly with Lesser sand plovers (*Charadrius mongolus*), however, often roost higher up on the beach and segregated from other shorebirds. The species inhabits coastal areas including sheltered sandy, shelly or muddy beaches, large intertidal mudflats, sandbanks, saltmarshes, estuaries, coral reefs, rocky islands rock platforms, tidal lagoons and dunes near the coast. Greater sand plovers mostly feed in a range of molluscs, worms, crustaceans, and insects in wet sand or mud on open intertidal flats of sheltered embayments, lagoons or estuaries. They are occasionally recorded on near-coastal saltworks, salt lakes, and brackish swamps but seldom occur at shallow freshwater wetlands.

3.3.3.5.2 Occurrence in Region

Greater sand plovers occur along the nearby coastline during summer. Numerous records for the species follow the coastline, but very few records occur inland in close proximity to watercourses. A search of the WildNet species list identified 389 records of the species within 100 km of the Project area (refer to Appendix J), whereas the ALA database

identified 688 records of the species within 100 km of the Project area (refer to Figure 3-5) between 1926 and 2021. Bowling Green Bay is listed as a key site for migratory shorebirds in the East Asian-Australasian Flyway Site Network.

3.3.3.5.3 Occurrence in Project Area

No Greater sand plovers were detected in ecology surveys due to the lack of preferred habitat. The closest record is approximately 17 km north-east in 2009, with the next closest inland record is from 1972 and approximately 38 km to the south-east.

3.3.3.6 Eastern curlew (Critically Endangered, Marine, Migratory)

Key data for the Eastern curlew is presented in Table 3-25 and mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-25 Key Data on Eastern curlew

Eastern curlew (<i>Numenius madagascariensis</i>)
Baseline Data Results
There were no individuals recorded during the 2022 field surveys. The closest known record of the species was recorded in in 2011, approximately 19 km northeast of the Project site.
EPBC Status
Critically Endangered
Key Threats
Key threats to the species (as per the SPRAT database) include: <ul style="list-style-type: none"> ▪ Ongoing human disturbance; ▪ Habitat loss; ▪ Habitat degradation from pollution; ▪ Changes to water regimes; ▪ Historical hunting for food; and ▪ Invasive flora.
Recovery Plans
There is no adopted or made recovery plan for this species. Recovery plan not required.
Threat Abatement Plans
No threat abatement plan has been identified as being relevant for this species.

3.3.3.6.1 Species Description

The Eastern curlew (*Numenius madagascariensis*) is currently listed as critically endangered under the EPBC Act and endangered under the NC Act. The Eastern curlew is the world’s largest migratory shorebird, measuring a wingspan of 110 cm, a long neck, long legs and downcurved bill, weighing approximately 900 grams. The species migrates to Australia from August to February, where it has a primarily coastal distribution, inhabiting estuaries, bays, harbours, inlets and coastal lagoons of the northern and eastern Australian coastlines, including Tasmania. The species does not breed in Australia. Eastern curlews are carnivorous during the non-breeding season, feeding on crustaceans, molluscs and insects. Roosting takes place during high tides on sandbars, islets, among coastal vegetation, near coastal wetlands or mangroves. Bowling Green Bay is listed as a key site for migratory shorebirds in the East Asian-Australasian Flyway Site Network

3.3.3.6.2 Occurrence in Region

A search of the ALA database identified several records of the species within a 100 km radius of the Project area, between 1925 and 2023; predominantly recorded along the coastline, within irrigated farmlands, in close proximity to waterways or within residential areas. Whereas the WildNet database returned 1,009 results of the species within a 100 km radius (refer to Appendix J and Figure 3-5).

3.3.3.6.3 Occurrence in Project Area

There were no individuals recorded during the 2022 field surveys. The closest known record of the species was recorded in in 2011, approximately 19 km northeast of the Project site.

3.3.3.7 McDonald’s frog (Critically Endangered)

Key data for the McDonald’s Frog is presented in Table 3-26 and mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-26 Key Data on McDonald’s frog

McDonald’s frog (<i>Cophixalus mcdonaldi</i>)
Baseline Data Results
Field surveys conducted in 2022 did not identify any records of McDonald’s frog. There is no suitable habitat within the Project area to support populations of McDonald’s frog.
EPBC Status
Critically Endangered
Key Threats
Key threats to the species include: <ul style="list-style-type: none"> ▪ Climate change; ▪ Clearing leading to habitat loss and fragmentation; ▪ Invasive species: Yellow crazy ants (<i>Anoplolepis gracilipes</i>); and ▪ Diseases: Amphibian chytrid fungus.
Recovery Plans
There is no adopted or made Recovery Plan for this species. Recovery plan not required.
Threat Abatement Plans
No Threat Abatement Plan has been identified as being relevant for this species

3.3.3.7.1 Species Description

McDonald’s frog (*Cophixalus mcdonaldi*) is listed as critically endangered under both the EPBC Act and NC Act. The McDonald’s frog is a smooth skinned amphibian, with pale to dark brown colouring and exhibits dark streaks on each arm, temporal streaks and dark facial markings. The species ranges in length, dependent on gender, with females measuring to 26 mm snout-to-vent length (SVL) and males 23 mm SVL. McDonald’s frog is highly restricted to habitats on Mount Elliot, south-east of Townsville. The species has only been recorded at elevations of 900 m above sea level and higher.

3.3.3.7.2 Occurrence in Region

Based on the ALA database, there are two known records of the McDonald’s frog occurring within a 100 km radius of the Project area (refer to Figure 3-5). Both records have been recorded numerous times between 1972 and 1999 and are located on the western and eastern boundary of Mount Elliot, with the closest record approximately 10 km from the closest point of the Project area. The WildNet species search returned 8 records of the species within 100 km of the Project (refer to Appendix J).

3.3.3.7.3 Occurrence in Project Area

Field surveys conducted in 2022 did not identify any records of McDonald’s frog. Habitat for the species is not present within the Project area.

3.3.3.8 Ghost bat (Vulnerable)

Key data for the Ghost bat is presented in Table 3-27 and mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-27 Key Data on Ghost bat

Ghost bat (<i>Macroderma gigas</i>)
Baseline Data Results
There were no individuals recorded during the 2022 field surveys. The closest known record of the species was recorded in 2019, approximately 20 km northeast of the Project site.
EPBC Status
Vulnerable
Key Threats
<p>Key threats to the species (as per the SPRAT database) include:</p> <ul style="list-style-type: none"> ▪ Habitat loss (destruction of or disturbance to roost sites or nearby areas) due to mining; ▪ Disturbance of (human visitation at) breeding sites; ▪ Modification to foraging habitat; ▪ Collision with fences, especially those barbed wire; ▪ Collapse or reworking of old mine adits; ▪ Contamination by mining residue at roost sites; ▪ Disease; ▪ Poisoning by cane toads; and ▪ Predation by feral cats (<i>Felis catus</i>) and European red foxes (<i>Vulpes vulpes</i>).
Recovery Plans
A recovery plan is required however, there is no adopted or made Recovery Plan for this species.
Threat Abatement Plans
<p>The following threat abatement plans are relevant to this species:</p> <ul style="list-style-type: none"> • <i>Threat abatement plan for predation by the European red fox</i> (DEWHA, 2008). <p>The Project is expected to be in accordance with the threat abatement plan listed above. The Project will implement management measures to reduce impacts from European foxes.</p>

3.3.3.8.1 Species Description

The Ghost bat (*Macroderma gigas*) is currently listed as vulnerable under the EPBC Act and endangered under the NC Act. The Ghost bat is Australia’s only carnivorous bat and largest microchiropteran bat, with an overall head/body length of 10-13 cm and a forearm length of 10-11 cm, weighing up to 150 grams. The species is generally found in northern Australia, north of 29°S in Western Australia, Northern Territory and Queensland, where it inhabits arid Pilbara regions, tropical savanna woodlands and rainforests. Habitats for roosting differ slightly, with species preferring caves, rock crevices and old mines. Breeding in the species occurs at two to three years, with females producing a single young per year (generally in late spring).

3.3.3.8.2 Occurrence in Region

A search of the ALA database identified five records of the species within a 100 km radius of the Project area, of which, four are recorded within Hervey Range within woodlands and one west of Mount Elliot within woodlands between 2001 and 2019 (refer to Figure 3-5). The WildNet database returned eight results of the species within a 100 km radius (refer to Appendix J).

3.3.3.8.3 Occurrence in Project Area

There were no individuals recorded during the 2022 field surveys. The closest known record of the species was recorded in 2019, approximately 20 km northeast of the Project site.

3.3.3.9 Semon’s leaf-nosed bat (Vulnerable)

Key data for the Semon’s leaf-nosed bat is presented in Table 3-28 and mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-28 Key Data on Semon’s leaf-nosed bat

Semon’s leaf-nosed bat (<i>Hipposideros semoni</i>)
Baseline Data Results
The species occurs in coastal Queensland, from Cape York to south of Cooktown, however; an outlier population exists near Gladstone and unconfirmed echolocation records exist outside its normal distribution. The species was not recorded during the 2022 field surveys.
EPBC Status
Vulnerable
Key Threats
<p>Key threats to the species include:</p> <ul style="list-style-type: none"> ▪ Mining; ▪ Habitat loss through the destruction of old hardrock mines and land clearing; ▪ Limestone quarrying; ▪ Predation by feral cats; ▪ Invasive species including cane toads and pigs; ▪ Ecotourism to caves; ▪ Increased fire extents; and ▪ Disturbance to roosting sites.
Recovery Plans
<i>‘Recovery plan for cave-dwelling bats, Rhinolophus philippinensis, Hipposideros semoni and Taphozous troughtoni 2001-2005’.</i>
Threat Abatement Plans
<p><i>‘Threat abatement plan for predation by feral cats’.</i></p> <p>The Project is expected to be in accordance with the threat abatement plans listed above. The Project will implement management measures to reduce impacts from feral cats.</p>

3.3.3.9.1 Species Description

Semon’s leaf-nosed bat (*Hipposideros semoni*) is listed as vulnerable under the EPBC Act and endangered under the NC Act. The species is a small bat with an overall length of approximately 40-50 mm and weighs approximately 6-10 grams. The bat is a dark smoky-grey colouring, with a well-developed, square shaped nose-leaf that covers most of the muzzle. The species occurs in coastal Queensland, from Cape York to south of Cooktown, however; an isolated population exists near Gladstone. The species is rare, even within its range, occurring in low densities of core habitats including rainforests and streams/rivers adjacent to rainforests. Roosting habitat includes caves and trees, however, has also been recorded to roost in residential homes and abandoned buildings. Breeding/birthing season in the species occurs in November, with females birthing one young per year.

3.3.3.9.2 Occurrence in Region

ALA records identify one occurrence of the species within a 100 km range of the Project area, recorded within a residential lot in Townsville city (refer to Figure 3-5). No WildNet records of the species exist within the broader region.

3.3.3.9.3 Occurrence in Project Area

The species was not recorded during the 2022 field surveys. No WildNet or ALA records of the species exist within the Project area.

3.3.3.10 Koala (Endangered)

Key data for the Koala is presented in Table 3-29 and mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-29 Key Data on Koala

Koala (<i>Phascolarctos cinereus</i>)
Baseline Data Results
There were no individuals recorded during the 2022 field surveys. The closest known record of the species was recorded in 2021, approximately 7 km northeast of the Project site.
EPBC Status
Endangered
Key Threats
Threats in Australia include: <ul style="list-style-type: none"> ▪ Loss of suitable habitat (due to climate change); ▪ Increased intensity and/or frequency of drought; ▪ Increased intensity and/or frequency of heatwaves; ▪ Increased intensity and/or frequency of bushfires; ▪ Declining nutritional value of foliage; ▪ Habitat clearing and degradation; ▪ Direct mortality from vehicle collisions and dogs; and ▪ Disease (e.g., Chlamydia and koala retrovirus (KoRV)).
Recovery Plans
<p><i>National Recovery Plan for the Koala Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory)</i> (DAWE, 2022b).</p> <p>The Project and its associated studies has undertaken survey and monitoring and provided additional information regarding the potential of the species to occur. This information will be useful to various research groups. Impacts associated with the studies are expected to provide great value. The Project is not expected to be inconsistent with the recovery plan.</p>
Threat Abatement Plans
No Threat Abatement Plan has been identified as being relevant for this species.

3.3.3.10.1 Species Description

The Koala (*Phascolarctos cinereus*) is listed as endangered under the EPBC Act and NC Act. The Koala is Australia’s most well-known marsupial, exhibiting a stocky body, rounded ears, sharp claws and grey in colouration. Northern populations are generally smaller (6.5 kg) and lighter in colouration than those in Southern Australian regions (12 kg in weight) (DAWE, 2022a). Species distribution is heavily dependent on food resources as Koala’s have a restricted diet of eucalypt leaves. Biophysical habitat attributes for the koala includes habitats containing the resources necessary for individual foraging, survival (including predator avoidance), growth, reproduction and movement (DAWE, 2022a).

The species typically occurs in eastern Australian forests and woodlands that are abundant with eucalypt including those in Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia. For listed populations in Queensland, New South Wales and the Australian Capital Territory, species extent of occurrence across its range is estimated to be 1,665,850 km² (DAWE, 2022a). Within Queensland, Koalas are widespread, occurring in the Einasleigh Uplands and Wet Tropics bioregion and south and west to the Desert Uplands, Central Mackay Coast, Mitchell Grass Downs, Mulga Lands, Brigalow Belt North, Brigalow Belt South, and South Eastern Queensland bioregions (Adams-Hosking et al., 2016). Females reach sexual maturity between two and three years of age, producing one offspring annually.

Genetically important populations of the Koala exists within four regions nationally, including:

- Queensland and New South Wales populations north of the Clarence River Valley, New South Wales;
- South of the Clarence River Valley, New South Wales to north of the Sydney Basin;
- South of the Sydney Basin to approximately the New South Wales /Victorian boarder; and
- Victoria and South Australia populations.

3.3.3.10.2 Occurrence in Region

A search of the ALA database identified 240 records of the species within a 100 km radius of the Project area, recorded between 1907 and 2023, with majority of records located on Magnetic Island (east of Townsville); some records exist within wooded forests, cleared land, along watercourses, roads and two records exist within Bowling Green Bay National Park. Whereas the WildNet database returned 102 results of the species within a 100 km radius (refer to Appendix J and Figure 3-5).

3.3.3.10.3 Occurrence in Project Area

There were no individuals recorded during the field surveys and there are no records of Koala sightings within the area publicly available. The closest known record of the species was recorded in 2021, approximately 7 km northeast of the Project site.

3.3.3.10.4 Habitat Quality within the Project Area

A habitat mapping exercise has mapped 48.8 ha as potential habitat for Koala within the Project area (refer to pg. 7-9 in Appendix K). Whilst it is noted that the alignment does contain Koala habitat the likelihood of an active Koala presence on the alignment is low. This species is identified as being on a high priority list due to the extensive bushfires which occurred in 2019-20 in southern and eastern Australia and although they are not considered likely to occur in the Project area, a detailed habitat assessment has been conducted to further quantify their potential presence.

Habitat quality scores for the Koala, including the overall species habitat score, are presented in Table 3-30, with overall habitat scores rating as intermediate, ranging from 1.78 to 4.53 out of 10. Breeding habitat scores for the Koala were considered identical to those for the foraging habitat as mature habitat trees recorded onsite were also preferred food species (Evolve, 2023). The species mobility scores for the Koala ranged from 5.00 (low scoring in non-remnant assessment units) to 25.00 (high scoring in remnant assessment units) out of a possible score of 25.00.

Table 3-30 MHQA for the Koala summarised by assessment unit

Assessment unit	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Regional Ecosystem	Remnant 11.3.30	Non-Remnant 11.3.30	Remnant 11.3.35	Non-Remnant 11.3.35	Remnant 11.3.27e	Remnant 11.3.25b	Remnant 11.3.12
Foraging Habitat							
Species richness of food trees	19.55	16.88	18.33	10.00	15.00	22.50	20.00
Abundance of food trees	14.09	9.38	16.67	7.50	10.00	20.00	25.00
Average Score	16.82	13.13	17.50	8.75	12.50	21.25	22.50
Breeding Habitat							
Species richness of habitat trees	19.55	16.88	18.33	10.00	15.00	22.50	20.00
Abundance of food trees	14.09	9.38	16.67	7.50	10.00	20.00	25.00
Average Score	16.82	13.13	17.50	8.75	12.50	21.25	22.50

Section 3 Habitat Assessment

Assessment unit	AU1	AU2	AU3	AU4	AU5	AU6	AU7
Role of site to overall population	5	5	5	5	5	5	5
Threats							
Dog attack	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Vehicle strike	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Risk of uncontrolled fires	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Drought	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Lowest score	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Species Mobility							
Connectivity between suitable habitats	21.36	5.00	16.67	5.00	25.00	25.00	25.00
Average Score	21.36	5.00	16.67	5.00	25.00	25.00	25.00
Overall species habitat score	3.83	2.19	3.50	1.78	3.28	4.53	3.84

3.3.3.11 Greater glider (northern) (Vulnerable)

Key data for the Greater glider (northern) is presented in Table 3-31 and mapping of known species records within the area is shown in Figure 3-5.

Table 3-31 Key Data on Greater glider (northern)

Greater glider (northern) (<i>Petauroides minor</i>)
Baseline Data Results
There are no records of the species within the Project area on either WildNet or ALA databases. The species was not recorded during field surveys in 2022.
EPBC Status
Vulnerable
Key Threats
Key threats to the species includes: <ul style="list-style-type: none"> ▪ Climate change; ▪ Habitat clearing and fragmentation; ▪ Timber harvesting; ▪ Inappropriate fire regimes; ▪ Barbed wire fencing (entanglement); and ▪ Predation by feral cats (<i>Felis catus</i>).
Recovery Plans
There is no adopted or made Recovery Plan for this species.
Threat Abatement Plans
No Threat Abatement Plan has been identified as being relevant for this species.

3.3.3.11.1 Species Description

Greater glider (northern) (*Petauroides minor*) is the largest gliding possum in north-eastern Australia. The species ranges in an overall body length of 32-40 cm and a tail length of 40-48 cm with weights ranging from 650 to 1,100 grams. The Greater glider (northern) is dusky brown in colouration, with a darker mid-dorsal stripe. The species occurs in patchy, isolated populations from Townsville north to the Windsor Tablelands. The Greater glider (northern) is generally restricted to eucalypt forest and woodlands on high elevations within its range. As the species is an arboreal nocturnal marsupial, the Greater glider (northern) shelters in large tree hollows of large, older trees for denning.

Habitat critical to the survival of the species includes:

- Large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees and a diverse range of the species' preferred food species in a particular region;
- Smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonization; and
- Cool microclimate forest/woodland areas (e.g., protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes); and
- Areas identified as refuges under future climate changes scenarios;
- Short-term or long-term post-fire refuges (i.e., unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas.

3.3.3.11.2 Occurrence in Region

Two-hundred and ten records of the species exist within the broader region (100 km) on the ALA database; all records are located within the Paluma Range National Park, approximately 82 km northwest of the Project area (refer to Figure 3-5). As per the WildNet database, there are 218 records of the species within 100 km of the Project area (refer to Appendix J).

3.3.3.11.3 Occurrence in Project Area

There are no records of the species within the Project area on either WildNet or ALA databases. The species was not recorded during field surveys in 2022.

3.3.3.12 Greater glider (southern and central) (Endangered)

Key data for the Greater glider (southern and central) is presented in Table 3-32 and mapping of known species records within 100 km of the Project area is shown in Figure 3-5.

Table 3-32 Key Data on Greater glider (southern and central)

Greater glider (southern and central) (<i>Petauroides volans</i>)	
Baseline Data Results	
There were no individuals recorded during the 2022 field surveys. The closest known record of the species occurs on the north-western area of Mingela State Forest, recorded in 2000, approximately 15 km west of the Project site.	
EPBC Status	
Endangered	
Key Threats	
Key threats to the species include: <ul style="list-style-type: none"> ▪ Inappropriate fire regimes; ▪ Habitat clearing and fragmentation; ▪ Timber harvesting; ▪ Entanglement in barbed wire fencing; ▪ Climate change; ▪ Hyper-predation by owls; ▪ Competition with Sulphur-crested cockatoos (<i>Cacatua galerita</i>); and ▪ Predation by feral cats (<i>Felis catus</i>) and European red foxes (<i>Vulpes vulpes</i>). 	
Recovery Plans	
A recovery plan is required however, there is no adopted or made Recovery Plan for this species.	
Threat Abatement Plans	
No Threat Abatement Plan has been identified as being relevant for this species	

3.3.3.12.1 Species Description

Greater Glider (southern and central) (*Petauroides volans*) is listed as endangered under both the EPBC Act and NC Act. The Greater glider (southern and central) is the largest gliding possum in eastern Australia, with a body length of 35-46 cm and tail length of 45-60 cm. On average, the species weighs approximately 900 – 1,700 grams. *Petauroides volans* is of a dark grey/dusky brown colouration, with a white/creamy underbody. The Greater glider (southern and central) occurs at elevations between 0 – 1,200 m above sea level, in eucalypt forests and woodlands of eastern Australia, from Proserpine QLD south to Wombat State Forest in Victoria. As the species is an arboreal nocturnal marsupial, the Greater glider (southern and central) shelters in large tree hollows of large, older trees, both live and standing dead for denning.

Habitat critical to the survival of the species includes:

- Large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees and a diverse range of the species' preferred food species in a particular region;
- Smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonization; and
- Cool microclimate forest/woodland areas (e.g., protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes); and
- Areas identified as refuges under future climate changes scenarios;
- Short-term or long-term post-fire refuges (i.e., unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas.

3.3.3.12.2 Occurrence in Region

A search of the ALA database identified fourteen records of the species within a 100 km radius of the Project area between 1976 and 2016 (refer to Figure 3-5), these were recorded within Bowling Green Bay National Park, Paluma Range National Park, Mingela State Forest, along waterways and within woody environments. The WildNet database returned no results of the species within a 100 km radius.

3.3.3.12.3 Occurrence in Project Area

There were no individuals recorded during the 2022 and 2023 field surveys. The closest known record of the species occurs on the north-western area of Mingela State Forest, recorded in 2000, approximately 15 km west of the Project site.

3.3.4 MNES Migratory Species

An assessment of impacts was undertaken against the significant impact criteria for the following migratory species which are known to occur (Table 3-8):

- Barn swallow (*Hirundo rustica*);
- Glossy ibis (*Plegadis falcinellus*);
- Fork-tailed swift (*Apus pacificus*);
- Rufous fantail (*Rhipidura rufifrons*);
- Oriental cuckoo (*Cuculus optatus*); and
- Black-faced monarch (*Monarcha melanopsis*).

Mapping of known species records within 100 km of the Project area is shown in Figure 3-5 and known records at Project level are shown in Figure 3-6.

There is suitable habitat for migratory bird species associated with wetlands within and around the Project area. Aerial species such as the Fork-tailed swift may occur over heavily disturbed areas as well as natural habitats and will not be impacted by Project activities. Descriptions of each of these species' occurrences and habitats are as follows with an important habitat assessment undertaken in Table 3-33:

- Barn swallow – The species usually occurs in northern Australia, and on the east to Fraser Island in Queensland. The Barn swallow is recorded in open country in coastal lowlands, often near water, towns and cities. Known to occur in freshwater wetlands. This species was not recorded previously or as part of the PMST. Species was however recorded as part of the second survey (Evolve, 2022b) and the February 2023 survey. It was not specified how many individuals were recorded during either survey. Species may occur within the locality of Serpentine Lagoon.
- Glossy ibis – This species preferred habitat for foraging and breeding are freshwater marshes at the edges of lakes and rivers, lagoons, floodplains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons. Multiple individuals were sighted by Evolve in May 2022 within the locality of Serpentine Lagoon. The premier habitat for the Glossy ibis is located within Serpentine Lagoon and associated wetlands to the North of the alignment near Serpentine Lagoon. Potential foraging and breeding habitat mapped within the locality of Serpentine Lagoon totals 1.19 ha of the alignment (refer to pg. 19 in Appendix K).
- Fork-tailed swift – This species is almost exclusively aerial and occurs mainly over inland plains. Habitats include riparian woodland, heathland and low scrub areas. One (1) individual of this species was previously recorded by EMM (EMM, 2022) within Lansdowne Creek in July 2021 and suitable habitat occurs within the Project area. It is considered a species that spends most of its time aloft, and could occur anywhere over the Project area, therefore the whole Project area is considered potential foraging habitat.

- Rufous Fantail – This species occurs in coastal and near coastal regions of northern and eastern Australia. Habitats include wet sclerophyll forests, gullies dominated by eucalypts, sub-tropical and temperate rainforests, areas of secondary regrowth and parks and gardens. Four (4) individual of Rufous fantail were recorded within Lansdowne Creek by EMM in July 2021.
- Oriental cuckoo – This species visits Australia in winter, mainly in the north of Australia. Oriental cuckoos are found in more humid habitats in wet eucalypt forests, river margins and near to mangroves. They are shy and quite solitary. One individual of the species was recorded by EMM in July 2021 in riparian vegetation near Lansdowne Creek. Evolve surveys did not observe the species over the survey periods. The species does not breed in Australia and can therefore be found potentially in any woodland environment, which has been mapped as 46.08 ha of the alignment (refer to pg. 10-12 in Appendix K).
- Black-faced monarch – This species mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest. The Black-faced monarch builds a deep cup nest of casuarina needles, bark, roots, moss and spider web in the fork of a tree, about 3 m to 6 m above the ground. Preferred nesting material (casuarina needles) are not available within impacted vegetation. The species also occurs in selectively logged and 20–30 years old regrowth rainforest, nearby open eucalypt forests, especially in gullies with a dense, shrubby understorey as well as in dry sclerophyll forests and woodlands, often with a patchy understorey. These ‘marginal’ habitats are especially likely to be utilised during winter and migration or by young, non-breeding birds and occur in multiple locations within the alignment. One individual was sighted by Evolve in riparian vegetation during September site survey and one individual during the February 2023 survey. Potential foraging habitat within the alignment totals 2.64 ha (refer to pg. 20-22 in Appendix K).

No significant impacts to species listed as Migratory are expected to occur as a result of Project activities (Table 3-34).

Table 3-33 Important Habitat Assessment – Migratory Species

Species	Habitat utilised by migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species	Habitat that is of critical importance to the species at particular life-cycle stages	Habitat utilised by a migratory species which is at the limit of the species range	Habitat within an area where the species is declining	Definition in the Referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE, 2015b)	Likelihood of occurrence of important habitat
Barn swallow	According to the <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act</i> (DoE, 2015b), an ecologically significant proportion of the Barn swallow population is 1,000 birds. ALA records show there to be only 10 records within 100 km of the Project area between 1984 and 2000. There are no records in recent years. It is unlikely that the region supports habitat for an ecologically significant proportion of the population of Barns swallows.	Barn swallows do not breed in Australia. The habitat present in and around the Project area is likely used for foraging but is small relative to the area of potential habitat within the region.	The Barn swallow’s range is mainly in the north of Australia. The species has a patchy distribution as far south as Fraser Island along the eastern coast. Therefore, habitat utilised by the species is not considered to be at the limit of its range.	This species is not currently considered to be declining.	Non-breeding habitat only: occurs in the air above open vegetated areas including native and agricultural grasslands as well as over open water areas.	Likely. Agricultural grasslands and areas of open water are present within the Project area

Species	Habitat utilised by migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species	Habitat that is of critical importance to the species at particular life-cycle stages	Habitat utilised by a migratory species which is at the limit of the species range	Habitat within an area where the species is declining	Definition in the <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE, 2015b)</i>	Likelihood of occurrence of important habitat
Glossy ibis	ALA records show there to be 1,817 records within 100 km of the Project area between 1944 and 2021. It is unlikely that the region supports habitat for an ecologically significant proportion of the population of Glossy ibis.	The Glossy ibis breeds in a limited number of locations in Australia. The region where the Project is located is not known as a location where large numbers of the species breed. The closest location is Channel Country of Queensland.	The Glossy ibis is widespread across Australia; therefore, the Project is not located at the limit of its range.	This species is not currently considered to be declining.	The Glossy ibis is not included in the <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE, 2015b)</i> . There is no additional definition of important habitat for the Glossy ibis.	Potentially. As per the SPRAT profile, the Glossy preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. Some marginal habitat is located near Serpentine Lagoon but is unlikely to be considered important.
Fork-tailed swift	According to the <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE, 2015b)</i> , an ecologically significant proportion of the Fork-tailed swift population is 100 birds. ALA records show there to be 424 records within 100 km of the Project area between 1969 and 2022. Large numbers were recorded south of Townsville in 2012 (Appendix A of DoE 2015b). It is likely that the region supports habitat for an ecologically significant proportion of the population of Fork-tailed swifts.	The Fork-tailed swift does not breed in Australia.	The Fork-tailed swift is widespread across Australia; therefore, the Project is not located at the limit of its range.	This species is not currently considered to be declining.	Non-breeding habitat only: Found across a range of habitats, from inland open plains to wooded areas, where it is exclusively aerial.	Potentially. It is considered a species that spends most of its time aloft, and could occur anywhere over the Project area, therefore the whole Project area is considered potential foraging habitat.

Species	Habitat utilised by migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species	Habitat that is of critical importance to the species at particular life-cycle stages	Habitat utilised by a migratory species which is at the limit of the species range	Habitat within an area where the species is declining	Definition in the <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE, 2015b)</i>	Likelihood of occurrence of important habitat
Oriental cuckoo	According to the <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE 2015b)</i> , an ecologically significant proportion of the Oriental cuckoo population is 1,000 birds. ALA records show there to be only 296 records within 100 km of the Project area between 1961 and 2021. It is unlikely that the region supports habitat for an ecologically significant proportion of the population of Oriental cuckoos.	The Oriental cuckoo does not breed in Australia.	The Oriental cuckoo's range extends north across northern Australia and south almost to Victoria, therefore the Project is not located at the limit of its range.	This species is not currently considered to be declining.	Non-breeding habitat only: monsoonal rainforest, vine thickets, wet sclerophyll forest or open <i>Casuarina</i> , <i>Acacia</i> or <i>Eucalyptus</i> woodlands. Frequently at edges or ecotones between habitat types. Riparian forest is favoured habitat in the Kimberley region.	Potentially. The species does not breed in Australia and can therefore be found potentially in any woodland environment, which has been mapped as 46.08 ha of the alignment
Black-faced monarch	According to the <i>Referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE, 2015b)</i> , an ecologically significant proportion of the Black-faced monarch population is 460 birds. ALA records show there to be 651 records within 100 km of the Project area between 1938 and 2022. It is unlikely that the region supports habitat for an ecologically significant proportion of the population of Black-faced monarchs.	Breeding occurs in eastern Australia, although habitat within the Project area is considered to be marginal. Thus, it is unlikely that the Black-faced monarch would breed in the habitat in the Project area.	The Black-faced monarch's range extends north to Cape Australia and south almost to Victoria, therefore the Project is not located at the limit of its range.	This species is not currently considered to be declining.	Wet forest specialist, found mainly in rainforest and wet sclerophyll forest, especially in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs.	Unlikely. Habitat is considered to be marginal.

Table 3-34 Assessment Against Significant Impact Criteria: Migratory Species

Criterion	Assessment
<i>An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:</i>	
Does the migratory species habitat within the Project Area represent 'important habitat'?	There is no evidence that habitat within the Project area should be considered as important habitat for a migratory species as described above. None of the species are known to be declining or are at the limit of their range. The Serpentine Lagoon provides habitat for the migratory species; however, the Project is on the edge of Serpentine Lagoon. Therefore, migratory species habitat within the Project area is unlikely to represent 'important habitat'.
Substantially modify, destroy or isolate an area of important habitat for a migratory species.	Wetland habitats, such as the Serpentine Lagoon within the Project area could be considered as important habitat for migratory species. However, the Project will not substantially modify, destroy or isolate the area. The water alignment is on the southern edge of the Serpentine Lagoon. Long lasting effects as a result of construction are not expected to occur and loss of habitat associated with the Serpentine Lagoon is expected to regenerate following construction of the pipeline.
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.	The Project construction management plans and CEMP will incorporate measures to control the introduction of weed and pest species across the Project area to limit the potential impact of feral predators and weed species on migratory species and their habitat. The Project is considered unlikely to result in invasive species becoming established in migratory species habitat.
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	An ecologically significant proportion' of a population varies with the species. Factors that should be considered include the species population status, genetic distinctiveness and species-specific behavioural patterns (i.e., site fidelity and dispersal rates) (DoE, 2013). None of the species assessed as possibly occurring in the Project area have been recorded in large enough numbers that may represent an ecologically significant proportion of the population of a migratory species.
Assessment of potential for significant residual impacts.	The Project does not meet any of the criteria that would constitute a significant impact to migratory species. As such, it is concluded that the proposed development is unlikely to significantly impact any of the potentially occurring species.

3.3.5 Adequacy of Surveys

Table 3-35 assesses the adequacy of surveys for detection of threatened species by cross-referencing the field survey methods and effort used against survey guidelines for the species or taxa.

Table 3-35 Field survey adequacy assessment

Species and Guidelines Referenced	Project Component	Survey Method and Effort	Justification
<ul style="list-style-type: none"> ▪ Squatter pigeon (southern) ▪ White-throated needletail ▪ Australian painted snipe ▪ Grey falcon ▪ Greater sand plover ▪ Curlew sandpiper ▪ Eastern curlew <p>Survey guidelines for Australia’s threatened birds (DEWHA, 2010b)</p>	<p>Pipeline</p>	<p><u>Diurnal bird surveys:</u></p> <ul style="list-style-type: none"> ▪ Targeted searches of habitat, nests, call detection and flocks of co-occurring finches ▪ 1 hr/ha within 600 m of a water source ▪ Water source observations ▪ Six observer-hours per day for two days at each water source ▪ Observations included three hours following first light ▪ Surveys conducted between 22 and 27 May 2022 <p><u>Camera trapping:</u></p> <ul style="list-style-type: none"> ▪ Not baited ▪ 3 photos per trigger ▪ 22 cameras x 4 nights – 12 to 16 September 2022 ▪ 22 cameras x 4 nights – 10 to 14 October 2022 ▪ Trigger distance up to 20 m when temperatures below 25°C, full field view trigger distance between 25°C and 60°C ▪ 70°PIR sensor detect wide and night vision up to 23 m ▪ Trigger time in 0.3 seconds 	<p>Methods were selected based on maximising the chance of detecting the Black-throated finch. These partially meet the recommended methods for surveying Australian painted snipe, Squatter pigeon (southern).</p> <p>There are no survey guidelines for the White-throated needletail, Grey falcon, Greater sand plover, Curlew sandpiper, and Eastern curlew, but diurnal bird surveys are likely to have detected these species should they have been present.</p>

Species and Guidelines Referenced	Project Component	Survey Method and Effort	Justification
	Precinct road alignments	<p><u>Camera trapping:</u></p> <ul style="list-style-type: none"> ▪ Not baited ▪ 3 photos per trigger ▪ 22 cameras x 4 nights – 12 to 16 September 2022 ▪ 22 cameras x 4 nights – 10 to 14 October 2022 ▪ Trigger distance up to 20 m when temperatures below 25°C, full field view trigger distance between 25°C and 60°C ▪ 70°PIR sensor detect wide and night vision up to 23 m ▪ Trigger time in 0.3 seconds <p><u>Diurnal bird surveys:</u></p> <ul style="list-style-type: none"> ▪ Targeted searches of habitat, nests, call detection and flocks of co-occurring finches ▪ 1 hr/ha within 600 m of a water source ▪ Water source observations ▪ Six observer-hours per day for two days at each water source ▪ Observations included three hours following first light ▪ Surveys conducted between 12-16 September 2022 and 10-14 October 2022 	
<ul style="list-style-type: none"> ▪ Black-throated finch (southern) • • Significant impact guidelines for the Black-throated finch (southern) (<i>Poephila cincta cincta</i>) (DEWHA, 2009a) • 	Pipeline	<p><u>Diurnal bird surveys:</u></p> <ul style="list-style-type: none"> ▪ Targeted searches of habitat, nests, call detection and flocks of co-occurring finches ▪ 1 hr/ha within 600 m of a water source ▪ Water source observations ▪ Six observer-hours per day for two days at each water source ▪ Observations included three hours following first light ▪ Surveys conducted between 22 and 27 May 2022 	Surveys were conducted in line with the significant impact guidelines for the Black-throated finch (southern) (<i>Poephila cincta cincta</i>) (DEWHA, 2009a). Serpentine Lagoon is an ephemeral wetland, therefore wet season surveys between March and May are appropriately timed.

Species and Guidelines Referenced	Project Component	Survey Method and Effort	Justification
	Precinct road alignments	<p><u>Camera trapping:</u></p> <ul style="list-style-type: none"> ▪ Not baited ▪ 3 photos per trigger ▪ 22 cameras x 4 nights – 12 to 16 September 2022 ▪ 22 cameras x 4 nights – 10 to 14 October 2022 ▪ Trigger distance up to 20 m when temperatures below 25°C, full field view trigger distance between 25°C and 60°C ▪ 70°PIR sensor detect wide and night vision up to 23 m ▪ Trigger time in 0.3 seconds <p><u>Diurnal bird surveys:</u></p> <ul style="list-style-type: none"> ▪ Targeted searches of habitat, nests, call detection and flocks of co-occurring finches ▪ 1 hr/ha within 600 m of a water source ▪ Water source observations ▪ Six observer-hours per day for two days at each water source ▪ Observations included three hours following first light ▪ Surveys conducted between 12-16 September 2022 and 10-14 October 2022 	
<ul style="list-style-type: none"> ▪ Masked owl (northern) • • Survey guidelines for Australia’s threatened birds (DEWHA, 2010b) 	Pipeline	<p><u>Spotlighting:</u></p> <ul style="list-style-type: none"> ▪ 100 m x 100 m plots ▪ Conducted on foot by two ecologists using 30W hand-held spotlight and binoculars ▪ Tree canopies inspected for 30 observer-minutes <p><u>Scat and sign searches:</u></p> <ul style="list-style-type: none"> ▪ Incidental while conducting other surveys <p><u>Audio Logging:</u></p> <ul style="list-style-type: none"> ▪ Recorded 15 seconds every minute between dusk and dawn ▪ Sample rate 256kHz ▪ 4 nights – 28 March to 1 April 2022 	Call playback surveys are recommended for in all wooded habitats. Likelihood of detection during spotlighting surveys is considered low due to its cryptic nature (DEWHA, 2010b). Audio logging may have been sufficient to detect the species.

Species and Guidelines Referenced	Project Component	Survey Method and Effort	Justification
	Precinct road alignments	<p><u>Spotlighting:</u></p> <ul style="list-style-type: none"> ▪ 100 m x 100 m plots ▪ Conducted on foot by two ecologists using 30W hand-held spotlight and binoculars ▪ Tree canopies inspected for 30 observer-minutes <p><u>Scat and sign searches:</u></p> <ul style="list-style-type: none"> ▪ Incidental while conducting other surveys <p><u>Audio Logging:</u></p> <ul style="list-style-type: none"> ▪ Recorded 2 minutes every 4 minutes between 1800 and 0630 	
<ul style="list-style-type: none"> ▪ Bare-rumped sheath-tail bat ▪ Ghost bat ▪ Semon’s leaf-nosed bat <p>Survey guidelines for Australia’s threatened bats (DEWHA, 2010a)</p>	Pipeline	<p><u>Audio Logging:</u></p> <ul style="list-style-type: none"> ▪ Recorded 15 seconds every minute between dusk and dawn ▪ Sample rate 256kHz ▪ 4 nights – 28 March to 1 April 2022 	<p>Presence of bat species are typically surveyed using echolocation call detection, trapping (under approval by the EPBC Act and local or state government regulations) and roost searches.</p> <p>Echolocation call detection is recommended for 30-60 minutes per night for 4-5 nights.</p>

Species and Guidelines Referenced	Project Component	Survey Method and Effort	Justification
	Precinct road alignments	<p><u>Audio Logging:</u></p> <ul style="list-style-type: none"> ▪ 6.0 kHz minimum recording frequency ▪ Recording period from 18:00 to 06:30 ▪ Cyclic sampling of 2 min sleep, 2 min recording ▪ Using Firmware version 1.8.1 	<p>Trapping and echolocation call detection surveys when combined are most efficient.</p> <p>For bare-rumped sheathtail bats, acoustic detection, trapping using nets above/below tree canopy and over isolated waterholes and roost searches are approved detection methods.</p> <p>For Ghost bats, a combination of echolocation call detection, hard traps and mist nets and roost searches are considered effective. Echolocation detection is most effective close to potential roost sites and within the first 2-3 hours after sunset (Bullen 2021). The survey methods used are adequate for detecting Ghost bats.</p> <p>For Semon’s leaf-nosed bat, recommended survey approaches include non-invasive methods such as echolocation call detection. Species should not be trapped.</p> <p>Physical trapping of the species was avoided to limit disturbance.</p>
<ul style="list-style-type: none"> ▪ Northern quoll ▪ Greater glider (northern) ▪ Greater glider (southern and central) <p>Survey guidelines for Australia’s threatened mammals (DEWHA, 2010d)</p> <p>Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre at al., 2018)</p>	Pipeline	<p><u>Camera trapping:</u></p> <ul style="list-style-type: none"> ▪ Not baited ▪ 3 photos per trigger ▪ Cameras securely attached 10 – 50 cm from the ground on a tree or post; ▪ 7 cameras x 4 nights - 28 March to 1 April 2022 ▪ 17 cameras x 4 nights - 23 to 27 May 2022 <p><u>Spotlighting:</u></p> <ul style="list-style-type: none"> ▪ 100 x 100 m plots ▪ Conducted on foot by two ecologists using 30W hand-held spotlight and binoculars • Tree canopies inspected for 30 observer-minutes <p><u>Scat and sign searches:</u></p> <ul style="list-style-type: none"> ▪ Incidental while conducting other surveys 	<p>Recommended surveys methods for the Northern quoll include daytime searches, camera trapping, spotlight surveys and Elliot trapping baited with oats, sardines and peanut butter.</p> <p>There are no specific survey guidelines for the Greater glider within the guidelines, however, the spotlighting surveys conducted should be adequate for detecting Greater gliders (both northern and southern and central species).</p> <p>Surveys were conducted in line with the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre at al., 2018). Physical trapping of the species was avoided to limit disturbance.</p>

Species and Guidelines Referenced	Project Component	Survey Method and Effort	Justification
	Precinct road alignments	<p><u>Camera trapping:</u></p> <ul style="list-style-type: none"> ▪ Not baited ▪ 3 photos per trigger ▪ 22 cameras x 4 nights – 12 to 16 September 2022 ▪ 22 cameras x 4 nights – 10 to 14 October 2022 ▪ Trigger distance up to 20 m when temperatures below 25°C, full field view trigger distance between 25°C and 60°C ▪ 70°PIR sensor detect wide and night vision up to 23 m ▪ Trigger time in 0.3 seconds <p><u>Spotlighting:</u></p> <ul style="list-style-type: none"> ▪ 100 x 100 m plots ▪ Conducted on foot by two ecologists using 30W hand-held spotlight and binoculars • Tree canopies inspected for 30 observer-minutes <p><u>Scat and sign searches:</u></p> <ul style="list-style-type: none"> ▪ Incidental while conducting other surveys 	
<ul style="list-style-type: none"> ▪ Koala <p>A review of koala habitat assessment criteria and methods (Youngentob et al. 2021a).</p>	Pipeline	<p><u>Scat and sign searches:</u></p> <ul style="list-style-type: none"> ▪ Incidental while conducting other surveys <p><u>Spotlighting:</u></p> <ul style="list-style-type: none"> ▪ 100 x 100 m plots ▪ Conducted on foot by two ecologists using 30W hand-held spotlight and binoculars ▪ Tree canopies inspected for 30 observer-minutes 	<p>There are no specific guidelines for surveying koalas and multiple survey methods are recommended. Spotlighting surveys, incidental opportunities to detect species during BioCondition surveys, and incidental scat and sign searches should be adequate to detect the presence of the koala.</p>

Species and Guidelines Referenced	Project Component	Survey Method and Effort	Justification
	Precinct road alignments	<u>Scat and sign searches:</u> <ul style="list-style-type: none"> ▪ Incidental while conducting other surveys <u>Spotlighting:</u> <ul style="list-style-type: none"> ▪ 100 x 100 m plots ▪ Conducted on foot by two ecologists using 30W hand-held spotlight and binoculars ▪ Tree canopies inspected for 30 observer-minutes 	
<ul style="list-style-type: none"> ▪ McDonald's frog <p>Survey guidelines for Australia's threatened frogs (DEWHA, 2010c)</p>	Pipeline	<u>Spotlighting at waterbodies:</u> <ul style="list-style-type: none"> ▪ Water body surveys were conducted searching for frogs, tadpoles and egg masses and listening for calling adult males ▪ Spotlighting surveys were conducted on-foot ▪ Each observer utilised a 30W hand-held spotlight ▪ Hand-held recording devices were carried to assist in call identification • Incidental observations whilst conducting other surveys. 	<p>Recommended survey methods for Australia's threatened frogs include visual encounters (traversing the site for a prescribed period of time, systematically searching for animals), echolocation call surveys, audio-strip transect surveys, night driving (10 km road transects) and trapping.</p> <p>Surveys were conducted in line with Survey guidelines for Australia's threatened frogs (DEWHA, 2010c).</p> <p>McDonald's frogs do not occur outside of Mount Elliot ranges and were not expected to be found on-site.</p>
	Precinct road alignments	<ul style="list-style-type: none"> • Incidental observations whilst conducting other surveys. 	

Section 4 Impact Assessment

4.1 Potential Impacts to MNES

The Project has the potential to impact MNES categories, as described in Table 4-1.

Table 4-1 Summary of Potential Impacts to MNES

Matters of National Environmental Significance	Relevance	Description
World Heritage Properties	X	No World Heritage Properties are located within the Project area. The closest World Heritage Property, the Great Barrier Reef, is located approximately 35 km northeast of the road reserve. Additionally, the southern end of the Wet Tropics of Queensland World Heritage Area is located approximately 50 km northwest.
National Heritage Properties	X	No National Heritage Properties are located within the Project area. The closest National Heritage Property, the Great Barrier Reef, is located approximately 35 km northeast of the road reserve. Additionally, the southern end of the Wet Tropics of Queensland World Heritage Area is located approximately 50 km northwest.
Wetlands of International Importance / Ramsar Wetlands	X	No Wetlands of International Importance are located within the Project area. The closest Wetland of International Importance, Bowling Green Bay, is located approximately 25 km to the northeast.
The Great Barrier Reef Marine Park	X	The Project area is located approximately 35 km from the Great Barrier Reef Marine Park.
Nationally Threatened Ecological Communities	X	No TECs were identified within the Project area.
Nationally Threatened Species	✓	<p>Five MNES listed threatened fauna species are likely or known to occur, including:</p> <ul style="list-style-type: none"> ▪ Squatter pigeon (southern); ▪ Black-throated finch (southern); ▪ Bare-rumped sheath-tail bat; ▪ Australian Painted Snipe; and ▪ White-throated needletail. <p>Two additional threatened species were identified as having a moderate potential to occur within the Project area, being:</p> <ul style="list-style-type: none"> ▪ Curlew sandpiper; and ▪ Northern quoll. <p>The Koala has also been considered as part of the significant impact assessment as have other species as identified in the RFI from the DCCEEW.</p>

Matters of National Environmental Significance	Relevance	Description
Migratory Species	✓	<p>Five migratory species were identified as having a moderate to high potential to occur within the Project area. An assessment of impacts was undertaken against the significant impact criteria for the following migratory species which are known to occur:</p> <ul style="list-style-type: none"> ▪ Barn swallow; ▪ Glossy ibis; ▪ Fork-tailed swift; ▪ Oriental cuckoo; ▪ Rufous fantail; and ▪ Black-faced monarch.
Nuclear Actions (including Uranium Mining)	X	Not applicable.
A water source, in relation to coal seam gas development and large coal mining development.	X	Not applicable.

4.1.1 Habitat Clearing and Connectivity

The Project layout will require clearing of vegetation as calculated in Table 4-1. There will be no impacts to threatened vegetation communities (including TECs) and any impacts to fauna will be those potentially utilising the remnant non-remnant habitat on site.

Direct impacts related to habitat clearing are temporary and in accordance with timing identified in Table 2-2

The impacted remnant vegetation is considered Least Concern under the VM Act and is widespread in the surrounding area and bioregion. The areas surrounding the Project area are generally representative of what is found within the Project area. Some areas that border the Project area are also cleared, for uses such as roads, rail and agriculture. Environmental values associated with the Serpentine Lagoon and surrounding water sources (e.g., farm dams) are able to provide important habitat for species.

The total Project footprint is approximately 87.58 ha. The disturbance footprints of Project components are identified in Table 2-1.

In-depth descriptions on each species are discussed in Section 3.3 and a significant impact assessment for each species is provided in Section 4.2.

Estimated clearance of MNES habitat is provided in Table 4-2, with supporting habitat mapping plans provided in Appendix K.

The Project will result in some temporary and permanent fragmentation of habitat where the water corridor and new roads cut through habitat. Along the water infrastructure network, fragmentation will be minimal due to the alignment being located along existing road corridors and rehabilitation of these areas following construction works will be completed. The impacts of this temporary fragmentation will also be minimal, due to the highly mobile nature of the threatened species in the area and their assumed propensity to cross open exposed areas. The area of greatest impact with regard to the water infrastructure network is likely to be near Serpentine Lagoon, where wetland species may be less inclined to move through the disturbed area. Fragmentation along the water infrastructure network will be greatest during the construction period and gradually lessen as the rehabilitated habitat matures.

Along the supporting roads for the Project, fragmentation through habitat areas will be permanent. Despite this, they are expected to have a relatively minor impact on the threatened species in the area, due to their highly mobile nature. The surrounding area of the Project area encompasses suitable habitat for the Bare-rumped sheath-tail bat and Squatter pigeon (southern). The impact of the new roads, namely, No Name Road (North), No Name Road (South) and Unnamed Road, will be greatest, with slightly increased fragmentation effects from the upgrade and widening of the Flinders

Highway, Jones Road and Bidwilli Road. From a landscape perspective, the impacts of fragmentation from the enabling infrastructure are likely to be minimal, with the areas to be permanently fragmented being relatively short in length. Both No Name Road (North) and Unnamed Road will be 1.7 km each and No Name Road (South) will be 2.2 km. In total, this will fragment 5.6 km of habitat in the Project area.

The construction period for the water infrastructure network is estimated to be 17 months, however, will be completed in stages and any one section of the network will be under construction for a much shorter period of time with progressive revegetation commencing as each section is completed. The time for the restored habitat to achieve suitable quality will vary depending on the type of habitat being restored in different sections. The wetland areas and waterway crossings are expected to be restored immediately following the completion of construction. In grassland areas, this is expected to be within one year of revegetation. However, it could take 5 or more years for woodland areas to reach a level of maturity to improve connectivity for species including those smaller and less-mobile species and even longer (50+ years) to provided key habitat features for biodiversity values to return to original conditions (Haslem et al. 2023).

All threatened species that are known or likely to occur in the Project area are highly mobile and are expected to move through restored habitat areas relatively quickly. Threatened species that have a moderate likelihood of occurrence are also expected to use to restored habitat areas of the water corridor quickly, should they be present. The Northern quoll and Koala are the species that are most likely to be impacted by any fragmentation effects, should they be present in the Project area.

The impacts of habitat loss and fragmentation are highly predictable in nature and have known consequences.

Table 4-2 Estimated Clearance of National Environmental Significance Habitat

Species	Habitat Type	Habitat Area to be cleared (ha)
Black-throated finch (southern)	Foraging	31.4
	Foraging and Breeding	46.4
Bare-rumped sheathtail bat	Roosting	0.09
	Foraging	79.71
Squatter pigeon (southern)	Breeding	17.87
	Foraging	25.58
	Dispersal	2.64
White-throated needletail	Total	This is an aerial species. Potential roosting habitat is generally absent in the Project area.
Australian painted snipe	Foraging	1.19

4.1.2 Direct Fauna Mortality

Direct mortality of native fauna may occur because of the Project during habitat clearing and through vehicle collisions during operation.

It is anticipated that vehicle collisions caused by an increase in vehicle traffic may pose a risk to native fauna. The following mitigation measures are proposed and further detailed in Table 5-4:

- The Project Construction Environmental Management Plan (CEMP) will include measures to establish protocols for pre-clearing surveys and data collection regarding fauna incidents; and
- Prior to any vegetation disturbance a trained ecologist or other qualified environmental specialist will be on site to remove fauna (if required).

During the Project's operational phase, there is expected to be few vehicle movements on new roads; however, fauna mortality from vehicles using new roads is considered a potential impact. Species who are attracted to roadside habitats containing food sources (i.e., birds foraging on seeds), or those that travel distances for resources present a higher risk of vehicle collisions, particularly during the breeding season. Road design including gap width and road sinuosity and operational characteristics including speed limits correlate with fauna mortality rates (Bennett, 2017).

Direct mortality of native fauna as a result of the Project is moderately unpredictable in terms of timing and the number of individuals that may be involved over the lifetime of the Project. The risk of fauna mortality during habitat clearing is moderately predictable and limited to the construction phase of the Project. However, mortality from vehicle strikes is much less predictable and depends on many factors, including but not limited to the abundance of the fauna species, modes of mobility, behavioural avoidance or attraction to the road, visibility on and in the verges of the roads, variability in the timing of fauna activity of different species and timing of peak traffic volumes.

4.1.3 Pests and Weeds

Pest fauna and particularly weeds may pose a threat to flora and fauna within the Project Area. The field surveys identified six pest species.

The transport and operation of construction vehicles, equipment and personnel has the potential to introduce pests and weeds into the Project Area. Many weed species thrive on ground disturbance and will rapidly colonise disturbed areas in advance of native species recolonisation.

Waste has the potential to impact flora and fauna, attracting pests and vermin through the supply of artificial food sources. This may impact on natural behaviour and natural species assemblages. A range of waste minimisation strategies will be in place to reduce waste streams generated. As such, it is not anticipated that waste generated as part of the Project will have a significant impact on flora and fauna communities within the Project Area. Waste storages are not likely to have significant impacts on native fauna and flora within or adjacent to the Project Area, as all waste produced as a result of the Project will be stored and disposed of appropriately, as per the relevant legislation.

The predictability of the introduction of pests and/or weeds is low, and the degree of potential ongoing impacts is dependent on the species introduced and the extent of its spread.

4.1.4 Air Quality and Dust

The existing air quality pollutants in the Project area are likely to be primarily particulate emissions (i.e., dust) and fumes (e.g., from vehicle and machinery exhaust) corresponding with rural land use activities.

Dust is expected to potentially be an issue during vegetation clearing and construction. Increased dust from vegetation clearing, soil stripping and vehicle movements during construction has the potential to temporarily and locally impact flora and fauna values in the vicinity of the Project footprint. Excess generation of dust and subsequent deposition on leaves can impair plant photosynthesis and productivity (also resulting in reduced habitat quality for fauna), impact on respiratory systems of fauna, alter soil properties impacting on plant species assemblages and reduce water quality in aquatic habitats.

The impacts of air quality and dust are highly predictable in timing, duration and magnitude.

4.1.5 Noise

The main noise and vibration sources in the Project area include traffic along State-controlled roads (i.e., Flinders Highway and Woodstock Giru Road), the railroad, and Donnington Airpark. There is also a motocross track located 2.5 km north of the Project area.

Noise may adversely affect fauna by interfering with communication (e.g., territorial bird song), masking the sound of predators and prey, causing avoidance reactions and displacement from habitat. Construction noise will be generated by the Project through the use of machinery, plant, and vehicles and will vary from short intermittent noise from plant and equipment to more persistent noise from generators. The generation of construction noise may be in areas which

have the potential to support threatened fauna species. Many animals react to new noise initially as a potential threat, but quickly 'learn' that the noise is not associated with a threat (Radle, 2007). Noise associated with the pump station may also occur or result in some minor impacts. The pump station is located at the north eastern section of the pipeline alignment near an existing pump station facility; therefore, this location is associated with existing noise impacts and further impacts are expected to be negligible.

Impacts associated with noise are highly predictable in terms of magnitude, timing and duration. The majority of impacts from noise are associated with the construction period and are therefore temporary.

4.1.6 Accidental Release of Pollutants

Accidental release of pollutants including oils, greases, fuel, chemicals and hydraulic fluid during Project construction has the potential to pose environmental risk and cause environmental harm. Risks associated with the accidental release of pollutants include:

- Soil contamination as a result of waste material and hazardous chemicals during earthworks;
- Asbestos Containing Material (ACM) – If any ACM is detected on site during earthwork and construction activities, it will be handled in accordance with the National Code of Practice for the Safe Removal of Asbestos. All asbestos containing material will be removed and disposed off-site at a licenced facility; and
- Chemical, oil or fuel spills as a result of utilising machinery onsite.

These impacts are likely to primarily be realised during the construction phase from construction vehicles, machinery and equipment. Some oil and fuel and oil leaks, although minor, may occur from vehicles. The potential impacts relating to the accidental release of pollutants are moderately predictable but variable depending on the type and amount of pollutant(s) released, the area where the pollutant(s) is released, and the species likely to come into contact with the pollutant(s).

4.1.7 Fire

Fire is a natural part of the Australian landscape, and most vegetation communities are adapted to periodic fires. The increased presence of construction vehicles and personnel in the road reserve may increase fire risk through use of machinery that may generate sparks and idling vehicles being present in areas of ground vegetation. Townsville City Plan Bushfire Risk Overlay Mapping indicates that sections of the Project area are areas of moderate bushfire risk.

Bushfire has the potential to threaten people and fauna, through incineration or smoke suffocation. Additionally, fire can cause short term impacts including loss of habitat, increased erosion and sedimentation of waterways. Changes in the natural fire regime may result in changes in the species composition and / or structure of the vegetation including an increase in weed species.

Through the development and implementation of relevant bushfire management measures, it is considered that potential bushfire risk associated with the Project can be appropriately managed. Measures outlined in Table 5-9 will be implemented to manage and mitigate bushfire risk.

The potential impacts of fire are moderately predictable but variable depending on the source of ignition and fuel, weather, and location, size, duration and intensity of the fire.

4.2 Significant Impact Criteria Assessment - Threatened Species

Threatened species that are known or likely to occur in the Project area have been assessed against significant impact criteria. Although this is usually not required for threatened species that are moderately or unlikely to occur in the Project area, those species that have been specified in the DCCEE RFI have also been assessed. The assessments against significant impacts are presented in Sections 4.2.1 to 4.2.17 below.

In the process of these assessments, the general definitions of a population of a species, habitat critical to the survival of a species or ecological community, and an important population are referenced.

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- a geographically distinct regional population, or collection of local populations; or
- a population, or collection of local populations, that occurs within a particular bioregion.

'Habitat critical to the survival of a species or ecological community' 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.

Such habitat may be but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

4.2.1 Black-throated finch (southern) (Endangered)

The assessment against the significant impact criteria for Black-throated finch (southern) is provided in Table 4-3. Habitat mapping for the Black-throated finch (southern) is provided on pg. 1-3 in Appendix K with a map of the surrounding habitat (5 km buffer) provided in Figure 3-8.

As per the conservation advice for the Black-throated finch (southern), which is included in Appendix L, the main threats to the species include:

- Clearance and fragmentation of woodlands, riparian habitats and wattle shrublands;
- 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; and
- Hybridisation with escapees of the northern subspecies

Table 4-3 Assessment Against Significant Impact Criteria: Black-throated finch (southern)

Criteria	Assessment against significance criteria (endangered)
Black-throated finch (southern)	
<i>An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:</i>	

Criteria	Assessment against significance criteria (endangered)
<i>Lead to a long-term decrease in the size of a population.</i>	Unlikely. The Project area is within the southern extent of the mapped 'Important Areas' for the subspecies in the Significant Impact Guidelines however the majority of core habitat for the species is located further north. The majority of the Project area is of reduced ecological value due to historical clearing and existing agricultural activities and while potential habitat may be cleared for construction it is unlikely that the Project area is heavily utilised and as such the action is unlikely to lead to a long-term decrease in the size of the population.
<i>Reduce the area of occupancy of the species.</i>	Potential. Potential nesting and foraging habitat occur within the Project area although the area is of reduced ecological value due to the extent of grazing and clearing disturbances as well as weed invasion. Clearing associated with the Project has the potential to reduce the area of occupancy of the species by up to 75.84 ha of habitat.
<i>Fragment an existing population into two or more populations.</i>	Unlikely. The Project area is already heavily fragmented as a result of historical clearing and farming, predominantly grazing. The Project corridor is generally between 20 to 30 m wide and non-operational areas such as the water infrastructure network will be rehabilitated when construction is completed. Vegetation clearance associated with the Project is unlikely to impede the movement of any Black-throated finch (southern).
<i>Adversely affect habitat critical to the survival of a species.</i>	Potential. It is considered unlikely that the Project area regularly supports Black-throated finch (southern), but consistent with guidelines this area was conservatively mapped as potential. The majority of the Project area is of reduced ecological value due to the extent of grazing and clearing disturbances. Ecological values of the Project area pertaining to granivorous grassland and wetland utilising species including the Black-throated finch (southern) are present although reduced due to altered species composition of the ground layer reducing seed availability.
<i>Disrupt the breeding cycle of a population.</i>	Potential. It is unlikely the Project area supports a significant breeding population due to the limited habitat value of the area. Should any breeding individuals occur, they are likely to be close to the watercourses or at the Serpentine Lagoon. Pre-clearance surveys will identify any breeding places for this species, and should breeding places be encountered, an exclusion zone will be placed around the nest until young have fledged consistent with the requirements of an approved Species Management Program under which the fauna spotter catcher(s) will be working. Despite this, the Project will result in 46.08 ha of breeding and foraging habitat and 29.76 ha of foraging habitat which may be considered critical to the survival of the species. The loss could disrupt the breeding cycle of the local black-throated finch (southern).
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</i>	Unlikely. The majority of the Project area is of reduced ecological value located on the southern limit of the mapped 'Important Areas' for the subspecies in the Significant Impact Guidelines. The species is unlikely to be reliant on the limited and degraded foraging resources within the area. The Project will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
<i>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.</i>	Unlikely. Degradation of habitat from invasive weeds and predators are threats to the species. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.
<i>Introduce disease that may cause the species to decline.</i>	Unlikely. Disease is not a known threat to the species, and the Project is unlikely to introduce disease that may cause the species to decline. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.

Criteria	Assessment against significance criteria (endangered)
<i>Interfere with the recovery of the species.</i>	<p>Unlikely. The <i>National Recovery Plan for the Black-throated finch (southern) subspecies</i> (Black-throated Finch Recovery Team, Department of the Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service, 2007) lists the following main challenges for the subspecies' recovery:</p> <ul style="list-style-type: none"> ▪ Investigate breeding requirements; ▪ Investigate breeding and other habitat requirements; ▪ Document sightings; ▪ Develop standard survey guidelines; ▪ Undertake mapping and habitat modelling; ▪ Undertake targeted surveys; ▪ Secure selected sites for conservation; ▪ Address threats on grazing lands; ▪ Monitor management effectiveness; ▪ Investigate development of other statutory planning instruments to minimise impacts of development on Southern black-throated finch; ▪ Determine suitability of birds currently in captivity for reintroduction Project; and ▪ Increase public awareness. <p>The Project is unlikely to interfere with any of these actions which support the recovery of the species.</p>
<p><i>Additionally, the following thresholds have been listed in the Significant impact guidelines for the endangered Black-throated finch (southern) (Poephila cincta cincta) – EPBC Act policy statement 3.13 (DEWHA, 2009a), and are assessed for applicability against the Project below. The character and quality of the habitat may be significantly diminished if an action results in:</i></p>	
<i>Net loss or degradation of water sources (either permanent or seasonal) in the locality.</i>	<p>Unlikely</p> <p>The Project will be designed and managed such that water sources, particularly watercourses intercepted by the Project, will not be impacted. An additional water source being the storage dam will provide an additional water source.</p>
<i>Widespread or indiscriminate loss of trees, including known nesting trees within one km of a water source.</i>	<p>Unlikely</p> <p>The clearing for the Project is narrow and linear. The habitat is degraded, and the loss of this habitat is not considered to be a significant impact to the species. The ability of the species to continue to use the surrounding habitats is maintained (extensive areas of open grassy woodland are present in the area). No nesting trees are known to occur in the area. Vegetation clearing near watercourses will be minimised to the extent practicable.</p>
<i>A decrease in tree recruitment capacity which limits the areas' ability to be self-sustaining.</i>	<p>Unlikely</p> <p>Much of the Project area is already subject to intense modification due to clearing and the introduction of grass species for cattle grazing and as such the recruitment capacity has already been compromised; however, loss of trees will occur along the linear alignment. Trees and grasses will be retained alongside the linear alignments. Weed management during, and rehabilitation of non-operational areas following construction will likely lead to an increase in tree recruitment capacity of the site.</p>
<i>The degradation of foraging habitat (grassland) where known black-throated finch (southern) records exist, including the intensification of biomass reduction or stocking rates.</i>	<p>Potential</p> <p>The Project has the potential to result in degradation of foraging habitat as the Project will result in clearance of 75.84 ha of habitat.</p> <p>Project maintenance and rehabilitation activities will have consideration for the requirement of Black-throated finch (southern) with regard to vegetation control, including fire breaks.</p>
Assessment of potential for significant impacts.	<p>Project has the potential to result in a significant impact on the Black-throated finch (southern). A risk assessment has been completed for this species in Section 4.4.4.</p>

4.2.2 Bare-rumped sheathtail bat (Vulnerable)

The assessment against the significant impact criteria for Bare-rumped sheathtail bat is provided in Table 4-4. Habitat mapping for the Bare-rumped sheath-tail bat is provided on pg. 16-18 in Appendix K.

As per the conservation advice for the Bare-rumped sheathtail bat, which is included in Appendix L, the main threats to the species include:

- Habitat loss and fragmentation;
- Competition for tree hollows by birds (native and non-native) and bees; and
- Too frequent burning, particularly with potential impacts on availability of roosting trees.
- Additionally, disease is cited as a possible threat given similar species are known to carry the Australian Bat Lyssavirus.

Table 4-4 Assessment Against Significant Impact Criteria: Bare-rumped sheathtail bat

Criterion	Assessment against significance criteria (vulnerable)
Bare-rumped sheathtail bat	
<i>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</i>	
<i>Lead to a long-term decrease in the size of an important population of the species.</i>	<p>Unlikely. There is potential for an important population in the Project area, as the species is close to the edge of its known range at the Project area. Potential roosting habitats are predominantly located within riparian corridors, refer to pg. 16-18 in Appendix K.</p> <p>Mitigation measures will be adopted, including staging of clearing and checking of any potential roost trees to be cleared. The species will still be able to forage across the Project area. The area will be cleared and developed so foraging activities are likely to be reduced although as a high-flying species it could still occur above the development, foraging on insects attracted by site lighting. It is likely that foraging habitat occurs widely throughout the Project area and region, as the species was even recorded during field surveys feeding over cleared paddocks. Suitable habitat for the Bare-rumped sheathtail bat exists within the surrounding area of the Project area.</p> <p>Connectivity to these areas will be maintained. The Project is unlikely to lead to a long-term decrease in the size of an important population.</p>
<i>Reduce the area of occupancy of an important population.</i>	<p>Unlikely. Potential roosting habitats in the region are largely located within riparian corridors, however, are considered isolated, and therefore, the removal of 0.09 ha of roosting habitat is considered insignificant to the species. (refer to pg 16-18 in Appendix K). Thirty-one (31) potentially suitable hollows were identified during the survey periods; however, this does not constitute 31 hollow bearing trees. Clearing of riparian vegetation will be limited to the minimum practicable on either side of the crossing. Large areas of roosting habitat are avoided by the development, and suitable hollow bearing trees to be cleared that are potential roost sites for Bare-rumped sheathtail bat will be identified during the day, and hollows closed off at night once any bats have vacated the tree. The following day, hollow bearing trees will be cleared using a soft felling approach. If practical, clearing of areas of potential roosting habitat will be avoided during the wet season which is when maternal roosting is suspected to occur. Suitable habitat for the Bare-rumped sheathtail bat exists within the surrounding area beyond the Project area.</p> <p>Through avoidance of the main areas of potential roosting and mitigation measures to be put in place, including staging of clearing and checking of any potential roost trees to be cleared, the Project is not expected to reduce the area of occupancy of an important population. The species will still be able to forage across the Project area.</p>

Criterion	Assessment against significance criteria (vulnerable)
<i>Fragment an existing important population into two or more populations</i>	<p>Unlikely. The Project area is already heavily fragmented as a result of historical and more contemporary clearing for agriculture, predominantly grazing. The Project does not impact on the regionally significant riparian vegetation corridor associated with Lansdowne Creek. Vegetation clearance will not impede the movement of any Bare-rumped sheath-tail bat present in the Project area. Suitable habitat for the Bare-rumped sheath-tail bat exists within the surrounding area of the Project area.</p> <p>It is unlikely that the potentially important population is restricted to the Project area given the occurrence of similar continuous open woodland habitat adjoining the road reserve and widespread detections on Anabat recorders in the region (GHD, 2005; AECOM, 2012; RPS, 2013; GHD, 2018; Campbell & Watherston, 2017; AECOM, 2019). The species have been recorded on a number of other projects in the region in recent years. The Project is unlikely to fragment an existing important population.</p>
<i>Adversely affect habitat critical to the survival of the species.</i>	<p>Unlikely. Critical habitat for this species has not been defined (TSSC, 2016b; Schultz and Thomson, 2007). Little is known about roosting and foraging habitat, although habitat in the Project area appears to be consistent with that of other records in the Townsville region.</p> <p>Large areas of eucalypt woodlands are being retained on the boundaries of the Project area adjacent to higher quality habitat present in riparian corridors. Suitable habitat for the Bare-rumped sheath-tail bat exists within the surrounding area beyond the Project area.</p> <p>Much of the habitat in the Project area has a lower potential to be utilised by the Bare-rumped sheath-tail bat, being dominated by weeds and with little woody vegetation. It is unlikely weedy, cleared areas in the Project area will provide significant foraging opportunities, although the species will still be able to transit these areas between retained patches of woodland. Additionally, lights of the facility may provide a foraging resource in attracting insects.</p> <p>As such, the Project is unlikely to adversely affect habitat critical to the survival of the species.</p>
<i>Disrupt the breeding cycle of an important population.</i>	<p>Unlikely. One young is born during the wet season however the exact periods of breeding are unknown (Hall, 1995; Schultz and Thomson, 2007).</p> <p>Project activities are not expected to disrupt the breeding cycle of an important population. Areas of habitat will be retained outside the Project area and immediate surrounds, including areas of higher quality habitat in riparian areas and movement corridors will be retained. The road reserve contains few roosting trees so the removal of this habitat is unlikely to disrupt the breeding cycle of an important population.</p> <p>Fauna spotter-catchers will be present to identify if Bare-rumped sheath-tail bat are present during the clearing process and ensure they are not harmed as works progress (e.g., through felling of trees or movement of machinery). This will include protocols for roost searches prior to clearing and relocation if necessary. Clearing of woodland in the Project area will be in accordance with an approved sequential clearing protocol to be detailed in a Species Management Plan. This will include requirements for soft felling of hollow bearing trees. Suitable hollow bearing trees to be cleared will be identified during the day, and hollows closed off at night once any bats have vacated the tree. The following day hollow bearing trees will be cleared using a soft felling approach. If practical, clearing of areas of potential roosting habitat will be avoided during the wet season when maternal roosting is suspected to occur.</p>
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</i>	<p>Unlikely. The Project footprint will result in the loss of up to 79.71 ha of potential habitat, including 0.09 ha of roosting habitat. Suitable habitat for the Bare-rumped sheath-tail bat exists within the surrounding area beyond the Project area. Mitigation measures will be adopted, including staging of clearing and checking of any potential roost trees to be cleared. The species will still be able to forage across the Project area. The area will be cleared and developed so foraging activities are likely to be reduced although as a high-flying species it could still occur above the development, foraging on insects attracted by site lighting. It is likely that foraging habitat occurs widely throughout the Project area and region, as the species was even recorded during field surveys feeding over cleared paddocks, and as such, the clearing of 79.71 ha of potential foraging habitat is considered insignificant to the species.</p> <p>Indirect impacts may occur to Bare-rumped sheath-tail bat habitat from the Project as a result of opening up further areas, including an increase in weeds adjacent to bushland. Vegetation that is retained in the Project area will be actively managed for weeds and pest animals to assist in maintaining retained habitat in its current ecological condition.</p>

Criterion	Assessment against significance criteria (vulnerable)
<i>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</i>	<p>Unlikely. The Project through clearing of vegetation, has the potential to increase light and open up areas which may then increase weed invasion and numbers of pest animals to adjacent retained areas of potential habitat. However, the road reserve is already subject to extensive weed infestation and pest fauna presence.</p> <p>The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. Hygiene protocols in the operational areas will also be implemented to reduce any weeds or disease being introduced to the site or spread from the site.</p> <p>Based on implementing the proposed mitigation measures it is not expected the Project will result in an increase of invasive species in the species habitat.</p>
<i>Introduce disease that may cause the species to decline.</i>	<p>Unlikely. No diseases have been recorded in this species in Australia.</p> <p>Disease is cited as a possible threat given similar species are known to carry the Australian Bat Lyssavirus (Schulz and Thomson, 2007). It has been recorded in other sheathtail species and may also occur in the Bare-rumped sheathtail bat. The Project is unlikely to introduce diseases that cause the species to decline.</p> <p>Hygiene protocols will be implemented to ensure soil borne disease which may impact on foraging habitat, is not introduced or spread.</p>
<i>Interfere substantially with the recovery of the species.</i>	<p>Unlikely. The specific objectives of the recovery plan have been adapted from Coles et al. (1999) in Woinarski and Milne (2002) and are summarised below along with applicability to the proposed action:</p> <ul style="list-style-type: none"> ▪ Developing more effective detection techniques and undertaking systematic surveys to enable a more effective assessment of distribution, population size, status and habitat preferences – not applicable to the action. ▪ Increasing protection of known roosts both on and outside reserved lands – applicable to the action, it is noted that there are no known roosts in the site with only six potentially suitable trees surveyed in the Project area. ▪ Determining the roosting and foraging requirements of the species, including seasonal and distributional differences – not applicable to the action. ▪ Identifying of threatening processes – not applicable to the action. ▪ Establishing monitoring sites to investigate population trends in the species – not applicable to the action. ▪ Further clarifying the taxonomic status of the species – not applicable to the action. <p>Given the relatively minor extent of clearing involved in relation to retained habitat in the region, any potential impact on Bare-rumped sheathtail bat habitat will be minor. Only one potential roost tree was identified in the northern access road location, and it was considered unlikely to form a roost (despite being of sufficient size for roosting microbats) due to the exposed nature of its location in direct sun (EMM, 2022). Nonetheless, clearing of potential roosting habitat will be in accordance with an approved sequential clearing protocol to be detailed in a Species Management Plan.</p> <p>This will include requirements for soft felling of hollow bearing trees. Suitable hollow bearing trees to be cleared will be identified during the day, and hollows closed off at night once any bats have vacated the tree. The following day hollow bearing trees will be cleared using a soft felling approach. If practical, clearing of areas of potential roosting habitat will be avoided during the wet season when maternal roosting is suspected to occur.</p>
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the Bare-rumped sheathtail bat

4.2.3 Squatter pigeon (southern) (Vulnerable)

The assessment against the significant impact criteria for Squatter pigeon (southern) is provided in Table 4-5. Habitat mapping for the Squatter pigeon (southern) is provided on pg. 4-6 in Appendix K.

As per the conservation advice for the Squatter pigeon (southern), which is included in Appendix L, the main threats to the species include:

- Vegetation clearing and fragmentation;
- Overgrazing of habitat by livestock and feral herbivores;
- Introduction of weeds;
- Inappropriate fire regimes;
- Thickening of understorey vegetation;
- Predation by feral cats and foxes;
- Trampling of nests by livestock; and
- Illegal shooting.

Table 4-5 Assessment Against Significant Impact Criteria: Squatter pigeon (southern)

Criterion	Assessment against significance criteria (vulnerable)
Squatter pigeon (southern)	
<i>An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:</i>	
<i>Lead to a long-term decrease in the size of an important population of the species.</i>	Unlikely. The Project is in the northern extent of the species distribution. North of Carnarvon Ranges the species is relatively common and is considered to be distributed as a single, continuous sub-population (Queensland Parks and Wildlife Service, 2011). As such, the population in the Project area is not considered to be an important population. Therefore, it is considered unlikely that the Project will lead to a long-term decrease of an important population.
<i>Reduce the area of occupancy of an important population.</i>	Unlikely. There are no important populations in the vicinity of the Project area. The ability of the Project area to support this species will be maintained and reinstated during rehabilitation works. It is considered unlikely that the Project will reduce the area of occupancy of an existing important population. The Project will result in the loss of 17.87 ha of breeding habitat, 25.58 ha of foraging habitat and 2.64 ha of dispersal habitat. The rehabilitation along the pipeline aspect of the water infrastructure network following construction will result in new habitat for the species. There is suitable habitat for the Squatter pigeon (southern) within the surrounding area of the project area, and since the species is known to locally disperse (Higgins and Davies, 1996), it is considered unlikely that the project will reduce the area of occupancy of an important population.
<i>Fragment an existing important population into two or more populations</i>	Unlikely. There are no important populations in the vicinity of the Project area. It is considered unlikely that the Project will fragment an important population. The species is sparsely distributed across a wide range. The species regularly forages alongside and on access tracks, and in other disturbed habitats. Access tracks and the construction areas throughout the Project area will have strict speed limits in place. The impact on movement across the road reserve will be negligible. There is suitable habitat for the Squatter pigeon (southern) within the surrounding area of the project area. Therefore, the Project is unlikely to fragment an existing important population.
<i>Adversely affect habitat critical to the survival of the species.</i>	Unlikely. No critical habitat for the species has been identified. The species occurs in grassy woodlands which remain abundant across much of its range and surrounding the Project area. The Project is unlikely to adversely affect habitat critical to the survival of the species.
<i>Disrupt the breeding cycle of an important population.</i>	Unlikely. There are no important populations in the area. Pre-clearance surveys will identify any breeding places for this species, and should breeding places be encountered, an exclusion zone will be placed around the nest until young have fledged consistent with the requirements of an approved Species Management Program under which the fauna spotter catcher(s) will be working. As such, the Project is therefore considered unlikely to disrupt the breeding cycle of an important population.

Criterion	Assessment against significance criteria (vulnerable)
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</i>	Unlikely. The Project will result in the removal of potential habitat, which is generally of low quality due to the prevalence of exotic grass and forb species. This is a minor impact in the context of the availability of habitat for the species, particularly as there is suitable habitat for the Squatter pigeon (southern) within the surrounding area of the project area. As such, it is considered unlikely that the Project area will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
<i>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</i>	Unlikely. Degradation of habitat from invasive weeds and predators are threats to the species. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. Therefore, the Project is considered unlikely to result in invasive species becoming established in this species' habitat.
<i>Introduce disease that may cause the species to decline.</i>	Unlikely. Disease is not a known threat to the species, and the Project is unlikely to introduce disease that may cause the species to decline. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere substantially with the recovery of the species.</i>	Unlikely. There is no State or Commonwealth approved recovery plan for this species. The main threats outlined in the Approved Conservation Advice for Squatter pigeon (southern) (TSSC, 2015) include the loss and fragmentation of habitat and degradation of habitat from invasive species. The Project will have a site-specific Construction Management Plan to ensure that activities with the potential to impact the Southern squatter pigeon will be managed to ensure the Project does not interfere substantially with the recovery of the species.
Assessment of potential for significant residual impacts.	The Project area is of reduced ecological value and subject to existing weed populations, and any disturbed areas along the water infrastructure network are to be rehabilitated. Additionally, there is suitable habitat for the Squatter pigeon surrounding the Project area. As such, it is considered unlikely that the Project will result in a significant residual impact on the Squatter pigeon (southern).

4.2.4 White-throated needletail (Vulnerable, Marine, Migratory)

The assessment against the significant impact criteria for the White-throated needletail is provided in Table 4-6. As the species is considered almost exclusively aerial, the entire Project area is considered suitable habitat. As per the conservation advice for the White-throated needletail, which is included in Appendix L, the main threats to the species include:

- Loss of breeding habitat;
- Loss of habitat in non-breeding ranges;
- Direct mortality as a result of overhead wires and wind turbines; and
- Poisoning through insecticides (organochlorines).

Table 4-6 Assessment Against Significant Impact Criteria: White-throated Needletail

Criterion	Assessment against significance criteria (vulnerable)
White-throated needletail	
<i>Lead to a long-term decrease in the size of an important population of the species.</i>	Unlikely. No 'important population' has been identified within the Project area. White-throated needletail is a non-breeding visitor to Australia arriving in October and departing by April. Numbers fluctuate on an annual basis and the species is widespread across the east coast, moving in response to foraging and weather conditions. The species migrates down the Great Dividing Range, and the Project area is a small component of this broader area. As White-throated needletail arrive and disperse over a broad front across northern and eastern Australia, it is not expected that the number of birds across the Project area will place an ecologically significant proportion of the population at risk. Further, the mechanisms for the Project to impact on this species are absent.
<i>Reduce the area of occupancy of an important population.</i>	Unlikely. No 'important population' has been identified within the Project area. The Project will not result in clearing of breeding habitats for the species, as they do not breed in Australia. The impact arising from the Project will not result in a detectable decrease in the area of occupancy for an important population
<i>Fragment an existing important population into two or more populations</i>	Unlikely. No 'important population' has been identified within the Project area. The species is almost exclusively aerial in Australia across a wide range of habitats. It is not expected that the Project will fragment the habitat for this species.
<i>Adversely affect habitat critical to the survival of the species.</i>	Unlikely. While tree hollows on site could be used as roosting sites, there is no indication the Project area comprises habitat critical to the survival of the species.
<i>Disrupt the breeding cycle of an important population.</i>	Unlikely. No 'important population' has been identified within the Project area. The species does not breed in Australia.
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</i>	Unlikely. There is no indication the Project area comprises habitat critical to the survival of the white-throated needletail and therefore the Project is not considered likely to affect the availability or quality of habitat to the extent that the species is likely to decline.
<i>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat.</i>	Unlikely. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.
<i>Introduce disease that may cause the species to decline.</i>	Unlikely. The Project construction and operational management plans will incorporate the management of invasive species which will assist in the prevention of pest plant introduction and associated diseases resulting from Project activities. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere substantially with the recovery of the species.</i>	Unlikely. There is no State or Commonwealth recovery plan for this species. With mitigation of potential impacts incorporated within the Project construction and operational management plans, any potential impact on White-throated needletail will be minor and is considered unlikely to interfere with the recovery of the species.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the White-throated needletail

4.2.5 Australian painted snipe (Endangered)

The assessment against the significant impact criteria for the Australian painted snipe is provided in Table 4-7. Habitat mapping for the Australian painted snipe is provided on pg. 14 in Appendix K.

As per the conservation advice for the Australian painted snipe, which is included in Appendix L, the main threats to the species include:

- Predation and nest predation by foxes (*Vulpes vulpes*) and cats (*Felis catus*);
- Loss of wetland habitat through drainage and diversion of water for agriculture and reservoirs;
- Degradation of habitat through drainage and diversion of water for agriculture and reservoirs;
- Loss of breeding habitat through reduced flooding frequency, increase in water depth and vegetation alteration;
- Human disturbance through coastal development, shale oil mining and replacement of native wetland vegetation with invasive species; and
- Climate change – reduced rainfall and runoff.

Table 4-7 Assessment Against Significant Impact Criteria: Australian painted snipe

Criterion	Assessment against significance criteria (endangered)
Australian painted snipe	
<i>Lead to a long-term decrease in the size of a population.</i>	Unlikely. Species previously recorded within the locality and potential wetland habitat is present within the Project area. The species was not detected in field surveys but may be present at times due to the presence of potential suitable habitat near Serpentine Lagoon and associated wetlands to the North of the alignment near Serpentine Lagoon. Impacts to Serpentine Lagoon will be temporary and will be limited to 1.19 ha, during construction and is unlikely to lead to a long-term decrease in the size of a population, should they be present.
<i>Reduce the area of occupancy of the species.</i>	Unlikely. Impacts to potential suitable habitat will be temporary and will be only associated with the Serpentine Lagoon. While disturbance in the area of 1.19 ha and associated activities may deter individuals during the construction period, the area will be rehabilitated post-construction. The area of occupancy of the species may be reduced temporarily, however, this will be on a small area relative to the potentially available habitat in the locality.
<i>Fragment an existing population into two or more populations.</i>	Unlikely. The Project is unlikely to fragment an existing population of the species due to the temporary nature of disturbance of potential habitat and the species being highly mobile, widespread and migratory.
<i>Adversely affect habitat critical to the survival of a species.</i>	Unlikely. According to the listing advice for the Australian painted snipe (TSSC, 2013), “ <i>Preservation of wetland habitat suitable for breeding is critical to the species’ survival</i> ”. Breeding habitat for the species is specific, requiring shallow wetlands with bare wet mud and upper and canopy cover nearby. The species breeds in response to wetland conditions rather than a typical breeding season. The Project will require the clearing of 1.19 ha of foraging habitat and not breeding habitat. This area will be restored to previous contours following construction.
<i>Disrupt the breeding cycle of a population.</i>	Unlikely. Breeding habitat for the species is more specific, requiring shallow wetlands with bare wet mud and upper and canopy cover nearby (DoEE, 2019). The species breeds in response to wetland conditions rather than a typical breeding season. Due to the ephemeral nature of the wetlands, it is possible that suitable breeding habitat occurs during and after wet weather but habitat mapped is considered foraging and not breeding.

Criterion	Assessment against significance criteria (endangered)
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</i>	Unlikely. Impacts to potential suitable habitat will be temporary. While disturbance in the area may deter individuals during the construction period, the area will be rehabilitated post-construction. The area of the suitable habitat that may be temporarily modified and have reduced availability will be small (1.19 ha) relative to the potentially available habitat in the locality and region. Therefore, it is unlikely that impacts on the habitat will cause the species to decline.
<i>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.</i>	Unlikely. Degradation of habitat from invasive weeds and predation by feral predators. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.
<i>Introduce disease that may cause the species to decline.</i>	Unlikely. Disease is not a known threat to the species, and the Project is unlikely to introduce disease that may cause the species to decline. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere with the recovery of the species.</i>	Unlikely. None of the Project activities during construction or operation stages will interfere with the recovery of the species.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the Australian painted snipe.

4.2.6 Masked owl (northern) (Vulnerable)

The assessment against the significant impact criteria for the Masked owl (northern) is provided in Table 4-8.

As per the conservation advice for the Masked owl (northern), which is included in Appendix L, the main threats to the species include:

- Broadscale clearing, particularly of areas containing large, hollow-bearing trees;
- Changed fire regimes;
- Livestock grazing;
- Invasive grasses that reduce foraging efficiency;
- Competition with feral predators; and
- Prey availability may be a limiting factor for this species, with any threats to small to medium mammals potentially indirectly impacting this species.

Table 4-8 Assessment Against Significant Impact Criteria: Masked owl (northern)

Criterion	Assessment against significance criteria (vulnerable)
Masked owl (northern)	
<i>Lead to a long-term decrease in the size of an important population of the species.</i>	Unlikely. This species occurs in the region and the project is close to the southern limit of the species range, thus important populations may occur in the region. However, no Masked owl (northern) were detected during ecological field surveys and the species is unlikely to occur in the Project Area due to the absence of habitat values within the Project area. Therefore, the Project is unlikely to lead to a long-term decrease in the size of an important population.

Criterion	Assessment against significance criteria (vulnerable)
<i>Reduce the area of occupancy of an important population.</i>	Unlikely. This species occurs in the region and the project is close to the southern limit of the species range, thus important populations may occur in the region. However, no Masked owl (northern) were detected during ecological field surveys and the species is unlikely to occur in the Project Area due to the absence of habitat values within the Project area. Therefore, the Project is unlikely to reduce the area of occupancy of an important population.
<i>Fragment an existing important population into two or more populations</i>	Unlikely. This species occurs in the region and the project is close to the southern limit of the species range, thus important populations may occur in the region. However, no Masked owl (northern) were detected during ecological field surveys and the species is unlikely to occur in the Project Area due to the absence of habitat values within the Project area. Therefore, the Project is unlikely to fragment an existing important population.
<i>Adversely affect habitat critical to the survival of the species.</i>	Unlikely. The Project area contains no habitat values for the Masked owl (northern).
<i>Disrupt the breeding cycle of an important population.</i>	Unlikely. The Project area contains no habitat values for the Masked owl (northern), and therefore, breeding is unlikely to occur in or directly surrounding the Project area.
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</i>	Unlikely. The Project area contains no habitat values for the Masked owl (northern).
<i>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat.</i>	Unlikely. Some invasive grasses and competition with feral predators are considered threats to the Masked owl (northern). The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. Hygiene protocols in the operational areas will also be implemented to reduce any weeds or disease being introduced to the site or spread from the site. Based on implementing the proposed mitigation measures it is not expected the Project will result in an increase of invasive species in the species' habitat.
<i>Introduce disease that may cause the species to decline.</i>	Unlikely. Disease is currently not considered a threat to this species. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere substantially with the recovery of the species.</i>	Unlikely. There is no State or Commonwealth approved recovery plan for this species. The Project is unlikely to interfere with the recovery of the species or cause increased threats to the species in the region.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the Masked owl (northern).

4.2.7 Grey falcon (Vulnerable)

The assessment against the significant impact criteria for the Grey falcon is provided in Table 4-9.

As per the conservation advice for the Grey falcon, which is included in Appendix L, the main threats to the species include:

- Predation by feral cats;
- Increased temperatures in arid and semi-arid areas due to climate change;
- Demographic and genetic stochastic events;
- Habitat loss, degradation, and fragmentation from land clearing and grazing of exotic herbivores (e.g., camels);

- Disturbance of nests by birdwatchers and photographers; and
- Mortality from collisions with vehicle, fences, and powerlines.

Table 4-9 Assessment Against Significant Impact Criteria: Grey falcon

Criterion	Assessment against significance criteria (vulnerable)
Grey falcon	
<i>Lead to a long-term decrease in the size of an important population of the species.</i>	Unlikely. Individuals of this species may occasionally occur in the region in times of drought. No Grey falcons were detected during ecological field surveys and the species is unlikely to occur in the Project Area due to the absence of habitat values. Therefore, the Project is unlikely to lead to a long-term decrease in the size of an important population.
<i>Reduce the area of occupancy of an important population.</i>	Unlikely. Individuals of this species may occasionally occur in the region in times of drought. No Grey falcons were detected during ecological field surveys and the species is unlikely to occur in the Project Area due to the absence of habitat values. Therefore, the Project is unlikely to reduce the area of occupancy of an important population.
<i>Fragment an existing important population into two or more populations</i>	Unlikely. Individuals of this species may occasionally occur in the region in times of drought. No Grey falcons were detected during ecological field surveys and the species is unlikely to occur in the Project Area due to the absence of habitat values. Therefore, the Project is unlikely to fragment an existing important population.
<i>Adversely affect habitat critical to the survival of the species.</i>	Unlikely. The Project area contains no habitat values for the Grey falcon.
<i>Disrupt the breeding cycle of an important population.</i>	Unlikely. The Project area contains no habitat for the Grey falcon, and therefore, breeding is unlikely to occur in or directly surrounding the Project area.
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</i>	Unlikely. The Project area contains no habitat for the Grey falcon.
<i>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat.</i>	Unlikely. Predation by cats is listed as a very high threat to the Grey falcon. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. Based on implementing the proposed mitigation measures it is not expected the Project will result in an increase of invasive species in the species' habitat.
<i>Introduce disease that may cause the species to decline.</i>	Unlikely. Disease is currently not considered a threat to this species. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere substantially with the recovery of the species.</i>	Unlikely. There is no State or Commonwealth approved recovery plan for this species. The Project is unlikely to interfere with the recovery of the species or cause increased threats to the species in the region.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the Grey falcon.

4.2.8 Greater sand plover (Critically Endangered, Marine, Migratory)

The assessment against the significant impact criteria for the Greater sand plover is provided in Table 4-10.

As per the conservation advice for the Greater sand plover, which is included in Appendix L, the main threats to the species include:

- Habitat loss and modification from coastline developments,

- Pollution from industrial activities and increased silt,
- Disturbance from recreational activities, particularly during feeding,
- Habitat modification caused by invasive weeds, such as Water Hyacinth (*Eichhornia crassipes*), and
- Reduction of food resources due to exotic marine pests

Table 4-10 Assessment Against Significant Impact Criteria: Greater sand plover

Criterion	Assessment against significance criteria (vulnerable)
Greater sand plover	
<i>Lead to a long-term decrease in the size of an important population of the species.</i>	Unlikely. This species occurs in the region, but its preferred habitat is not present in the Project area. No Greater sand plovers were detected during ecological field surveys and the species is unlikely to occur in the Project area. Therefore, the Project is unlikely to lead to a long-term decrease in the size of an important population.
<i>Reduce the area of occupancy of an important population.</i>	Unlikely. This species occurs in the region, but its preferred habitat is not present in the Project area. No Greater sand plovers were detected during ecological field surveys and the species is unlikely to occur in the Project area. Therefore, the Project is unlikely to reduce the area of occupancy of an important population.
<i>Fragment an existing important population into two or more populations</i>	Unlikely. This species occurs in the region, but its preferred habitat is not present in the Project area. No Greater sand plovers were detected during ecological field surveys and the species is unlikely to occur in the Project area. Therefore, the Project is unlikely to fragment an existing important population.
<i>Adversely affect habitat critical to the survival of the species.</i>	Unlikely. The Project area contains no preferred habitat for the Greater sand plover.
<i>Disrupt the breeding cycle of an important population.</i>	Unlikely. The Project area contains no preferred habitat for the Greater sand plover, and therefore, breeding is unlikely to occur in or directly surrounding the Project area.
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</i>	Unlikely. The Project area contains no preferred habitat for the Greater sand plover.
<i>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat.</i>	Unlikely. Habitat modification caused by invasive weeds are a threat to this species. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. Hygiene protocols in the operational areas will also be implemented to reduce any weeds or disease being introduced to the site or spread from the site. Based on implementing the proposed mitigation measures it is not expected the Project will result in an increase of invasive species in the species' habitat.
<i>Introduce disease that may cause the species to decline.</i>	Unlikely. Disease is currently not considered a threat to this species. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere substantially with the recovery of the species.</i>	Unlikely. There is no State or Commonwealth approved recovery plan for this species. The Project is unlikely to interfere with the recovery of the species or cause increased threats to the species in the region.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the Greater sand plover.

4.2.9 Curlew sandpiper (Critically Endangered, Marine, Migratory)

The assessment against the significant impact criteria for the Curlew sandpiper is provided in Table 4-11.

As per the conservation advice for the Curlew sandpiper (DoE, 2015a), also included in Appendix L, the main threats to the species include:

- Loss of feeding and roosting habitat;
- Fragmentation or isolation of sites within feeding areas resulting in decreasing abundance;
- Human disturbance;
- Habitat degradation from pollution;
- Changes to water regimes;
- Invasive flora; and
- Disturbance by dogs at roosting sites.

Table 4-11 Assessment Against Significant Impact Criteria: Curlew sandpiper

Criteria	Assessment against significance criteria (critically endangered)
Curlew sandpiper	
<i>An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:</i>	
<i>Lead to a long-term decrease in the size of a population</i>	Unlikely. Species previously recorded within the locality and potential wetland habitat is present within the Project area. The species was not detected in field surveys but may be present at times due to the presence of potential suitable habitat near Serpentine Lagoon and associated wetlands to the north of the alignment near Serpentine Lagoon. Impacts to Serpentine Lagoon will be temporary during construction and is unlikely to lead to a long-term decrease in the size of a population, should they be present.
<i>Reduce the area of occupancy of the species</i>	Unlikely. Impacts to potential suitable habitat will be temporary. While disturbance in the area may deter individuals during the construction period, the area will be rehabilitated post-construction. The area of occupancy of the species may be reduced temporarily, however, this will be on a small area relative to the potentially available habitat in the locality.
<i>Fragment an existing population into two or more populations</i>	Unlikely. The Project is unlikely to fragment an existing population of the species due to the temporary nature of disturbance of potential habitat and the species being highly mobile, widespread and migratory.
<i>Adversely affect habitat critical to the survival of a species</i>	Unlikely. Potential habitat in the Project area at Serpentine Lagoon may provide some foraging habitat, yet higher quality habitat exists elsewhere in the region (including Bowling Green Bay, which is listed as a key site for migratory shorebirds in the East Asian-Australasian Flyway Site Network).
<i>Disrupt the breeding cycle of a population</i>	Unlikely. Curlew sandpipers do not breed in Australia.
<i>Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</i>	Unlikely. Impacts to potential suitable habitat will be temporary. While disturbance in the area may deter individuals during the construction period, the area will be rehabilitated post-construction. The area of the suitable habitat that may be temporarily modified and have reduced availability will be small (1.19 ha) relative to the potentially available habitat in the locality and region. Therefore, it is unlikely that impacts on the habitat will cause the species to decline.
<i>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</i>	Unlikely. Degradation of habitat from invasive weeds and domestic dogs can disturb roosting sites are key threats to the species. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. No domestic pets will be allowed in the Project area. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.

Section 4 Impact Assessment

Criteria	Assessment against significance criteria (critically endangered)
<i>Introduce disease that may cause the species to decline</i>	Unlikely. Disease is not a known threat to the species, and the Project is unlikely to introduce disease that may cause the species to decline. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere with the recovery of the species</i>	Unlikely. None of the Project activities during construction or operation stages will interfere with the recovery of the species.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a residual significant impact on the Curlew sandpiper.

4.2.10 Eastern curlew (Critically Endangered, Marine, Migratory)

The assessment against the significant impact criteria for the Eastern Curlew is provided in Table 4-12.

As per the conservation advice for the Eastern curlew, which is included in Appendix L, the main threats to the species include:

- Loss of feeding and roosting habitat;
- Fragmentation or isolation of sites within feeding areas resulting in decreasing abundance;
- Human disturbance through approach and development (e.g., coastal development);
- Habitat degradation from pollution;
- Changes to water regimes;
- Invasive flora; and
- Hunting (e.g., Historically, the species was shot for food in Tasmania).

Table 4-12 Assessment Against Significant Impact Criteria: Eastern curlew

Criteria	Assessment against significance criteria (critically endangered)
Eastern curlew	
<i>An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:</i>	
<i>Lead to a long-term decrease in the size of a population</i>	Unlikely. Species previously recorded within the locality and potential wetland habitat is present within the Project area. The species was not detected in field surveys but may be present at times due to the presence of potential suitable habitat near Serpentine Lagoon and associated wetlands to the North of the alignment near Serpentine Lagoon. Impacts to Serpentine Lagoon will be temporary during construction and is unlikely to lead to a long-term decrease in the size of a population, should they be present.
<i>Reduce the area of occupancy of the species</i>	Unlikely. Impacts to potential suitable habitat will be temporary. While disturbance in the area may deter individuals during the construction period, the area will be rehabilitated post-construction. The area of occupancy of the species may be reduced temporarily, however, this will be on a small area relative to the potentially available habitat in the locality.
<i>Fragment an existing population into two or more populations</i>	Unlikely. The Project is unlikely to fragment an existing population of the species due to the temporary nature of disturbance of potential habitat and the species being highly mobile, widespread and migratory.
<i>Adversely affect habitat critical to the survival of a species</i>	Unlikely. Potential habitat in the Project area at Serpentine Lagoon may provide some foraging habitat, yet higher quality habitat exists elsewhere in the region (including Bowling Green Bay, which is listed as a key site for migratory shorebirds in the East Asian-Australasian Flyway Site Network).
<i>Disrupt the breeding cycle of a population</i>	Unlikely. Eastern curlews do not breed in Australia.
<i>Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</i>	Unlikely. Impacts to potential suitable habitat will be temporary. While disturbance in the area may deter individuals during the construction period, the area will be rehabilitated post-construction. The area of the suitable habitat that may be temporarily modified and have reduced availability will be small (1.11 ha) relative to the potentially available habitat in the locality and region. Therefore, it is unlikely that impacts on the habitat will cause the species to decline.

Criteria	Assessment against significance criteria (critically endangered)
<i>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</i>	Unlikely. Degradation of habitat from invasive weeds and domestic dogs can disturb roosting sites are key threats to the species. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. No domestic pets will be allowed in the Project area. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.
<i>Introduce disease that may cause the species to decline</i>	Unlikely. Disease is not a known threat to the species, and the Project is unlikely to introduce disease that may cause the species to decline. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere with the recovery of the species</i>	Unlikely. None of the Project activities during construction or operation stages will interfere with the recovery of the species.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a residual significant impact on the Eastern curlew.

4.2.11 Northern quoll (Endangered)

The assessment against the significant impact criteria for the Northern quoll is provided in Table 4-13. Habitat mapping for the Northern quoll is provided on pg. 13 in Appendix K.

As per the conservation advice for the Northern quoll, which is included in Appendix L, the main threats to the species include:

- Lethal toxic ingestion caused by cane toads;
- Removal, degradation and fragmentation of habitat;
- Inappropriate fire regimes;
- Invasive flora;
- Predation by feral fauna; and
- Parasitism.

Table 4-13 Assessment Against Significant Impact Criteria: Northern quoll

Criteria	Assessment against significance criteria (endangered)
Northern quoll	
<i>An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:</i>	
<i>Lead to a long-term decrease in the size of a population</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in the long-term decrease in the size of a population. There is approximately 4 ha of habitat within the project area.
<i>Reduce the area of occupancy of the species</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in a reduction of the area of occupancy of the species.
<i>Fragment an existing population into two or more populations</i>	Unlikely. The species is unlikely to occur in the Project area and therefore fragmentation of an existing population is unlikely to occur.
<i>Adversely affect habitat critical to the survival of a species</i>	Unlikely. There is approximately 4 ha of habitat within the Project area. Habitat is not expected to be considered significant to the survival.

Criteria	Assessment against significance criteria (endangered)
<i>Disrupt the breeding cycle of a population</i>	Unlikely. There is approximately 4 ha of habitat within the Project area. Given the limited suitability of the area for the species, it is unlikely that the Project will disrupt the breeding cycle of a population.
<i>Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</i>	Unlikely. There is approximately 4 ha of habitat within the Project area. There is not expected to be any significant impact on habitat. This area is likely to be rehabilitated as part of the water pipeline.
<i>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</i>	Unlikely. Ingestion of toxic cane toads is identified as a key threat to the survival of Northern quolls. Additionally, invasive weeds, such as gamba grass, contribute to altered fire regimes and competition and predation by feral predators are threats to the species. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.
<i>Introduce disease that may cause the species to decline</i>	Unlikely. Disease is not currently a key threat to the Northern quoll, although toxoplasmosis does infect the species. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere with the recovery of the species</i>	Unlikely. There is no suitable habitat for the species in the Project area and the Project will not interfere with the recovery of the species.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the Northern quoll.

4.2.12 McDonald's frog (Critically Endangered)

The assessment against the significant impact criteria for the McDonald's frog is provided in Table 4-14. As per the conservation advice for the McDonald's frog, which is included in Appendix L, the main threats to the species include:

- Climate change (temperature increases, extreme weather events etc.);
- Habitat loss and degradation;
- Invasive species (e.g., Yellow crazy ants (*Anoplolepis gracilipes*)); and
- Disease (e.g., amphibian chytrid fungus).

Table 4-14 Assessment Against Significant Impact Criteria: McDonald's frog

Criteria	Assessment against significance criteria (critically endangered)
McDonald's frog	
<i>An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:</i>	
<i>Lead to a long-term decrease in the size of a population</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in the long-term decrease in the size of a population.
<i>Reduce the area of occupancy of the species</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in a reduction of the area of occupancy of the species.
<i>Fragment an existing population into two or more populations</i>	Unlikely. The species is unlikely to occur in the Project area and therefore fragmentation of an existing population is unlikely to occur.

Criteria	Assessment against significance criteria (critically endangered)
<i>Adversely affect habitat critical to the survival of a species</i>	Unlikely. There is no suitable habitat for the species in the Project area.
<i>Disrupt the breeding cycle of a population</i>	Unlikely. There is no suitable habitat for the species in the Project area.
<i>Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</i>	Unlikely. There is no suitable habitat for the species in the Project area.
<i>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</i>	Unlikely. Yellow crazy ants are listed as a threat to the McDonald's frog. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.
<i>Introduce disease that may cause the species to decline</i>	Unlikely. Amphibian chytrid fungus is a key threat threatened frog species. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere with the recovery of the species</i>	Unlikely. There is no suitable habitat for the species in the Project area and the Project will not interfere with the recovery of the species.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the McDonald's frog.

4.2.13 Ghost bat (Vulnerable)

The assessment against the significant impact criteria for the Ghost bat is provided in Table 4-15. As per the conservation advice for the Ghost Bat, which is included in Appendix L, the main threats to the species include:

- Habitat loss due to mining activities;
- Human disturbance at breeding sites;
- Modification to foraging habitat;
- Collision with fences;
- Collapse or reworking of old mine adits;
- Contamination by mining residue at roost sites;
- Disease;
- Poisoning by cane toads; and
- Competition for prey with foxes and feral cats.

Table 4-15 Assessment Against Significant Impact Criteria: Ghost bat

Criterion	Assessment against significance criteria (vulnerable)
Ghost bat	
<i>Lead to a long-term decrease in the size of an important population of the species.</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in the long-term decrease in the size of a population.

Criterion	Assessment against significance criteria (vulnerable)
<i>Reduce the area of occupancy of an important population.</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in a reduction of the area of occupancy of the species.
<i>Fragment an existing important population into two or more populations</i>	Unlikely. The species is unlikely to occur in the Project area and therefore fragmentation of an existing population is unlikely to occur.
<i>Adversely affect habitat critical to the survival of the species.</i>	Unlikely. Not considered to occur and no suitable habitat for the species is in the Project area.
<i>Disrupt the breeding cycle of an important population.</i>	Unlikely. The species is considered unlikely to occur in the Project area and therefore the Project will not disrupt the breeding cycle of a population.
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</i>	Unlikely. Not considered to occur and no suitable habitat for the species is in the Project area.
<i>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat.</i>	Unlikely. Feral cats, foxes and cane toads are a key threat to this species through predation and toxic poisoning. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.
<i>Introduce disease that may cause the species to decline.</i>	Unlikely. Currently, no diseases are listed as a threat to the species but have the potential to become a future threat. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere substantially with the recovery of the species.</i>	Unlikely. There is no suitable habitat for the species in the Project area and the Project will not interfere with the recovery of the species.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the Ghost bat.

4.2.14 Semon's leaf-nosed bat (Vulnerable)

The assessment against the significant impact criteria for the Semon's leaf-nosed bat is provided in Table 4-16. As per the conservation advice for the Semon's leaf-nosed bat, which is included in Appendix L, the main threats to the species include:

- Disturbance, destruction or reduced accessibility to roost sites;
- Habitat loss and fragmentation;
- Habitat change due to pastoralism;
- Increased fire extent, intensity and frequency;
- Predation by cats (*Felis catus*).

Table 4-16 Assessment Against Significant Impact Criteria: Semon's leaf-nosed bat

Criterion	Assessment against significance criteria (vulnerable)
Semon's Leaf-nosed Bat	
<i>Lead to a long-term decrease in the size of an important population of the species.</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in the long-term decrease in the size of a population.

Criterion	Assessment against significance criteria (vulnerable)
<i>Reduce the area of occupancy of an important population.</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in a reduction of the area of occupancy of the species.
<i>Fragment an existing important population into two or more populations</i>	Unlikely. The species is unlikely to occur in the Project area and therefore fragmentation of an existing population is unlikely to occur.
<i>Adversely affect habitat critical to the survival of the species.</i>	Unlikely. Not considered to occur and no suitable habitat for the species is in the Project area.
<i>Disrupt the breeding cycle of an important population.</i>	Unlikely. The species is considered unlikely to occur in the Project area and therefore the Project will not disrupt the breeding cycle of a population.
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</i>	Unlikely. Not considered to occur and no suitable habitat for the species is in the Project area.
<i>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat.</i>	Unlikely. Feral cats are a key threat to this species through predation and toxic poisoning. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.
<i>Introduce disease that may cause the species to decline.</i>	Unlikely. Currently, no diseases are listed as a threat to the species but have the potential to become a future threat. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.
<i>Interfere substantially with the recovery of the species.</i>	Unlikely. There is no suitable habitat for the species in the Project area and the Project will not interfere with the recovery of the species.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the Semon's leaf-nosed bat.

4.2.15 Koala (Endangered)

The assessment against the significant impact criteria for the Koala is provided in Table 4-17. Habitat mapping for the Koala is provided on pg. 7-9 in Appendix K.

As per the conservation advice for the Koala, which is included in Appendix L, the main threats to the species include:

- Loss of suitable habitat (due to climate change);
- Increased intensity and/or frequency of drought;
- Increased intensity and/or frequency of heatwaves;
- Increased intensity and/or frequency of bushfires;
- Declining nutritional value of foliage;
- Habitat clearing and degradation;
- Direct mortality from vehicle collisions and dogs; and
- Disease (e.g., Chlamydia and koala retrovirus (KoRV)).

Table 4-17 Assessment Against Significant Impact Criteria: Koala

Criteria	Assessment against significance criteria (endangered)
Koala	
<i>An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:</i>	
<i>Lead to a long-term decrease in the size of a population</i>	Unlikely. No sighting of Koalas or Koala scats have been found. No evidence of species presence detected during on-ground surveys, other than a potential scratch mark on a tree, therefore it is considered unlikely to occur in large numbers. Within the Townsville region, the species is scarce on the mainland.
<i>Reduce the area of occupancy of the species</i>	Unlikely. As per the EPBC Act referral guidelines for Endangered Koalas, habitat at the LEIP is not defined to be critical. Although the species have potential to utilise eucalypt woodlands within the Project area, field surveys recorded no direct sightings of the species, suggesting if they were to inhabit the LEIP site, it is on a sporadic and infrequent basis.
<i>Fragment an existing population into two or more populations</i>	Unlikely. The Project area is heavily fragmented from previous land clearing and farming activities. Vegetation clearance will not impede the movement of koalas at the Project area, localised koala movements are likely restricted to Lansdown Creek and Gilligan Creek, as a result these areas will be avoided. Existing corridors will be maintained allowing the species to utilise a large area including habitats outside the Project area.
<i>Adversely affect habitat critical to the survival of a species</i>	Unlikely. Koala habitat on site has not been defined as critical habitat under the EPBC Act referral guidelines for the species. The majority of Koala habitat present in the subject area is of low value (dominated by weeds with little woody vegetation present). The Project will result in clearing up to 46.08 ha of potential habitat, however a large area of eucalypt forest is to be maintained on the site boundaries adjacent to higher quality habitat present in the riparian corridors.
<i>Disrupt the breeding cycle of a population</i>	Unlikely. It is considered unlikely the Project area supports a breeding population due to the limited habitat value of the area and limited records in the area.
<i>Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</i>	Unlikely. Potential habitat is predominantly located within the riparian corridors on the Project area boundaries, dominated by <i>E. platyphylla</i> and <i>C. tessellaris</i> species. Indirect impacts may occur from the Project resulting from construction noise and the potential to introduce weed and pest animals to the area. Mitigation measures including wild dog control are to be in place to reduce the possibility of weed and pest species. The Project will result in a minor loss of low quality habitat, however it not expected to an extent that will cause the species population to decline.
<i>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</i>	Unlikely. As clearing occurs, there is an increase in potential for weed and pest species to move into the adjacent retained areas of potential habitat. Specific weeds including <i>Hyptis</i> and Rubber Vine have the potential to reduce Koala movement within the habitat and feral animals including wild dogs pose a significant threat to Koalas. An increase in wild animals may be influenced in cleared areas as wild dog hunting may become more efficient. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site, and active pest management will be enforced to reduce wild dogs. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.
<i>Introduce disease that may cause the species to decline</i>	Unlikely. No direct Koalas records in the Project area or within the surrounding area, (indirect evidence of scratches were recorded). Koalas are prone to outbreaks of <i>Chlamydia</i> , a bacterial infections weakening the immune system and can result in adverse problems including blindness and infertility during high stress situations (i.e., loss of habitat, food, or shelter). Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.

Criteria	Assessment against significance criteria (endangered)
<i>Interfere with the recovery of the species</i>	Unlikely. The Project will not interfere with any of the objectives outlined in the Commonwealth Conservation Advice for the species (DAWE, 2022a). The ability of the subject site and its immediate surrounds to offer breeding opportunities, dispersal functions and genetic diversity, and to act as a climate refuge as temperatures rise will be maintained. Significant areas of habitat values for the Koala will be retained in the subject site along the riparian corridor of Lansdown Creek and Gilligan Creek.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the Koala.

4.2.16 Greater glider (northern) (Vulnerable)

The assessment against the significant impact criteria for the Greater glider (northern) is provided in Table 4-18.

As per the conservation advice for the Greater glider (northern), which is provided in Appendix L, the main threats to the species include:

- Climate change;
- Habitat clearing and fragmentation;
- Timber harvesting;
- Inappropriate fire regimes;
- Barbed wire fencing (entanglement); and
- Predation by feral cats (*Felis catus*).

Table 4-18 Assessment Against Significant Impact Criteria: Greater glider (northern)

Criterion	Assessment against significance criteria (vulnerable)
Greater glider (northern)	
<i>Lead to a long-term decrease in the size of an important population of the species.</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in the long-term decrease in the size of a population.
<i>Reduce the area of occupancy of an important population.</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in a reduction of the area of occupancy of the species.
<i>Fragment an existing important population into two or more populations</i>	Unlikely. The species is unlikely to occur in the Project area and therefore fragmentation of an existing population is unlikely to occur.
<i>Adversely affect habitat critical to the survival of the species.</i>	<p>Unlikely. Habitat critical to the survival of the species is not present in the Project area. This is based on the absence of:</p> <ul style="list-style-type: none"> • Large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees and a diverse range of the species' preferred food species in the region; • Smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonisation; • Cool microclimate forest/woodland areas (e.g., protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes); • Areas identified as refuges under future climate changes scenarios; and • Short-term or long-term post-fire refuges (i.e., unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas.
<i>Disrupt the breeding cycle of an important population.</i>	Unlikely. The species is considered unlikely to occur in the Project area and therefore the Project will not disrupt the breeding cycle of a population.

Criterion	Assessment against significance criteria (vulnerable)
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.</i>	<p>Unlikely. Habitat suitable for the species is not present in the Project area. This is based on the absence of:</p> <ul style="list-style-type: none"> • Large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees and a diverse range of the species' preferred food species in the region; • Smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonisation; • Cool microclimate forest/woodland areas (e.g., protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes); • Areas identified as refuges under future climate changes scenarios; and • Short-term or long-term post-fire refuges (i.e., unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas (DCCEEW 2022a).
<i>Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat.</i>	<p>Unlikely. Feral cats are a key threat to this species through predation. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.</p>
<i>Introduce disease that may cause the species to decline.</i>	<p>Unlikely. Currently, no diseases are listed as a threat to the species. Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.</p>
<i>Interfere substantially with the recovery of the species.</i>	<p>Unlikely. There is no suitable habitat for the species in the Project area and the Project will not interfere with the recovery of the species.</p>
Assessment of potential for significant residual impacts.	<p>Project is unlikely to result in a significant residual impact on the Greater glider (northern).</p>

4.2.17 Greater glider (southern and central) (Endangered)

The assessment against the significant impact criteria for the Greater glider (southern and central) is provided in Table 4-19.

As per the conservation advice for the Greater glider (southern and central), which is included in Appendix L, the main threats to the species include:

- Inappropriate fire regimes;
- Habitat clearing and fragmentation;
- Timber harvesting;
- Entanglement in barbed wire fencing;
- Climate change;
- Hyper-predation by owls;
- Competition with Sulphur-crested cockatoos (*Cacatua galerita*); and
- Predation by feral cats (*Felis catus*) and European red foxes (*Vulpes vulpes*).

Table 4-19 Assessment Against Significant Impact Criteria: Greater glider (southern and central)

Criteria	Assessment against significance criteria (endangered)
Greater glider (southern and central)	

Criteria	Assessment against significance criteria (endangered)
<i>An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:</i>	
<i>Lead to a long-term decrease in the size of a population</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in the long-term decrease in the size of a population.
<i>Reduce the area of occupancy of the species</i>	Unlikely. The species is unlikely to occur in the Project area and Project activities are unlikely to result in a reduction of the area of occupancy of the species.
<i>Fragment an existing population into two or more populations</i>	Unlikely. The species is unlikely to occur in the Project area and therefore fragmentation of an existing population is unlikely to occur.
<i>Adversely affect habitat critical to the survival of a species</i>	<p>Unlikely. Habitat critical to the survival of the species is not present in the Project area. This is based on the absence of:</p> <ul style="list-style-type: none"> • Large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees and a diverse range of the species' preferred food species in the region; • Smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonisation; • Cool microclimate forest/woodland areas (e.g., protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes); • Areas identified as refuges under future climate changes scenarios; and • Short-term or long-term post-fire refuges (i.e., unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas (DCCEEW 2022b).
<i>Disrupt the breeding cycle of a population</i>	Unlikely. The species is considered unlikely to occur in the Project area and therefore the Project will not disrupt the breeding cycle of a population.
<i>Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</i>	Unlikely. Not considered to occur and therefore no suitable habitat for the species in the Project area.
<i>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</i>	Unlikely. Feral cats and foxes are key threats to this species through predation. The Project has the potential to facilitate the spread of invasive species through the use of machinery, vehicles and disturbance of native vegetation. Much of the Project area is already subject to intense modification due to the introduction of grass species for cattle grazing. The Project weed and pest management plan outlines measures to control the introduction and spread of weed and pest species across the Project area. The Project is considered unlikely to result in invasive species becoming established in this species' habitat.
<i>Introduce disease that may cause the species to decline</i>	<p>Unlikely. Currently, no diseases are listed as a threat to the species.</p> <p>Hygiene protocols will be implemented within operational zones of the Project area to reduce weeds or diseases that may be introduced to the site.</p>
<i>Interfere with the recovery of the species</i>	Unlikely. There is no suitable habitat for the species in the Project area and the Project will not interfere with the recovery of the species.
Assessment of potential for significant residual impacts.	Project is unlikely to result in a significant residual impact on the Greater glider (southern and central).

4.3 Impacts to Breeding and Migration Season as a Result of Project Construction

Project construction has the potential to interfere with species breeding seasons, as listed in Table 4-20 below.

Table 4-20 Species Breeding Season and Project Construction Timeframes

Species	Breeding Season	Migration Season	Project Phase
Black-throated finch (southern)	Throughout the year, dependent on conditions. Typically, February – May	Not Applicable	No Name Road (north) Upgrade (previously approved) Jones Road to Flinders Highway intersection upgrade No Name Road (south) Upgrade External water pipeline Internal water pipeline Storage dam Pump station
Bare-rumped sheathtail bat	November - March	Not Applicable	All Project Phases
Squatter pigeon (southern)	Throughout the year, dependent on food resources. Typically, April – October	Not Applicable	No Name Road (north) (previously approved) Flinders Highway upgrade Jones Road to Flinders Highway intersection upgrade External water pipeline Internal water pipeline Storage dam Pump stations
White-throated needletail	Not Applicable, species does not breed in Australia	September – April	No Name Road (north) Upgrade (previously approved) Jones Road to Flinders Highway intersection upgrade Flinders Highway upgrade No Name Road (south) Upgrade External water pipeline Internal water pipeline Storage dam

Species	Breeding Season	Migration Season	Project Phase
Australian painted snipe	All months, in response to wetland conditions. Typically, May – October	Poorly known.	Flinders Highway upgrade Jones Road to Flinders Highway intersection upgrade External water pipeline Internal water pipeline Storage dam Pump stations
Masked owl (northern)	March – October	Not Applicable	No Name Road (north) Upgrade (previously approved) Flinders Highway upgrade Jones Road to Flinders Highway intersection upgrade No Name Road (south) Upgrade External water pipeline Internal water pipeline Storage dam Pump stations
Grey falcon	June – November	Not Applicable	All Project Phases
Greater sand plover	Not Applicable, species does not breed in Australia	Late July – April	All Project Phases
Curlew sandpiper	Not Applicable, species does not breed in Australia	August – March	All Project Phases
Eastern curlew	Not Applicable, species does not breed in Australia	August – March	All Project Phases
Northern quoll	June – August	Not Applicable	Flinders Highway upgrade Jones Road to Flinders Highway intersection upgrade No Name Road (south) Upgrade External water pipeline Internal water pipeline Storage dam Pump stations

Species	Breeding Season	Migration Season	Project Phase
McDonald's frog	October – March after rain	Not Applicable	No Name Road (north) Upgrade (previously approved) Flinders Highway upgrade Jones Road to Flinders Highway intersection upgrade No Name Road (south) Upgrade External water pipeline Internal water pipeline Storage dam
Ghost bat	October – November	Not Applicable	No Name Road (south) Upgrade Flinders Highway upgrade Jones Road to Flinders Highway intersection upgrade External water pipeline Storage dam
Semon's leaf-nosed bat	October – November	Not Applicable	No Name Road (south) Upgrade Flinders Highway upgrade Jones Road to Flinders Highway intersection upgrade External water pipeline Storage dam
Koala	August – March	Not Applicable	All Project Phases
Greater glider (northern)	February – May	Not Applicable	No Name Road (north) Upgrade (previously approved) Jones Road to Flinders Highway intersection upgrade No Name Road (south) Upgrade External water pipeline Internal water pipeline Storage dam Pump station
Greater glider (southern and central)	March – June	Not Applicable	All Project Phases

4.4 Overall MNES Risk Assessment

4.4.1 Risk Assessment Methodology

The Commonwealth Government Environmental Assessment Manual (DSEWPaC, 2012b) (the manual) provides guidance to assessing officers on how to consider referred and controlled actions under Chapter 4 of the EBPC Act. While it is acknowledged the manual should not be relied upon by any other persons, the manual provides an effective logic for proponents to consider potential impacts to MNES in parity with that of DCCEE. As such the manual has been supplemental to this risk assessment. Though Section 2G of the manual relates to referrals, it provides guidance on considering whether a proponent has provided effective means of avoiding or reducing potential impacts to MNES, below the significant impact threshold. This consideration of management and mitigation measures on potential project impacts is further addressed in Section 3 of the manual. Where possible, the approach of a proponent should be to reduce the probability of an impact occurring to ‘unlikely’ and/or reduce the consequence of a potential impact to ‘not significant’ (DSEWPaC, 2012b). Plate 4-1 provides a diagram of that approach, extracted from the manual.

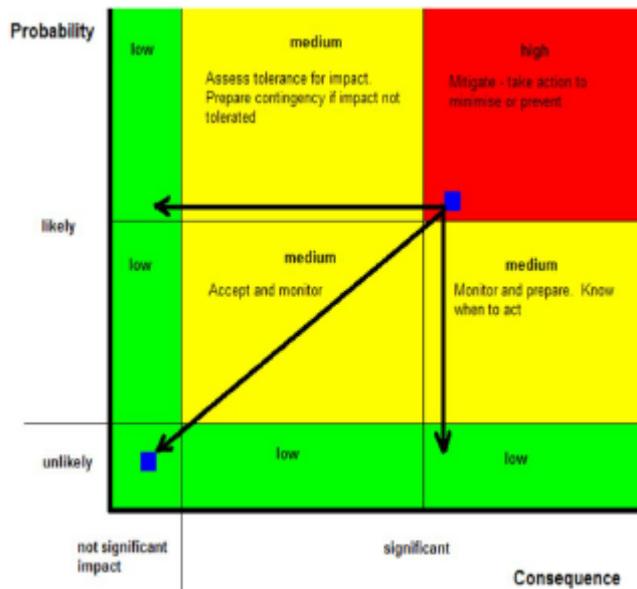


Plate 4-1 Approach to Considering Significance of Impacts Accounting for Probability of Consequence (DSEWPaC, 2012b)

Section 3 of the manual states the aim of the assessment process includes both confirming the nature of potential impacts and establishing the effectiveness of the proposed management measures. Section 4.2 of this Preliminary Documentation Report provide an assessment of the relevant MNES against significant impact criteria from the Significant Impact Guidelines (DoE, 2013). However, this overall risk assessment has been prepared to clarify which management and mitigation measures apply to potential impacts and provide a consideration of risk in a format similar to the manual (DSEWPaC, 2012b). To quantify the potential for an aspect of the action to cause a significant impact to MNES, a risk analysis was undertaken using the ISO 31000:2018 criteria.

The risk assessment defines the risk of any adverse outcome and considers the elements within the analysis including the identified hazards, consequence and the probability. This risk assessment identifies the consequence and probability rating and applies a risk matrix to prescribe a risk. The risk assessment process was undertaken on unmitigated risks and residual (mitigated) risks using the potential impacts (risks) discussed in Section 4.1 and Section 4.2. Mitigated risks are those with controls to minimise the probability and consequence of a detrimental impact occurring and utilise the measures detailed in Section 5. These controls include:

- Alternative technology or processes;

- Alternative locations for activities or infrastructure;
- Reduction in onsite storage of dangerous goods;
- Modification of process and storage conditions;
- Early detection, control and clean-up of any releases;
- Containment and collections systems;
- Improvements in plant operability; and
- Operational and organisational safeguards (including training).

The risk assessment criteria in ISO 31000:2018 establishes a method for identifying risk profiles through combining a probability rating of a hazard or impact occurring with a consequences rating of a hazard or impact occurring. Definitions applicable to the risk assessment process as described in this chapter are outlined in Table 4-21. A description of the ratings used for probability and consequence has been provided in Table 4-22 and Table 4-23, respectively.

Table 4-21 Definitions for Assessment of Hazard and Risk

Term	Definition
Hazard	Something with the potential to significantly impact MNES. This can include hazardous substances, plant and equipment, work processes or other aspects of the surrounding environment.
Probability	The chance or likelihood of an event resulting in a significant impact to MNES occurring.
Consequence	The significance of the impact, how much of an MNES species, community or its habitat could be harmed and the duration of that harm.
Unmitigated Risk	The probability that a significant impact/consequence to the MNES might result when exposed to the hazard without implementation of the proposed mitigation measures.
Residual Risk	The probability that a significant impact/consequence to the MNES might result when exposed to the hazard with the effective implementation of the proposed mitigation measures.

4.4.2 Probability Assessment

A qualitative assessment of the possible event frequency was undertaken to assess the probability of an impact occurring and rated based on the ratings included in Table 4-22.

Table 4-22 Ratings for Probability of Occurrence

Probability Rating	Probability	Description
1.	Almost Certain	Will almost certainly occur. Has a 95% or greater chance of occurring within any 12 month period.
2.	Likely	Probably will occur. Has a 70% to 95% chance of occurring any 12 month period.
3.	Possible	May possibly occur. Has a 30% to 70% chance of occurring any 12 month period.
4.	Unlikely	Could possibly occur. Has a 5% to 30% chance of occurring any 12 month period.
5.	Rare	Only likely to occur in exceptional circumstances. Has a 5% or less chance of occurring any 12 month period.

4.4.3 Consequence Assessment

The potential level of consequence of an impact was rated in accordance with the definitions shown in Table 4-23. Each outcome has been individually assessed where an incident may have multiple impacts.

Table 4-23 Consequence Ratings

Score	Maximum Potential Consequence (Realistic) ¹	
	Description	Interpretation
1.	Catastrophic	Extensive detrimental long-term or permanent decrease or fragmentation in size of population(s) or habitat critical to the MNES. Long-term or permanent disruption of MNES breeding cycles, introduction of diseases and invasive species to MNES or its habitat. Long-term or permanent interference with recovery of the MNES or its habitat.
2.	Major	Widespread medium to long-term decrease or fragmentation in size of population(s) or habitat critical to the MNES. Medium to long-term disruption of MNES breeding cycles, introduction of diseases and invasive species to MNES or its habitat. Medium to long-term interference with recovery of the MNES or its habitat.
3.	Moderate	Localised medium-term decrease or fragmentation in size of population(s) or habitat critical to the MNES. Medium-term disruption of MNES breeding cycles, introduction of diseases and invasive species to MNES or its habitat. Medium-term interference with recovery of the MNES or its habitat.
4.	Minor	On-site short to medium-term decrease or fragmentation in size of population(s) or habitat critical to the MNES. Short to medium-term disruption of MNES breeding cycles, introduction of diseases and invasive species to MNES or its habitat. Short to medium-term interference with recovery of the MNES or its habitat.
5.	Insignificant	Limited or unobservable impact to an on-site area. No lasting effects (i.e., temporary) on MNES or its habitat.

1 – the interpretation based on the significant impact criteria for MNES provided in the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE, 2013).

For the purpose of the consequence ratings the extents are interpreted as:

- Extensive – Impact may occur at bioregional or catchment level or at a scale encompassing the entire known population or habitat for the MNES species;
- Widespread – Impact may occur over a large portion of the Project Area and may extend well beyond these defined areas;
- Localised – Impact is largely confined within the Project Area and may extend beyond, but generally not far from, this defined areas; and
- On-site – Impact is limited to discrete areas within the Project Area.

For the purpose of the consequence ratings the duration categorisation is interpreted as:

- Permanent – Impact on the MNES or its habitat is observable continuously or intermittently beyond the life of the Project;
- Long-term – Impact to the MNES or its habitat is observable continuously or intermittently for the life of the Project but cease at completion of the Project;
- Medium-term – Impact to the MNES or its habitat is observable continuously or intermittently for a period of >1 to 15 years;
- Short-term – Impact to the MNES or its habitat is observable continuously or intermittently for a period of >1 month to 1 year (typically limited to the construction period); and
- Temporary – Impact to the MNES or its habitat is observable for a very short continuous duration (up to 1 month) or occurs as a rare intermittent event

4.4.4 Risk Matrix

This risk matrix adopted for the assessment is included in Table 4-24. The colour shading refers to the qualitative bands of risk level. The risk assessment tables are structured to show the results of the unmitigated risk profile and residual risk profile. The table presents the results in the following order:

- The location that the risk occurs (e.g., within the Project Area);
- The phase in which the hazard occurs (e.g., construction, operation or decommissioning);
- The aspect or activity of the Project the hazard stems from;
- A description of the potential impacts to MNES that could occur from the activity;
- The relevant criterion from the Significant Impact Guidelines (DoE, 2013);
- The probability, consequence and existing (unmitigated) risk to the MNES from the hazard;
- The management and mitigation measures to be implemented to reduce risk to MNES from the activity; and
- The probability, consequence and residual (mitigated) risk to the MNES from the hazard.

For the purpose of this risk assessment, the risk levels are defined as follows:

- Extreme – The activity or works must not proceed until suitable mitigation measures have been adopted to minimise the risk to MNES or its habitat;
- High – The activity or works should not proceed without consideration of alternative options or additional controls to minimise the risk to MNES or its habitat. A documented action plan is required;
- Medium – Acceptable with formal review. A documented action plan is required; and
- Low – Acceptable with review.

Table 4-24 Risk Assessment Matrix

Probability	Consequence				
	Catastrophic 1	Major 2	Moderate 3	Minor 4	Insignificant 5
Almost certain 1	Extreme	Extreme	Extreme	High	Medium
Likely 2	Extreme	Extreme	High	Medium	Medium
Possible 3	Extreme	High	High	Medium	Low
Unlikely 4	High	High	Medium	Low	Low
Rare 5	Medium	Medium	Low	Low	Low

The risk assessment is tailored to consider potential probability and consequence of Project activities impacting MNES as per the criteria from the Significant Impact Guidelines (DoE, 2013). While the criteria define consequence and duration categories, and the analysis provided in the Preliminary Documentation provides context to existing and residual risk levels, the assessment is largely qualitative and has relied on the technical expertise of the consultants who have completed the impact assessment analysis. To check accuracy of the applied ratings, the risk assessment was technically reviewed by a Principal Environmental Scientist with experience with similar risk assessments. Table 4-25

Section 4 Impact Assessment

provides the qualitative risk assessment of potential impacts to MNES. Management and mitigation measures identified in Table 4-25 correlate with those identified in Section 5.

Table 4-25 Qualitative Risk Assessment of Potential Impacts to MNES

Location	Phase	Phase (future)	Aspect	Potential Impacts	Relevant Significant Impact Criteria	Probability	Consequence	Existing Risk	Management and Mitigation Measures as per CEMP ³	Probability	Consequence	Residual Risk
Black-throated finch (southern) - Endangered												
Project Area	Construction and Operation	Future Development enabled by the Project	Clearing of habitat	<p>The following potential impacts, partly derived as per the conservation advice (refer to Appendix L) are per below:</p> <ul style="list-style-type: none"> Clearance and fragmentation of woodlands, riparian habitats and wattle shrublands; 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; The Project will result in loss up to 29.76 ha of potential foraging habitat and the loss of 46.08 ha of potential foraging and breeding habitat. <p>The duration of impacts is expected to be only during the construction phase.</p> <p>The species is unlikely to be impacted by future development or maintenance activities.</p> <p>There are 4 ALA records within 100 km of the Project. The closest record on the ALA database is located approximately 23 km south-east of the Project area. There was one potential and unverified species sighting in 2022 as part of survey close to Serpentine Lagoon. A pair of individuals were recorded in 2023 close to the rail line.</p>	<ul style="list-style-type: none"> Criteria 3 – Habitat fragmentation Criteria 3 – Habitat degradation Criteria 2 – Reduced area of occupancy Criteria 7 – Invasive species introduction Criteria 8 – Disease Introduction 	2	4	High	G1 – G5 TF1 – TF6 TF9 – TF11 TF18, TF20 FS1-FS6 FS8, FS13, FS20, FS30	3	4	Medium

Location	Phase	Phase (future)	Aspect	Potential Impacts	Relevant Significant Impact Criteria	Probability	Consequence	Existing Risk	Management and Mitigation Measures as per CEMP ³	Probability	Consequence	Residual Risk
Black-throated finch (southern) - Endangered												
Project Area	Construction, operation and decommissioning	Future Development enabled by the Project	Fauna Mortality	<p>The following potential impacts, partly derived as per the conservation advice (refer to Appendix L) are per below:</p> <ul style="list-style-type: none"> Direct mortality as a result of construction through habitat clearing, earthworks activities and vehicle collision. Mortality may also occur as a result of the Black-throated finch becoming trapped and exposed to inclement weather during construction. <p>The duration of impacts is expected to be only during the construction phase. Operational vehicles may also result in vehicle collision during the operation phase however these are expected to be minimal and only related to the maintenance vehicles.</p> <p>The species is unlikely to be impacted by future development or maintenance activities. There are 4 ALA records within 100 km of the Project. The closest record on the ALA database is located approximately 23 km south-east of the Project area. There was one potential and unverified species sighting in 2022 as part of survey close to Serpentine Lagoon. A pair of individuals were recorded in 2023 close to the rail line.</p>	<ul style="list-style-type: none"> Criteria 3 – Habitat fragmentation Criteria 3 – Habitat degradation 	4	4	Low	G1, G3, G4 L9 – L12, L14, L15, L24 FS5, FS6, FS8 – FS12, FS15, FS18, FS20, FS25, FS29, FS31 T1 – T5	4	5	Low

³ Refer to Section 5 and Appendix M CEMP for the consolidated list of management and mitigations with corresponding identification numbers.

Location	Phase	Phase (future)	Aspect	Potential Impacts	Relevant Significant Impact Criteria	Probability	Consequence	Existing Risk	Management and Mitigation Measures as per CEMP ³	Probability	Consequence	Residual Risk
Black-throated finch (southern) - Endangered												
Project Area	Construction and Operation	Future Development enabled by the Project	Habitat Degradation	<p>Habitat degradation from future development associated with the LEIP may occur to Black-throated finch (southern) habitat as a result of:</p> <ul style="list-style-type: none"> ▪ Accidental release of pollutants; ▪ Introduction of invasive species; ▪ Increased fire risk from Project; ▪ Erosion; and ▪ Flood inundation changes. <p>The duration of impacts is expected to be only during the construction phase. Operational vehicles may also result in vehicle collision during the operation phase however these are expected to be minimal and only related to the maintenance vehicles.</p> <p>The species is unlikely to be impacted by future development or maintenance activities.</p> <p>There are 4 ALA records within 100 km of the Project. The closest record on the ALA database is located approximately 23 km south-east of the Project area. There was one potential and unverified species sighting in 2022 as part of survey close to Serpentine Lagoon. A pair of individuals were recorded in 2023 close to the rail line.</p>	<ul style="list-style-type: none"> ▪ Criteria 3 – Habitat fragmentation ▪ Criteria 3 – Habitat degradation ▪ Criteria 2 – Reduced area of occupancy ▪ Criteria 7 – Invasive species introduction 	2	4	High	L1 – L6 L9, L10, L12 – L16 L23, L25 TF4 – TF6 TF12, TF13 – TF21 WPMP4, WPMP5, WPMP11 FS26 B2 – B11 WS1	3	4	Medium

Location	Phase	Phase (future)	Aspect	Potential Impacts	Relevant Significant Impact Criteria	Probability	Consequence	Existing Risk	Management and Mitigation Measures as per CEMP ³	Probability	Consequence	Residual Risk
Black-throated finch (southern) - Endangered												
Surrounding Project Area	Operation	Future Development enabled by the project	Impacts associated with future actions enabled by the proposed action	<p>The Project is created to facilitate future development in the immediate region. As per Section 2.10, the Stage 2 (2026-2030) will result in early proponents moving into the LEIP with expansion to the south, with provision of necessary infrastructure to service other proponents and Stages 3 & 4 (2031-2041) where other proponents will move into the LEIP. The total potentially developable area of the LEIP is estimated at 1,627.6 ha. This area is expected to include habitat suitable for the Black-throated finch (southern). Future development may result in:</p> <ul style="list-style-type: none"> ▪ Degradation of habitat. ▪ Direct mortality as a result of construction through habitat clearing, earthworks activities and vehicle collision. ▪ Accidental release of pollutants; ▪ Introduction of invasive species; ▪ Increased fire risk from Project; ▪ Erosion; and ▪ Flood inundation changes. 	<ul style="list-style-type: none"> ▪ Criteria 3 – Habitat fragmentation ▪ Criteria 3 – Habitat degradation ▪ Criteria 2 – Reduced area of occupancy ▪ Criteria 7 – Invasive species introduction 	2	4	High	<p>Impacts associated with future development is unable to specifically managed as a result of this Project. Management for the impacts of future development will be the responsibility of those proponents undertaking the development.</p>	N/A	N/A	N/A
<p>Summary: Black-throated finch Considering the assessment undertaken in 4.2 and risk assessment undertaken in this table, the Project is likely to result in significant residual impacts to the Black-throated finch.</p>												

4.4.5 Potential Facilitated Impacts

This action may be facilitated by future clearance and development of the LEIP. Constraints analysis assessments have previously been undertaken for the LEIP to understand the total area of the LEIP and the total developable area (refer to Figure 4-1 for the constraints mapping). The constraints mapping was undertaken by overlapping relevant constraining factors, including but not limited to:

- Archaeological and cultural heritage materials and artifacts using Department of Seniors, Disability and Aboriginal and Torres Strait Islander Partnership (DSDSATSIP) (formerly DATSIP) and in accordance with the Aboriginal Heritage Act 2003;
- Vegetation data including vegetation categories under the Vegetation Management Act 1999 (VM Act), Protected Plants Trigger mapping and Regional Ecosystems (REs);
- Fauna data including Protected Matters Search Tool (PMST) records, Wildlife online records, essential habitat mapping, biodiversity corridors; and
- Matters of National Environmental Significance (MNES) including Species Profile and Threats (SPRAT) database mapping.

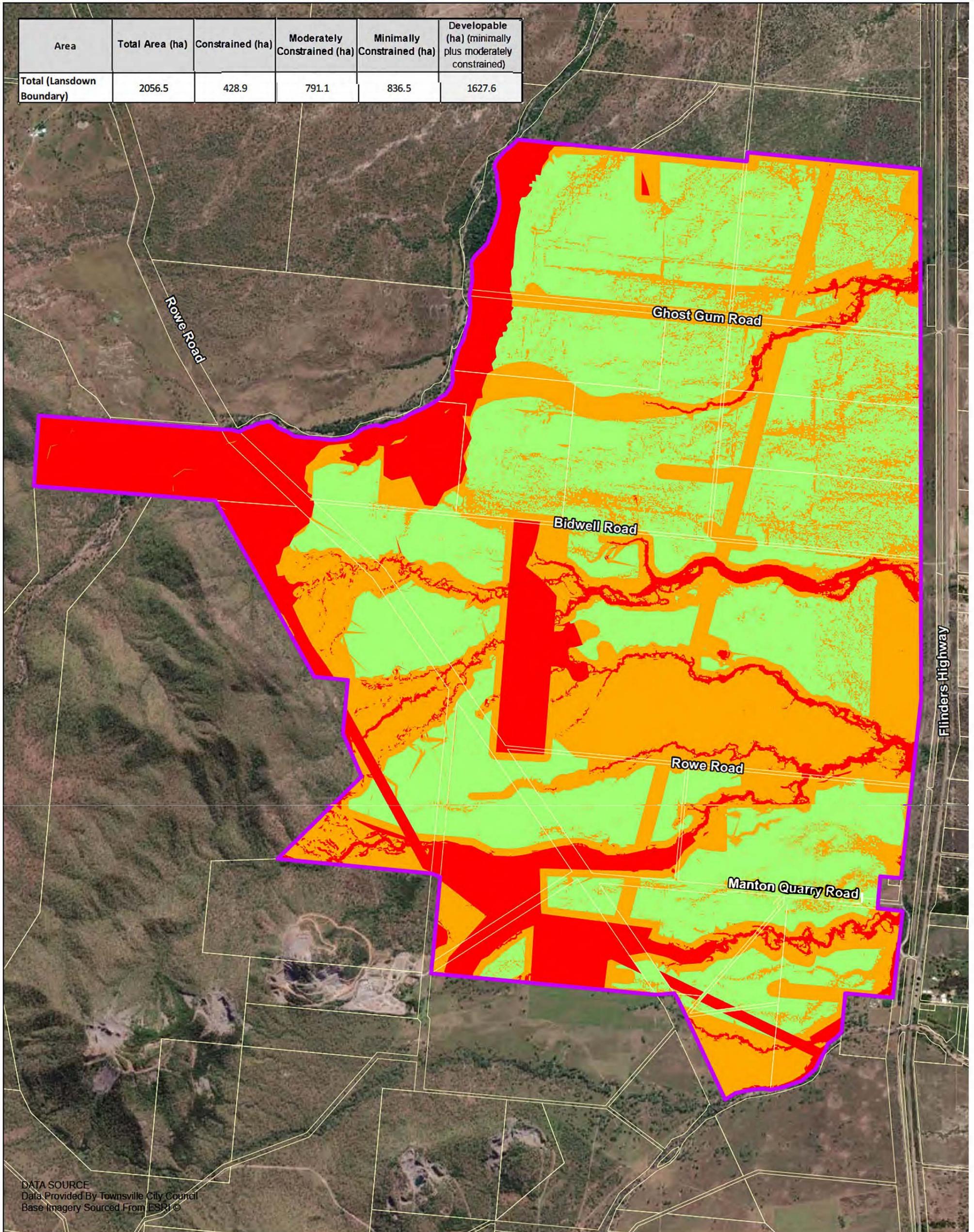
As per the constraints analysis previously conducted, the LEIP encompasses a total area of 2,056.5 ha, of which 1,627.6 ha is considered developable land (refer to Figure 4-1). The total area of the LEIP is broken down into the following:

- Area of land parcels within the LEIP – 1,949.6 ha; and
- Area of road reserves, waterways and easements – 106.9 ha.

Of the total area of developable land, QPM have already obtained an EPBC approval for a site area of 291 ha total, of which 222 ha is developable. In addition to this, Drive-IT NQ is already established within the LEIP (having opened in May 2023) and had obtained development approvals for a site area of 305.7 ha, of which 244 ha is developable. As these two proponents have already gained approvals for sections of the developable land within the precinct, a total of 1,459.8 ha of land remains, of which 1,161.6 ha is considered developable.

Any future proponents of the LEIP will be required to undertake their own ecological surveys and obtain their own EPBC approvals for potential development within the LEIP.

Area	Total Area (ha)	Constrained (ha)	Moderately Constrained (ha)	Minimally Constrained (ha)	Developable (ha) (minimally plus moderately constrained)
Total (Lansdown Boundary)	2056.5	428.9	791.1	836.5	1627.6



DATA SOURCE
 Data Provided By Townsville City Council
 Base Imagery Sourced From ESRI ©



0 290 580
 Meters

Scale @ A3 1:22,500
 Date: 08/02/22
 Drawn: Andrew Barker

Figure 4-1 LEIP Developable Areas

Legend

- LEIP Boundary
- Cadastre Boundaries

LEIP MCA Ranking

- Highly Constrained
- Moderately Constrained
- Minimally Constrained

C1 - Development Plan
 (without proponents)



4.5 Potential Residual Impacts and Offsets

The EPBC Act Environmental Offsets Policy 2012 (Offsets Policy) defines offsets as measures that compensate for the residual adverse impacts of an action on the environment. Avoidance and mitigation measures are the primary strategies for managing the potential significant impacts of a project. Offsets are not intended to reduce the likely impacts of the Project but are implemented to compensate any residual (after mitigation) significant impacts.

The Offsets Policy outlines the approach to environmental offsets under the EPBC Act. The policy applies to offsetting requirements in terrestrial and aquatic (including marine) environments and applies to projects assessed under the EPBC Act. Under the Offsets Policy, offsets act as a compensation mechanism for impacts (direct and indirect) to all protected matters under the EPBC Act including one relevant MNES for this Project: Listed threatened species. Offsets under Commonwealth legislation are only required where residual impacts are considered significant as defined under the detailed significance criteria. The current Project footprint and design have been planned to avoid significant environmental impacts, where possible or practicable, however, potential residual environmental impacts may be unavoidable.

As per risk assessment undertaken in Section 4.4 for the Black-throated finch (southern) and individual assessments for other species in Section 4.2, the Project is unlikely to result in significant residual impacts to these species other than the Black-throated finch (southern). As per the residual impacts likely to require referral stipulated in the Significant impact guidelines for the endangered Black-throated finch (southern) (*Poephila cincta cincta*), the Project has the potential to result in significant residual impacts to the Black-throated finch (southern). The clearing of vegetation and habitat for the Black-throated finch (southern) is expected to result in the loss of habitat. **With the mitigation measures proposed, the Project is not expected to result in significantly fewer impacts and is therefore likely to result in a significant residual impact.**

Section 5 Avoidance, Mitigation and Management Measures

Mitigation measures have been developed to minimise impacts associated with the construction and operation phases of the Project. Mitigation strategies have been developed based on the following hierarchical criteria:

- Avoid potential impacts where possible;
- Minimise the severity and/or duration of the impact; and
- Offset unavoidable impacts.

The potential impacts to MNES, including threatened fauna and flora because of the activities, and suggested mitigation measures are outlined in the following sections.

All MNES management measures will be developed to be consistent with the S.M.A.R.T principle, to ensure measures are:

- Specific – prescriptive, with no uncertainty or ambiguity around their purpose or implementation;
- Measurable – the status (i.e., success or failure) and outcomes/results can be measured;
- Achievable – through the chosen method of implementation, by the responsible personnel and within the specified timeframe;
- Relevant – to the action/impact being controlled and to the protected matter; and
- Time bound – measures were given specific and achievable timeframes for implementation in relation to specific development activities or stages.

5.1 Relevant Guidance Material

The guidance material for the management measures included consider:

- Recovery Plans;
- Threat Abatement Plans; and
- Species Conservation Advice.

These are identified in the relevant species in Section 3.3. Relevant measures were considered and if relevant, included in Section 5.2.

5.2 Mitigation Measures and Sub Plans

Each measure listed in the sections below identifies the following:

- Action;
- Responsible party;
- Environmental outcomes to be achieved;
- Milestones / performance / completion criteria; and
- Proposed monitoring and evaluation program.

The following management plans have been prepared:

- Project Construction Environment Management Plan (CEMP) (refer to Appendix M);
- Weed and Pest Management Plan (WPMP) (refer to Appendix N);

Section 5 Avoidance, Mitigation and Management Measures

- Bushfire Management Plan (BMP) (refer to Appendix O); and
- Matters of National Environmental Significance Management Plan (MNES MP) (refer to Appendix P). This includes a detailed list of all management measures specific to each MNES species.

5.2.1 Land

The objective to management measures relevant to the environment include:

- Reduce accumulation of contaminants leading to land and water contamination;
- Ensure soil and sediment transport do not significantly impact on the receiving environment;
- Prevent spill or leakage of chemicals and fuel; and
- Prevent infiltration of chemicals to groundwater as a result of spills and leaks.

The mitigation measures are proposed in Table 5-1 will be implemented.

Table 5-1 Land Objectives and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G1	Environmental awareness training aimed at ecological issues as part of site induction.	Prior to clearing and construction	Site Supervisor	Environmental harm is minimised.	To be completed as part of induction training prior to construction and operation for all staff.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G2	<p>Vehicle washdown procedures.</p> <p>Wash-down areas will be clearly marked to prevent contaminated water from leaching into soils or flowing into nearby watercourses.</p>	During clearing and construction	Site Supervisor	Environmental harm to soils and watercourses is minimised.	To be enforced daily.	To be enforced as part of CEMP.	<p>High</p> <p>This is a repeatable management measure.</p> <p>Vehicle washdown implemented across various Projects of this type.</p>
G3	Ensuring all vehicles are strictly controlled and do not operate in areas outside the needs of the Project construction.	During all Project phases	Site Supervisor	<p>Environmental harm is minimised.</p> <p>Unnecessary damage to vegetation is minimised.</p>	Completed daily during construction at relevant work areas.	Works to be undertaken in accordance with the proposed CEMP.	<p>High</p> <p>This is a repeatable management measure.</p>
G4	Ensuring all vehicles comply with designated speed limits whilst traversing site.	During all Project phases	Site Supervisor	<p>Environmental harm is minimised.</p> <p>Unnecessary damage to vegetation is minimised.</p>	Completed daily during construction at relevant work areas.	Works to be undertaken in accordance with the proposed CEMP.	<p>High</p> <p>This is a repeatable management measure.</p> <p>Speed limits are routinely enforced across various Projects of this type.</p>

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
L1	Earthworks, landscaping and drainage are to be in accordance with AS2870-2011.	During construction	Site Supervisor	Environmental harm is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a standard management measure which involves inclusion of strategies identified in proven material.
L2	Erosion and sediment control devices are to be installed and monitored as per the certified Erosion and Sediment Control Plan (ESCP).	During construction	Project Manager / Site Supervisor	Erosion and sediment control.	Sediment control mechanisms to be inspected weekly during construction and operation.	Monitoring to be included in the proposed CEMP.	Medium The effectiveness of this management measure depends on the implementation and type of sediment control mechanisms employed.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
L3	Sediment and erosion control measures to prevent soil loss will be developed consistent with the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control (BPESC) documents	During Project design	Project Manager / Site Supervisor	Erosion and sediment control.	Sediment control mechanisms to be inspected weekly during construction and operation.	Monitoring to be included in the proposed CEMP.	Medium The effectiveness of this management measure depends on the implementation and type of sediment control mechanisms employed.
L4	Inspect erosion and sediment control devices during construction and immediately after rainfall events to ensure good working order. Remove any visible debris during inspections.	During construction	Site Supervisor	Environmental harm is minimised. Damage to equipment is minimised.	Sediment control mechanisms to be inspected weekly during construction and operation.	To be enforced as part of CEMP.	Medium The effectiveness of this management measure relies on enforcement at the site level.
L5	Management of runoff will be of particular focus to limit environmental impact to watercourses.	During clearing, construction and operation	Site Supervisor	Environmental harm to surrounding watercourses is minimised.	To be enforced daily.	To be enforced as part of CEMP. To be recorded in detailed design documentation.	High This management measure involves inclusion of strategies identified in proven material.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
L6	Dust suppression is to be managed using water when and where necessary.	During all Project phases	All personnel	Environmental harm is minimised.	Regular monitoring of dust control measures during adverse weather conditions.	To be enforced as part of CEMP.	Medium The effectiveness of this management measure relies on enforcement at the site level.
L7	Roads and access tracks are to be appropriately maintained to limit environmental harm to immediate and surrounding areas.	During all Project phases	Site Supervisor	Environmental harm to roads and surrounding vegetation is minimised.	Regular monitoring of road conditions during adverse weather and high traffic conditions.	To be enforced as part of CEMP.	Medium The effectiveness of this management measure relies on enforcement at the site level.
L8	Spill kit(s) are to be located at the construction site.	During all Project phases	Site Supervisor	Environmental harm is minimised.	At all times.	Monitoring to be included in the proposed CEMP.	High This is a repeatable management measure which can be enforced simply.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
L9	Handling and storage of combustible and flammable liquids is to be done in accordance with AS1940:2017.	During all Project phases	Site Supervisor	Environmental harm is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a standard management measure which involves inclusion of strategies identified in proven material.
L10	Construction vehicles are to be visually monitored during construction works to ensure movements are in compliance with the CEMP.	During construction	All personnel	Environmental harm is minimised. Unnecessary damage to vegetation is minimised.	Regular monitoring of equipment during construction works.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
L11	Any spills are to be immediately cleaned using appropriate spill kit equipment and methods.	During all Project phases	All personnel	Environmental harm is minimised.	Immediately after spill.	To be enforced as part of CEMP. To be recorded in the on-site incident register.	High This is a repeatable management measure.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
L12	Staff are to be made aware of spill response procedure and reporting requirements.	Prior to clearing and construction	Site Supervisor	Environmental harm is minimised.	To be completed as part of induction training prior to construction and operation for all staff.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
L13	Construction and plant equipment is to be regularly monitored and checked for spills and breakages.	During construction	All personnel	Environmental harm is minimised. Damage to equipment is minimised.	Regular monitoring of equipment during construction works.	To be enforced as part of CEMP.	Medium The effectiveness of this management measure relies on enforcement at the site level through inspections.
L14	Fuel, oil and chemical storage and handling are to be in accordance with Australian Standards.	During all Project phases	Project Manager / Site Supervisor	Environmental harm is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a standard management measure which involves inclusion of strategies identified in proven material.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
L15	Land clearance and disturbance to the project area and slope angles is to be limited.	During Project design and clearing	All personnel	Environmental harm is minimised.	To be enforced daily.	To be enforced as part of CEMP.	Medium This management measure depends on the enforcement at the site and implementation and type of sediment control mechanisms employed.
L16	Appropriately designed laydown areas are to be used.	During Project design	Site Supervisor	Environmental harm is minimised.	To be enforced daily.	To be enforced as part of CEMP.	Medium The effectiveness of this management measure relies on enforcement at the site level through inspections.
L17	Topsoil is to be managed in accordance with the CEMP to limit disturbance, erosion and soil degradation.	During clearing, construction and rehabilitation	Site Supervisor	Environmental harm is minimised. Unnecessary disturbance to soil is minimised.	To be enforced daily.	To be enforced as part of CEMP.	Medium This management measure depends on the enforcement at the site.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
L18	Subsoils are to be managed in accordance with the CEMP to limit disturbance, erosion and soil degradation.	During clearing, construction and rehabilitation	Site Supervisor	Environmental harm is minimised. Unnecessary disturbance to soil is minimised.	To be enforced daily.	To be enforced as part of CEMP.	Medium This management measure depends on the enforcement at the site.
L19	In the event that contaminated sites are uncovered during construction, cessation of ground disturbance at the location and within the immediate vicinity will be in effect immediately.	During construction	All personnel	Environmental harm is minimised.	To be enforced immediately after potential contaminated sites are uncovered.	To be enforced as part of CEMP.	Medium This management measure depends on the enforcement at the site.
L20	Spills of hazardous materials will be rendered safe (unable to further contaminate) and, where required, collected for treatment and disposal at a designated site, including cleaning materials, absorbents and contaminated soils.	During all Project phases	Site Supervisor	Environmental harm is minimised.	To be enforced daily.	To be enforced as part of CEMP.	Medium This management measure depends on the enforcement at the site.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
L21	No equipment or materials will be stored across flow paths.	During all Project phases	All personnel	Environmental harm is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High. This is a repeatable management measure that can be implemented simply.
L22	The extent of the area required to carry out the permitted activity must be limited to the minimum area necessary to reasonably carry out the works.	During Project design, clearing and construction	Site Supervisor	Environmental harm is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High. This is a repeatable management measure that can be implemented simply.
L23	All temporary erosion and sediment control structures are to be removed post-construction works.	Post construction, during rehabilitation	Site Supervisor	Environmental harm is minimised. Returning of disturbed land to previous quality.	Completed upon finish of works.	Works to be undertaken in accordance with the proposed CEMP.	High. This is a repeatable management measure that can be implemented simply.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
L24	Disturbed areas are to be progressively rehabilitated during and post construction works.	Post construction, during rehabilitation	Project Manager / Site Supervisor	Returning of disturbed land to previous quality.	Completed upon finish of works throughout construction.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the quality of revegetation works undertaken.

5.2.2 Water

The objective to management measures relevant to waterways and watercourses include:

- To prevent the degradation or contamination of water quality in the area surrounding the Project;
- Environmental harm is minimised;
- Construction of the Project in accordance with planning, environmental and other approvals;
- Sediment and erosion control measures are installed and maintained and perform to the designed levels for the duration of the construction works; and
- No exceedances of the following parameters:
 - pH – 6.5 – 8.5
 - Total Suspended Solids – TBA*
 - Electrical Conductivity – TBA*
 - Dissolved Oxygen – TBA*

* Subject to further studies.

The mitigation measures proposed in Table 5-2 will be implemented. Further information on waterways and mitigation measures and types of structures proposed at these locations is provided in Appendix I. Appendix I provides an overview of all mapped and ground-truthed waterways within the Project area, including the Serpentine Lagoon wetland. A total

Section 5 Avoidance, Mitigation and Management Measures

of thirty-seven (37) waterway locations were assessed using the relevant methodology / criteria, including the GPS locations, Water Act classification (i.e., unmapped / drainage feature), distinguishable features, photos and a field assessment summary against the above four criteria. Appendix I further outlines the existing environment (i.e., flora species) within the waterways and the construction methodology for the clearing and construction works that intercept waterway locations (also referred to in 2.6.3 of this PD). Appendix I specifies management measures and restoration activities to be used where the water infrastructure network intercepts the identified 37 waterway locations.

Table 5-2 Waterway Objectives and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G1	Environmental awareness training aimed at ecological issues as part of site induction.	Prior to clearing and construction	Site Supervisor	Environmental harm to be minimised.	To be completed as part of induction training prior to construction and operation for all staff.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
W1	All major watercourse earthworks will commence during the dry season and ensure bed and banks are stabilised before the onset of the wet season	During clearing and construction	Project Manager / Site Supervisor	Environmental harm to be minimised.	To be enforced daily during construction works.	To be enforced as per CEMP. To be recorded in detailed design documentation.	High This is a repeatable management measure which can be enforced simply.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
W2	Impacts to aquatic habitat will be minimised by locating ancillary works (i.e., all piping and piping components) outside the waterway where possible and restoring original bed and banks conditions following construction.	During Project design, clearing, construction and rehabilitation	Site Supervisor	Environmental harm to aquatic habitats to be minimised.	To be enforced daily during construction works.	To be enforced as per CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the enforcement at the site.
W3	Watercourse crossings have been located at established crossing points on existing access tracks, where possible.	During Project design	Site Supervisor	Environmental harm to aquatic habitats to be minimised.	To be enforced daily during construction works.	To be enforced as per CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process
W4	Duration of in-stream works will be minimised to reduce the potential for sedimentation.	During clearing and construction	All personnel	Environmental harm to aquatic habitats to be minimised. Sedimentation to be minimised.	To be enforced daily during construction works.	To be enforced as part of CEMP.	Medium This management measure depends on the enforcement at the site.
W5	Weather conditions will be monitored during the construction stage and temporary controls will be established during extreme weather events.	During construction	Site Supervisor	Environmental harm to be minimised during extreme weather events.	To be enforced daily during construction works.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
W6	Construction equipment is to be maintained to minimise risk of spill or leakage.	During construction	All personnel	Environmental harm from chemical/oil/fuel spillage to be minimised.	Monitored weekly.	To be enforced as part of CEMP.	Medium This management measure depends on the enforcement at the site.
W7	All refuelling facilities, or storage facilities for hydrocarbons and chemicals will be in appropriately designed sites and comply with Australian Standards (e.g., AS 1940: The storage and handling of flammable and combustible liquids).	During Project design, clearing and construction	Site Supervisor	Environmental harm from chemicals/oil/fuel to be minimised.	To be enforced daily. Monitoring weekly.	To be enforced as per CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process
W7	All refuelling facilities, or storage facilities for hydrocarbons and chemicals will be stored within bunded areas with a storage capacity of 110% of the storage vessel. Bunding will have floors and walls lined with impermeable material. These areas must be adequately protected from rainfall and stormwater.	During Project design, clearing and construction	Site Supervisor	Environmental harm to be minimised and safe keeping of chemical materials.	To be enforced daily. Monitoring weekly Monitored immediately after rainfall events.	To be enforced as per CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process
W9	Refuelling will not take place within 50 m of a watercourse.	During clearing and construction	All personnel	Environmental harm to aquatic habitats as a result of refuelling to be minimised.	To be enforced daily.	To be enforced as per CEMP.	Medium This management measure depends on the enforcement at the site.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
W10	Refuelling and major maintenance work will be undertaken at predetermined locations away from watercourses and in a manner that prevents spillages.	During Project design, clearing and construction	All personnel	Environmental harm to aquatic habitats as a result of refuelling to be minimised.	To be enforced daily.	To be enforced as per CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process
W11	Spill control materials such as booms and absorbent materials will be maintained on site, commensurate with the types and volumes of materials in use, and in place where hazardous materials are stored or used.	During clearing and construction	Site Supervisor	Environmental harm to be minimised.	To be enforced daily.	To be enforced as per CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process
W12	Ensure pipeline trenching near watercourses/waterways is sufficient to avoid exposure of the pipeline as a result of river bed erosion and interference with the flow of water.	During Project design and construction	Site Supervisor	Environmental harm to be minimised. Minimise the risk of erosion to river beds and water flow.	To be enforced daily.	To be enforced as per CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
W13	Store waste prior to transport and disposal off-site (including general waste and hazardous waste) in designated areas away of waterways/watercourses as per the relevant Australian Standards, as required.	During clearing and construction	All personnel	Environmental harm to waterways as a result of waste to be minimised. Environmental harm to aquatic species be minimised.	To be enforced daily.	To be enforced as per CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process
W14	Ancillary works (i.e., all piping and piping components) will be located outside waterways and wetlands.	During Project design and construction	All personnel	Environmental harm to be minimised.	To be enforced daily.	To be enforced as per CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process
W15	Duration of instream works will be minimised to reduce the potential for sedimentation.	During clearing and construction	All personnel	Sedimentation risk to be minimised.	To be enforced daily.	To be enforced as part of CEMP.	Medium This management measure depends on the enforcement at the site.
W16	Should groundwater be encountered during construction works, works will cease until further examination occurs	During construction	All personnel	Environmental harm to groundwater to be minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
W17	Develop and implement a certified ESCP and associated monitoring to mitigate the potential impacts.	Prior to construction	Project Manager	Environmental harm to be minimised.	Prior to construction.	To be enforced as part of CEMP.	Medium The effectiveness of this management measure depends on the implementation and type of sediment control mechanisms employed.
W18	Where required to undertake works within drainage channels, works should not commence during times of elevated flows. Where possible schedule works in low or no flow periods and ensure that all bed and banks are stabilised prior to the onset of the wet season.	During clearing and construction	Project Manager / Site Supervisor	Environmental harm to be minimised. Stabilisation of waterway beds and banks is maintained.	To be enforced daily.	To be enforced as part of CEMP.	Medium This management measure depends on the enforcement at the site.
W19	Construction methodology to avoid prolonged open excavations, i.e., suction intake and drainage channel areas, which may accumulate groundwater or surface water	During Project design and construction	Site Supervisor	Environmental harm to be minimised.	To be enforced daily.	To be enforced as part of CEMP.	Medium This management measure depends on the detailed design process
W20	Earthworks, particularly within the wetland and or drainage paths are to be conducted to maintain the hydraulic capacity and minimise potential impacts to upstream or downstream.	During clearing and construction	Site Supervisor	Maintain the hydraulic capacity and minimise potential impacts to upstream or downstream environments.	To be enforced daily.	To be enforced as part of CEMP.	Medium This management measure depends on the enforcement at the site.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
W21	Potentially hazardous and flammable substances/ liquids will be stored in accordance with relevant Australian standards (AS1940), <i>Work Health and Safety Act 2011</i> and National Occupational Health and Safety Commission (NOHSC) 'Approved Criteria for the Storage and Handling of Flammable and Combustible Liquids' and in predetermined locations away from watercourses.	During clearing and construction	Site Supervisor	Environmental harm to be minimised.	To be enforced daily.	To be enforced as part of CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process
W22	Structures and realignments have been designed to minimise changes to flow velocities.	During Project design	Site Supervisor	Minimise changes to flow velocities.	To be enforced daily.	To be enforced as per CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process
W23	Clearing areas to be minimised to only the extent required.	During Project design and clearing	Site Supervisor	Environmental harm to vegetation and aquatic environments to be minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
W24	The construction of culverts and structures will be programmed during periods of low flow, where possible.	During construction	Site Supervisor	Environmental harm to be minimised.	To be enforced daily.	To be enforced as part of CEMP.	Medium This management measure depends on the enforcement at the site.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
W25	Where dry beds are required for the construction of culverts, salvage of fish and aquatic fauna will be undertaken in accordance with the DAF Fish Salvage Guidelines.	During construction	Site Supervisor	Impacts to fish and aquatic fauna to be minimised i.e., prevention of fauna mortality	To be enforced daily.	In accordance with the DAF Fish Salvage Guidelines and CEMP.	High This is a repeatable management measure which can be enforced simply.
W26	Site construction personnel will complete inductions and spill kits will be available to all personnel in the event of a spill or leak.	Prior to clearing and construction	Site Supervisor	Environmental harm to be minimised.	To be enforced prior to construction/visitation on site.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
W27	During any works around waterways/water courses, water quality will need to be monitored. Downstream turbidity will need to be maintained at comparable levels to upstream turbidity. Water samples are to be tested onsite by a calibrated water quality meter.	During clearing and construction	Site Supervisor	Environmental harm to be minimised. Impacts to water quality to be minimised.	To be completed as part of induction training prior to construction and operation for all staff.	Works to be undertaken in accordance with the proposed CEMP. Success rates to be reported and kept with on-site documentation.	Medium This management measure depends on the enforcement at the site.
W28	All temporary erosion and sediment control structures are to be removed post-construction works.	Post construction, during rehabilitation	Site Supervisor	Environmental harm is minimised. Returning of disturbed land to previous quality.	Completed upon finish of works.	Works to be undertaken in accordance with the proposed CEMP.	High. This is a repeatable management measure that can be implemented simply.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
W29	Rehabilitation of any disturbed ground due to temporary construction infrastructure will be conducted progressively as soon as construction activities are complete.	During rehabilitation	Site Supervisor	Environmental harm is minimised. Returning of disturbed land to previous quality.	Completed upon finish of works throughout construction.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the quality of revegetation works undertaken.
W30	Bunding of chemical storage facilities and appropriate storage of chemicals according to AS 1940 'The storage and handling of flammable and combustible liquids'.	During Project design	Site Supervisor	Environmental harm is minimised.	Prior to construction. During design process.	To be enforced as per CEMP. To be recorded in detailed design documentation.	High This is a repeatable management measure which can be enforced simply.
W31	Drainage design that allows for the retention of mine affected water prior to any discharge into the aquatic environment	During Project design	Project Manager	Environmental harm is minimised.	Prior to construction. During design process.	To be enforced as per CEMP. To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process
W32	Excavation within the Serpentine Lagoon are to be minimised to only the extent required.	During Project design and clearing	All personnel	Environmental harm is minimised. Disturbance to Serpentine Lagoon is minimised.	To be enforced daily during clearing / construction works.	Works to be undertaken in accordance with the proposed CEMP.	High This is a repeatable management measure which can be enforced simply.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
W33	Excavated land for the underground infrastructure within the Serpentine Lagoon are to be restore, as far as practicable, to its original contours after the infrastructure is established.	During rehabilitation	Site Supervisor	Environmental harm is minimised. Disturbance to Serpentine Lagoon is minimised.	To be enforced daily during clearing / construction works.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the quality of works undertaken.
W34	Pipe jacking methods will be used to remove requirement for drainage and/or diversion works.	During Project design and clearing	Site Supervisor	Environmental harm is minimised.	To be enforced daily during clearing	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the detailed design process
W35	All construction works around waterways will be designated and undertaken in accordance with the IECA Guidelines.	During Project design and construction	Project Manager / Site Supervisor	Environmental harm is minimised. Disturbance to waterways is minimised.	To be enforced daily during construction works.	Works to be undertaken in accordance with the proposed CEMP and IECA Guidelines.	Medium This management measure depends on the detailed design process
W36	Waterways/watercourses with no flow which are mapped shall have controls designed from the relevant arrangement with P3.3 of IECA, 2008 regardless of if there is water present or they are dry.	During Project design and construction	Project Manager / Site Supervisor	Environmental harm is minimised. Disturbance to waterways is minimised.	To be enforced daily during clearing / construction works.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the detailed design process

5.2.3 Habitat Clearing and Connectivity

The objective to management measures relevant to habitat clearing and connectivity include:

- Compliance with legal and other requirements (i.e., permits, licences and approval conditions);

Section 5 Avoidance, Mitigation and Management Measures

- Environmental harm is minimised;
- Environmental performance and compliance is monitored;
- Ensure all staff are aware of the environmentally friendly sensitive features on-site;
- Ensure impacts to vegetation as a result of the Project are minimised;
- No clearing of vegetation outside of approved areas; and
- No harm or injury to fauna as a result of the works.

The mitigation measures are proposed in Table 5-3 will be implemented. A MNES MP is provided in Appendix P.

Table 5-3 Habitat Clearing and Connectivity Objectives and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G1	Environmental awareness training aimed at ecological issues as part of site induction.	Prior to clearing and construction	Site Supervisor	Environmental harm caused to fauna is minimised. Preservation of vegetation and limiting unnecessary clearing.	To be completed as part of induction training prior to construction and operation for all staff.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
G2	Vehicle washdown procedures. Wash-down areas will be clearly marked to prevent contaminated water from leaching into soils or flowing into nearby watercourses.	During clearing and construction	Site Supervisor	Preservation of vegetation and limiting unnecessary clearing. Environmental harm caused to fauna is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a repeatable management measure. Vehicle washdown implemented across various Projects of this type.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G3	Ensuring all vehicles are strictly controlled and do not operate in areas outside the needs of the Project construction.	During all Project phases	Site Supervisor	Environmental harm caused to fauna is minimised. Unnecessary damage to vegetation is minimised.	Completed daily during construction at relevant work areas.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the enforcement at the site.
G4	Ensuring all vehicles comply with designated speed limits whilst traversing site.	During all Project phases	Site Supervisor	Environmental harm caused to fauna is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a repeatable management measure. Speed limits are routinely enforced across various Projects of this type.
G5	Minimise the occurrence of off-road vehicle movements.	During all Project phases	Site Supervisor	Environmental harm caused to fauna is minimised. Unnecessary damage to vegetation is minimised.	Completed daily during construction at relevant work areas.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the enforcement at the site.
TF9	Vegetation located adjacent to the Project construction works to be appropriately marked to avoid unnecessary clearing/vegetation damage.	During clearing and construction	Site Supervisor	Preservation of vegetation and limiting unnecessary clearing.	Completed daily during construction at relevant work areas.	Monitoring to be included in the proposed CEMP.	High This is a repeatable measure which provides clear direction. This is a proven measure suitable for limiting disturbance.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
TF10	<p>The pre-construction environment should be reinstated, and vegetation re-established where it does not affect the Project operation and integrity.</p> <p>Regular monitoring of revegetation works will be undertaken to ensure effectiveness. Where and/or if revegetation does not take, another layer of hydro-mulching will be applied and revegetation methods will be re-considered.</p>	During rehabilitation and monitoring	Site Supervisor	Returning of disturbed land to previous quality.	Completed upon finish of works throughout construction.	Works to be undertaken in accordance with Section 6 of this Preliminary Documentation and the CEMP.	<p>Medium</p> <p>This management measure depends on the quality of revegetation works undertaken.</p>
TF11	Visual inspection of progressively rehabilitated areas.	During rehabilitation and monitoring	Site Supervisor	Returning of disturbed land to previous quality.	Weekly during construction and during operation.	To be documented in the CEMP.	<p>Medium</p> <p>Measure is dependent on visual inspection</p>
TF18	Revegetation works to be undertaken where land has been disturbed for construction where land is not required for operations.	During rehabilitation	Site Supervisor	Returning of disturbed land to previous quality.	Completed upon finish of works throughout construction.	Monitoring to be undertaken progressively as revegetation occurs.	<p>Medium</p> <p>This management measure depends on the quality of revegetation works undertaken.</p>
TF20	Refine location of work areas where it overlaps with ground-truthed remnant vegetation to avoid disturbance as far as possible.	During Project design, clearing and construction	Site Supervisor	Preservation of vegetation and limiting unnecessary clearing.	To be undertaken during detailed design process.	To be recorded in detailed design documentation.	<p>Medium</p> <p>This management measure depends on the detailed design process.</p>

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
TF21	Survey and pegged disturbance footprint, prior to clearing to avoid unnecessary clearing of vegetation beyond that detailed during the design phase.	During Project design and prior to clearing	Site Supervisor	Preservation of vegetation and limiting unnecessary clearing.	Completed daily during construction at relevant work areas.	Monitoring to be included in the proposed CEMP. To be recorded in detailed design documentation.	High This is a repeatable measure which provides clear direction. This is a proven measure suitable for limiting disturbance.
FS18	To reduce the risk of mortality to native wildlife, no domestic animals are permitted onsite.	During all Project Phases	All personnel	Environmental harm caused to fauna is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
FS20	Prior to any vegetation disturbance, a trained ecologist or other qualified environmental specialist to be onsite to inspect and remove fauna (if required). All fauna recorded during pre-clearing surveys will be recorded on a dedicated fauna register. Construction areas that pose a risk to fauna to be fenced off where practical.	Prior to clearing	Project Manager	Environmental harm caused to fauna is minimised.	Completed daily during construction at relevant work areas.	Works to be undertaken in accordance with the proposed CEMP.	High Presence of a trained ecologist during preclearance surveys is a proven measure to prevent any impacts to fauna.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
FS29	Avoid clearing trees with obvious hollows. If trees are required to be removed the proponent shall engage the services of a licensed, qualified Spotter Catcher to complete preclearing checks and be present during removal. They should also inspect the “no go” zone and clearing limits prior to clearing. If hollow bearing trees do require removal, they should first be inspected using an elevated work platform to determine if fauna are present. If fauna are detected, they would be safety removed prior to tree felling.	During Project design and clearing	All Personnel / Project Manager / Site Supervisor	Environmental harm caused to fauna is minimised.	To be enforced during construction.	To be enforced as part of CEMP.	Medium This measure requires a spotter catcher to enforce. Potential for trees with hollows may be missed.
FS30	Design and construction of fencing/infrastructure to direct fauna towards safe passage and around construction area.	During Project design and construction	Site Supervisor	Preservation of vegetation and limiting unnecessary clearing. Environmental harm caused to fauna is minimised.	To be undertaken during detailed design process. To be monitored during operation.	To be recorded in detailed design documentation.	Medium This management measure depends on the detailed design process.

5.2.4 Direct Fauna Mortality

The object of management measures relevant to direct fauna mortality include:

- Compliance with legal and other requirements e.g., permits, licences and approval condition;
- Environmental harm is minimised;
- Environmental performance and compliance are monitored;
- To prevent the introduction or spread of new declared weeds into construction area and control existing pest species within construction work areas during construction;

Section 5 Avoidance, Mitigation and Management Measures

- Ensure all staff are aware of the environmentally sensitive features on site;
- No clearing of vegetation outside of approved areas; and
- No harm or injury to fauna as a result of the works.

The following mitigation measures are proposed and further detailed in Table 5-4:

- The Project CEMP will include measures to establish protocols for pre-clearing surveys and data collection regarding fauna incidents; and
- Prior to any vegetation disturbance, a trained ecologist or other qualified environmental specialist will be on-site to remove fauna (if required).

A MNES MP is provided in Appendix P.

Table 5-4 Direct Fauna Mortality Objectives and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G1	Environmental awareness training aimed at ecological issues as part of site induction.	Prior to clearing and construction	Site Supervisor	Environmental harm caused to fauna is minimised. Preservation of vegetation and limiting unnecessary clearing.	To be completed as part of induction training prior to construction and operation for all staff.	To be enforced as part of CEMP and WPMP.	High This is a repeatable management measure which can be enforced simply.
G3	Ensuring all vehicles are strictly controlled and do not operate in areas outside the needs of the Project construction.	During clearing and construction	Site Supervisor	Environmental harm caused to fauna is minimised. Unnecessary damage to vegetation is minimised.	Completed daily during construction at relevant work areas.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the enforcement at the site.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G4	Ensuring all vehicles comply with designated speed limits whilst traversing site.	During all Project phases	Site Supervisor	Environmental harm caused to fauna is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a repeatable management measure. Speed limits are routinely enforced across various Projects of this type.
G5	Minimise the occurrence of off-road vehicle movements.	During all Project phases	All personnel	Environmental harm caused to fauna is minimised. Unnecessary damage to vegetation is minimised.	Completed daily during construction at relevant work areas.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the enforcement at the site.
TF9	Vegetation located adjacent to the Project construction works to be appropriately marked to avoid unnecessary clearing/vegetation damage.	During all Project phases	Site Supervisor	Preservation of vegetation and limiting unnecessary clearing.	Completed daily during construction at relevant work areas.	Monitoring to be included in the proposed CEMP.	High This is a repeatable measure which provides clear direction. This is a proven measure suitable for limiting disturbance.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
TF10	The pre-construction environment should be reinstated, and vegetation re-established where it does not affect the Project operation and integrity. Regular monitoring of revegetation works will be undertaken to ensure effectiveness. Where and/or if revegetation does not take, another layer of hydro-mulching will be applied and revegetation methods will be re-considered	During rehabilitation and monitoring	Site Supervisor	Returning of disturbed land to previous quality.	Completed upon finish of works throughout construction.	To be evaluated in accordance with the proposed CEMP.	Medium This management measure depends on the enforcement at the site.
TF11	Visual inspection of progressively rehabilitated areas.	During rehabilitation and monitoring	Site Supervisor	Returning of disturbed land to previous quality.	Weekly during construction and during operation.	To be documented in the CEMP.	Medium Measure is dependent on visual inspection
FS10	All fauna encountered (e.g., vehicle strike or during clearing activities) will be recorded in a central register by the Project Environment Manager. Any injured fauna will be reported as required in the MP that will be in place for the Project.	During all Project phases	All personnel / Project Manager	Environmental harm caused to fauna is minimised.	To be enforced during construction and operation.	To be enforced as part of CEMP and WPMP.	High This measure is repeatable. The register will provide a place to record any species and incidents.
FS18	To reduce the risk of mortality to native wildlife, no domestic animals are permitted onsite.	During all Project phases	All personnel	Environmental harm caused to fauna is minimised.	To be enforced daily.	To be enforced as part of CEMP and WPMP.	High This is a repeatable management measure which can be enforced simply.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
FS20	Prior to any vegetation disturbance, a trained ecologist or other qualified environmental specialist to be onsite to inspect and remove fauna (if required). All fauna recorded during pre-clearing surveys will be recorded on a dedicated fauna register. Construction areas that pose a risk to fauna to be fenced off where practical.	Prior to clearing	Project Manager	Environmental harm caused to fauna is minimised.	Completed daily during construction at relevant work areas.	Works to be undertaken in accordance with the proposed CEMP.	High Presence of a trained ecologist during preclearance surveys is a proven measure to prevent any impacts to fauna.
FS29	Avoid clearing trees with obvious hollows. If trees are required to be removed the proponent shall engage the services of a licensed, qualified Spotter Catcher to complete preclearing checks and be present during removal. They should also inspect the “no go” zone and clearing limits prior to clearing. If hollow bearing trees do require removal, they should first be inspected using an elevated work platform to determine if fauna are present. If fauna are detected, they would be safety removed prior to tree felling.	During Project design and clearing	Project Manager / Site Supervisor / All personnel	Environmental harm caused to fauna is minimised.	To be enforced during construction.	To be enforced as part of CEMP.	Medium This measure requires a spotter catcher to enforce. Potential for trees with hollows may be missed.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
T2	The onsite protocols to include measures for monitoring and recording wildlife road collision incidents throughout construction to help remediate 'high risk' collision areas and set conditions for attending to injured native wildlife.	During all Project phases	Site Supervisor	Environmental harm caused to fauna is minimised.	To be enforced during construction.	To be enforced as part of CEMP.	High This measure is repeatable and will expand on preclearance Survey requirements proposed as part of this document.

5.2.5 Weeds and Pests

The objective of management measures relevant to weeds and pests include:

- No introduction of pest fauna and flora, and diseases to the Project location;
- No increase in existing weed infestations on site;
- There are no new weed species introduced to the site or adjacent areas resulting from proposed action;
- Environmental weed species and their extent are mapped, monitored and managed in line with the Weed and Pest Management Plan;
- No weed outbreaks in disturbed areas and soil stockpiles;
- Minimize the impact of established weeds in no go areas through management measures in the Weed and Pest Management Plan; and
- Overall health of native species is improved with management measures implemented in the Weed and Pest Management Plan.

Weed and pest management will be an important and integral part of proposed site management activities and will be detailed in specific weed and pest management protocols to be developed for the site. A weed and pest management plan is provided in Appendix N. Proposed protocols and management measures are included in Table 5-5.

Section 5 Avoidance, Mitigation and Management Measures

Table 5-5 Pests and Weeds Objectives and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G1	Environmental awareness training aimed at ecological issues as part of site induction.	Prior to clearing and construction	Site Supervisor	Environmental harm caused to fauna is minimised. Preservation of vegetation and limiting unnecessary clearing.	To be completed as part of induction training prior to construction and operation for all staff.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
G2	Vehicle washdown procedures. Wash-down areas will be clearly marked to prevent contaminated water from leaching into soils or flowing into nearby watercourses.	During clearing and construction	Site Supervisor	Environmental harm caused to fauna is minimised. Preservation of vegetation and limiting unnecessary clearing.	To be enforced daily.	To be enforced as part of CEMP.	High This is a repeatable management measure. Vehicle washdown implemented across various Projects of this type.
G3	Ensuring all vehicles are strictly controlled and do not operate in areas outside the needs of the Project construction.	During all Project phases	Site Supervisor	Environmental harm caused to fauna is minimised. Unnecessary damage to vegetation is minimised.	Completed daily during construction at relevant work areas.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the enforcement at the site.
G5	Minimise the occurrence of off-road vehicle movements.	During all Project phases	All personnel	Environmental harm caused to fauna is minimised. Unnecessary damage to vegetation is minimised.	Completed daily during construction at relevant work areas.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the enforcement at the site.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
TF10	The pre-construction environment should be reinstated, and vegetation re-established where it does not affect the Project operation and integrity. Regular monitoring of revegetation works will be undertaken to ensure effectiveness. Where and/or if revegetation does not take, another layer of hydro-mulching will be applied and revegetation methods will be re-considered.	During rehabilitation and monitoring	Site Supervisor	Returning of disturbed land to previous quality.	Completed upon finish of works throughout construction.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the quality of revegetation works undertaken.
TF11	Visual inspection of progressively rehabilitated areas.	During rehabilitation and monitoring	Site Supervisor	Preservation of vegetation and limiting unnecessary clearing. Environmental harm caused to fauna is minimised.	To be undertaken during detailed design process. To be monitored during operation.	To be recorded in detailed design documentation. Success to be documented in the rehabilitation documentation.	Medium Measure is dependent on visual inspection.
TF12	Monitoring and weed inspections particularly in response to reported outbreaks or complaints from adjacent property owners	During all Project phases	Site Supervisor	Prevent the introduction or spread weeds.	Limit the outbreaks based on a robust monitoring scheme.	Weekly monitoring during construction and monthly during operations. To be included in CEMP and WPMP.	Medium The effectiveness of this management measure relies on enforcement at the site level and receiving information from the adjacent property owners which may not always be forthcoming.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
TF13	Implementation of sediment control mechanisms to minimise the risk of weed seed washing into drainage channels.	During Project design, clearing and construction	Project Manager / Site Supervisor	Prevent the introduction or spread weeds.	Sediment control mechanisms to be inspected weekly during construction and operation.	To be included in WPMP.	Medium The effectiveness of this management measure depends on the implementation and type of sediment control mechanisms employed.
TF15	Implement control strategies outlined in the Department of Agriculture and Fisheries (DAF) weed and pest animal fact sheets and other relevant government biosecurity management strategies.	Prior to clearing and construction	Project Manager	Prevent the introduction or spread weeds. Control pest species.	Control strategies to be inspected as required and will be subject to specific documentation and performance metrics.	To be included in CEMP and WPMP.	High This management measure involves inclusion of strategies identified in proven material.
FS18	To reduce the risk of mortality to native wildlife, no domestic animals are permitted onsite.	During all Project Phases	All personnel	Environmental harm caused to fauna is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
FS17	Onsite waste disposal strategies (particularly for food wastes) to be employed that will not encourage the presence of pest fauna	During all Project Phases	Site Supervisor	Control pest species and limit the potential for pest species to occur.	Limit the potential for pest species to occur.	Weekly monitoring during construction and monthly during operations. To be included in CEMP and WPMP.	Medium The effectiveness of this management measure relies on enforcement at the site level.
FS27	Regular onsite inspections of site infrastructure / equipment for resident pest fauna and establishment of a register for pest sightings	During all Project phases	Site Supervisor	Control pest species.	Identifying pest fauna will help ensure no further impacts occur.	Weekly monitoring during construction and monthly during operations. To be included in CEMP and WPMP.	Medium The effectiveness of this management measure relies on enforcement at the site level through inspections.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
FS30	Design and construction of fencing/infrastructure to direct fauna towards safe passage and around construction area.	During Project design and construction	Project Manager / Site Supervisor	Preservation of vegetation and limiting unnecessary clearing. Environmental harm caused to fauna is minimised.	To be undertaken during detailed design process.	To be recorded in detailed design documentation. Success to be documented in environmental report.	Medium This management measure depends on the detailed design process.
A12	Weed management during and following rehabilitation to prevent habitat degradation and potential increased fire risk.	During rehabilitation and monitoring	Site Supervisor	No adverse impacts from air pollution and dust during construction and operation No adverse impacts from fire during construction and operation. Prevent the introduction or spread weeds.	Identification and reporting of weed management effectiveness.	To be enforced as part of CEMP and WPMP but requires enforcement at the site.	Medium The effectiveness of this management measure relies on enforcement at the site level through inspections.

5.2.6 Air Quality and Dust

The objective of management measures relevant to dust include:

- No adverse impacts from air pollution and dust during construction;
- Compliance with EP (Air Quality) Policy 2019; and
- No complaints of Air quality issues are received.

Dust is not anticipated to significantly impact terrestrial or aquatic habitats in the Project or surrounding areas. However, regular inspections for dust accumulation impacts on riparian vegetation located adjacent to the Project will be implemented as part of standard operating protocols for the Project. The following measures in Table 5-6 have been developed to ensure dust levels resulting from the Project are kept to a minimum. A MNES MP is provided in Appendix P.

Section 5 Avoidance, Mitigation and Management Measures

Table 5-6 Air Objectives and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G1	Environmental awareness training aimed at ecological issues as part of site induction.	Prior to clearing and construction	Site Supervisor	Environmental harm caused to fauna is minimised. Preservation of vegetation and limiting unnecessary clearing.	To be completed as part of induction training prior to construction and operation for all staff.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
G2	Vehicle washdown procedures. Wash-down areas will be clearly marked to prevent contaminated water from leaching into soils or flowing into nearby watercourses.	During clearing and construction	Site Supervisor	Preservation of vegetation and limiting unnecessary clearing. Environmental harm caused to fauna is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a repeatable management measure. Vehicle washdown implemented across various Projects of this type.
G4	Ensuring all vehicles comply with designated speed limits whilst traversing site.	During all Project phases	Site Supervisor	Environmental harm caused to fauna is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a repeatable management measure. Speed limits are routinely enforced across various Projects of this type.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G6	Provide timely, ongoing communication and consultation with all directly impacted landowners and other stakeholders.	During all Project phases	Site Supervisor	No adverse impacts from air pollution and dust during construction and operation.	Ensure checks are completed with landholders prior to any activities which may result in impacts to landholders and other stakeholders.	To be enforced through construction and operation procedures.	Medium Landholder and stakeholder consultation is often overlooked. Will require the site representative to correctly carry out timely notifications.
A1	Implementation of dust suppression measures, if dust is visible or when wind conditions become adverse, including: <ul style="list-style-type: none"> Watering of exposed areas; and Physical barriers (e.g., covering of exposed soil piles). The aim of measures is to prevent an increase of particulates (PM ¹⁰ and PM ^{2.5}) above the current baseline conditions.	During clearing and construction	Site Supervisor	No adverse impacts from air pollution and dust during construction and operation	Minimal to no offsite impacts.	To be enforced as part of CEMP.	Medium Dust suppression is a common management measure with proven success and effectiveness.
A2	Trigger points for management decisions based on any or all of the following: <ul style="list-style-type: none"> Real-time measurements of wind conditions; Wind conditions as forecast by predictive numerical weather systems; and Dust monitoring at sensitive receptors when complaints are received. 	During clearing and construction	Site Supervisor	No adverse impacts from air pollution and dust during construction and operation	Minimal to no offsite impacts.	To be enforced as part of CEMP.	Medium Relies on an effective real time mechanism and appropriate trigger points to guide site personnel.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
A4	Monitor dust control measures regularly for effectiveness.	During clearing, construction and rehabilitation	Site Supervisor	No adverse impacts from air pollution and dust during construction and operation.	Regular monitoring	Regular monitoring of dust control measures during adverse weather conditions. To be enforced as part of CEMP.	Medium Relies on regulator monitoring during adverse weather conditions.
A6	If required, vehicles carrying loads with the potential to produce dust will be covered when moving within or outside the construction-site.	During clearing and construction	All personnel	No adverse impacts from air pollution and dust during construction and operation.	This measure will be implemented throughout construction and operational phases.	To be enforced as part of CEMP.	High Covering of loads is a regulated in Queensland. This will be enforced onsite.
A8	Minimise extended engine idling and queuing adjacent to sensitive receptors.	During clearing and construction	All personnel	No adverse impacts from air pollution and dust during construction and operation.	This measure will be implemented throughout construction and operational phases.	To be enforced as part of CEMP but requires enforcement at the site. Inclusion in site induction material.	Low This measure is dependent on the type of machinery or equipment used. This is a readily used management measure which is hard to enforce.
A9	Onsite burning of any material will not be undertaken without a valid permit from the relevant QFES Fire Warden.	During all Project phases	Site Supervisor / All personnel	No adverse impacts from air pollution and dust during construction and operation. No adverse impacts from fire during construction and operation.	This measure will be implemented throughout construction and operational phases.	To be enforced as part of CEMP but requires enforcement at the site.	High This measure is effective in ensuring the strict no burning unless permitted.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
A11	Ensure onsite fire-fighting equipment is regularly maintained and adequate staff training is implemented.	During all Project phases	Site Supervisor	No adverse impacts from air pollution and dust during construction and operation. No adverse impacts from fire during construction and operation.	Equipment is regularly maintained and there are no breaches.	To be enforced as part of CEMP but requires enforcement at the site.	High This measure will ensure equipment is working and appropriate should it be required. This measure is readily implemented across various projects.
A14	Suspension of earthworks during high wind conditions and change in operations during worst-case conditions (e.g., implementation of stricter dust controls).	During clearing and construction	All personnel	No adverse impacts from air pollution and dust during construction and operation.	Minimal to no offsite impacts.	To be enforced as part of CEMP.	High Suspension of earthworks and change to operations will alleviate any potential impacts.
A15	Regular cleaning of machinery and vehicle tyres to prevent wheel entrained dust emissions.	During clearing and construction	All personnel	No adverse impacts from air pollution and dust during construction and operation.	Equipment is regularly maintained and there are no breaches.	Enforce equipment and vehicle maintenance schedule.	Low Will require the site representative to correctly carry out maintenance procedures. Effectiveness is generally limited.

Section 5 Avoidance, Mitigation and Management Measures

5.2.7 Noise

The objective of management measures relevant to noise include:

- Minimise any potential nuisance or loss of amenity due to construction activities of the Project in accordance with planning, environmental and other approvals;
- Compliance with EP (Noise) Policy 2019;
- Works are conducted within specific operating hours (as per local law requirements);
- Construction Noise will not exceed the nominated noise management level (TBA)* at any of the receptor locations; and
- No complaints of noise are received.

The measures in Table 5-7 will be implemented to reduce any impacts which may result from construction and operational noise. A MNES MP is provided in Appendix P.

Table 5-7 Noise Objectives and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G3	Ensuring all vehicles are strictly controlled and do not operate in areas outside the needs of the Project construction.	During all Project phases	Site Supervisor	Environmental harm caused to fauna is minimised. Unnecessary damage to vegetation is minimised.	Completed daily during construction at relevant work areas.	Works to be undertaken in accordance with the proposed CEMP.	Medium This management measure depends on the enforcement at the site.
G4	Ensuring all vehicles comply with designated speed limits whilst traversing site.	During all Project phases	Site Supervisor	Environmental harm caused to fauna is minimised. No adverse impacts from noise during construction and operation. Minimal to no complaints as a result of construction.	To be enforced daily.	Implement as part of construction procedures, including in the CEMP.	High This is a repeatable management measure. Speed limits are routinely enforced across various Projects of this type.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G6	Provide timely, ongoing communication and consultation with all directly impacted landowners and other stakeholders.	During all Project phases	Site Supervisor	No adverse impacts from noise during construction and operation.	Ensure checks are completed with landholders prior to any activities which may result in impacts to landholders and other stakeholders.	To be enforced through construction and operation procedures.	Medium Landholder and stakeholder consultation is often overlooked. Will require the site representative to correctly carry out timely notifications.
N1	Undertake works during approved operating hours and notify landholders of works that have the potential to cause nuisance (e.g., excavation works, compaction activities, drilling). If work required outside of normal hours consultation to be undertaken with Environmental Representative.	During clearing and construction	All personnel / Site Supervisor	No adverse impacts from noise during construction and operation.	Ensure noise generative activities are completed within these hours.	To be enforced through construction and operation procedures and as part of CEMP	High Setting a time based management measure is able to be easily enforced. Any exceedance is likely to be reported by neighbouring landholders and stakeholders.
N2	Use of horns, bells, beepers, and other audible signals will be minimised as much as practicable without contravening safe work procedures.	During all Project phases	All personnel	No adverse impacts from noise during construction and operation.	Ensure noise generative activities are generally limited.	Enforced but governed by per safe work procedures.	Low A number of safe work procedures require such audible signals, therefore limiting the effectiveness.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
N3	Plant and equipment will be switched off when not required.	During all Project phases	All personnel	No adverse impacts from noise during construction and operation.	Ensure noise generative activities are generally limited.	To be enforced through construction and operation procedures and as part of CEMP. Potential to be governed by per safe work procedures.	Medium Requires onsite enforcement. Regularly implemented measure.
N4	In cases where noise or vibration levels are identified as being too high, modification or substitution of work methods will be considered and undertaken where possible.	During all Project phases	Site Supervisor	No adverse impacts from noise during construction and operation.	Ensure noise generative activities are generally limited.	To be enforced through construction and operation procedures and as part of CEMP. Potential to be governed by per safe work procedures.	Medium Effective in limiting noise impacts. However, work methods may be governed by safe work procedures therefore limiting modification or substitution.
N5	Noise to be mitigated by properly maintaining all equipment used onsite in accordance with manufacturers specifications. Where in accordance with manufactures specifications, equipment will be fitted with noise suppression equipment.	During all Project phases	Site Supervisor	No adverse impacts from noise during construction and operation.	Ensure noise generative activities are generally limited.	To be enforced through construction and operation procedures and as part of CEMP. Potential to be governed by per safe work procedures.	Medium Effective in limiting noise impacts. However, work methods may be governed by safe work procedures therefore limiting modification or substitution.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
N8	Use designated access routes, unloading areas and parking areas.	During all Project phases	All personnel	No adverse impacts from noise during construction and operation.	Proper designation of these routes and areas.	To be identified during detailed design.	Low Designation of these areas is important to limit offsite noise impacts.
N10	Sensitive receptors located in proximity to the proposed works will be consulted with and given advance warning of any out of hours or high noise work activities.	During all Project phases	Site Supervisor / HSE Manager	No adverse impacts from noise during construction and operation.	Ensure checks are completed with landholders prior to any activities which may result in impacts to landholders and other stakeholders.	To be enforced through construction and operation procedures.	Medium Landholder and stakeholder consultation is often overlooked. Will require the site representative to correctly carry out timely notifications.
N11	Minimise the drop heights of materials.	During Project design and construction	All personnel	No adverse impacts from noise during construction and operation.	Minimal to no complaints as a result of construction.	Implement as part of construction procedures, including in the CEMP.	Medium Effective management measure to limit noise impacts offsite. Requires enforcement by site personnel.

Section 5 Avoidance, Mitigation and Management Measures

5.2.8 Accidental Release of Pollutants

The objective of management measures relevant to accidental release of pollutants is to minimise any potential pollution nuisance or damage to the surrounding environment due to construction activities of the Project in accordance with planning, environmental and other approvals.

The following measures in Table 5-8 will be implemented to reduce any impacts which may result from accidental release of pollutants. A MNES MP is provided in Appendix P.

Table 5-8 Accidental Release of Pollutants Objectives and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G1	Environmental awareness training aimed at ecological issues as part of site induction.	Prior to clearing and construction	Site Supervisor	Environmental harm caused to fauna is minimised. Preservation of vegetation and limiting unnecessary clearing.	To be completed as part of induction training prior to construction and operation for all staff.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
G2	Vehicle washdown procedures. Wash-down areas will be clearly marked to prevent contaminated water from leaching into soils or flowing into nearby watercourses.	During clearing and construction	Site Supervisor	Preservation of vegetation and limiting unnecessary clearing. Environmental harm caused to fauna is minimised.	To be enforced daily.	To be enforced as part of CEMP.	High This is a repeatable management measure. Vehicle washdown implemented across various Projects of this type.
A16	Locate and design roads and other built infrastructure so that minimal runoff to waterways occurs.	During Project design	Site Supervisor	No adverse impacts from accidental release of pollutants during construction and operation.	Proper environmental design of roads and built infrastructure.	To be identified during detailed design.	Medium Design of roads and other built infrastructure is important to limit onsite and offsite runoff impacts.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
W7	All refuelling facilities, or storage facilities for hydrocarbons and chemicals will be in appropriately designed sites and comply with Australian Standards (e.g., AS 1940: The storage and handling of flammable and combustible liquids).	During Project design, clearing and construction	All personnel	No adverse impacts from accidental release of pollutants during construction and operation.	To be enforced during construction and operation.	To be enforced as part of CEMP. Regular checks to be completed.	High This is an effective management measure which ensures such chemicals are effectively stored.
W11	Appropriate spill control materials including booms and absorbent materials will be onsite at refuelling facilities at all times. These will be used for mitigating and managing events where a substance is spilled into surrounding waters.	During clearing and construction	All personnel	No adverse impacts from accidental release of pollutants during construction and operation.	To be enforced during construction and operation.	To be enforced as part of CEMP. Regular checks to be completed.	Medium This management measure is reactive but effective in ensuring impacts should spills occur are limited.
W30	Bunding of chemical storage facilities and appropriate storage of chemicals according to AS 1940 'The storage and handling of flammable and combustible liquids'.	During Project design	All personnel	No adverse impacts from accidental release of pollutants during construction and operation.	To be enforced during construction and operation.	To be enforced as part of CEMP. Regular checks to be completed.	High This is an effective management measure which ensures such chemicals are effectively stored.
W31	Drainage design that allows for the retention of mine affected water prior to any discharge into the aquatic environment.	During Project design	Project Manager	No adverse impacts from accidental release of pollutants during construction and operation.	Proper environmental design of roads and built infrastructure.	To be identified during detailed design.	Medium Design of drainage is important to limit onsite and offsite runoff impacts.

Section 5 Avoidance, Mitigation and Management Measures

5.2.9 Fire

The objective of management measures relevant to fire is no adverse impacts from fire during construction and operation.

Fire management measures have been developed to reduce the potential impacts of a site fire. Bushfire setbacks will be provided around Project infrastructure and powerlines in accordance with standards and legislation. Setbacks and firebreaks will be in accordance with the Australian Standard for the Construction of Buildings in Bushfire Prone Areas - AS3959 – 2009. AS3959. The following measures in Table 5-9 will be implemented to reduce any impacts which may result from fires. A bushfire management plan is provided in Appendix O.

Table 5-9 Fire Objectives and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
G1	Environmental awareness training aimed at ecological issues as part of site induction.	Prior to clearing and construction	Site Supervisor	Environmental harm caused to fauna is minimised. Preservation of vegetation and limiting unnecessary clearing.	To be completed as part of induction training prior to construction and operation for all staff.	To be enforced as part of CEMP.	High This is a repeatable management measure which can be enforced simply.
TF16	Weed management during and following rehabilitation to prevent habitat degradation and potential increased fire risk.	Post rehabilitation and during monitoring	Site Supervisor	No adverse impacts from air pollution and dust during construction and operation. No adverse impacts from fire during construction and operation. Prevent the introduction or spread weeds.	Identification and reporting of weed management effectiveness.	To be enforced as part of CEMP but requires enforcement at the site.	Medium The effectiveness of this management measure relies on enforcement at the site level through inspections.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
A9	Onsite burning of any material will not be undertaken without a valid permit from the relevant QFES Fire Warden.	During all Project phases	All personnel / Site Supervisor	No adverse impacts from air pollution and dust during construction and operation.	This measure will be implemented throughout construction and operational phases.	To be enforced as part of CEMP but requires enforcement at the site.	High This measure is effective in ensuring the strict no burning unless permitted.
A11	Ensure onsite fire-fighting equipment is regularly maintained and adequate staff training is implemented.	Prior to and during clearing and construction	Site Supervisor	No adverse impacts from fire during construction and operation.	Equipment is regularly maintained and there are no breaches.	To be enforced as part of CEMP but requires enforcement at the site.	High This measure will ensure equipment is working and appropriate should it be required. This measure is readily implemented across various projects.
B1	A qualified person will be appointed as Site Safety Advisor during construction and will have on-site a set of safety data sheets (SDS) for hazardous and dangerous materials.	Prior to clearing and construction	Project Manager	No adverse impacts from fire during construction and operation	Enforcement onsite.	To be enforced as part of CEMP but requires enforcement at the site.	High This is a management measure which can be enforced simply.
B4	If works are undertaken during the bushfire season, the fire danger rating will be monitored daily through the QFES website.	During clearing and construction	Site Supervisor	No adverse impacts from fire during construction and operation	To be enforced daily.	To be enforced as part of CEMP but requires enforcement at the site.	High This is a management measure which can be enforced simply.
B5	Open fires, including open barbeques, billy fires and brush burning will not be permitted on site.	During all Project Phases	All personnel	No adverse impacts from fire during construction and operation.	Enforcement onsite daily.	To be enforced as part of CEMP but requires enforcement at the site.	High This is a management measure which can be enforced simply.

Section 5 Avoidance, Mitigation and Management Measures

No.	Action	Applicable Phase	Responsibility	Environmental Outcome to be achieved	Milestone / Performance / Completion Criteria	Proposed Monitoring and Evaluation Program	Effectiveness
B8	Vehicles may not idle or be parked in areas of long grass.	During all Project phases	All personnel	No adverse impacts from fire during construction and operation.	Enforcement onsite.	To be enforced as part of CEMP	Medium The effectiveness of this management measure relies on enforcement at the site
B9	Smoking is not permitted on site aside from in a designated safe zone.	During all Project phases	All personnel	No adverse impacts from fire during construction and operation.	Enforcement onsite.	To be identified during detailed design.	High Designation of onsite smoking areas will greatly limit the potential for impacts associated with fire.
B10	Protocols outlining the fire management measures for the Project will be developed and implemented prior to the Commencement of Project operations.	Prior to clearing and construction	Site Supervisor	No adverse impacts from fire during construction and operation.	Inclusion and enforcement of management measures.	To be enforced as part of CEMP.	High Protocols to be developed by a suitably qualified person.
B11	Vegetation within the site will be regularly inspected and managed for fuel loads.	During all Project phases	Site Supervisor	No adverse impacts from fire during construction and operation.	Regular checklists.	To be enforced as part of CEMP.	High Effective management of fuel loads greatly decreasing the risk and impacts of fire.

Section 5 Avoidance, Mitigation and Management Measures

5.2.10 Matters of National Environmental Significance

Potential threats to the MNES species have previously been outlined throughout Section 4 and Section 4.2. Mitigation measures to manage threats to MNES species as a result of the Project are provided in Table 5-10. A MNES MP is provided in Appendix P.

Table 5-10 Mitigation Measures to Manage Threats to MNES

MNES	Commonwealth Identified Threats				
	Habitat Loss and Fragmentation	Habitat Degradation/Disturbance	Injury and Mortality	Invasive weeds and Pests	Disease
Black-throated finch (southern)	Minimise clearing, minimise work in waterways, implementation of no-go zones, implementation of CEMP and MNES MP	Implementation of CEMP and MNES MP	Qualified and experienced fauna spotter/catcher, flag and sign potential habitat areas, implementation of CEMP and MNES MP and avoidance of active nests	Management as per WPMP and CEMP	N/A
Bare-rumped sheathtail bat	Minimise clearing, minimise work in waterways, implementation of no-go zones, implementation of CEMP and MNES MP	Restrict artificial light, direct lighting away from sensitive habitats, Implementation of CEMP and MNES MP, monitor vehicle movements, restrict speed limits, reduce duration in waterways and monitor weather	Qualified and experienced fauna spotter/catcher, flag and sign potential habitat areas, implementation of CEMP and MNES MP.	Management as per WPMP and CEMP	Hygiene protocols in CEMP
Squatter pigeon (southern)	Minimise clearing, minimise work in waterways, implementation of no-go zones, implementation of CEMP and MNES MP	Restrict artificial light, direct lighting away from sensitive habitats, Implementation of CEMP and MNES MP, , reduce duration in waterways and monitor weather	Qualified and experienced fauna spotter/catcher, flag and sign potential habitat areas, implementation of CEMP and MNES MP, avoidance of active nests, monitor vehicle movements, and restrict speed limits	Management as per WPMP and CEMP	N/A
White-throated needletail	Minimise clearing, implementation of CEMP	N/A	N/A	N/A	N/A

Section 5 Avoidance, Mitigation and Management Measures

MNES	Commonwealth Identified Threats				
	Habitat Loss and Fragmentation	Habitat Degradation/Disturbance	Injury and Mortality	Invasive weeds and Pests	Disease
Australian painted snipe	Minimise clearing, minimise work in waterways, implementation of no-go zones, implementation of CEMP and MNES MP	Implementation of CEMP and MNES MP, reduce duration in waterways and monitor weather	Qualified and experienced fauna spotter/catcher, implementation of CEMP and MNES MP, monitor vehicle movements, restrict speed limits	Management as per WPMP and CEMP	N/A
Masked owl (northern)	Minimise clearing, implementation of no-go zones, implementation of CEMP	Restrict artificial light, direct lighting away from sensitive habitats, Implementation of CEMP and MNES MP, reduce duration in waterways and monitor weather	Qualified and experienced fauna spotter/catcher, flag and sign potential habitat areas, implementation of CEMP and MNES MP, monitor vehicle movements, and restrict speed limits	Management as per WPMP and CEMP	N/A
Grey falcon	Minimise clearing, implementation of CEMP	Minimise clearing, implementation of CEMP	Qualified and experienced fauna spotter/catcher, implementation of CEMP, monitor vehicle movements, and restrict speed limits	Management as per WPMP and CEMP	N/A
Greater sand plover	Minimise clearing, implementation of CEMP, minimise works in waterways	Implementation of CEMP, reduce duration in waterways and monitor weather	Qualified and experienced fauna spotter/catcher, implementation of CEMP, monitor vehicle movements, and restrict speed limits	Management as per WPMP and CEMP	N/A
Curlew sandpiper	Minimise clearing, implementation of CEMP, minimise works in waterways	Implementation of CEMP, reduce duration in waterways and monitor weather	Qualified and experienced fauna spotter/catcher, implementation of CEMP, monitor vehicle movements, and restrict speed limits	Management as per WPMP and CEMP	N/A

Section 5 Avoidance, Mitigation and Management Measures

MNES	Commonwealth Identified Threats				
	Habitat Loss and Fragmentation	Habitat Degradation/Disturbance	Injury and Mortality	Invasive weeds and Pests	Disease
Eastern curlew	Minimise clearing, implementation of CEMP, minimise works in waterways	Implementation of CEMP, reduce duration in waterways and monitor weather	Qualified and experienced fauna spotter/catcher, implementation of CEMP, monitor vehicle movements, and restrict speed limits	Management as per WPMP and CEMP	N/A
Northern quoll	Minimise clearing, implementation of no-go zones, implementation of CEMP	Restrict artificial light, direct lighting away from sensitive habitats, implementation of CEMP and MNES MP, reduce duration in waterways and monitor weather	Qualified and experienced fauna spotter/catcher, flag and sign potential habitat areas, implementation of CEMP and MNES MP, monitor vehicle movements, and restrict speed limits	Management as per WPMP and CEMP	N/A
McDonald's frog	N/A Species is not likely to occur in the Project area	N/A Species is not likely to occur in the Project area	N/A Species is not likely to occur in the Project area	Management as per WPMP and CEMP	Hygiene protocols in CEMP
Ghost bat	Minimise clearing, implementation of no-go zones, implementation of CEMP	Restrict artificial light, direct lighting away from sensitive habitats, Implementation of CEMP and MNES MP, monitor vehicle movements, restrict speed limits, reduce duration in waterways and monitor weather	Qualified and experienced fauna spotter/catcher, flag and sign potential habitat areas, implementation of CEMP and MNES MP, monitor vehicle movements, and restrict speed limits	Management as per WPMP and CEMP	Hygiene protocols in CEMP
Semon's leaf-nosed bat	Minimise clearing, implementation of no-go zones, implementation of CEMP	Restrict artificial light, direct lighting away from sensitive habitats, Implementation of CEMP and MNES MP, monitor vehicle movements, restrict speed limits, reduce duration in waterways and monitor weather	Qualified and experienced fauna spotter/catcher, flag and sign potential habitat areas, implementation of CEMP and MNES MP, monitor vehicle movements, and restrict speed limits	Management as per WPMP and CEMP	Hygiene protocols in CEMP

Section 5 Avoidance, Mitigation and Management Measures

MNES	Commonwealth Identified Threats				
	Habitat Loss and Fragmentation	Habitat Degradation/Disturbance	Injury and Mortality	Invasive weeds and Pests	Disease
Koala	Minimise clearing in disturbed areas, implement no-go zones, implementation of CEMP and MNES MP	Qualified and experienced fauna spotter/catcher on-site, clearing in daylight only, sequential clearing, implementation of no-go zones, restricted speed limits and monitoring of vehicle movements, waste management (CEMP) and weed and pest management (WPMP)	Qualified and experienced fauna spotter/catcher on-site, monitor vehicle movements and speed, reduce duration of works in waterways, monitor weather, implementation of CEMP	Management as per WPMP and CEMP	Hygiene protocols in CEMP
Greater glider (northern)	Minimise clearing, minimise work in waterways, implementation of no-go zones, implementation of CEMP	Qualified and experienced fauna spotter/catcher on-site, clearing in daylight only, sequential clearing, implementation of no-go zones, restricted speed limits and monitoring of vehicle movements, waste management (CEMP) and weed and pest management (WPMP)	Qualified and experienced fauna spotter/catcher on-site, monitor vehicle movements and speed, reduce duration of works in waterways, monitor weather, implementation of CEMP	Management as per WPMP and CEMP	N/A
Greater glider (southern and central)	Minimise clearing, minimise work in waterways, implementation of no-go zones, implementation of CEMP	Qualified and experienced fauna spotter/catcher on-site, clearing in daylight only, sequential clearing, implementation of no-go zones, restricted speed limits and monitoring of vehicle movements, waste management (CEMP) and weed and pest management (WPMP)	Qualified and experienced fauna spotter/catcher on-site, monitor vehicle movements and speed, reduce duration of works in waterways, monitor weather, implementation of CEMP	Management as per WPMP and CEMP	N/A

5.3 Pre-clearance and Clearance Procedures

5.3.1 Pre-clearing

Preclearance surveys will be conducted by a qualified fauna spotter/ecologist prior to any disturbance on site. Handling of fauna should be limited to a suitably qualified and experienced fauna handler that holds a wildlife Damage Mitigation Permit (DMP) for the removal and relocation of wildlife. Any animals encountered will be recorded on a dedicated register held by the Environmental Representative.

During the pre-clearance survey, the qualified fauna spotter/ecologist will comprehensively traverse the Project footprint on foot in search of protected flora and fauna. Where protected and threatened flora or fauna species is detected, the ecologist will notify the construction contractors and an exclusion zone will be clearly demarcated using coloured flagging tape or bunting.

The precise location (including accuracy of recorded location) of all observed protected flora and fauna species will be recorded with a GPS for future reference and for notification to relevant parties (e.g., Queensland Herbarium) and for inclusion on site plans.

Supplementary information regarding the occurrence of the protected flora and fauna species is to be recorded including a description of the supporting habitat, the size and maturity of individuals, the presence of reproductive output, and any observations on health and condition.

5.3.2 Clearing

A fauna spotter/ecologist will be present during clearing activities for all fauna handling and to provide guidance to the Environmental Representative. Any fauna encountered will only be handled by the fauna spotter/ecologist. Vegetation clearing will be done in a sequential manner to ensure wildlife is directed towards adjacent habitat and not into areas of threat (road or earthworks).

Construction areas that pose a risk to fauna to be fenced off where practicable and where possible, any active breeding places identified will be avoided. Where this is not possible, the nest is to be relocated to adjacent undisturbed habitat and monitor the active nest to determine a return by breeding individuals. If required, young or eggs will be removed and placed into care of a wildlife carer. Individuals to be released within proximity of their original point of capture. Any injured animals must be taken to the nearest wildlife facility or vet.

Where clearing of preferred habitat for the Squatter pigeon is unavoidable the following procedure will be applied during the clearing process:

- Briefings regarding the significance of the habitat for this species will be provided during toolbox meetings involving construction, field operations and environmental staff. This will include the preparation of toolbox meeting sheets which clearly identify the relevant species and its habitat requirements;
- Habitat to be avoided will be flagged;
- Documentation of amounts of identified preferred habitat to be cleared or – disturbed;
- Documentation of any incidents where Squatter pigeon (southern) are impacted by construction activities;
- Due to the location of nests (predominately on the ground) and the ground dwelling nature of the birds, all vehicles and pedestrians are to remain within the designated access tracks and construction footprint; and
- Vehicle and machinery speed limits will be restricted to 20km/hr within key nominated areas with appropriate signage erected, due to the tendency of the Squatter Pigeon to utilise disturbed areas (such as access tracks and grasslands).

All construction activities will be carried out in accordance with relevant Management Plans (MPs). Compliance with industry standards will minimise adverse impacts on receiving environments by construction activities. Weeds will be

Section 5 Avoidance, Mitigation and Management Measures

managed in accordance with the Weeds and Pest Management Plan for the Project. Vertebrate pests, particularly foxes and cats will be managed in accordance with feral animal management guidelines through the Weeds and Pest Management Plan for the Project.

5.4 Summary of Permanent and Temporary Impacts

Construction and operational phases of the Project present numerous impacts, as summarised in the following subsections.

The construction and operation of the Project will result in disturbance of up to 87.58 ha, comprised of the following:

- Temporary impacts – 87.58 ha; and
- Permanent impacts – 58.75 ha.

The difference between temporary and permanent impacted area totals 28.83 ha. This area is expected to undergo rehabilitation in accordance with Section 6; however, it should be noted that the type and extent of rehabilitation will be restricted as discussed in Section 6. It is not expected that the rehabilitation will reach the ‘pre-construction’ quality. This is because the water infrastructure network will need to be regularly maintained and potentially traversed when it requires servicing during the operations phase.

5.4.1 Construction Phase

A summary of impacts as a result of the construction phase of the Project is presented in Table 5-11.

Table 5-11 Summary of impacts and mitigation measures as a result of Project construction

Impacting Processes	Mitigation and Management Measures
Loss of habitat	<p>Environmental awareness training to be conducted prior to construction works for all personnel and contractors.</p> <p>Vegetation clearing is restricted to the minimum required area</p> <p>Clearing areas must be clearly identified during construction</p> <p>Progressive rehabilitation of disturbed areas</p> <p>Implementation of a CEMP, WPMP and MNES MP.</p> <p>Ensuring all vehicles are strictly controlled and do not operate in areas outside the needs of the Project construction</p> <p>Prior to any vegetation disturbance, a trained ecologist or other qualified environmental specialist to be onsite to inspect and remove fauna (if required). All fauna recorded during pre-clearing surveys will be recorded on a dedicated fauna register. Construction areas that pose a risk to fauna to be fenced off where practical.</p>
Injury or mortality	<p>Prior to any vegetation disturbance, a trained ecologist or other qualified environmental specialist to be onsite to inspect and remove fauna (if required). All fauna recorded during pre-clearing surveys will be recorded on a dedicated fauna register. Construction areas that pose a risk to fauna to be fenced off where practical.</p> <p>Ensuring all vehicles are strictly controlled and do not operate in areas outside the needs of the Project construction.</p> <p>Vehicles are to comply with enforced speed limits.</p> <p>CEMP to include protocols on fauna injury and mortality</p>

Section 5 Avoidance, Mitigation and Management Measures

Impacting Processes	Mitigation and Management Measures
Air Quality and Dust	<p>Implementation of dust suppression measures, if dust is visible or when wind conditions become adverse, including:</p> <ul style="list-style-type: none"> - Watering of exposed areas; and - Physical barriers (e.g., covering of exposed soil piles). <p>Suspension of earthworks during high wind conditions and change in operations during worst-case conditions (e.g., implementation of stricter dust controls).</p> <p>vehicles carrying loads with the potential to produce dust will be covered when moving within or outside the construction-site.</p> <p>Regular cleaning of machinery and vehicle tyres to prevent wheel entrained dust emissions.</p>
Habitat disturbance as a result of light, noise and vibration	<p>Undertake works during approved operating hours and notify landholders of works that have the potential to cause nuisance (e.g., excavation works, compaction activities, drilling).</p> <p>Plant and equipment will be switched off when not required.</p> <p>Use of horns, bells, beepers, and other audible signals will be minimised as much as practicable without contravening safe work procedures.</p> <p>Minimise the drop heights of materials.</p>
Spread of invasive species	<p>Hygiene protocols as part of the Weed and Pest Management Plan</p> <p>Vehicle washdown procedures. Wash-down areas will be clearly marked to prevent contaminated water from leaching into soils or flowing into nearby watercourses.</p> <p>No domestic animals are permitted on-site.</p> <p>Ensuring all vehicles are strictly controlled and do not operate in areas outside the needs of the Project construction.</p>
Fire	<p>Onsite burning of any material will not be undertaken without a valid permit from the relevant QFES Fire Warden.</p> <p>A qualified person will be appointed as Site Safety Advisor during construction and will have on-site a set of safety data sheets (SDS) for hazardous and dangerous materials.</p> <p>A Bushfire Management Plan will be enforced.</p>

5.4.2 Operational Phase

A summary of impacts as a result of the operational phase of the Project is presented in Table 5-12.

Table 5-12 Summary of impacts and mitigation measures as a result of Project operation

Impacting Processes	Mitigation and Management Measures
Direct injury or mortality	Vehicle speed limits.
Habitat disturbance as a result of light, noise and vibration	<p>Undertake works during approved operating hours and notify landholders of works that have the potential to cause nuisance (e.g., excavation works, compaction activities, drilling). If work required outside of normal hours consultation to be undertaken with Environmental Representative.</p> <p>Use of horns, bells, beepers, and other audible signals will be minimised as much as practicable without contravening safe work procedures.</p> <p>Plant and equipment will be switched off when not required.</p>
Habitat degradation and increased erosion	<p>No further clearing.</p> <p>Vehicles to remain on roads.</p> <p>Inspection of erosion management measures.</p>
Spread of invasive species	<p>Hygiene protocols as part of the Weed and Pest Management Plan</p> <p>Restricted vehicle access to access roads and dedicated tracks only.</p> <p>Vehicle washdown procedures. Wash-down areas will be clearly marked to prevent contaminated water from leaching into soils or flowing into nearby watercourses.</p> <p>No domestic animals are permitted on-site.</p>

Section 5 Avoidance, Mitigation and Management Measures

5.4.3 Maintenance

A summary of impacts as a result of the maintenance phase of the Project is presented in Table 5-13.

Table 5-13 Summary of impacts and mitigation measures as a result of Project maintenance

Impacting Processes	Mitigation and Management Measures
Direct injury or mortality	Ensuring all vehicles are strictly controlled and do not operate in areas outside the needs of the Project construction.
Habitat disturbance as a result of light, noise and vibration	<p>Undertake works during approved operating hours and notify landholders of works that have the potential to cause nuisance (e.g., excavation works, compaction activities, drilling). If work required outside of normal hours consultation to be undertaken with Environmental Representative.</p> <p>Use of horns, bells, beepers, and other audible signals will be minimised as much as practicable without contravening safe work procedures.</p> <p>Plant and equipment will be switched off when not required.</p>
Habitat degradation and increased erosion	<p>No further clearing.</p> <p>Vehicles to remain on roads.</p> <p>Inspection of erosion management measures.</p>
Spread of invasive species	<p>Hygiene protocols as part of the Weed and Pest Management Plan</p> <p>Ensuring all vehicles are strictly controlled and do not operate in areas outside the needs of the Project construction.</p> <p>No domestic animals are permitted on-site.</p> <p>Vehicle washdown procedures. Wash-down areas will be clearly marked to prevent contaminated water from leaching into soils or flowing into nearby watercourses.</p>

Section 6 Rehabilitation Requirements

6.1 Rehabilitation Activities

Disturbed land, as a result of the project water infrastructure network installation, being proposed as part of this action must be rehabilitated to meet desirable final acceptance criteria following the completion of construction, decommissioning and/or abandonment for any reason. The assessment of impacts to MNES protected under the EPBC Act associated with the construction, operational and maintenance identified that the Project is likely to result in residual significant impacts on the Black-throated finch (southern).

Rehabilitation of areas within 400 m of a watercourse, as per the Department of Resources (DoR) Vegetation Management Watercourse and Drainage Feature map will be revegetated with riparian and/or woodland Regional Ecosystems (i.e., RE 11.3.30 and/or RE 11.3.35) and hydromulch comprising endemic grasses to support habitat values for Black-throated finch (southern), Squatter pigeon (southern), Koala and Bare-rumped sheathtail bat. All other areas of the Project footprint will be rehabilitated using hydromulch with endemic grass species.

Rehabilitation extents including locations are displayed in Figure 6-1. This predominately includes rehabilitation of the buried water pipeline and laydown area. Acceptance criteria of rehabilitation works is as follows:

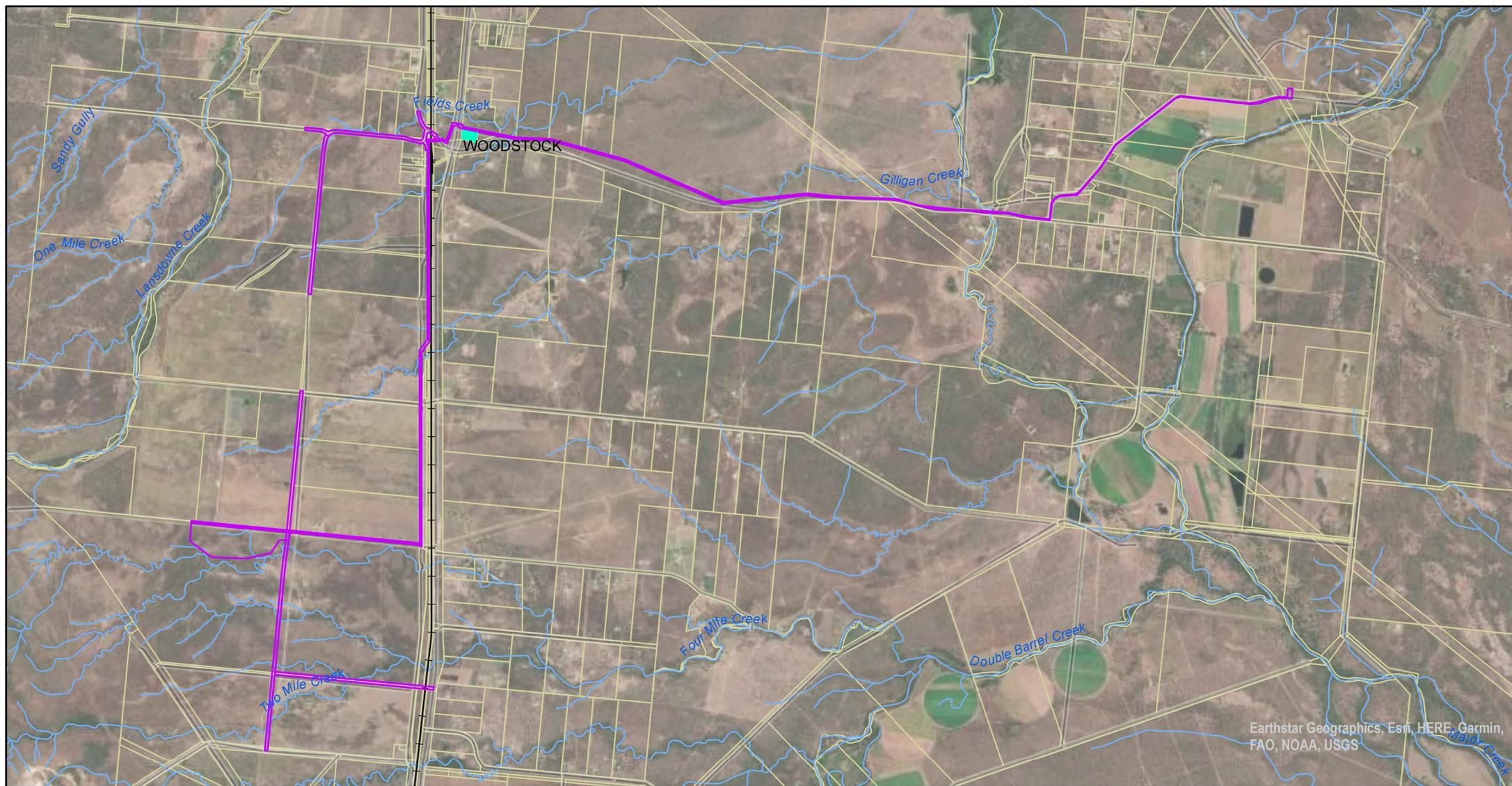
- Contaminated land (e.g., contaminated soils) must be remediated and rehabilitated;
- For land within the Project footprint:
 - Groundcover, that is not a declared pest species is established and self-sustaining; and/or
 - Vegetation of similar species richness and diversity to pre-existing sites is established and self-sustaining.
- For land disturbed and outside of the Project footprint, groundcover that is not a declared pest species is established and self-sustaining.

To ensure successiveness of rehabilitation measures of the Project, the ‘rehabilitation lifecycle’ will be implemented for the entirety of the Project’s duration. Rehabilitation measures for the Project consists of stabilisation and rehabilitation works will be completed concurrent to construction and upon completion of construction activities within the Project footprint and surrounding impacted areas. Progressive rehabilitation of clearance areas will be undertaken concurrent to Project construction to ensure safe and effective operation measures and risk minimisation of relevant environmental issues.

No further vegetation clearing or ground disturbance of rehabilitation areas are to be undertaken without a works approval (or equivalent Contractor permit to work approval). The works approval will confirm proposed works are undertaken within a pre-approved area and all environmental management requirements have been considered and are enforced, or construction teams are sufficiently resourced to implement such management measures. Works approvals will be reviewed by a suitably qualified representative familiar with the Project requirements (i.e., environmental manager or environmental representative).

Table 6-1 Assessment of Rehabilitation Activity Predicted Effectiveness

Rehabilitation Activity	Timing / Duration	Predicted Effectiveness
Hydro-mulching with endemic grasses	Progressive rehabilitation – within six weeks of the cessation of work packages.	Highly effective. Provides erosion and seed protection, dust suppression, eliminated pathogens and weed growth.
Fencing (Temporary, general stock fencing)	For the duration of the construction, rehabilitation and monitoring period.	Highly effective. Restrict livestock and vehicle movements to protect rehabilitation areas.

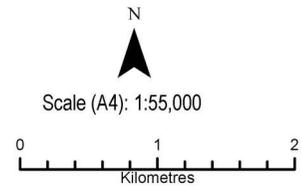


Earthstar Geographics, Esri, HERE, Garmin, FAO, NOAA, USGS

Figure 6-1 Rehabilitation Areas

Legend

- Rehabilitated as per pre-construction environment
- Grass species only
- Rail Network
- Existing Roads
- Cadastre (DCDB)
- Watercourse
- placenames



GDA 1994 MGA Zone 55



Date: 26/06/2023
 Author: EMH
 DISCLAIMER
 CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



6.1.1.1 Roads

All of the roadworks within the Project area constitute either:

- Upgrading an existing unpaved road into a new paved road to suit heavy vehicles; or
- Creation of a new paved road to suit heavy vehicles.

Therefore, rehabilitation is limited to grassing of the shoulders/verges of the remaining road corridor only (refer to Figure 6-1).

6.1.1.2 Storage Reservoir / Internal Pump Station

This work constitutes the construction of a new storage reservoir and an internal pump station structure. The nature of the storage reservoir construction is such that its external batter will have limited opportunity for revegetation, due its height/slope and the need to mitigate the risk of wall failure. The storage reservoir will also incorporate a maintenance track around the perimeter.

Given the extents of the new and permanent works, limited rehabilitation will occur and generally be restricted to grassing of remaining disturbed areas (refer to Figure 6-1).

6.1.1.3 Site Laydown Area

After construction completion, the site laydown area is to be rehabilitated to return to its pre-construction state using the appropriate vegetation (refer to Figure 6-1).

6.1.1.4 Pipeline

The pipeline has limited above ground structures (i.e., air valves, scour valves and butterfly valve pits).

Rehabilitation is to be undertaken to all disturbed areas inside the Construction Right of Way (ROW) that is a maximum 20 m wide (refer to Figure 6-1). Rehabilitation of the ROW will be undertaken using indigenous grass species. Outside the 10 m corridor across the pipeline, revegetation will be undertaken using Tubestock that is consistent with the relevant riparian or woodland Regional Ecosystems within the ROW.

Tubestock is to be allowed to mature within 3 to 4 months. As Tubestock requires water, it is the Contractor's responsibility to irrigate the Tubestock if planted during the dry season. Dry seasons will assist in establishing vegetation and be established and more resistant to wet weather and water movement. Tubestocks can include a combination of canopy trees, sub-canopy trees, shrubs, forbs and sedges.

The Contractor is to engage a suitably qualified soil scientist to assess soil amelioration requirements and to undertake topsoil and subsoil sampling and laboratory testing. Testing is required for in-situ soil that includes stockpiles and imported topsoils. All topsoil samples shall be taken as in described in Australian Standards 'Soil Organic Garden Mix' (AS 4419).

As per the contractor's remediation and rehabilitation plan, the landscaping and revegetation works shall be done in accordance with TMR specifications MRTS16 (TMR, 2017), including but not limited to:

- All site topsoil will be tested before installation;
- Hold points, witness points and milestones will be confirmed;
- A construction Soil Management Plan will be developed;
- A Seed Harvesting proposal will be submitted;
- Imported topsoil will all be sampled and tested prior to installation;
- Soil wetting and holding agents will be applied;
- Target herbicides will be used exclusively for the eradication of the target plant species;

- Broadcast seeding treatment will be applied;
- Grass seeding will be applied;
- Seeding fertilizer will be applied;
- Site manufactured mulch will be applied;
- Establishment and monitoring period directly following seeding;
- Pest, disease and weed control will be undertaken during entirety of rehabilitation and monitoring period;
- Repair and re-installation of treatments if unsuccessful;
- Monthly program and inspection will be undertaken to document successiveness of revegetation works.

6.1.2 Fencing

Fencing of the construction areas will remain in place until the end of the monitoring period to restrict livestock and vehicle movements to protect rehabilitation areas. Fencing will be temporary until the end of the monitoring period and will likely consist of general stock fencing (i.e., wire fencing and gates).

6.1.3 Revegetation

Site preparation will be undertaken prior to revegetation works, through the following steps:

- Revegetation must be undertaken by a suitably qualified and experienced contractor;
- Eradicate weeds prior to undertaking revegetation works;
 - An ESCP will be developed prior to undertaking the Project rehabilitation works to identify any appropriate weed treatments required prior to revegetation, including seasonality and materials such as geosynthetic fabrics etc.
- Soil testing must be undertaken prior to hydro-mulching activities to determine soil characteristics and imbalances that may affect vegetation growth (i.e., pH balance, microbial organisms etc.);
- Calculate required materials for rehabilitation in advance of revegetation work commencing;
- Contact nursery/seed providers to ascertain the availability of seed for use in revegetation works; and
- Nursery/seed providers must provide proof of 'local providence' for all material. A record of providence will be maintained by the contractor undertaking the work.

Subsequent to site preparation, the application of hydromulch mix is to be as follows:

- Apply hydro-mulching material to revegetation areas (100% cover on all areas to be revegetated) at the minimum application rate as per the nominated product requirements;
- Hydromulch must not be applied under the following conditions:
 - Temperatures higher than 35°C;
 - Winds exceeding 15 km/hour
 - Where surface is too wet (in discretion of superintendent); and
 - During rain periods of when rain appears imminent.

Suitable flora species (as per the ground-truthed REs) for hydromulch activities are provided in Table 6-2.

Rehabilitation of vegetation that is considered potentially suitable habitat for listed threatened species will consider suitable flora species, as described in Table 6-3. The flora species within Table 6-3 were chosen as per the species preferred foraging/breeding/dispersal habitat and are specific to the surrounding Project area region. This information was gathered from the species SPRAT profiles and conservation advices, respectively. Rehabilitation for the Project

Section 6 Rehabilitation Requirements

should be undertaken for all listed threatened fauna as per Table 6-3. White-throated needletail are known to be almost exclusively aerial and therefore, has been excluded from the table.

Table 6-2 Hydromulch mix endemic grass species

Scientific Name	Common Name	RE 11.3.35	RE 11.3.30	All other areas
<i>Alloteropsis cimicina</i>	Carpet grass	-	-	X
<i>Dichanthium sericeum</i>	Bluegrass	X	X	X
<i>Enteropogon acicularis</i>	Curly windmill grass	-	-	X
<i>Heteropogon contortus</i>	Black speargrass	X	X	X
<i>Heteropogon triticeus</i>	Giant speargrass	X	X	X
<i>Panicum decompositum</i>	Native millet	-	-	X
<i>Panicum effusum</i>	Hairy panic	-	-	X
<i>Setaria surgens</i>	Pigeon grass	X	X	X
<i>Themeda triandra</i>	Kangaroo grass	X	X	X

Table 6-3 Suitable Flora Species for Listed Threatened Fauna

Scientific Name	Common Name	Relevant Fauna Species
<i>Angophora floribunda</i>	Rough-barked apple	Black-throated finch (southern) Squatter pigeon (southern)
<i>Alloteropsis semialata</i>	Carpet grass	
<i>Casuarina cunninghamiana</i>	River sheoak	
<i>Corymbia clarksoniana</i>	Clarkson's bloodwood	
<i>Dichanthium sericeum</i>	Bluegrass	
<i>Enteropogon acicularis</i>	Curly windmill grass	
<i>Eragrostis sororia</i>	Woodland lovegrass	
<i>Eucalyptus platyphylla</i>	Poplar gum	
<i>Leptospermum flavescens</i>	yellow tea-tree	
<i>Melaleuca leucadendra</i>	Weeping paperbark	
<i>Melaleuca viridiflora</i>	Broad-leafed paperbark	
<i>Panicum decompositum</i>	Native millet	
<i>Panicum effusum</i>	Hairy panic	
<i>Themeda triandra</i>	Kangaroo grass	
<i>Urochloa mosambicensis</i>	Sabi grass	Bare-rumped sheath-tail bat
<i>Corymbia clarksoniana</i>	Clarkson's bloodwood	
<i>Corymbia tessellaris</i>	Carbeen	
<i>Eucalyptus papuana</i>	Ghost gum	
<i>Eucalyptus platyphylla</i>	Poplar gum	Koala
<i>Melaleuca leucadendra</i>	Weeping paperbark	
<i>Corymbia clarksoniana</i>	Clarkson's bloodwood	
<i>Corymbia tessellaris</i>	Carbeen	
<i>Eucalyptus crebra</i>	Narrow-leaved ironbark	

Scientific Name	Common Name	Relevant Fauna Species
<i>Eucalyptus platyphylla</i>	Poplar gum	
<i>Melaleuca leucadendra</i>	Weeping paperbark	
<i>Melaleuca fluviatilis</i>	Weeping tea-tree	
<i>Nauclea orientalis</i>	Bur tree	
<i>Dichanthium sericeum</i>	Bluegrass	Australian painted snipe
<i>Eragrostis australasica</i>	Canegrass	
<i>Melaleuca fluviatilis</i>	Weeping tea-tree	
<i>Muehlenbeckia complexa</i>	Muehlenbeckia	
<i>Phragmites australis</i>	Common Reed	
<i>Salicornia europaea</i>	Samphire	
<i>Typha spp.</i>	Cumbungi	

6.2 Rehabilitation Timing

Areas that have been temporarily cleared for the construction of the water infrastructure network and are no longer required will be progressively rehabilitated (nominally within six weeks of the cessation of works). Progressive rehabilitation refers to the continual and sequential rehabilitation of an area during the entirety of the Project lifecycle. Progressive rehabilitation of clearance areas will be undertaken as the Project is being constructed to minimise the opportunity for weed and pest establishment, erosion and soil loss, ensuring Project areas are stabilised and to enable safe and efficient operations.

6.3 Rehabilitation Monitoring

As a part of the rehabilitation monitoring, the rehabilitation success will be determined. If the monitoring program indicates that rehabilitation progress is poor, or if re-profiled areas become unstable, action would be taken to ensure rehabilitation success.

As part of the final rehabilitation plan, a monitoring program will be undertaken for a period of 12 months following rehabilitation to ensure successful establishment and health of the vegetation. This may include but is not limited to:

- Watering;
- Weed species control;
- Stock control (unlikely);
- Vehicle access restrictions;
- Soil stability – visual observations of watercourses for signs of erosion;
- Photographic monitoring points – two established photographic monitoring points per DoR Vegetation Management Watercourse, capturing north, south, east and west photo angles;
- Groundcover at DoR Vegetation Management Watercourses – quadrat surveys at each DoR Vegetation Management Watercourse, as well as an additional 10 sites where areas have been hydro-mulched to assess the following:
 - Species present and percent cover;
 - Litter percent cover;
 - Rock percent cover;

- Cryptogram percent cover; and
- Bare earth percent cover.

Upon completion of Project construction and rehabilitation monitoring, the Proponent will prepare a decommissioning and handover plan in consultation with landholders and government.

6.4 Acceptance Criteria and Corrective Actions

Acceptance criteria have been developed for each of the rehabilitation actions and are provided in Table 6-4. Assessment of monitoring results against these criteria will serve as a trigger for implementation of corrective actions, also detailed in Table 6-4.

Table 6-4 Acceptance Criteria and Corrective Actions

Element	Criteria	Compliance	Potential Corrective Actions
Remnant vegetation within 400 m of a Department of Resources (DoR) Vegetation Management Watercourse			
Landform	Final landform is stable	At completion of rehabilitation maintenance period	Installation or repair of erosion and sediment control measures where erosion or stabilisation issues are identified
Restricted Invasive Weeds	No presence of restricted invasive weeds.	At completion of rehabilitation maintenance period	Removal of restricted invasive weeds
Groundcover	Land is vegetated with ground cover exceeding 70%	At completion of rehabilitation maintenance period	Removal of restricted invasive weeds and any other species observed to be inhibiting endemic ground layer establishment; Re-application of hydromulch where bare patches persist.
Suitability	Land is suitable for purpose (i.e., supports an establishing ecosystem that will provide future habitat for Black-throated finch, Bare-rumped sheathtail bat and Koala habitat) and safe for humans and wildlife. Additionally, land is safe for humans and wildlife.	At completion of rehabilitation maintenance period	All of the above
All other areas			
Landform	Final landform is stable	At completion of rehabilitation maintenance period	Installation or repair of erosion and sediment control measures where erosion or stabilisation issues are identified
Restricted Invasive Weeds	No presence of restricted invasive weeds.	At completion of rehabilitation maintenance period	Removal of restricted invasive weeds
Groundcover	Land is vegetated with ground cover exceeding 50%	At completion of rehabilitation maintenance period	Removal of restricted invasive weeds and any other species observed to be inhibiting endemic ground layer establishment; Re-application of hydromulch where bare patches persist.
Suitability	Land is suitable for purpose (e.g., grazing pasture, bank stabilisation) and safe for humans and wildlife. Additionally, land is safe for humans and wildlife.	At completion of rehabilitation maintenance period	All of the above

6.5 Rehabilitation Works Completion

The Contractor is to notify the Superintendent immediately on completion of the works for inspection by a suitably qualified and experienced representative (e.g., environmental manager). A rehabilitation completion report with suitable records is to be provided to the superintendent within five days following the completion of the rehabilitation works.

Following completion of the revegetation maintenance period (which shall correspond to the Contract Defects Liability Period), a rehabilitation completion report demonstrating compliance of the revegetation works against the acceptance criteria shall be developed by a suitably qualified ecologist engaged by the Contractor and submitted to the Superintendent.

The completion report will be submitted by Townsville City Council to relevant Commonwealth/State government departments under conditions of approval.

Section 7 Offsets

7.1 Background

Environmental offsets are required where a residual significant impact of an action of the environment is imposed on a particular species. A significant impact assessment as per the Significant impact guidelines 1.1 (DoE, 2013) has been undertaken in Section 4.2 for all MNES species known or likely to occur within the Project area. Subsequently, a residual significant impact assessment was undertaken in Table 4-25 with avoidance, mitigation and management measures applied to assess the overall residual risk on MNES species as a result of the Project.

Environmental offsets are proposed for the following MNES species that are subject to significant residual impacts as a result of the project, including the Black-throated finch (southern).

A summary of habitat loss as a result of the Project and representing a residual significant impact are outlined in Table 7-1.

Table 7-1 Summary of habitat loss representing a significant residual impact

Species	Loss of habitat
Black-throated finch	77.8 ha

The following subsections provide information on offset requirements, off-site site options and the offset management strategy proposed for the Project.

7.2 EPBC Act Environmental Offsets Policy

The EPBC Act Environmental Offsets Policy 2012 (the policy) outlines the Australian Government's approach to the use of environmental offsets (herein referred to as offsets) under the EPBC Act. The policy comprises a range of principles to guide the development of strategies for offsetting residual impacts, as outlined in Table 7-2. Offsets provide environmental benefits to counterbalance the impacts that remain after avoidance and mitigation measures. The EPBC Act Environmental Offsets Policy has five key objectives, including:

- Ensure the efficient, effective, timely, transparent, proportionate, scientifically robust and reasonable use of offsets under the EPBC Act;
- Provide proponents, the community and other stakeholders with greater certainty and guidance on how offsets are determined and when they may be considered under the EPBC Act;
- Deliver improved environmental outcomes by consistently applying the policy;
- Outline the appropriate nature and scale of offsets and how they are determined ;and
- Provide guidance on acceptable delivery mechanisms for offsets.

The EPBC Act Environmental Offsets Policy acknowledges that avoidance and mitigation measures are the primary strategies for managing the potential impact of a proposed action. Offsets are not intended to reduce the likely impacts of the Project but are implemented to compensate any residual (after mitigation) significant impacts.

The policy applies to offsetting requirements in terrestrial and aquatic (including marine) environments and applies to projects assessed under the EPBC Act. Under the Offsets Policy, offsets act as a compensation mechanism for both direct and indirect impacts to all protected matters under the EPBC Act. Offsets under Commonwealth legislation are only required where residual impacts are considered significant as defined under the detailed significance criteria.

The policy outlines that offsets must compensate for an impact for the full duration of the impact, both indirect, direct and/or future offsets that deliver a conservation gain. However, the policy states that direct offsets must account for a minimum of 90 per cent of the offset requirements for any given impact. Conservation gain is the benefit that a direct

offset delivers to the proposed matter, maintaining and/or increasing viability or reduced threats of damage, destruction or extinction. As per the policy, conservation gain can be achieved by:

- Improving existing habitat for the protected matter (i.e., threatened species);
- Creating a new habitat for the protected matter;
- Reducing threats to the protected matter;
- Increasing the values of a heritage place; and/or
- Adverting the loss of a protected matter or its habitat that is under threat.

Table 7-2 EPBC Act Offset Principles

Item	Offsets Principle	Response
1.	Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action.	<p>Due to the extent of clearance of Black-throated finch (southern) habitat, offsets for the protection and management of the species is required. The total offset area will be determined in accordance with the EPBC Act Environmental Offsets Policy offsets assessment guide (a copy of the OMP been provided in Appendix Q).</p> <p>The protection and ongoing improvements proposed will secure an area of Black-throated finch (southern) habitat which will be confirmed as habitat for the species. The offset site will be secured by a legally binding mechanisms as discussed in more detail below.</p> <p>The offset area will be managed through the implementation of an adaptive management framework to improve the condition of habitat and vegetation communities for the Black-throated finch (southern).</p> <p>The management of the area through an appropriate mechanism is considered important for the long-term viability of the threatened species and ecological communities at this offset site.</p>
2.	Be built around direct offsets but may include other compensatory measures.	The management of habitat through ongoing protection and associated on ground measures to improve vegetation condition is a considered to be a direct offset.
3.	Be in proportion to the level of statutory protection that applies to the protected matter.	The proposed offset site is expected to be up to 342.2 ha and is in proportion to the level of statutory protection that applies to the Black-throated finch (southern) (refer to the calculation in Appendix Q), in accordance with the EPBC Act.
4.	Be of a size and scale proportionate to the residual impacts on the protected matter.	The proposed offset site (that is yet to be confirmed), will be required to protect approximately 342.2 ha for an impact of 75.84 ha of Black-throated finch (southern) habitat. A potential offset site is identified in Appendix Q.
5.	Effectively account for and manage the risks of the offset not succeeding.	<p>Risk assessments completed for the Project have been undertaken to identify key threats to Black-throated finch (southern) habitat values. The results of these risk assessments have informed the development of management objectives, performance criteria, adaptive management triggers and corrective actions included within the Preliminary Documentation. Offset management objectives, performance criteria, adaptive management triggers and corrective actions for a potential offset site are identified in Appendix Q.</p> <p>The main management approaches to successfully deliver the offset on an offset site in the same bioregion are considerate management of grazing, control of weeds and regeneration of regrowth.</p>
6.	Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs.	No specific offsets for Black-throated finch (southern) are prescribed under any State or Local Government offset prescriptions relevant to the Project.

Item	Offsets Principle	Response
7.	Be efficient, effective, timely, transparent, scientifically robust and reasonable.	An evidence-based and scientifically robust approach will be used to select an offset site. Site assessments have informed the potential Black-throated finch (southern) offset areas. The approach identified below will provide a suitable approach to providing offsets.
8.	Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	Governance will include supervision by the Proponent and auditing by a suitable qualified and independent person with formal reporting submitted to the DCCEEW where requested or conditioned.

7.3 Project Offset Requirements

7.3.1 Black-throated finch (southern)

The Project area contains suitable foraging and breeding habitat for the Black-throated finch and the species has been recorded to inhabit the Project area frequently. A qualitative risk assessment was undertaken for the Black-throated finch to determine if the Project results in residual significant impacts to the species. As per Table 4-25 it was determined that the clearing of vegetation and habitat for the Black-throated finch is expected to result in the loss of foraging and breeding habitat (31.4 ha foraging habitat and a further 46.4 ha breeding and foraging habitat). With mitigation measures applied, this significant impact is not expected to decrease, therefore, residual significant impacts are expected and environmental offsets must be considered.

7.3.2 Habitat Calculation Method

As described in Section 3.1.2.6 and pg. 13 in Appendix G, the Project has been assessed using a modified version of the Queensland 'Guide to determining terrestrial habitat quality: A toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy' version 1.3, (February 2020) and BioCondition-A Condition Assessment Framework for Terrestrial Biodiversity in Queensland Assessment Manual Queensland Herbarium Version 2.2).

Raw site data and scoring as per the Modified Habitat Quality Assessment (MHQA) were collated in an excel spreadsheet (Modified QLD Habitat Quality spreadsheet) which outputs to three main scores: Site Condition Score, Site Context Score and Species Stocking Rate (SSR) Score. The scores are combined in the ratio: Site Condition (a score out of 3), Site Context (a score out of 3) and SSR (a score out of 4) to arrive at a Final Habitat Quality score for the site out of 10.

The SSR assesses the site for the following attributes:

- Proximity of the site to known records for the species
- Species usage of the site (habitat type and evidence of use)
- An approximate density of the species on the site
- The role and importance of the species population on that site, whether it be in breeding, population dispersal, maintaining genetic diversity or supporting a population at the limit of its species range.

The Site Condition score and Site Context score combined are equivalent to the output of the unmodified 'Guide to determining terrestrial habitat quality: A toolkit for assessing land-based offsets under the Queensland Environmental Offsets Policy' Version 1.3. The addition of the SSR score completes the MHQA score.

The final habitat quality scores (MHQA) for the relevant species are as follows:

- Black-throated finch (Table 7-3):
 - Non-remnant vegetation: 6.64 out of 10
 - Remnant vegetation: 6.96 out of 10

Table 7-3 Final Habitat Quality Impact Site – Black-throated finch

Final Habitat Quality Score (Weighted)	Non-Remnant Vegetation			Remnant Vegetation					
	AU2	AU4	Average / Final	AU1	AU3	AU5	AU6	AU7	Average / Final
Site condition score (out of 3)	1.51	0.65	1.08	1.37	1.19	1.90	1.66	2.12	1.65
Site context score (out of 3)	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41
Species stocking rate (out of 4)	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14
MHQA - Habitat quality score (out of 10)	7.06	6.20	6.63	6.92	6.74	7.45	7.21	7.67	7.20
Assessment unit area (ha) in disturbance footprint	40.1	6.3	46.4	25.1	3.3	0.3	0.9	1.9	31.4
Total impact area (ha) for this MNES	46.4	46.4	46.4	31.4	31.4	31.4	31.4	31.4	31.4
Size weighting	0.86	0.14	1.0	0.80	0.10	0.01	0.03	0.06	1.0
Weighted habitat quality score	5.80	0.84	6.64	5.53	0.70	0.06	0.21	0.46	6.96
Overall site size weighting	40.07	6.30		25.11	3.26	0.26	0.91	1.87	
Sitewide Weighted Habitat Quality Score	0.515	0.081		0.323	0.042	0.003	0.012	0.024	
Total Site BTF Habitat Score	Average/final - 6.77								

7.3.3 Required Offsets

The Preliminary Documentation identifies a 'significant residual impact', and therefore a necessary offset to Black-throated finch (southern) which are known to occur in the Project area. The species was identified during site surveys conducted by Evolve in 2022 and/or 2023.

7.3.4 Estimate of Required Offset Area

As per section 7.4 a potential offset site is currently being considered for the Black-throated finch (southern). The potential site is located approximately 14 km north of the Project area and is 762 hectares in size. Habitat values for the required species will be confirmed as investigations into the offset site continue.

The proposed offset site consists of a combination of freehold (16), state owned (6), road reserve (1) and rail corridor (1). Two major corridors along the eastern boundary of the offset site survey area include the Mount Isa Railway Line and Flinders Highway. An additional easement runs north to south across the eastern aspect, covering land facilitating a state owned pipeline connection. Any offsets required will only be utilised within the freehold land parcels. This freehold land is owned by Townsville City Council, and currently managed by its Department for Water Supply and Dams.

Appendix Q provides a detailed description and survey methodology for the potential offset site proposed. The document provides information regarding the selection process of the offset site, ecological survey methodology and results, a summary of the proposed environmental offset and any avoidance, mitigation and management measures.

Table 7-4 Impact Calculation Values

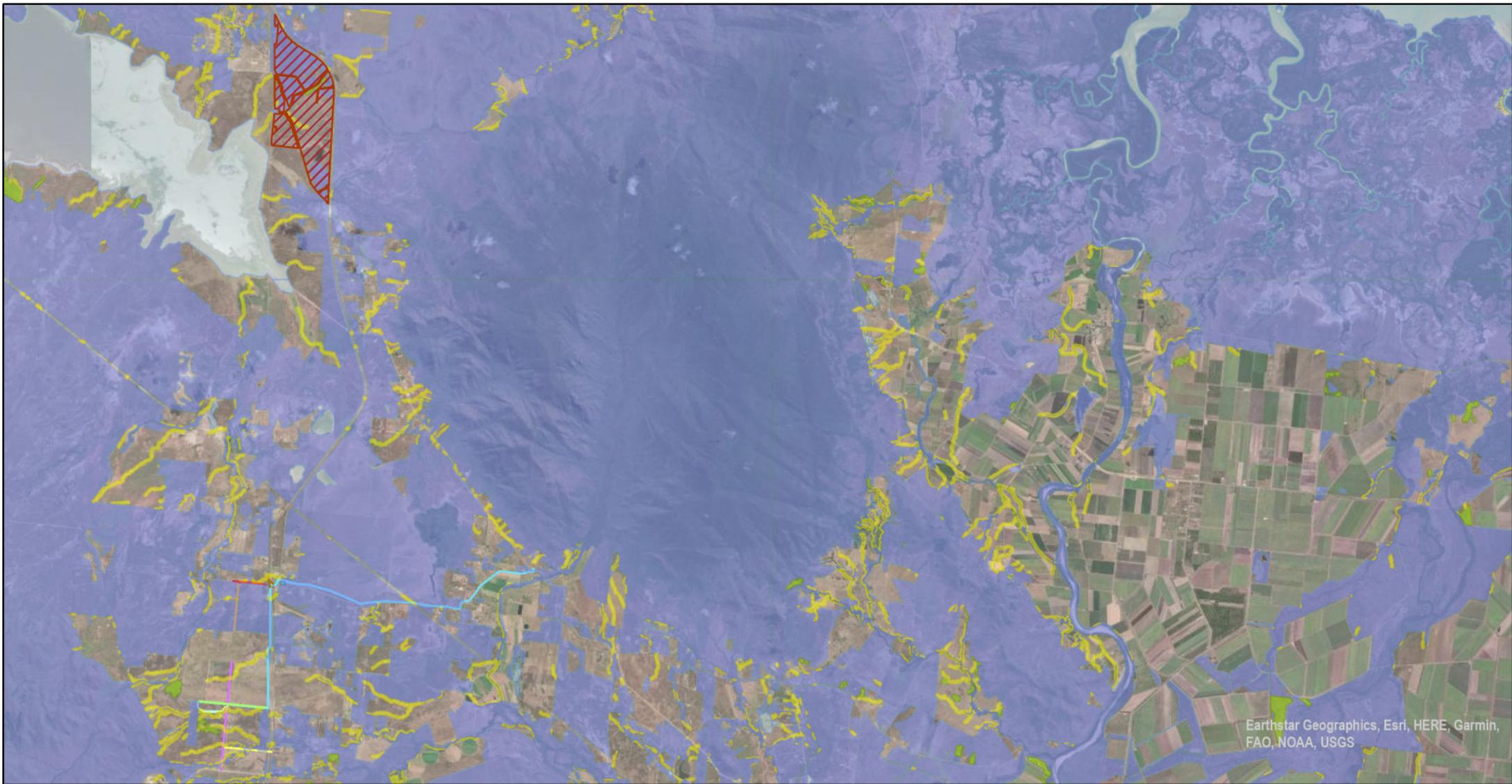
Condition	Black-throated finch
	Value
Area of habitat to be cleared	77.8 ha
Quality of area to be cleared	6.77

7.4 Offset Site Options

The Proponent is exploring offset site options suitable for hosting an offset site. A potential offset site is identified below (Table 7-5) and shown on Figure 7-1.

Table 7-5 Potential Offset Site Options

Size (ha)	RE Values	Comment	Records Black-throated finch (southern)	Connectivity
762	RE 11.3.31 RE 11.3.35 RE 11.3.35a RE 11.12.9 RE 11.3.25b	<p>Positives: wetland values on site, multiple watercourses intersect the site (e.g., Antill Plains Creek and Stonehouse Creek), located in close proximity to major wetland (Lake Ross)</p> <p>Negatives: Site is intersected by numerous dirt tracks and situated directly adjacent to a major railway (Mt Isa Line)</p>	40 records of the Black-throated finch within 10 km radius.	This site is partially located in a state-wide terrestrial biodiversity corridor buffer and a regional terrestrial Biodiversity corridor buffer



Earthstar Geographics, Esri, HERE, Garmin, FAO, NOAA, USGS

Figure 7-1 Potential Offset Site

Legend

Potential Offset Areas

 Potential Offset Areas

Regulated Vegetation Management (RVM)

 Category B - Remnant vegetation

 Category C - High value regrowth

 Category R - Reef regrowth watercourse vegetation

 Water

 Jones Road Intersection Upgrade

 Jones Road to Flinders Highway Upgrade

 No Name Road (north)

 No Name Road (south)

 Bidwilli Road

 Unnamed Road

 Water Infrastructure Network

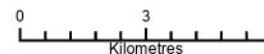
 Storage Dam and Internal Pump Station

 Site Laydown Area

N



Scale (A4): 1:180,000



GDA 1994 MGA Zone 55

CDM Smith
listen. think. deliver.

Date: 7/03/2023
Author: EMH

DISCLAIMER
CDM Smith has endeavoured to ensure accuracy and completeness of the data. CDM Smith assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.



Townsville



Burdekin

7.5 Offset Site Habitat Quality Assessment

Habitat quality assessments are to be undertaken for the proposed offset site(s) and are described in **Appendix Q**. The methods for habitat assessments are further described below.

7.5.1 Desktop Assessment

Prior to undertaking field surveys of the offset site(s), a desktop assessment was undertaken to identify ecosystems and listed threatened species present within the offset area(s) and the surrounding landscape. The desktop assessment will include a review of publicly available mapping material, such as:

- Identification of state mapped REs and Regulated Vegetation Management mapping (version 4.12) to identify areas of assessable and non- assessable vegetation;
- Review QImagery historical aerial photo series to verify clearing areas and whether they accorded with currently mapped HVR areas and currently mapped remnant vegetation; and
- Data collected as part of any nearby site surveys.

7.5.2 Field Survey

Following desktop assessments, field surveys using the methodology described in Appendix Q, were undertaken at the offset site(s) to identify and confirm REs and correct if required, as well as collect data, conduct target searches of the relevant species and potential habitat for threatened fauna.

Vegetation communities within the potential offset site will be assigned assessment units. A BioCondition and fauna habitat survey will be conducted at designated locations within the potential offset site.

7.5.3 Reporting and Scoring

The “*Guide to Determining Terrestrial Habitat Quality Version 1.3*” (DES, 2020) will be used to form the basis of the methodology and reporting species habitat.

Three key indicators for determining habitat quality within the offset site to be reported include:

- Site condition: a general condition assessment of vegetation compared to a benchmark (the results of the BioCondition survey);
- Site context: an analysis of the site in relation to the surrounding environment; and
- Species habitat index: the ability of the site to support a species.

The MHQA spreadsheet will be used to output three main habitat quality scores, including: Site Condition Score, Site Context Score and Species Stocking Rate (SSR) Scores. A ratio will be produced using each of the scores to arrive at a final habitat quality score for the offset site out of 10. This final habitat quality score for the offset should be at a quality of 5 (at a minimum) to achieve the ‘start quality’ assigned in the offset calculator.

7.5.4 Offset Site Habitat Quality Results

The offset site habitat quality results are included in Appendix Q. Three offset management zones (OMZs) were established to coordinate management of the offset site. The OMZ habitat quality results is provided in Table 7-6 (refer to Appendix Q for further details).

Table 7-6 Overview of Offset Management Zone

Mechanism	OMZ-1	OMZ-2	OMZ-3
OMZ Area	205.2	72	95
Weighted Habitat Quality Score	6.81	6.90	6.82

7.6 Offset Management Strategy

7.6.1 Offset Management Plan

An Offset Management Plan (OMP) has been prepared for the offset site (see Appendix Q) and will be submitted to DCCEE for written approval. Within this, offsets are being designed to meet the requirements of the EPBC Act Offsets Policy and the OMP will outline how offsets are consistent with the policy. The OMP addresses the performance and completion criteria for the offsets, applicable management measures and include monitoring and reporting program. The OMP ensures the proposed offsets are designed in ways that are efficient, effective, timely, transparent, scientifically robust and reasonable.

Specific details included in the OMP include:

- A figure presenting the offset areas;
- A detailed description of offset areas including details on field surveys and baseline habitat conditions for the relevant species;
- Descriptions of all management measures to be implemented to protect relevant species and species habitat, with reference to species approved conservation advice;
- Performance and completion criteria for the management of the offset area; and
- A monitoring program to ensure effectiveness of measures is maintained.

Management actions are developed based on detailed site surveys and in accordance with the key threats and recommended priority actions for the Black-throated finch, as listed in conservation advices.

The OMP incorporates management actions addressing the relevant identified threats, including:

- Incorporating areas of species habitat and if possible, riparian habitats of any potential offset site;
- Mitigate risk of vehicle strike;
- Manage any emerging threats;
- Minimising loss and fragmentation of habitat by reduction of stock (i.e., cattle);
- Control of invasive flora species; and
- Control of feral pest animals and predation of dogs.

The DCCEE Species Profile and Threats database (SPRAT) identifies the following management documents as relevant to consider in relation to:

- Black-throated finch:
 - The National Recovery Plan of the Black-throated finch (southern) subspecies (Black-throated Finch Recovery Team, Department of Environment and Climate Change (New South Wales (NSW)) and Queensland Parks and Wildlife Service, 2007);
 - Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses (DSEWPC, 2012); and

- Threat abatement plan for competition and land degradation by rabbits (DotEE, 2016).

7.6.2 Mechanism to Legally Secure Offsets

Legal mechanisms within all Australian states and territories enable the protection of the land that has been set aside for environmental use on either a permanent or long-term basis. The mechanism for legally securing the offset property will be confirmed during offset site investigations, but will include mechanisms such as:

- Voluntary declaration under the VM Act;
- Nature refuge under the NC Act; and
- Statutory covenant under the Land Title Act 1994 or the Land Act 1994.

A summary of each of the above mechanisms is provided in Table 7-7; however, it is expected a voluntary declaration will be the mechanism used.

Table 7-7 Legally Binding Mechanisms to Secure Offset Areas

Mechanism	Summary
Voluntary Declaration	
<p><i>Vegetation Management Act 1999</i> (Qld) Division 4, Subdivision 2 - Declarations by the Chief Executive, sections 19E to 19L</p>	<ul style="list-style-type: none"> ▪ Voluntary mechanism for protecting areas of native vegetation on land of high conservation value. ▪ Registered on property title so its associated restrictions and obligations are binding on any subsequent landowner. ▪ Requires implementation of an approved management plan [i.e., offset area management plan; s.19E(2)-(4)]. ▪ Remains in place until the objectives of that plan are achieved, the declaration ends (s.19J and 19L), or in some cases, permanently. ▪ Offset area is mapped on a PMAV and given at least the same level of protection as a remnant endangered REs under the VM Act. ▪ Simple application process and less costly than other forms of protection such as a statutory covenant. ▪ Enforcement is more certain than a statutory covenant. ▪ Some activities can be exempt from the protection. ▪ Can be removed by the Chief Executive if it is found to be not in the interests of the State, having regard to the public interest. ▪ Option for clearing of category C under the Code. ▪ Timeframe: 3 to 12 months.
Nature Refuge	
<p>Nature Conservation Act 1992 (Qld) Part 4, Division 4</p>	<ul style="list-style-type: none"> ▪ Voluntary nature refuge agreement between a landholder and the Government that acknowledges a commitment to manage and preserve land with significant conservation values while allowing compatible and sustainable land uses to continue. ▪ High level, long-term protection. <p>Nature Refuges are managed to:</p> <ul style="list-style-type: none"> ▪ Conserve the area’s significant cultural and natural resources; ▪ Provide for controlled use of the area’s cultural and natural resources; and ▪ Provide for the interests of landholders to be considered. ▪ Can allow for the continuation of other land uses including grazing, forestry and mining. ▪ Some landholders may not wish to enter such a long-term agreement. ▪ The Queensland Government no longer directly handles the establishment of privately-owned nature refuges. The Queensland Trust for Nature has been appointed by the Queensland

Mechanism	Summary
Statutory Covenant	
<p>Freehold land - Land Title Act 1994 (Qld), Part 6 Div. 4A</p> <p>Non-freehold land – Land Act 1994 (Qld), Chapter 6 Part 4 Div. 8A</p>	<ul style="list-style-type: none"> ▪ Voluntary written agreement between two or more parties that restricts or requires certain activities be carried out upon the land. ▪ Registered on the land title, so the obligations they impose also bind any subsequent purchaser of the land. ▪ For statutory covenants related to environmental offsets, the parties are typically: <ul style="list-style-type: none"> ▪ The State of Queensland or another entity representing the State or a local government (covenantee) who ensures that the conditions of the statutory covenant are observed, and ▪ The landowner (covenantor) who is subject to the obligations outlined by the covenant which, for an offset, includes complying with restrictions outlined in the offset area management plan. ▪ To be capable of registration under Queensland legislation a statutory covenant must: <ul style="list-style-type: none"> – Relate to the use of a lot or part of a lot; or a proposed or existing building on the lot; or – Be aimed directly at preserving a native animal or plant; or a natural or physical feature of cultural or scientific significance; or – Ensure that the subject lots are transferred to single ownership only. ▪ A plan of survey is required if covenant affects part of the lot. ▪ Can be expensive due to survey costs as per the Registrar of Titles Directions for the preparation of Plans. May not be suitable for land with multiple owners. ▪ Can be terminated or amended by agreement of the Government covenantee. <p>Timeframe: 6 to 12 months.</p>

Section 8 Ecologically Sustainable Development

The Project has been considered against the core objectives and guiding principles of Ecologically Sustainable Development (ESD) as outlined in the National Strategy for Ecologically Sustainable Development (NSESD) (ESD Steering Committee, 1992). ESD as defined in the NSESD is *‘development which meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations.’* The NSESD was adopted by all levels of Australian Government in 1992 and provides broad strategic directions and framework for governments to direct policy and decision- making.

The core objectives of the NSESD are to:

- Enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- Provide for equity within and between generations; and
- Protect biodiversity and maintain essential ecological processes and life-support systems
- The following principles are principles of ecologically sustainable development:
 - Decision making processes should effectively integrate both long term and short term economic, environmental, social and equitable considerations;
 - If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
 - The principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;
 - The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making; and
 - Improved valuation, pricing and incentive mechanisms should be promoted.

Table 8-1 Core Objectives and Guiding Principles of ESD Addressed

Objective / Principle	Address
Objectives	
To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations	The Proponent is committed to enhancing the well-being and welfare of the local community within which the Project will be constructed and operated through providing employment opportunities to members of the community, including supplier opportunities and flow-on benefits for local businesses and the wider region where possible.

Section 8 Ecologically Sustainable Development

Objective / Principle	Address
<p>To provide for equity within and between generations</p>	<p>The Project will facilitate and enable development within the Townsville region, benefitting regional, state and national economies. The Project is for a proposed +50 years, including construction and operational phases.</p> <p>The LEIP is expected to generate 14,000 jobs, of which 7,381 during construction and 6,628 during operational phases of the Project (TCC, 2022). The LEIP will provide upskilling and reskilling opportunities in emerging communities for all generations (TCC, 2022).</p> <p>Stakeholder consultation with Indigenous peoples has been undertaken to engage and maintain a constructive relationship where a Cultural Heritage Management Agreement (CHMA) pursuant to Section 23 of the ACHA has been agreed on and executed. The CHMA covers the entire LEIP project area and is intended to guide and manage the undertaking of project development activities for the LEIP Project.</p> <p>A rehabilitation framework will be developed and finalised to ensure no legacy economic cost or environmental impacts are left for future generations (see Section 6).</p>
<p>To protect biodiversity and maintain essential ecological processes and life-support systems</p>	<p>Biodiversity conservation has been considered during the development of the Project. Significant species and ecosystems have been assessed and, where possible, avoided or the impacts mitigated.</p>
<p>Principles</p>	
<p>Decision-making processes should effectively integrate both long and short term economic, environmental, social and equity considerations</p>	<p>The Proponent has considered economic, environmental, social and equity issues for both the short and long term of the Project. Environmental impacts are expected during construction phases of the Project, however, will be mitigated and rehabilitated effectively to minimise overall impact. The economic impacts on the local, regional and Queensland are positive, positioning Townsville for advanced manufacturing and processing, technology and emerging industries.</p> <p>Further, consultation has been undertaken through the development planning of the Project, refer to Section 9.2 and Section 9.3.</p>
<p>Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (the Precautionary Principle)</p>	<p>The Project design, site selections and investigative works (desktop and field studies) have been undertaken to limit the risk of serious or irreversible environmental damage. Numerous ecological assessments have been undertaken to assess the potential impacts, avoidance and management measures as a result of the Project.</p> <p>The MNES assessment has taken a conservative (precautionary) approach to establishing potential impact areas, MNES occurrence and potential MNES habitat quantification.</p>
<p>The global dimension of environmental impacts of actions and policies should be recognised and considered</p>	<p>The Project is not expected to have a global environmental impact.</p>
<p>The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised</p>	<p>The Project is economically significant at a local, regional and state level. The LEIP is expected to generate and use various sources of affordable and reliable clean energy, such as solar, hydrogen and gas (TCC, 2022). Businesses within the LEIP will be encouraged to pool resources and exchange materials, water, energy and waste to promote reuse and recycling opportunities and in turn potentially reducing costs (TCC, 2022).</p>
<p>The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised</p>	<p>A significant proportion of the Proponent's investment into the Project will flow directly into the local and regional economy from the goods and services required.</p> <p>The Project is a key component ensuring renewable energy can be obtained in an economically competitive manner. As identified any impacts, should there be any, will be negligible and intermittent.</p>

Section 8 Ecologically Sustainable Development

Objective / Principle	Address
<p>Cost-effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentives mechanisms</p>	<p>The Proponent supports all levels of Government in the use of cost-effective and flexible policy instruments that oversee valuation, pricing and incentives.</p> <p>TCC acknowledges the need for improved valuation, pricing and incentive mechanisms and endeavours to pursue these principles when appropriate. For example, environmental factors have greatly determined the location of the final footprint, with the project having a strong focus on reducing its direct and indirect clearing footprint.</p> <p>Impacts on flora, vegetation and terrestrial fauna have been assessed and mitigation and management measures proposed. TCC accepts that the cost of the Proposed Action must include environmental impact mitigation, management and maintenance activities. These requirements will be incorporated into the overall Proposed Action costs.</p> <p>Any contractor working on the project will be required to have sound cost effective policies that reflect TCC policies and evidence of implementation will be used as a preselection criteria, where practical.</p>
<p>Decisions and actions should provide for broad community involvement on issues which affect them</p>	<p>As part of the Project, the Project's EPBC Act referral and this Preliminary Documentation Report must be made publicly available. As part of this, the Proponent is required to consider submissions on the Preliminary Documentation and advise DCCEEW of any changes or additions needed to take account of comments and provide a summary of the comments received and how those comments have been addressed.</p>

Section 9 Economic and Social Matters

9.1 Economic and Social Costs and Benefits

The Lansdown Eco-Industrial Precinct aspires to be northern Australia's foremost eco-industrial precinct for advanced manufacturing, processing, technology and emerging industries.

The LEIP is projected to deliver a local jobs boom, supporting more than 5,000 during construction and an estimated 1,600 direct and 9,100 indirect jobs once fully developed (Queensland Government, 2023). Specific workforce numbers related to the Project are provided in Section 2.5.

The LEIP has already attracted substantial private sector interest with more than half of the site committed or conditionally committed to advanced battery manufacturing, clean energy and battery minerals processing industries. This includes Queensland Pacific Metals, which has chosen the LEIP as the future home of its Townsville Energy Chemicals Hub project, producing critical materials for use in new-technology batteries.

Activation of the LEIP will result in significant economic and social benefits to the local, regional and Queensland economy, with benefits including:

- Securing long-term jobs, supplier opportunities and flow-on benefits for local businesses;
- Helping to position Townsville as a leader in advanced manufacturing and as a hydrogen and renewable energy hub;
- Developing products, processes and technologies that contribute to a sustainable society;
- Offer exciting new jobs, careers, upskilling and reskilling opportunities in emerging industries;
- Increase the volume and diversity of products exported from Townsville each year, with expanded Townsville Port and Airport throughput;
- Partner with organisations such as Townsville's world-class tertiary education and research facilities at James Cook University, Townsville University Hospital, TropiQ, Smart Precinct NQ, NQ Spart and NQ ICT Centre of Excellence; and
- Provision of a community multi-purpose venue with a dedicated zone for driver education, motorsport recreation and large-scale community events.

The LEIP will boost the Townsville and North Queensland economy and job market and stimulate future-focussed industries while protecting the natural environment.

On a vacant 2,200 ha site, 40 km south of Townsville, the LEIP is ideally located adjacent the Flinders Highway and Mt Isa rail line, with convenient access to rail, road, port, airport, water, power, natural gas and all the advantages of the City of Townsville, including a proud and strong local economy, consistent population growth, affordable housing, skilled and specialist labour forces, world-class tertiary education and research facilities, tertiary hospital and health services and a broad range of public and private schooling options.

The LEIP's sustainability framework aligns with the United Nations Industrial Development Organisation (UNIDO) international framework for eco-industrial parks.

The LEIP is forecast to increase gross state product by \$815 million per annum, with a \$570 million per annum increase locally.

In recognition of the Project's economic and social significance, on 7 March 2023 the LEIP was declared a 'prescribed project' under section 76E of the *State Development and Public Works Organisation Act 1971* by the Queensland State Government.

9.2 Public Stakeholder Consultation

The 'Lansdown Opportunities Assessment Masterplan and Infrastructure Strategy – June 2017' report by Ranbury, produced on behalf of the Department of State Development, concluded that there was a critical shortage of zoned and available land for high impact industries and that the Lansdown site was generally suitable for industrial uses. During this study, stakeholder consultation occurred with a number of parties including various authority bodies, project proponents and surrounding landowners, such as:

- Department of State Development;
- Coordinator General's Office;
- Townsville City Council;
- Queensland Rail;
- Department of Transport and Main Roads;
- Ergon Energy;
- Department of Environment and Heritage Protection;
- Wellard – live cattle export project proponent;
- Adelaide Brighton (existing quarry operators);
- Gas authority;
- Civil Aviation Safety Authority;
- Department of Agriculture and Fisheries;
- Townsville Enterprise Limited;
- Trade and Invest Queensland; and
- Regional Development Australia.

The outcome of this study was the approval by Townsville City Council in July 2017 for commencement of rezoning of the land for industrial purposes via a planning scheme major amendment, with associated formal community consultation. The proposed Lansdown major amendment was undertaken via a section 18 amendment process as per the requirements outlined in the Planning Act 2016 and the Minister's Guidelines and Rules (July 2017).

Public consultation on the proposed major amendment was undertaken from 4 November 2019 to 20 December 2019 (having been extended from an initial 20 business days, at the request of the public, to 35 business days. Information sessions were also held at Woodstock, enabling Woodstock residents to be consulted.

With reference to the 'Public Consultation Submissions Review Report, Townsville City Plan Proposed Major Amendment – Lansdown Station – January 2020' produced by Townsville City Council, with 269 submissions received (from 207 individual submitters). All issues raised were summarised, assessed and responses prepared with some changes proposed to the major amendment. The Public Consultation Submission Review Report and the amended Townsville City Plan Lansdown Station Major Amendment were submitted to council for consideration in January 2020. Following approval from Townsville City Council, the Public Consultation Submissions Review Report and the proposed changes to the Townsville City Plan Lansdown Station Major Amendment were published on the council website, with submitters notified of this.

After careful consideration of the issues raised in the respective submissions regarding the proposed major amendment, Council made a number of changes to the proposed major amendment, including; additional noise criteria standards, rural zoning of land located in the Dam catchment overlay, and landscaping buffer requirements.

On 28 January 2020 Council then resolved to write to the Minister and request that the Minister consider allowing Council to adopt the proposed planning scheme amendment, with changes.

The proposed Lansdown major amendment was submitted to the Minister for State Development, Manufacturing, Infrastructure and Planning for consideration on 7 February 2020.

On 8 April 2020 council received correspondence from the Minister advising that Council may adopt the proposed amendment, subject to conditions and advice including recommending that Council prepare a baseline hydrogeological survey, including sampling of water from bores in reasonable proximity to the Lansdown High Impact Industry Precinct.

Council resolved to adopt the proposed major amendment, with changes in accordance with the Minister's conditions on 30 April 2020.

The Townsville City Council website provides regular updates on the status of the LEIP on the council website.

9.3 Indigenous Stakeholder Consultation

The department considers that best practice consultation, in accordance with the Guidance for proponents on best practice Indigenous engagement for environmental assessments under the EPBC Act (2016) includes:

- Identifying and acknowledging all relevant affected Indigenous peoples and communities;
- Committing to early engagement;
- Building trust through early and ongoing communication for the duration of the project, including approvals, implementation and future management;
- Setting appropriate timeframes for consultation; and
- Demonstrating cultural awareness.

As of 18 November 2016, the Bindal People #2 have held a Registered Native Title Claim over lands in the greater Townsville to Ayr region, extending south from the mid-point of the Ross River (Townsville) to the northern bank of the Burdekin River (Ayr) (Bird, 2022). The LEIP project area is located within the external boundary of the Bindal People #2 Registered Native Title Determination Application (QC2016/005 and QUD503/2016). Under the provisions of the *Aboriginal Cultural Heritage Act 2003* (ACHA), the relevant 'Aboriginal Party' for the LEIP Project is the Bindal People #2 (Bird, 2022).

Consultation between the Bindal People #2 Native Title Applicants and Townsville City Council for the LEIP Project commenced during late July 2021 and communications have been ongoing over an extended period to August 2022. An inclusive and transparent consultation process with all Bindal Applicants was instigated and maintained from 30 July 2021 and throughout the duration of the cultural heritage investigations. The consultation between the parties resulted in the agreement and execution of a Cultural Heritage Management Agreement (CHMA) pursuant to Section 23 of the ACHA. The CHMA was agreed and executed by the parties on 14 November 2021. It is noted that the CHMA covers the entire LEIP project area (that is, the expected ultimate infrastructure layout and not just Stage 1 of the project). The CHMA is intended to guide and manage the undertaking of project development activities for the LEIP Project. The Cultural Heritage Duty of Care provisions established under the ACHA are met by the implementation of the terms of this agreement. The cultural heritage survey and assessment process undertaken for Stage 1 of the Project (as documented in this cultural heritage report) was carried out under the terms and provisions of the Project CHMA.

Over the course of this cultural heritage investigation, the Project Archaeologist has maintained consultation with the nine Bindal Native Title Applicants.

Following is a summary of communications and extended consultation undertaken:

- 30 July 2021 – At the request of Council, the Project Archaeologist commenced a consultation process with the Bindal Aboriginal Party to provide advance notice of the LEIP Project. The initial advance notice of the project

was provided at a face-to-face meeting between the Bindal Applicants and the Project Archaeologist in Townsville.

- August to September 2021 – Detailed consultation was undertaken, mainly via email correspondence and telephone discussions, to agree upon a meeting date and to plan and arrange the start-up meeting.
- 16 October 2021 – LEIP Project Meeting #1. This meeting was held in Townsville at the Townsville Stadium (Murray Sports Complex). All nine (9) Bindal Applicants, the Project Archaeologist and two Townsville City Council representatives attended the meeting (Oriel Webster and Ryan Coppola).
- Mid-October to Mid-November 2021 – There was ongoing consultation between the parties follow up action items from Project Meeting #1 and to prepare and plan for Project Meeting #2.
- 8 November 2021 – Townsville City Council issued a Draft CHMA to the Bindal Aboriginal Party for the LEIP Project, in advance of and in preparation for Project Meeting #2.
- 13 and 14 November 2021 – LEIP Project Meeting #2. This meeting was held at the Townsville Stadium (Murray Sports Complex). All nine (9) Bindal Applicants, the Project Archaeologist and two Townsville City Council representatives attended the meeting (Oriel Webster and Ryan Coppola).
- February to March 2022 – Consultation took place between the parties to reschedule and plan the cultural field survey and assessment process for the LEIP Project.
- 24 March 2022 – Under the provisions of the LEIP Project CHMA (Clause 3.2.8), Townsville City Council issued a Work Notice to the Bindal Aboriginal Party requesting that the Cultural Heritage Investigation of designated Stage 1 core infrastructure development areas be conducted between 4 to 10 April 2022.
- Late March and early April 2022 – Detailed consultation with the parties relative to the fieldwork program.
- 4 to 10 April 2022 – During field work there were daily discussions with the Bindal Aboriginal Party to record oral history, identify known cultural sites, places, or values, and develop appropriate management and mitigation strategies for Stage 1 of the LEIP Project and the designated project impact and work areas.
- 13 April 2022 – The Bindal Aboriginal Party were provided a set of detailed Draft Cultural Heritage Management Recommendations for the LEIP Project (Stage 1) for review and comment.
- 1 June 2022 to 8 August 2022 – Consultation with the Bindal Aboriginal Party to discuss the designated Cultural Monitoring Areas for the LEIP Project.

Section 10 Environmental Record of the Person Proposing to take the Action

Section 10 Environmental Record of the Person Proposing to take the Action

The Proponent for the LEIP Project is TCC. Proponent details are provided in Table 10-1 below. The TCC has a satisfactory record of responsible environmental management.

Table 10-1 Proponent Details

Item	Proponent Details
Organisation name (as registered for ABN/CAN)	Townsville City Council
ABN	44741992072
Business address	103 Walker Street, Townsville, QLD 4810
Postal address	PO Box 1268, Townsville, QLD 4810
Primary contact	Danny Lynch
Job title	Program Director – Major Projects, Infrastructure and Operations

Section 11 Conclusion

The TCC is proposing to construct and maintain the Project, which is early enabling infrastructure works to service the LEIP and involves road access at the northern and southern section of the site and a raw water network (including external pipeline, storage dam, internal pump station and internal pipeline) to service the initial proponents.

A desktop assessment and field assessments have been undertaken to establish the existing ecological values of the Project site and determine the level of likely impact upon them from the Project. Various extensive ecological surveys have been completed across the Project area in 2022 and 2023. Five ecological surveys have been conducted by Evolve Environmental Solutions Pty Ltd across the Project area and surrounds.

No EPBC Act listed flora species, or threatened ecological communities were observed within the Project footprint itself during the field assessments. Evidence of EPBC Act listed fauna species was identified, including:

- Black-throated finch (southern);
- Squatter pigeon (southern); and
- Bare-rumped sheath-tail bat.

The White-throated needletail and Australian painted snipe was also determined likely to occur based on close proximity of records for these species. The presence of EPBC Act listed migratory species were also recorded. The presence of EPBC Act listed migratory species were also recorded.

It was determined that the Project has the potential to result in residual significant impacts to the Black-throated finch (southern). The clearing of vegetation and habitat for the Black-throated finch (southern) is expected to result in the loss of habitat. With the mitigation measures proposed, the Project is likely to result in a significant residual impact and as such, environmental offsets are required.

A selection process has been undertaken to identify an offset site that will be suitable to counterbalance the loss of habitat and ecosystem services at the impact site. An Offset Management Plan has been prepared that to help demonstrate that the offset site is of an appropriate size and condition (calculated to offset > 105% of the Significant Residual Impact), while outlining performance goals and management actions to achieve the desired conservation outcome.

The design and mitigation measures proposed will minimise additional indirect impacts to terrestrial fauna and flora communities within and surrounding the Project area from construction and operational activities. These measures include minimising fauna interactions and weed spread during construction, and rehabilitation, all to be incorporated within the Construction Environmental Management Plan, Weed and Pest Management Plan and the Matters of National Environmental Significance Environmental Management Plan. With control measures in place indirect impacts to fauna and flora additional to those previously described are not expected to be significant.

An assessment of the socio-economic impacts of the Project indicates there will be positive impact on the regional economy due to the economic stimulus provided by the Project's construction, operation and future development and industry uses. This will also result in positive impacts to the regional supply chain and employment opportunities. Adverse impacts from the Project are minor and generally related to a loss of ecosystem services from clearing of remnant vegetation.

Section 12 References

- Bennett, V. 2017. *Effects of Road Density and Pattern on the Conservation of Species and Biodiversity*. Current Landscape Ecology Reports 2, pp 1-11.
- Black-throated Finch Recovery Team, Department of Environment and Climate Change (NSW) and Queensland Parks and Wildlife Service. 2007. *National recovery plan for the black-throated finch southern subspecies Poephila cincta cincta*. Report to the Department of the Environment and Water Resources, Canberra. Department of Environment and Climate Change (NSW), Hurstville and Queensland Parks and Wildlife Service, Brisbane. In effect under the EPBC Act from 08-Jan-2008. <http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-black-throated-finch-southern-subspecies-poephila-cincta-cincta>
- Bird. 2022. *Cultural Heritage Survey and Impact Assessment Report*. Townsville: North QLD Cultural Heritage Pty Ltd.
- Blakers, M., Davies, S. & Reilly, P. 1984. *The Atlas of Australian Birds*. Carlton: Melbourne University Press.
- Bullen, R.D. 2021. *A review of ghost bat ecology, threats and survey requirements*. Prepared for the Department of Agriculture, Water and Environment. Bat Call WA. Available at: <https://www.dcceew.gov.au/environment/epbc/publications/review-ghost-bat> Available at: <https://www.dcceew.gov.au/environment/epbc/publications/review-ghost-bat>
- Calibre Professional Services Pty Ltd. 2022. TCW00425 – Lansdown Eco-Industrial Precinct – Infrastructure Master Plan, February 2022, Prepared for Townsville City Council.
- Churchill, S. 2008. *Australian Bats*. 2nd ed. Crows Nest, NSW: Allen & Unwin.
- Coles, R., Richards, G., Hall, L. & Clague, C. 1999. 'Bare-rumped Sheathtail Bat'. In The Action Plan for Australian Bats (Eds. A. Duncan, G.B Baker, & N. Montgomery). Pp 17-19. Canberra: Environment Australia.
- Commonwealth of Australia. 2015. *Wildlife Conservation Plan for Migratory Shorebirds*. Canberra, ACT: Department of the Environment. Available from: <http://www.environment.gov.au/biodiversity/publications/wildlife-conservation-plan-migratory-shorebirds-2016>. In effect under the EPBC Act from 15-Jan-2016.
- Crome, F. & Shields, J. 1992. *Parrots & Pigeons of Australia: The National Photographic Index of Australian Wildlife*. Berrima: Angus & Robertson.
- Crome, F.H.J. 1976. Breeding, moult and food of the Squatter Pigeon in north-eastern Queensland. Australian Wildlife Research. 3:45-59.
- Dennis, A.J. 2012. Bare-rumped Sheathtail 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 and Fisheries. 2020. *Restricted Invasive Animals of Queensland*. The State of Queensland: Department of Agriculture and Fisheries. Available at: https://www.daf.qld.gov.au/data/assets/pdf_file/0011/403868/restricted-invasive-animals.pdf Available at: https://www.daf.qld.gov.au/data/assets/pdf_file/0011/403868/restricted-invasive-animals.pdf
- Department of Agriculture, Water and the Environment (DAWE). 2022a. *Conservation Advice for Phascolarctos cinereus (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory*. Canberra: Department of Agriculture, Water and the Environment. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/85104-conservation-advice-12022022.pdf>. In effect under the EPBC Act from 12-Feb-2022.
- Department of Agriculture, Water and the Environment (DAWE). 2022b. *National Recovery Plan for the Koala Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory)*. Department of Agriculture, Water and the Environment, Canberra. Available from: <http://www.dcceew.gov.au/environment/biodiversity/threatened/publications/recovery/koala-2022>. In effect under the EPBC Act from 08-Apr-2022.

- Department of Climate Change, Energy, the Environment and Water (DCCEEW). 2022a. Conservation Advice for *Petauroides minor* (greater glider (northern)). Australian Government, Canberra. <https://www.environment.gov.au/biodiversity/threatened/species/pubs/92008-conservation-advice-05072022.pdf>
- Department of Climate Change, Energy, the Environment and Water (DCCEEW). 2022b. Conservation Advice for *Petauroides volans* (greater glider (southern and central)). Australian Government, Canberra. <https://www.environment.gov.au/biodiversity/threatened/species/pubs/254-conservation-advice-05072022.pdf>
- Department of Climate Change, Energy, the Environment and Water (DCCEEW). 2022c. *Dasyurus hallucatus* — Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu]. Species Profile and Threats Database, Canberra. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=331
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). 2012a. *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*. Canberra: Australian Government.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). 2012b. *Environment Protection and Biodiversity Conservation Act 1999: Environment Assessment Manual - Implementing Chapter 4, EPBC Act*. Canberra: Australian Government.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). 2013. *Approved Conservation Advice for Rostratula australis (Australian painted snipe)*. Canberra: Department of Sustainability, Environment, Water, Population and Communities. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/77037-conservation-advice.pdf>.
- Department of the Environment (DoE). 2013. *Matters of National Environmental Significance Significant Impact Guidelines 1.1*. Canberra: Commonwealth of Australia. https://www.dcceew.gov.au/sites/default/files/documents/nes-guidelines_1.pdf
- Department of the Environment (DoE). 2015a. *Conservation Advice Calidris ferruginea curlew sandpiper*. Canberra: Department of the Environment. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/856-conservation-advice.pdf>. In effect under the EPBC Act from 26-May-2015.
- Department of the Environment (DoE). 2015b. 'Draft referral guideline for 14 birds listed as migratory species under the EPBC Act', Commonwealth of Australia 2015. Available from: <https://www.dcceew.gov.au/environment/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds> Available from: <https://www.dcceew.gov.au/environment/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds>
- Department of the Environment (DoE). 2015c. *Threat abatement plan for predation by feral cats*. Canberra: Commonwealth of Australia. <http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats>
- Department of the Environment, Water, Heritage and the Arts (DEWHA). 2008. *Threat abatement plan for predation by the European red fox*. Canberra: Commonwealth of Australia. <http://www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox>
- Department of the Environment, Water, Heritage and the Arts (DEWHA). 2009a. *Significant impact guidelines for the endangered black-throated finch (southern) (Poephila cincta cincta) - EPBC Act policy statement 3.13*. Canberra: Commonwealth of Australia. <https://www.dcceew.gov.au/sites/default/files/documents/black-throated-finch.pdf> <https://www.dcceew.gov.au/sites/default/files/documents/black-throated-finch.pdf>
- Department of the Environment, Water, Heritage and the Arts (DEWHA). 2009b. Survey guidelines for Australia's threatened birds. Australian Government, Canberra Eyre TJ, Ferguson DJ, Hourigan CL, Smith GC, Mathieson MT, Kelly, AL, Venz MF, Hogan, LD & Rowland, J. (2018). Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland. Department of Environment and Science, Queensland Government, Brisbane.

- Department of the Environment and Energy (DotEE). 2016. *Threat abatement plan for competition and land degradation by rabbits*. Canberra: Commonwealth of Australia. In effect under the EPBC Act from 07-Jan-2017. <http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-rabbits-2016>
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). 2011. *Threat abatement plan for the biological effects, including lethal toxic ingestion, caused by cane toads*. Canberra, ACT: Commonwealth of Australia. Available from: <http://www.environment.gov.au/resource/threat-abatement-plan-biological-effects-including-lethal-toxic-ingestion-caused-cane-toads>. In effect under the EPBC Act from 06-Jul-2011.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). 2012. *Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses*.
- EMM Consulting (EMM). 2022. *Matters of National Environmental Significance Report – No Named Road*. Report to Townsville City Council.
- ESD Steering Committee. 1992. *National Strategy for Ecologically Sustainable Development (NSES)*.
- Evolve Environmental Solutions. 2022a. *Ecological Assessment Report – Lansdown Eco-Industrial Precinct, Woodstock Issue B*.
- Evolve Environmental Solutions. 2022b. *Second Ecological Assessment Report: Week Two – Lansdown Eco-Industrial Precinct, Woodstock*.
- Evolve Environmental Solutions. 2022c. *Ecological Assessment Report: Precinct Road Alignments*.
- Evolve Environmental Solutions. 2023. *Ecological Assessment Report: Precinct Road Alignments*
- 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. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane.
- Eyre, T.J., Ferguson, D.J., Hourigan, C.L., Smith, G.C., Mathieson, M.T., Kelly, A.L., Venz, M.F., Hogan, L.D. & Rowland, J., 2018. Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland. Department of Environment and Science, Queensland Government, Brisbane.
- Forster, P.I. 1996, 'Asclepiadaceae', In: Orchard, A.E. & Wilson, A. (Eds) *Flora of Australia*, vol. 28, CSIRO Melbourne.
- Frith, H. J. 1982. *Pigeons and doves of Australia*. Adelaide: Rigby.
- Haslem, A., Maisey, A.C., Clarke, R.H., Stewart, A., Radford, J.Q., and Bennett, A.F. 2023. Quantifying the landscape-scale recovery of bird communities over time in response to on-farm restoration plantings. *Biological Conservation* **280**: 109987. doi:10.1016/j.biocon.2023.109987
- Higgins, P. J. & Davies, S. 1996. *Australian, New Zealand & Antarctic birds*. Auckland: Oxford University Press.
- Hill, B. M & Ward, S. J. 2010. *National Recovery Plan For the Northern Quoll *Dasyurus hallucatus**. Department of Natural Resources, Environment, The Arts and Sport, Darwin. Available from: <http://www.environment.gov.au/resource/national-recovery-plan-northern-quoll-dasyurus-hallucatus>. In effect under the EPBC Act from 16-Dec-2010. Available from: <http://www.environment.gov.au/resource/national-recovery-plan-northern-quoll-dasyurus-hallucatus>. In effect under the EPBC Act from 16-Dec-2010.
- Lord, E.A.R. 1956. The Birds of the Murphy's Creek District, southern Queensland. *Emu*. 56:100-128.
- Marchant, S., & Higgins, P.J. (eds). 1993. *Handbook of Australian, New Zealand and Antarctic Birds*. Volume 2 - Raptors to Lapwings. Melbourne, Victoria: Oxford University Press.
- Menkhorst, P., Rogers, D., Clarke, R., & Sullivan, P. 2017. *The Australian bird guide* (p. 260). Melbourne: CSIRO Publishing.

- 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*. M.Sc. Thesis. Townsville: James Cook University of North Queensland.
- Munks, S. A., R. Corkrey, and Foley, W.J. 1996. Characteristics of arboreal marsupial habitat in the semi-arid woodlands of northern Queensland. *Wildlife Research* 23:185–195.
- 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.
- Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S., Butler, D.W., McDonald, W.J.F., Addicott, E.P., & Appelman, C.N. 2022. Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland. Version 6. Brisbane: Queensland Herbarium, Queensland Department of Environment and Science.
- Pizzey and Knight. 2012. The field guide to the Birds of Australia birds Ninth Ed, CSIRO Publishing, Collingwood, Victoria Australia.
- Queensland Government 2023, Media Statements – Joint Statement, Lansdown Precinct One Step Closer to Supercharging NQ’s Future, Available: <https://statements.qld.gov.au/statements/97315>.
- Queensland Parks and Wildlife Service. 2011. *Proceedings from the workshop for the Squatter Pigeon (southern)*. Toowoomba Office of the Queensland Parks and Wildlife Service, 14-15 December 2011.
- Radle, AL. 2007. Effects of noise on wildlife: a literature review, Available at: <http://wfae.proscenia.net/library/articles>.<http://wfae.proscenia.net/library/articles>.
- Reardon, T.B., S.K.A. Robson, J.G. Parsons & T. Inkster. 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.
- Rogers, D., I. Hance, S. Paton, C. Tzaros, P. Griffioen, M. Herring, R. Jaensch, L. Oring, A. Silcocks & M. Weston. 2005. The breeding bottleneck: breeding habitat and population decline in the Australian Painted Snipe. In: Straw, P., ed. Status and Conservation of Seabirds in the East Asian-Australasian Flyway. Pp. 15-23.
- Schulz, M. & Thomson, B. 2007. *National recovery plan for the bare-rumped sheathtail bat *Saccolaimus saccolaimus nudicluniatus**. Brisbane: Queensland Parks and Wildlife Service.
<http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-bare-rumped-sheathtail-bat-saccolaimus-saccolaimus-nudicluniatus>
- Threatened Species Scientific Committee (TSSC). 2013. *Commonwealth Listing Advice on *Rostratula australis* (Australian Painted Snipe)*. Department of Sustainability, Environment, Water, Population and Communities. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/77037-listing-advice.pdf>.
- Threatened Species Scientific Committee (TSSC). 2015. Conservation Advice *Geophaps scripta scripta squatter pigeon (southern)*. Canberra: Department of the Environment. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/64440-conservation-advice-31102015.pdf>. In effect under the EPBC Act from 27-Oct-2015.
- Threatened Species Scientific Committee (TSSC). 2016a. *Conservation Advice *Macroderma gigas ghost bat**. Canberra: Department of the Environment. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/174-conservation-advice-05052016.pdf>. In effect under the EPBC Act from 05-May-2016.

Threatened Species Scientific Committee (TSSC). 2016b. *Saccolaimus saccolaimus nudicluniatu*s (Bare-rumped Sheath-tail Bat) Conservation Advice. Commonwealth of Australia.

Threatened Species Scientific Committee (TSSC). 2019. *Conservation Advice Hirundapus caudacutus* White-throated Needletail. Canberra: Department of the Environment and Energy. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/682-conservation-advice-04072019.pdf>. In effect under the EPBC Act from 04-Jul-2019.

Threatened Species Scientific Committee (TSSC). 2020. *Conservation Advice for Falco hypoleucos* Grey Falcon. Canberra: Department of Agriculture, Water and the Environment. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/929-conservation-advice-09072020.pdf>. In effect under the EPBC Act from 09-Jul-2020.

Townsville City Council (TCC). 2022. Lansdown Eco-Industrial Precinct – Infrastructure Master Plan. City of Townsville.

Woinarski, J. & Milne, D. 2002. *Bare-rumped Sheath-tail Bat Saccolaimus saccolaimus*. Threatened Species Information Sheet. Darwin: Parks and Wildlife Commission.

Woinarski, J.C.Z. 2004. *National Multi-species Recovery Plan for the Partridge Pigeon Geophaps smithii smithii, Crested Shrike-tit, Falcunculus frontatus whitei, Masked Owl Tyto novaehollandiae kimberli and Masked Owl Tiwi Islands Tyto novaehollandiae melvillensis 2004-2008*. Darwin: Northern Territory Department of Infrastructure Planning and Environment. Available from:

[Http://www.environment.gov.au/biodiversity/threatened/publications/recovery/smithii-whitei-kimberli-melvillensis/index.html](http://www.environment.gov.au/biodiversity/threatened/publications/recovery/smithii-whitei-kimberli-melvillensis/index.html). In effect under the EPBC Act from 10-Jun-2005. Ceased to be in effect under the EPBC Act from 01-Oct-2015.

Youngentob, K.N, Marsh, K.F. and Skewes, J. 2021a. A review of koala habitat assessment criteria and methods. Report prepared for the Department of Agriculture, Water and the Environment, Canberra. Available from: <https://www.dcceew.gov.au/environment/epbc/publications/review-koala-habitat-assessment-criteria-and-methods>
Available from: <https://www.dcceew.gov.au/environment/epbc/publications/review-koala-habitat-assessment-criteria-and-methods>

Youngentob, K.N., Lindenmayer, D.B., Marsh, K.J. 2021b. Food intake: an overlooked driver of climate change casualties? Trends in ecology & evolution (Amsterdam).



Appendix A State Assessment and Referral Agency Meeting Minutes



Appendix B DCCEEW Referral Decision and Request for Information



Appendix C Waterway and Wetland Crossing Design Plans



Appendix D Evolve Ecology Report 1



Appendix E Evolve Ecology Report 2

Appendix F Evolve Ecology Report 3

Appendix G Evolve Ecology Report 4

Appendix H Survey Effort Locations



Appendix I Waterway Assessments



Appendix J PMST Report and WildNet Species List



Appendix K Habitat Mapping



Appendix L Species Conservation Advice



Appendix M Construction Environmental Management Plan

Appendix N Weed and Pest Management Plan

Appendix O Bushfire Management Plan



Appendix P Matters of National Environmental Significance Management Plan

Appendix Q Offset Management Plan