

4.3.3 VEGETATION AND HABITAT ASSESSMENTS

Vegetation community assessments and habitat assessments were undertaken to describe the type and condition of the vegetation communities in the Project Area. The outcomes of the vegetation and habitat field assessments were used to inform a final LoO assessment of listed threatened species and TECs or other ecological significance.

4.3.3.1 QUATERNARY VEGETATION ASSESSMENTS

Quaternary assessments were used to assess vegetation communities to ground-truth state-mapped REs in the Project Area. Verifying REs helps determine the presence of specific habitat types and ecological processes within the Project Area to inform a LoO for listed threatened species and ecological communities and assess the Proposed Development's potential impact to MNES related to vegetation community types. Quaternary level vegetation assessments were undertaken in accordance with Neldner et al. (2022).

4.3.3.2 HABITAT QUALITY ASSESSMENTS

Habitat assessments were undertaken to describe the condition of the habitats in the Project Area. Habitat quality assessments identify micro and macro habitat features (e.g. hollows, woody debris and presence of foraging material such as grass seed) as well as other ecological values present specific to threatened species in order to identify presence or absence of viable habitat within the Project Area. Habitat assessments included recording the following features:

- Representative sampling of each habitat type;
- Representative sampling of each regional ecosystem type;
- Assessment of wetland or water features (for example dams) where fauna may frequent;
- Recording of topographical features (outcrops, escarpments or low points) that may provide variable habitat; and
- Defining boundaries of disturbed and undisturbed areas.

Parameters recorded at habitat assessment sample sites are likely to include (but not be limited to):

- Context in the landscape (for example connectivity, elevation, proximity to water);
- Condition (for example weeds and evidence of pest species, recruitment, erosion, evidence of disturbance);
- Breeding and roosting habitat features (for example hollows (size and density), den sites, nests, shedding bark, caves);
- Foraging resources (for example flowering tree species, other food trees, termite mounds, waterbodies);
- Microhabitats present (for example woody debris, leaf litter, rocky outcrop);
- Characteristics of any wetland features (for example, presence of aquatic vegetation, water depth, soil or substrate type); and
- Signs of threatened species, such as scats, track or scratches.

Incidental fauna observations are also collected at habitat assessment points. If any threatened or migratory species are detected, the details of the observation (including number of individuals, geographic coordinates, behaviour and surrounding habitat) were recorded.

4.3.4 BIOCONDITION AND MODIFIED HABITAT QUALITY ASSESSMENTS

For the purposes of commencing the offset assessments for the Proposed Action, BioCondition Assessments and Modified Habitat Quality Assessments (MHQAs) have been undertaken to determine the qualitative and quantitative condition of vegetation for relevant MNES and their habitat. BioCondition assessments are completed in accordance with the BioCondition Assessment Manual (Queensland Herbarium, 2015).

The BioCondition method is an assessment framework for Queensland that provides a measure of how well a terrestrial ecosystem is functioning for biodiversity values. It is a site-based quantitative and therefore repeatable assessment procedure that can be used in any vegetative state and provides a numeric score that can be summarised as a condition rating.

The BioCondition method is designed for use by assessors who have a reasonable working knowledge of RE mapping and vegetation assessment at the site scale. It provides a protocol for vegetation condition assessment at the patch, paddock or property scale. The BioCondition score does not provide an index of habitat suitability for fauna, as this will depend on many other factors that are not directly surrogates of condition, such as predator risk, and sheltering component of habitat such as rock cover and density of dead, hollow-bearing trees. As such this is where the MHQA is utilised in combination with the BioCondition to determine the surrogates for condition and context for species.

Habitat quality is assessed using a combination of indicators that measure the overall viability of the site and its capacity to support a prescribed environmental matter. The method for assessing habitat quality is also designed to be simple and repeatable. The MHQA process is an approved method for determining offsets under the *Queensland Environmental Offsets Act 2014* and is also approved methodology for quantifying impacts as per DCCEEW's Offset Assessment Guide.

4.3.5 TARGETED FLORA SURVEYS

Targeted surveys are required in accordance with the Flora Survey Guidelines – Protected Plants, *Nature Conservation Act 1992* ('Flora Survey Guidelines') in areas identified by the Protected Plants Flora Survey Trigger Map where impacts are proposed, however it is noted that no high-risk trigger areas are mapped within the Project Area.

Therefore, threatened flora surveys were undertaken on an observational basis with targeted surveys undertaken concurrently with quaternary vegetation sampling locations and habitat assessments. No specific targeted threatened flora surveys have been undertaken to date.

4.3.6 TARGETED SURVEYS FOR LISTED FAUNA SPECIES

Targeted surveys were undertaken for listed fauna identified from the desktop searches as potentially occurring within the Project Area. The following sections summarises the main techniques targeting listed mammals, birds, bats, and reptiles within the Project Area.

4.3.6.1 TERRESTRIAL AND ARBOREAL MAMMALS

The preliminary desktop LoO assessment identified koala and greater glider as having potential to occur within the Project Area. A targeted survey approach has been implemented to assess the presence of terrestrial and arboreal species within the Project Area.

Scat and scratch marks searches were undertaken for koala as per the *Survey Guidelines for Australia's Threatened Mammals* (as listed under the EPBC Act) (DSEWPC, 2011a). Scat searches are not a specific survey guideline recommendation for locating greater gliders, however this method has been listed in the *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (Eyre, et al., 2022), to locate cryptic and nocturnal species.

Other relevant guidelines and their recommended survey method and extent for the koala and greater glider are as follows.

The Terrestrial Vertebrate Fauna Survey Guidelines (Eyre, et al., 2022) for Queensland indicate techniques for greater glider to include:

- Two person, 30-minute spotlight searches of 100 x 100 m survey site; and
- Scat and sign search can coincide with the systematic diurnal active searches, within 50 x 50 m quadrats of the survey site.

Relevant guidelines and requirements specific to the koala are:

- A review of koala habitat assessment criteria (Youngentob, Marsh, & Skewes, 2021);
- Strip transects which involve diurnal distance sampling and density searches;
- Camera traps;
- Nocturnal spotlighting for smaller sites to determine presence and density; and
- Spot Assessment Technique which involves looking at the base of koala food trees for presence of koala scats and the trunks of smooth bark gums for koala scratches.

Nocturnal spotlighting surveys were conducted during the November 2024 field survey as targeted searches for the koala and greater glider. These surveys occurred across two transects over one night for two person hours of spotlighting. Spotlighting was undertaken per guideline requirements focusing on arboreal species, particularly targeting koala and greater glider. Higher quality habitat areas for these species (as identified through habitat assessments) were targeted for spotlighting efforts, as these areas contain a higher abundance of microhabitat features for these species (i.e. denning hollows). Spotlighting was limited to one night due to the lack of suitable koala habitat across the Project Area (sparse occurrences of eucalypt species, sparse canopy cover with tree heights generally between 3-6 m).

Additionally, a SAT survey for koala presence was conducted at each habitat quality assessment location (13 surveys), with the majority of these locations having no mature *Eucalyptus* trees present.

4.3.6.2 REPTILES

Searches for listed reptiles identified in the desktop searches, were undertaken in accordance with the following guidelines:

- *Draft referral guidelines for nationally listed Brigalow Belt reptiles* (DCCEE, 2024); and
- *Survey guidelines for Australia's threatened reptiles* (DSEWPC, 2011b).

Searches for reptiles involve microhabitat identification and searches for signs of the species. This occurred throughout the Project Area concurrently with habitat quality assessments in areas identified as potential habitat for listed reptiles identified in desktop searches. Other searches involved active searches in suitable habitat areas, including overturning of rocks / logs and disturbance of leaf litter.

4.3.6.3 BIRDS

Point bird surveys involved 20-minute fix point surveys to provide data on the species present and number of individuals observed. Each fixed-point survey site was located to provide a search radius of approximately 100 m for small birds and up to 800 m for large birds. This was accomplished by conducting the majority of bird surveys in open paddock land adjacent to remnant woodlands. Searches primarily focused on birds most likely to be affected by the development, such as woodland and ground roosting birds.

The survey guidelines for diurnal bird surveys and their requirements are as follows:

- *Survey Guidelines for Australia's threatened birds* (DEWHA, 2017):
 - Point surveys involve recording the presence, and usually number of individuals, of each taxon detected at a series of specified locations. The sampling points are usually pre-determined and selected either randomly or systematically within the Project Area; and
 - Point surveys typically involve an allocated survey time of between 5-20 minutes.

The point bird surveys were conducted in accordance with the time and effort required by the survey guideline requirements where appropriate.

Survey Guidelines for Australia's threatened birds (DEWHA, 2017) outlines steps that aid in determining survey effort and timing, noting a particular focus on optimal timing for surveys of 'target' taxa.

With the timing of surveys critical to species detection, it is important that surveys be timed to maximise potential detection across the year. As such, the survey event has occurred during the lead up to summer to include greater activity during migratory movements and typical breeding seasons (Eyre, et al., 2022).

To date, there have been 13 unique point bird survey locations that have been surveyed within the Project Area.

4.3.7 SURVEY CONDITIONS

Survey Condition data has been collected from Emerald Airport Bureau Station, which is the closest Bureau Station to the Project Area (Table 4-4). The survey conditions for the four-day field survey in November 2024 were higher in temperature and lower in rainfall than the historical mean values for the month of November. The maximum daily temperature during the survey period (39.5°C) was higher than the historical mean value of 33.4 °C for November. Additionally, the period leading up to the field survey seemed to also be drier than usual with the historical mean rainfall for October being 46.8 mm and the area only receiving a total of 10.6 mm of rainfall over the month of October 2024 (with no rainfall during the survey period) (BOM, 2024).

TABLE 4-4 DAILY WEATHER OBSERVATIONS AT EMERALD AIRPORT FOR NOVEMBER 2024

Date	Temp		Rain	9:00 AM				3:00 PM			
	Min	Max		Temp	RH	Dir	Spd	Temp	RH	Dir	Spd
	°C	°C		°C	%			°C	%		
04/11/24	18.3	36.5	0	27.0	54	N	17	35.8	24	ENE	19
05/11/24	19.1	37.1	0	27.4	51	ENE	7	36.3	22	NE	20
06/11/24	19.6	38.7	0	28.0	45	NNE	15	37.5	20	NE	17
07/11/24	20.5	39.5	0	28.3	44	NNE	15	38.3	21	NNW	11

Dir = wind direction; Spd = wind speed; RH = relative humidity

Source: Australian Government Bureau of Meteorology, www.bom.gov.au

4.3.8 SURVEY ADEQUACY

A survey adequacy review has been undertaken for the field survey effort, with a full list of the targeted EPBC Act listed flora and fauna, against their species-specific survey guideline requirements, provided in Table 4-5. The survey adequacy assesses the effectiveness of the completed surveys for identifying targeted flora and fauna species.

It is noted that the purpose of the survey program was to provide a point-in-time summary of applicable ecological values within the Project Area which does not form a targeted baseline survey process consistent with State and Federal guidelines.

TABLE 4-5 SURVEY ADEQUACY

Target Species	EPBC Act Status	Survey Guidelines and Requirements	Sampling technique / effort	Comment on Survey Adequacy
Birds (threatened and migratory)				
Grey falcon <i>(Falco hypoleucos)</i>	V	Conservation Advice <i>Falco hypoleucos</i> - grey falcon (TSSC, 2020). Surveys for grey falcon can be conducted by: Visiting known nests used in previous years; Actively searching for new nests in suitable habitat areas; and following up records from the public, including from Indigenous communities, land managers and bird watchers.	<ul style="list-style-type: none"> • 13 point bird surveys; • 13 habitat quality assessments; and • Seven BioCondition with MHQA plots. 	<p><i>Survey effort meets the survey adequacy requirements.</i></p> <ul style="list-style-type: none"> • A total of 13 point bird surveys were conducted in primarily wooded and open areas. surveys included early morning, midday and late afternoon surveys; • Total of 13 habitat assessments were conducted within the Project Area to assess suitability for the species; • Seven BioCondition/MHQA plots to assess the condition of vegetation and habitat; and • Incidental searches were conducted whilst traversing throughout the Project Area for all threatened/migratory species. <p>Grey falcon was not recorded during the survey effort.</p> <p><i>Species has the potential to occur within Project Area with general habitat identified during field surveys.</i></p>
Squatter pigeon (southern) <i>(Geophaps scripta scripta)</i>	V	Survey Guidelines for Australia's Threatened Birds (DEWHA, 2017). Squatter pigeon (southern) surveys should be conducted by area searches or transect surveys in suitable habitat. Additionally, flushing surveys are considered likely to be useful, however, are not the preferable method. Optimal survey conditions are	<ul style="list-style-type: none"> • 13 point bird surveys; • 13 habitat quality assessments; and • Seven BioCondition with MHQA plots. 	<p><i>Survey effort meets the survey adequacy requirements.</i></p> <ul style="list-style-type: none"> • A total of 13 point bird surveys were conducted in primarily wooded and open areas. surveys included early

Target Species	EPBC Act Status	Survey Guidelines and Requirements	Sampling technique / effort	Comment on Survey Adequacy
		likely between May to late October, and juveniles are predominantly detected during June.		<p>morning, midday and late afternoon surveys;</p> <ul style="list-style-type: none"> • A total of 13 habitat assessments were conducted within the Project Area to assess suitability for the species (including in potentially rocky habitats); • Seven BioCondition/MHQA plots to assess the condition of vegetation and habitat; and • Incidental searches were conducted whilst traversing throughout the Project Area for all threatened/migratory species. <p>Squatter pigeon (southern) was not recorded during the survey effort.</p> <p><i>Species has the potential to occur within Project Area with general habitat identified during field surveys.</i></p>
Diamond firetail <i>(Stagonopleura guttata)</i>	V	<p>Survey Guidelines for Australia's Threatened Birds (DEWHA, 2017).</p> <p>There are no targeted survey guidelines for this species. Active searches or transects whilst recording any sightings and calls within suitable habitat is recommended. Suitable habitats include; grassy eucalypt, acacia, or casuarina woodlands, other suitable habitat include open forests, mallees or natural temperate grasslands. Active searches for microhabitat features include; globular structured nests within the shrubby understorey of woodland areas.</p>	<ul style="list-style-type: none"> • 13 point bird surveys; • 13 habitat quality assessments; and • Seven BioCondition with MHQA plots. 	<p><i>Survey effort meets the survey adequacy requirements.</i></p> <ul style="list-style-type: none"> • A total of 13 point bird surveys were conducted in primarily wooded and open areas. surveys included early morning, midday and late afternoon surveys; • A total of 13 habitat assessments were conducted within the Project Area to assess suitability for the species; • Seven BioCondition/MHQA plots to assess the condition of vegetation and habitat; and

Target Species	EPBC Act Status	Survey Guidelines and Requirements	Sampling technique / effort	Comment on Survey Adequacy
				<ul style="list-style-type: none"> Incidental searches were conducted whilst traversing throughout the Project Area for all threatened/migratory species. <p>Diamond firetail was not recorded during the survey effort.</p> <p><i>Species has the potential to occur within Project Area with general habitat identified during field surveys.</i></p>
Fork-tailed swift <i>(Apus pacificus)</i>	Mi	<p>Referral guideline for 14 birds listed as migratory under the EPBC Act (DoE, 2015b). There are no specific survey guidelines for the fork-tailed swift, however, it is recommended that a two-hectare survey in 20 minutes is undertaken in preferred habitat (i.e., moist forests, eucalyptus, or Brigalow woodlands). During annual migration periods, standardised timed surveys should be conducted, and observers should listen for calls as well as sightings.</p>	<ul style="list-style-type: none"> 13 point bird surveys; 13 habitat quality assessments; and Seven BioCondition with MHQA plots. 	<p><i>Survey effort meets the survey adequacy requirements.</i></p> <ul style="list-style-type: none"> A total of 13 point bird surveys were conducted in primarily wooded and open areas. Surveys included early morning, midday and late afternoon; A total of 13 habitat assessments were conducted within the Project Area to assess suitability for the species; Seven BioCondition/MHQA plots to assess the condition of vegetation and habitat; and Incidental searches were conducted whilst traversing throughout the Project Area for all threatened/migratory species. <p>Fork-tailed swift was not recorded during the survey effort.</p> <p><i>Species has the potential to occur within Project Area with general habitat identified during field surveys.</i></p>

Mammals				
Koala <i>(Phascolarctos cinereus)</i>	E	<p>Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre, et al., 2022).</p> <p>Requires two-person, 30-minute spotlight searches of 100 x 100 m survey site. This can include spotlighting up one side of the 100 x 100 m area and then spotlighting back the other side of the 100 x 100 m area.</p> <p>Scat and sign search can coincide with the systematic diurnal active searches, within 50 x 50 m quadrats.</p> <p>A review of koala habitat assessment criteria and methods (Youngentob, Marsh, & Skewes, 2021)</p> <p>The koala habitat assessment criteria and methods specify koala surveys are to be completed by a case-by-case scenario, however general methods include:</p> <p><u>Direct observations:</u></p> <ul style="list-style-type: none"> • Direct observations should be undertaken between August and January for peak activity; • Transect and point surveys (most commonly strip transects); • Nocturnal spotlighting at smaller sites to determine species presence (detecting reflected eye shine) and density; • Trained koala detection dogs; • Mark-resight or mark-recapture; • Thermal detection drones; • Radio tracking; and • Camera trapping in areas where fresh scats and/or scratches have been recorded. <p><u>Indirect observations:</u></p> <ul style="list-style-type: none"> • Scats – rapid-SAT; • Scats – koala optimised Rapid Assessment Methodology; • Scats – balanced koala scat survey; • Scats – faecal standing crop method; • Scats – trained scat detection dogs; 	<ul style="list-style-type: none"> • 13 habitat quality assessments; • Seven BioCondition with MHQA plots; • 1 spotlighting transect over 1 night by 2 ecologist (totaling two person hours); and • 13 koala Spot Assessment Technique surveys 	<p><i>Survey effort meets the survey adequacy requirements.</i></p> <ul style="list-style-type: none"> • A total of 13 habitat assessments were conducted within the Project Area to assess suitability for the species; • Seven BioCondition/MHQA plots to assess the condition of vegetation and habitat; • One spotlighting survey was conducted for a total of two person hours; and • Incidental searches were conducted whilst traversing throughout the Project Area. <p>Koala was not recorded during the survey effort.</p> <p><i>Species has the potential to occur within Project Area with general habitat identified during field surveys.</i></p>

Target Species	EPBC Act Status	Survey Guidelines and Requirements	Sampling technique / effort	Comment on Survey Adequacy
		<ul style="list-style-type: none"> • Scats – genetic sampling from faecal pellets; • Call playback; • Passive acoustics; • Scratches; and • Landscape nutritional quality surveys. 		
Reptiles				
Yakka skink <i>(Egernia rugosa)</i>	V	<p>Draft referral guidelines for the nationally listed Brigalow Belt reptiles (DCCEEW, 2024). The DSEWPC, 2013 recommends the following survey methods for yakka skink:</p> <ul style="list-style-type: none"> • One-off diurnal searches within microhabitats during the coolest part of the day for a minimum of 1.5 hours per hectare over a minimum of 3 days. Potential yakka skink colonies can be watched using a telescope or binoculars at 30 m distance; • Transects; • Spotlighting – targeting water-inundated gilgais, wetlands, riparian habitats and the surrounding environment between dusk and early morning hours. Spotlighting for a minimum 1.5 person hours per hectare over a minimum of 3 days; and • Elliot and cage trapping – targeting colony sites, checking traps every morning and early evening over four days. <p>Survey guidelines for Australia’s threatened reptiles (DSEWPC, 2011b). Searching for burrow systems and communal defecation sites is the most reliable method of detection. The species can be confirmed by Elliott trapping around the burrows, by distant observation with binoculars or by shining a torch down the burrows at night. Burrows seem to often be located in situations where excavation of the</p>	<ul style="list-style-type: none"> • 13 habitat quality assessments; • Seven BioCondition with MHQA plots; and • 1 spotlighting transect over 1 night by 2 ecologist (totaling two person hours) 	<p><i>Survey effort meets the survey adequacy requirements.</i></p> <ul style="list-style-type: none"> • A total of 13 habitat assessments were conducted within the Project Area to assess suitability for the species (including in potentially rocky habitats); • Seven BioCondition/MHQA plots to assess the condition of vegetation and habitat; • One spotlighting survey was conducted for a total of two person hours; • Elliot and cage trapping was not conducted during the survey effort; and • Incidental searches were conducted whilst traversing throughout the Project Area. <p>Yakka skink was not recorded during the survey effort.</p> <p><i>Species has the potential to occur within Project Area with general habitat identified during field surveys.</i></p>

Target Species	EPBC Act Status	Survey Guidelines and Requirements	Sampling technique / effort	Comment on Survey Adequacy
		<p>burrow system to locate the lizards is impractical. Potential records of the yakka skink should be supported by a good quality colour photograph. Photo vouchers – including burrows (macro and microhabitat) and latrine sites – should be forwarded to the Queensland museum for positive identification and databasing of the record.</p>		
<p>Retro slider (<i>Lerista allanae</i>)</p>	E	<p>Draft referral guidelines for the nationally listed Brigalow Belt reptiles (DCCEEW, 2024). The DSEWPC, 2023 recommends the following survey methods for retro slider:</p> <ul style="list-style-type: none"> • One-off diurnal searches within microhabitats during the coolest part of the day for a minimum of 1.5 hours per hectare over a minimum of 3 days; and • Pitfall and funnel trapping – six 20 L buckets under a 30 m drift fence in suitable microhabitat. Two replicates per habitat type and checking every morning and early evening over four days. <p>Survey guidelines for Australia’s threatened reptiles (DSEWPC, 2011b). Appropriate survey methodology for detecting the presence of the Retro slider would be raking leaf litter and associated surface soils under trees and shrubs, raking surface soils under logs, loose surface rocks, corrugated iron etc., in combination with pitfall trapping at a time of year when the species is most likely to be active. If the survey is a targeted search for this species, a series of pitfall trap lines comprising six 10 litre buckets spread along a 15 metre fence would be adequate for detecting the species, although other pitfall trap arrays could be trialled. An artificial cover array (e.g. roof tiles, plywood squares, etc.) may be</p>	<ul style="list-style-type: none"> • 13 habitat quality assessments; • Seven BioCondition with MHQA plots; and • 1 spotlighting transect over 1 night by 2 ecologist (totaling two person hours). 	<p><i>Survey effort partially meets the survey effort requirements.</i></p> <ul style="list-style-type: none"> • A total of 13 habitat assessments were conducted within the Project Area to assess suitability for the species (including in potentially rocky habitats); • Seven BioCondition/MHQA plots to assess the condition of vegetation and habitat; • One spotlighting survey was conducted for a total of two person hours; • Pitfall trapping and funnel trapping was not conducted during the survey effort; and • Incidental searches were conducted whilst traversing throughout the Project Area. <p>The retro slider was not recorded during the survey effort.</p> <p><i>To be conservative (due to only partially meeting survey requirements), the species has been considered potential to occur with general habitat present within the Project Area.</i></p>

Target Species	EPBC Act Status	Survey Guidelines and Requirements	Sampling technique / effort	Comment on Survey Adequacy
		worth trialing where a longer survey period is possible.		

4.4 LIKELIHOOD OF OCCURRENCE

Consistent with the accepted approach for baseline ecological value assessments, a LoO, informed by desktop sources and the field survey was undertaken (refer to Appendix B for the full LoO assessment).

Desktop sources identified several fauna, flora and ecological communities listed under Commonwealth and State Legislation which have been recorded previously or are predicted to occur within an approximately 10 km buffer.

The LoO approach refines the desktop generated list using site-specific information and species-specific habitat information obtained from field surveys. Desktop sources are indicative only and likelihood rankings, particularly regarding the presence of preferred habitat, are conservative.

The assessment ranks the likelihood of the species occurring through analysis of species distribution information and the presence of specific habitat attributes as identified through the desktop analysis and field survey. The criteria applied are outlined in Table 4-6.

According to the MNES terminology, suitable habitat are areas or a location which has the potential to provide necessary resources needed for the maintenance of a population. This can include breeding, nesting and foraging habitat features or food resources. General habitat are areas that also could have been used transiently by a species.

Habitat and distribution information for MNES is sourced from the SPRAT database and/or Conservation Advice where available, supplemented by other primary sources (e.g., published literature). Species records were sourced from WildNet and/or ALA. Where a species was recorded within 10 km of the Project Area that is dated within the previous 20 years, these records are defined as a 'recent record'.

TABLE 4-6 LIKELIHOOD OF OCCURENCE CRITERIA

	Preferred habitat exists	Suitable habitat exists¹	Habitat does not exist²
Records within Project Area (based on site surveys and recent (last 20 years) records)	Known	Known	Known
Records within 10 km of the Project Area	Likely	Potential	Unlikely
No records within 10 km of the Project Area, but Project Area is within known distribution	Potential	Potential	Unlikely
No records within 10 km of the Project Area, and Project Area is outside of distribution	Unlikely	Unlikely	Unlikely

¹Habitat may be considered potential but not known suitable because: some desired habitat features may be present, but not all; habitat may have poor connectivity; or habitat may be known to be disturbed; or suitable habitat requires confirmation.

²Based on sources reviewed and/or field survey results.

4.5 HABITAT MAPPING

Habitat for known or likely listed threatened or migratory species has been mapped based on ground-truthed vegetation communities, defined habitat preferences and conditions (as observed during the field survey).

Habitat mapping will be used to inform quantification of impacts to habitats as part of future impact assessments associated with the Proposed Development. The vegetation communities used to underpin the broad habitat mapping for the listed threatened and/or migratory species and listed TECs have been recorded in the likelihood of occurrence table, informed by data obtained from desktop sources and field surveys (e.g. SPRAT profiles and/or Conservation Advice where available, supplemented by other primary sources as required).

Broad habitat mapping was prepared and underpinned by representative vegetation communities identified through desktop resources and field observations. Mapped areas are reflective of observed conditions, with minor amendments to the extent in response to field observations.

Species habitat mapping was prepared to best reflect actual ground conditions based on data collected during the field surveys. While species mapping is based on broad habitat types (BHTs), some species require more specialised mapping that considers factors beyond BHT, as such, some species habitat is 'associated' rather than 'entirely' a BHT. This nuance lies within different threatened species' habitat requirements related to their breeding, foraging, roosting and dispersal requirements as well as considerations of connectivity, records in the broader region etc.

4.6 SIGNIFICANT IMPACT ASSESSMENT

The MNES significant impact assessments have been undertaken in accordance with the SIG 1.1 (DEWHA, 2013) for all listed threatened species known, likely or with the potential to occur within the Project Area. The impact assessments consider any mitigation measures, as outlined in Section 7, that will be implemented by the Proposed Development.

The impact assessments further consider the presence of habitat critical to the survival of species, and whether this habitat is present within the Project Area. Habitat critical to the survival of a species is defined in the SIG 1.1 as areas that are necessary for the species, as follows:

- Habitat for activities such as foraging, breeding, roosting or dispersal;
- habitat 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);
- habitat necessary to maintain genetic diversity and long-term evolutionary development; or
- for the reintroduction of populations or recovery of the species or ecological community (DEWHA, 2013).

A summary of the impact assessment, and whether the Proposed Development will have a significant impact on a threatened or migratory species is summarised in Section 8, whilst the detailed significant impact assessments for each MNES is provided in Appendix E.

4.7 ASSUMPTIONS AND LIMITATIONS

The field and desktop assessment undertaken provide an overview of the ecological values that exist within the Project Area. One field survey was undertaken for the Project Area, with multiple survey locations to gain a detailed understanding of the types of species and habitat features that occur. Sampling methods were distributed across the Project Area to obtain a spread of survey locations well distributed across the Disturbance Footprint to understand potential direct and indirect impacts.

The absence of a species from a database list or observational studies does not confirm its absence from the Project Area. The lack of existing records from databases is more likely to indicate a low historic sampling effort in the region, as opposed to an absence of threatening processes and species.

To overcome these limitations, the likelihood of occurrence approach takes a precautionary approach and identifies species that have potential to occur (considering habitat features), to assess potential impacts accordingly. It is noted that ecological values within the Project Area are degraded in most parts, due to historic clearing, cattle grazing, introduced pest animals and weeds.

All BHT and habitat calculations were rounded to the nearest decimal place throughout this Report, unless where two decimal places are regarded as beneficial.

5. ECOLOGICAL VALUES

The following section presents the ecological values of the Project Area based on the findings from the desktop review and one field survey. MNES relevant to the Proposed Development are addressed individually, in Sections 5.6.

5.1 LANDSCAPE CONTEXT

The Project Area is in the Northern Brigalow Belt bioregion. The topography of the Project Area is predominantly flat grazing land with a gentle rise to the west of the Project Area. Detached regrowth forest and woodland are occasionally present in open expanses of grazing land and native vegetation regrowth. Three ephemeral creeks intersect the Project Area as part of alluvial plains, deposits and riparian zones.

The dominant historical land use of clearing and cattle grazing has prevented recovery of native ecological condition throughout the majority of Project Area. Patches of remnant vegetation exist in areas adjacent to the Project Area as well as regrowth areas of numerous species. Cleared areas are dominated by pastured land, sparse shrubs and juvenile regrowth. Additionally, the riparian fringing woodlands are limited to creek lines where they are immature, sparse and thin as a result of grazing activities and historic clearing.

There are no protected areas within the Project Area, however one state forest, Bundoora State Forest, exists 24 km north of the Project Area.

5.2 REGIONAL ECOSYSTEMS



Regional Ecosystem (RE) mapping developed by the Queensland Government was reviewed to gain an understanding of the vegetation communities which may be present within the Project Area, and any historical clearing which may have occurred. The desktop review of the state-mapped REs found that remnant REs do not occur within the Project Area. The field survey confirmed four REs were identified adjacent to the Project Area in the north-east corner.



The Project Area is contained entirely within Category X vegetation.



5.3 BROAD HABITAT TYPES

The Project Area has been classified into seven ground-truthed BHTs, based on RE mapping (refer to Table 5-1). The broad habitat types are presented on Figure 5-1.

TABLE 5-1 BROAD HABITAT TYPES IN THE PROJECT AREA

Habitat Type and Occurrence in Project Area	Structure	Habitat Features / Condition	Area (ha)	Photographic Example
Brigalow regrowth (Non-TEC)	<p>Tree layer: Stands of <i>Acacia harpophylla</i> regrowth to approximately 4m.</p> <p>Shrub layer: Absence of dominant shrub layer. With occasional native shrub in surrounds.</p> <p>Ground microhabitat layer: Sparse grass layer, heavily grazed with moderate woody debris and leaf litter.</p>	<p>Includes <i>Acacia harpophylla</i> in isolated stands of regrowth.</p> <p>Offers minimal habitat value to any species as there is limited complexity, shelter, connectivity and food sources. This habitat is typically used by generalist species, and unlikely to accommodate threatened species due to the small patch size.</p>	0.78 ha	
Cleared land with Brigalow regrowth (Non-TEC)	<p>Tree layer: Absence of tree canopy</p> <p>Shrub layer: <i>Acacia harpophylla</i> regrowth in an area of cleared land to approximately 2m. Moderate mixed dieback between regrowth.</p> <p>Ground microhabitat layer: Heavily grazed grass layer dominated by introduced species.</p>	<p>Includes <i>Acacia harpophylla</i> sparse or scattered regrowth.</p> <p>Offers minimal habitat value to any species as there is limited canopy, complexity, maturity, shelter, and food sources. This habitat is typically used by generalist species. Birds of prey may take advantage of the minimal canopy cover to hunt for ground dwelling species.</p>	1.22 ha	

Habitat Type and Occurrence in Project Area	Structure	Habitat Features / Condition	Area (ha)	Photographic Example
<p>Cleared land with regrowth open shrubland & occasional <i>Lysiphyllum</i></p>	<p>Tree layer: Absence of tree canopy with occasional <i>Lysiphyllum hookeri</i> varying between 3m – 12m in height.</p> <p>Shrub layer: Sparse shrub layer consisting of <i>Terminalia oblongata</i>, <i>Eramophilla mitchelli</i>, <i>Acacia</i> spp. and <i>Acacia harpophylla</i>. With significant dieback throughout.</p> <p>Ground microhabitat layer: Heavily grazed grass layer dominated by introduced species.</p>	<p>Includes cleared land with open shrubland (<10% cover) and occasional tree, <i>Lysiphyllum hookeri</i>.</p> <p>This is a very open and homogenous habitat type that offers little value to any species unless they are a grassland specialist. Birds of prey may take advantage of the minimal canopy cover to hunt for ground dwelling species.</p>	95.59 ha	
<p><i>Eucalyptus</i> and <i>Corymbia</i> dieback with scattered emergent shrubs</p>	<p>Tree layer: 100% tree canopy dieback reaching a height of approximately 12m. Likely to have been a mixture of <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp.</p> <p>Shrub layer: Sparse and emerging shrubs exist between the dieback. <i>Cariss Ovata</i>, <i>Eramophilla mitchelli</i>, <i>Erathroxlyum australe</i>. With dieback also observed throughout the shrub layer.</p> <p>Ground microhabitat layer: Dense grass layer with occasional and isolated heavy grazing observed in sections consisting of native and introduced species. <i>Heteropogon contortus</i>, <i>Aristida</i> spp., <i>Panicum</i> spp. <i>Melinis repens</i>, <i>Cenchrus ciliaris</i>, <i>Chloris gayana</i>, <i>Megathyrus maximus</i>.</p>	<p>Includes areas subject to severe deterioration and tree death appearing to have previously been a mixed Eucalypt woodland.</p> <p>Occasional native emergent shrubs exist <i>Cariss Ovata</i> / <i>Eramophilla Mitchelli</i> / <i>Erathroxlyum australe</i> and a mixture of introduced and native grasses. The ground cover is heavily grazed in sections.</p> <p>The significant dieback offers little value to any species unless they are a grassland specialist. Birds of prey may take advantage of the minimal canopy cover to hunt for ground dwelling species. Although hollows do exist within the dieback canopy, connectivity to adjacent Eucalypt woodlands does not exist.</p>	36.0 ha	

Habitat Type and Occurrence in Project Area	Structure	Habitat Features / Condition	Area (ha)	Photographic Example
<p>Mixed regrowth, and <i>Eucalyptus</i> & <i>Corymbia</i> woodland</p>	<p>Tree layer: Canopy height reaches 6m dominated by <i>Corymbia clarksoniana</i> and <i>Corymbia citriodora</i> with <i>Acacia salicina</i> throughout.</p> <p>Shrub layer: Medium to dense shrub layer dominated by <i>Cassia brewsteri</i>, <i>Bursaria incana</i> and <i>Erythroxylum australe</i>. Juvenile <i>Acacia</i> spp. and <i>Eucalyptus</i> spp. also exist throughout.</p> <p>Ground microhabitat layer: Grassy understorey with scattered woody debris and leaf litter. Ground cover is mostly comprised of <i>Heteropogon contortus</i>, <i>Melinis repens</i> and <i>Cenchrus ciliaris</i>.</p>	<p>Includes mixed <i>Eucalyptus</i> spp. and <i>Corymbia</i> spp. woodland to approximately 10m. Generally sparse canopy coverage / tree density (10-30%). Shrub layer present with areas of dense shrub including <i>Geijera parviflora</i> and <i>terminalia oblonata</i>.</p> <p>Offers potential dispersal habitat value to Eucalypt specialists (i.e. koala), where suitably connected to other dispersal habitat (such as the riparian zone), but are unlikely to provide habitat to large gliders due to limited patch sizes, absence of hollows and trees with significant DBH.</p> <p>Occurs as highly fragmented regrowth patches within the Project Area and is considered to be of low quality.</p>	4.94 ha	
<p>Watercourse with <i>Lysiphyllum</i> woodland, occasional <i>Brigalow</i> and significant dieback</p>	<p>Tree layer: Canopy height reaches approximately 12m dominated by <i>Lysiphyllum Hookeri</i> and less dominant <i>Acacia harpophylla</i>. Sparse juvenile <i>Eucalyptus</i> spp. are present.</p> <p>Shrub layer: Mixed shrub layer of <i>Eremophila mitchelli</i>, <i>Carissa ovata</i> and <i>Terminalia oblongata</i></p> <p>Ground microhabitat layer: Sparse to dense grass layer (dependent on level of grazing). Some shelter and habitat was observed for smaller reptiles or ground-dwelling species due to the presence of woody debris and organic litter. Parthenium (Weed of national significance) observed throughout.</p>	<p>Includes riparian vegetation adjacent a tributary with a dominant <i>Lysiphyllum</i> spp. canopy, occasional <i>Acacia harpophylla</i> and significant dieback throughout the canopy. The shrub layer is sparse with introduced species dominating the ground layer. Occasional juvenile <i>Eucalyptus</i> spp. are present and likely to emerge over time.</p> <p>Offers potential dispersal habitat value to koala but not large gliders due to the absence of mature <i>Eucalyptus</i> spp., hollows and trees with significant DBH. This habitat is typically used by generalist species, but on occasion threatened species have the potential to utilize it.</p>	3.88 ha	

Habitat Type and Occurrence in Project Area	Structure	Habitat Features / Condition	Area (ha)	Photographic Example
		Generally of low quality with minimal presence of Eucalypt species. The low density of Eucalypt species limits the habitat's value to koala populations to dispersal function only. Stands of mixed woodland and low scattered eucalypts potentially provide connectivity and refuge for the species if dispersing through the Project Area.		
Watercourse with mixed regrowth low open woodland and occasional Eucalyptus	<p>Tree layer: Occasional fringing sparse <i>Eucalyptus</i> spp. and <i>Acacia</i> spp. Tree canopy height typically no more than 3m with occasional emergent tree up to 10m.</p> <p>Shrub layer: Sparse shrub layer of <i>Carissa ovata</i>, <i>Grewia latifolia</i>, <i>Terminalia oblongata</i> and <i>Acacia</i> spp.</p> <p>Ground microhabitat layer: Sparse to dense grass layer (dependent on level of grazing). Often low tree coverage within these areas and a lack of rocky or woody debris along the watercourse. Occasional shelter or habitat observed for smaller reptiles or ground-dwelling species. Likely to be used as a water source rather than resting or sheltering habitat. Parthenium (Weed of national significance) observed throughout.</p>	<p>Includes riparian mixed regrowth and occasional <i>Eucalyptus</i> spp. adjacent a tributary with significant dieback throughout and sparse cover (<10%). The shrub layer is sparse with introduced species dominating the ground layer.</p> <p>Offers potential dispersal habitat value to koala but not large gliders due to the absence of mature <i>Eucalyptus</i> spp., hollows and trees with significant DBH. This habitat is typically used by generalist species, but on occasion threatened species have the potential to utilize it.</p> <p>Generally of low quality with minimal presence of Eucalypt species. The low density of Eucalypt species limits the habitat's value to koala populations to dispersal function only. Stands of mixed woodland and low scattered eucalypts potentially provide connectivity and refuge for the species if dispersing through the Project Area.</p>	7.6 ha	