Habitat Management and Rehabilitation Plan

Yarrabilba

EPBC Number: 2013/6791
Project name: Yarrabilba
Proponent's ACN: 103 578 436
Proposed action: To construct the Yarrabilba residential development and associated infrastructure approximately 40 kilometres south east of Brisbane, Queensland (see EPBC Act referral 3013/6791 and request to vary proposal dated 5 August 2013)
Prepared for: Lend Lease
Prepared by: Dr S. Butler, K. Richardt
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Declaration of Accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the *EPBC Act* or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed

Full name (please print)

ROBERT BALL - SENIOR DEVELOPMENT MANAGER.

Organisation (please print)

LEND LEASE COMMUNITIES (YARRABILBA) PTY LTD.

Date

8 November 2017

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1 Executive Summary

Natura Consulting developed a Habitat Rehabilitation Management Plan in response to Condition 4 of approval for Yarrabilba Residential Development, reference no. EPBC 2013/6791, dated 13 November 2014. Condition 4 states that *"The approval holder must prepare and submit, at least 3 months prior to commencement of the action, for the Minister's written approval, a Habitat Rehabilitation and Management Plan".*

The intent of the Habitat Rehabilitation Management Plan is to provide management measures to rehabilitate Koala habitat within the Fauna Corridor, Greenspace Corridor and Environmental Protection Zone. The areas to be rehabilitated are Existing Assessable Koala Habitat to be protected and managed and Offset Requirement areas. This plan ensures that Koala habitat is specifically maintained within at least 195 ha of Offset Area as well as in Existing Assessable Koala Habitat area in the Fauna Corridor, Greenspace Corridor and Environmental Protection Zone.

The Koala habitat rehabilitation area has been divided into Offset Rehabilitation and Habitat Rehabilitation units and Crossing Rehabilitation Units, which are described in the following sections. This totals an area of 1,981,771 m^2 (198.2 ha) in the Offset Areas and an additional 754,657 m^2 (75.5 ha) within Existing Assessable Koala Habitat areas outside of Offset areas, comprising a combined area of 2,736,428 m^2 (273.6 ha) to be rehabilitated. Each rehabilitation unit (ORU1 to ORU23 and HRU1 to HRU31) and crossing rehabilitation unit (CRU1 to CRU15) is mapped with the area, pre-clearing Regional Ecosystems, management type and corridor type tabulated. A short description of the Pre-clearing Regional Ecosystems is also provided.

Each rehabilitation unit is to be rehabilitated to a vegetation structure and species composition that is in line with that of the appropriate pre-clearing Regional Ecosystem (RE). The reference benchmark for rehabilitation of each rehabilitation unit is derived from the vegetation structure and species composition of the appropriate pre-clearing RE, including average canopy cover, average height of canopy, dominant canopy species, average shrub cover, average groundcover, species richness and weed cover.

The final benchmark for rehabilitation is derived from the definition of remnant vegetation under the *Vegetation Management Act 1999* (canopy is 70% of the height, 50% of the cover and similar species composition of the appropriate pre-clearing RE). Therefore, the final benchmark for rehabilitation is 70% of the reference benchmark cover (for canopy, shrub and ground-layer) and 50% of the reference benchmark height (for canopy and shrub layer) of the appropriate RE.

Interim benchmarks are also provided whereby an assessment at regular intervals can be made on the progress of the rehabilitation/revegetation efforts towards achieving this plan's outcomes. For Interim Benchmark years 1 to 10, vegetation structure has been quantified from a cumulative growth curve (CGC), which for biological organisms including trees and shrubs is sigmoidal. The reference Benchmark, Interim Benchmarks and Final Benchmarks have been tabulated for each RE, with the relevant rehabilitation unit also identified. A species list for each RE, including dominant species within each stratum, has also been provided.

An outline for the rehabilitation approach, including planting and maintenance, species selection and weed control, has been provided. These approaches need to be adhered to in the development of detailed rehabilitation planning for each rehabilitation unit during the development of the relevant development stage.

A comprehensive monitoring plan has been detailed, where there will be a minimum of two monitoring sites per rehabilitation unit in order to document and assess rehabilitation through time. The location of 148 monitoring sites has been mapped, although flexibility will remain to adjust the final location of monitoring sites depending on the final locations of roads and development layout. The monitoring plan details methodology for photo point monitoring and transect and quadrat monitoring to monitor

changes in species richness, percentage foliage cover for the ground layer, shrub and canopy layers, canopy height, and weed prevalence.

Contingency measures and corrective actions have also been provided to account for instances of when Interim Benchmarks are not being met. ‘As constructed’ data and surveyed boundaries will also be provided for each rehabilitation unit to test and demonstrate compliance within the offset area (at least 195 ha) requirement.

The Yarrabilba Urban Development is a staged development which will be undertaken over approximately thirty years. As rehabilitation works are tied to the roll-out of construction, any planting will be commenced in conjunction with the construction for each stage. A staging plan has been provided in this plan outlining when the development of each stage is planned to occur, and when each rehabilitation management objective is to take place.

2 Introduction

2.1 Background

The Yarrabilba development site is located on the eastern side of Waterford - Tamborine Road and to the south of Logan Village (refer to Figure 1). It is bounded by rural residential areas to the north, Plunkett Road to the south and the Plunkett Conservation Park to the east. The site consists of approximately 2,200 ha, of which 1931 ha is controlled by Lend Lease Communities (Yarrabilba) Pty Ltd. The land has been historically used for pine forestry, a military training camp in WWII and for live stock grazing, when first cleared. Yarrabilba is predominately vegetated with areas of regrowth native vegetation, regenerating pines and exotic grasslands. Some limited areas of native remnant and regrowth vegetation exist but they are mostly confined to creeks, drainage channels and wetlands.

The site is currently in the early stages of development with the growth of Yarrabilba projected to span approximately 30 years. With regards to areas relating to the EPBC referral, the action has not commenced. Works have only commenced at the Yarrabilba site in areas that are not subject to the EPBC referral. It is anticipated that the commencement of the action will occur within 3 months of final approval from EPBC. The long-term master-planned development incorporates an extensive network of dedicated open space (in excess of 25% of the site). A significant component of the open space is dedicated to the conservation of habitat for the Koala (*Phascolarctos cinereus*).

Natura Consulting developed a Habitat Rehabilitation Management Plan in response to Condition 4 and 5 of approval for Yarrabilba Residential Development, reference no. EPBC 2013/6791, dated 13 November 2014 (Table 1). Condition 4 states that *"The approval holder must prepare and submit, at least 3 months prior to commencement of the action, for the Minister's written approval, a Habitat Rehabilitation and Management Plan".* Specific details of the condition are outlined in Table 1.

2.2 Objectives of Habitat Rehabilitation Management Plan

The intent of the Habitat Rehabilitation Management Plan is to provide management measures to rehabilitate Koala habitat within the Fauna Corridor, Greenspace Corridor and Environmental Protection Zone. This Habitat Rehabilitation Plan is consistent with the Koala Management Plan (Austecology 2012), the Fauna Corridor Infrastructure Master Plan (Natura Consulting 2011) and the Offset Management Plan (Austecology 2015) in terms of the corridor network and rehabilitation objectives.

The areas to be rehabilitated are identified in Figure 1 as "Existing Assessable Koala Habitat to be protected and managed" (Austecology 2012) and in Figure 2 as "Offset Requirement". This Koala Habitat Rehabilitation Management Plan ensures that Koala habitat is specifically maintained within at least 195 ha of Offset Area as well as outside of Offset Area within the Fauna Corridor, Greenspace Corridor and Environmental Protection Zone.

In particular the objectives of this report are to:

- Clearly define the management measures that reflect an adaptive management approach to improve Koala habitat in the designated areas;
- State clear and concise outcomes and performance indicators against which achievement of the outcomes identified will be measured;
- State the timeframe for implementation of the plan;
- Specify a method to monitor the impact and effectiveness of the management measures described above;
- Identify the contingency measures and appropriate corrective actions that will be undertaken if the performance indicators or outcomes are being met;
- Be consistent with Koala Management Plan and Fauna Corridor Infrastructure Master Plan.

Table 1 Requirements of Approval Condition 4 and corresponding sections of the report.

Cond.	Condition Requirement	Plan Reference	Page	Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements
4	Submit a Habitat Rehabilitation and Management Plan for Minster's written approval prior to commencement	This Report	NA	This Report
4(a)	clearly define the management measures and reflect an adaptive management approach to improve koala habitat quality within the Fauna Corridor, Greenspace Corridor and Environmental Protection Zone	**S2 – Description of Rehabilitation Area** **Figure 2** **Figure 4** **S3.1.2 Rehabilitation Approach** **S3.1.3 Weed management** **S3.3 Rehabilitation of Road Crossings**	12 11 18 53 53 64	Details location of areas to be rehabilitated for koala habitat within the corridor network (rehabilitation units); provides specification of each rehabilitation unit including size, Regional Ecosystem, landzone geology, Corridor/protection type. Details integrated approach to rehabilitation including weed management, planting and plant selection and care, and plant placement and protection in order to improve koala habitat within the corridor network. Specifies additional rehabilitation guidelines for rehabilitation of road crossings to mitigate the impact of traffic on Koalas.
4(b)	state clear and concise outcomes and **performance indicators** against which achievement of the outcomes identified will be measured	**S3.1.1 - Performance Indicators** **Table 5** **Table 6**	21 23 28	Identifies performance indicators, specifying benchmarks with a specific timeframe for achieving staged rehabilitation for each rehabilitation unit. Benchmarks have been formulated from Pre-Clearing RE maps (Qld Government 2015) and detailed information on species composition and structure for each RE (Queensland Government 2015).
4(c)	state the timeframe for implementation of the plan	**S4 – Rehabilitation Staging** **Figure 6** – Rehabilitation staging plan	65 65	The timeframe of implementing the plan is outlined in this section, with Figure 6 showing rehabilitation stage times. Rehabilitation works are tied to the roll-out of construction of each stage of development,

				which will be undertaken over approximately 30 years. However, weed control measures are to be commenced ahead of construction staging.
4(d)	specify a method to monitor the impact and effectiveness of the management measures described above	**S3.4 Monitoring**	61	This section identifies the location of monitoring sites within each habitat rehabilitation unit and road crossing rehabilitation unit. Monitoring will include photo-point monitoring, quantitative monitoring of species richness, percent foliage cover (canopy, shrub and ground layer), canopy height and weed prevalence within transects and quadrats. The timeframe for monitoring is also specified – baseline (0 months), 6 months, and 1, 1.5, 2, 2.5, 3, 4, 5, 10 and 15 years.
4(e)	identify the contingency measures and appropriate corrective actions that will be undertaken if the **performance indicators** or outcomes are not being met	**S3.6 Contingency Measures and Corrective Actions**	64	Where Interim Benchmarks are not being met, the timeframes to achieve the Final Benchmarks will be reviewed and extended, whereby Lend Lease will continue to undertake rehabilitation works with continued monitoring until the Final Benchmarks are met. Contingency measures are outlined where 'as constructed data' and surveys of Habitat Rehabilitation Area boundaries (Existing Assessable Koala Habitat to be protected and managed and Offset Area) within 3 months of completion of earthworks will be used to assess/demonstrate compliance.
4(f)	be consistent with **Koala Management Plan** and **Fauna Corridor Infrastructure Master Plan**	Throughout report	NA	The Habitat Rehabilitation Plan is consistent with the Koala Management Plan (Austecology 2012) and the Fauna Corridor Infrastructure Master Plan (Natura Consulting 2011), in terms of the corridor network and rehabilitation objectives.

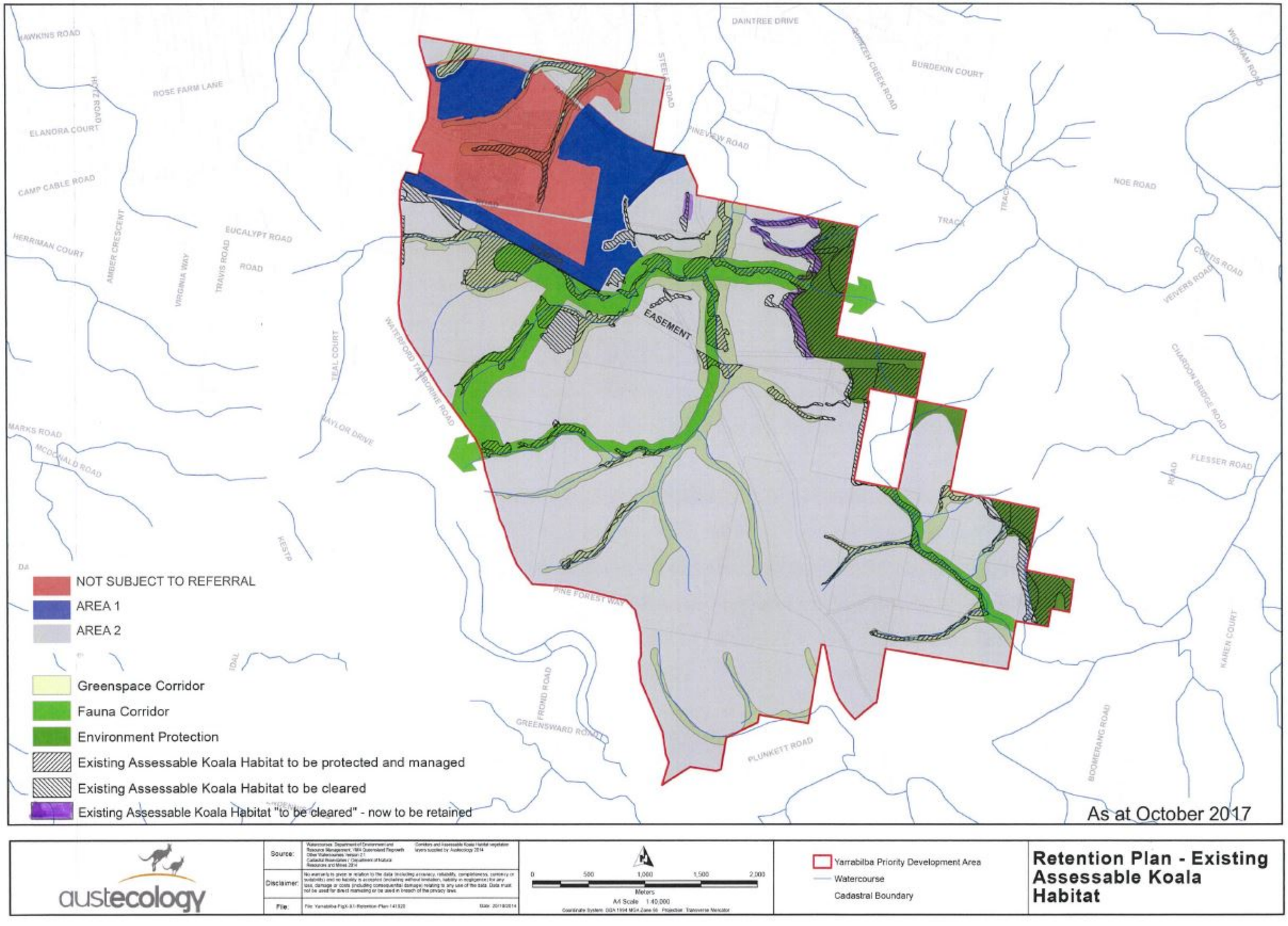

Figure 1 Site location and Existing Assessable Koala Habitat within the corridor network.

YARRABILBA

LEGEND

ENVIRONMENTAL PROTECTION

FAUNA CORRIDOR

GREENSPACE CORRIDOR

YARRABILBA OFFSET REQUIREMENT UNDER EPBC ACT - 195 ha

YARRABILBA SITE BOUNDARY

OFFSET AREAS 2 AND 3 (85ha) INCLUDES ADDITIONAL RETAINED HABITAT

APPENDIX 2

NOTE:
The boundaries and areas shown hereon are subject to detailed engineering design, final survey and approval of subsequent development applications by the relevant authorities.

YARRABILBA - OFFSET LAND

Lendlease

File No. YAR-OLL Dgn No. YAR-EPBC-OSL-171103 Date 03 NOV 2017

Figure 2 Yarrabilba Offset Requirement areas.

2 Rehabilitation Areas

2.1 Purpose of Habitat Rehabilitation

Habitat rehabilitation is intended to improve Koala habitat quality within the site in order to significantly increase the site's Koala carrying capacity in the medium to long term. In addition, the configuration of key elements of the open space system (Fauna Corridor, Greenspace Corridor and Environmental Protection Zone) will enhance the site's contribution to Koala movement opportunities within the context of larger areas of Koala habitat to the east and west of the site (Austecology 2012). Under the development of Yarrabilba, all existing fragments of remnant vegetation which have value for koalas will be retained (approximately 5.4% of the total site area) (Austecology 2012). The rehabilitation of the Fauna Corridor, Greenspace Corridor and Environmental Protection Zone will significantly expand on these values by providing additional Koala habitat (Natura Consulting 2011).

Koala habitat rehabilitation is to be undertaken within "Existing Assessable Koala Habitat to be protected and managed" and "Offset Areas" within Fauna Corridors, Greenspace Corridors and Environmental Protection Zones. This totals an area of 1,981,771 m^2 (198.2 ha) in the Offset Areas and an additional 754,657 m^2 (75.5 ha) within Existing Assessable Koala Habitat areas outside of Offset areas, comprising a combined area of 2,736,428 m^2 (273.6 ha) to be rehabilitated.

The Koala habitat rehabilitation area has been divided into Offset Rehabilitation and Habitat Rehabilitation units and Crossing Rehabilitation Units, which are described in the following sections.

2.2 Offset and Habitat Rehabilitation Units

Koala habitat rehabilitation is to occur within Offset and Habitat Rehabilitation units as shown in Figure 3. Each rehabilitation unit (ORU1 to ORU23 and HRU1 to HRU31) is a mapped polygon, where the polygon boundaries are the mapped Pre-Clearing RE. The Regional Ecosystem (RE) code applicable to each unit was determined by overlapping Pre-Clearing Regional Ecosystem mapping (Queensland Government 2015b) with Existing Assessable Koala Habitat mapping and Offset Requirement area mapping within the Fauna Corridors, Greenspace Corridors and Environmental Protection Zones.

The following table presents a summary of rehabilitation units attributes, including:

- The area of the rehabilitation unit in square metres;
- The corridor within which the rehabilitation unit is located;
- Whether it is an Offset Area and/or Existing Koala Habitat area;
- The RE code for pre-clearing vegetation within the rehabilitation unit and the landzone/geology of the rehabilitation unit.

It is noted that the minimum rehabilitation unit size is ~2,500 m^2 to reflect the mapping limitation of the Pre-Clearing Regional Ecosystems mapping dataset (Queensland Government 2015). However, there are two rehabilitation units with areas of are slightly less than 2,500 m^2, which were retained due to their immediate proximity to adjacent rehabilitation units.

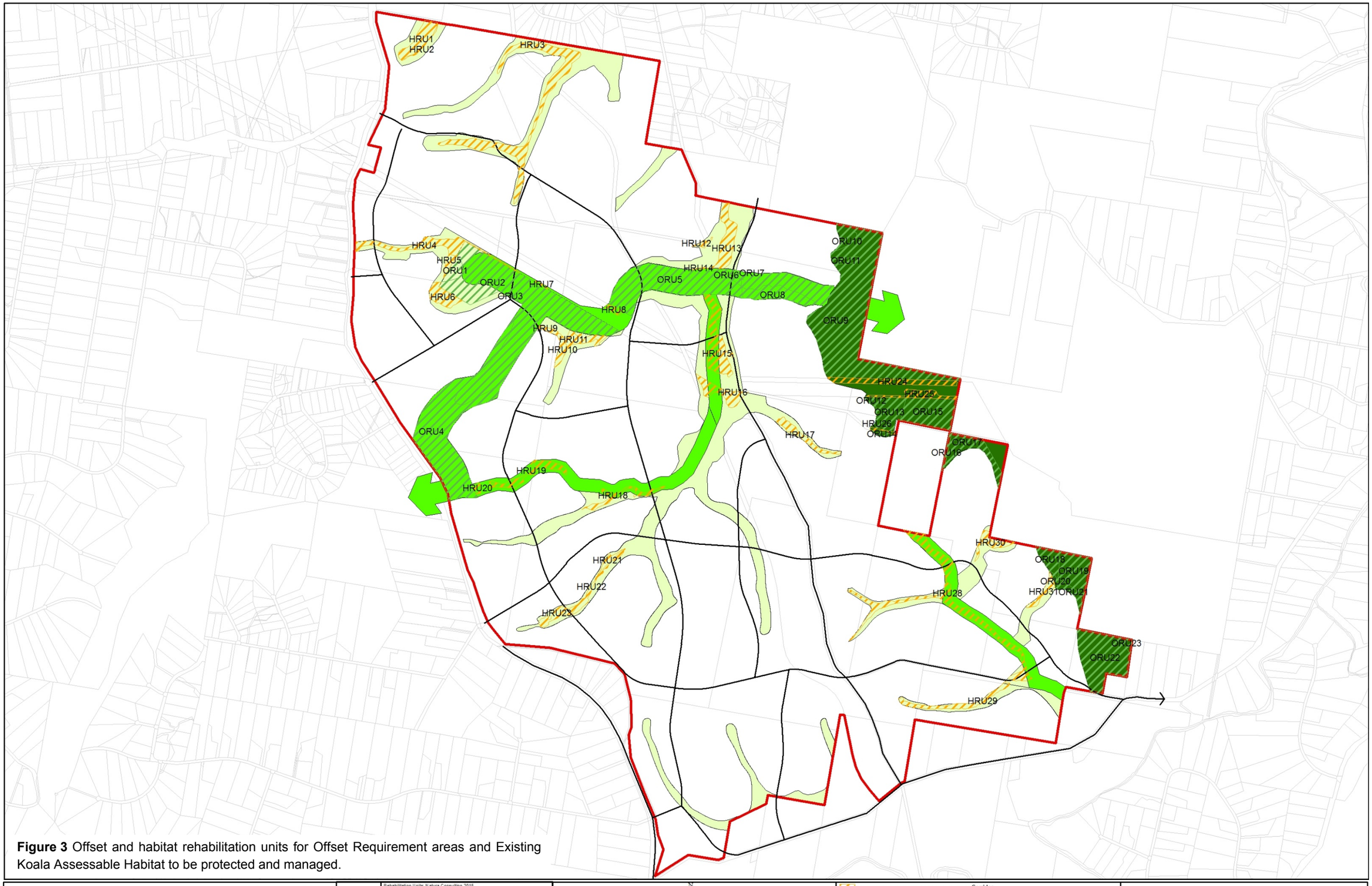

Figure 3 Offset and habitat rehabilitation units for Offset Requirement areas and Existing Koala Assessable Habitat to be protected and managed.

NATURA CONSULTING

Source:	Rehabilitation Units: Natura Consulting 2015 Watercourses: Department of Environment and Resource Management Cadastre Boundary: Department of Natural Resources and Mines Corridors and Assessable Koala Habitat: Lend Lease / Austecology Internal Roads: Lend Lease
Desclaimer:	No warranty is given in relation the data (including accuracy, reliability, completeness, currency of suitability) and no liability is accepted (including without limitation liability in negligence) for any loss, damage or costs (including subsequent damage) relating to any use of the data. Data must not be used for direct marketing purposes or be used in breach of privacy laws.
File/Date:	Koala Habitat Rehabilitation Plan - Offset and Habitat Rehabilitation Units Date: 30/03/2015

N

0 250 500 1,000 1,500 2,000

Meters

Coordinate System: WGS 1984 Zone 56S Projection: Transerve Mercator

- Habitat Rehabilitation Units (HRU1 to HRU31)
- Offset Rehabilitation Units (ORU1 to ORU23)
- Internal Roads

Corridor
- Greenspace Corridor
- Fauna Corridor
- Environmental Protection
- Yarrabilba Priority Development Area
- Cadastral Boundary

Offset and habitat rehabilitation units within Offset Requirement areas and Asssessable Koala habitat to be protected and managed

Table 2 Offset rehabilitation units (ORU) and Habitat Rehabilitation Units (HRU) within the corridor network.

Rehab. Unit	Area (m^2)	Corridor/ Protection type	RE Code(s)	Landzone/ Geology
Offset Area				
ORU1	16,933	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU2	439,297	Fauna Corridor / GreenSpace Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
ORU3	1,451	Fauna Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU4	269,317	Fauna Corridor	12.3.11/12.3.6/12.3.7 12.9-10.17/12.9-10.2	Recent quaternary alluvial systems – Alluvial river and creek flats and Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU5	201,530	Fauna Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
ORU6	10,205	Fauna Corridor	12.3.11/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
ORU7	7,264	Fauna Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
ORU8	46,711	Fauna Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU9	513,080	Environmental Protection Fauna Corridor	12.9-10.17/12.9-10.19	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU10	8777	Environmental Protection	12.9-10.17	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU11	8,324	Environmental Protection	12.9-10.17	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU12	46,711	Environmental Protection	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU13	49,644	Environmental Protection	12.9-10.17/12.9-10.19/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU14	4,286	Environmental Protection	12.9-10.17/12.9-10.19/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU15	80,800	Environmental Protection	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU16	4,708	Environmental Protection	12.9-10.17/12.9-10.19	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU17	47,475	Environmental Protection	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU18	24,352	Environmental Protection	12.9-10.17	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU19	59,917	Environmental Protection	12.11.5/12.11.3	Recent quaternary alluvial systems – Alluvial river and creek flats
ORU20	3,154	Environmental Protection	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
ORU21	13,374	Environmental Protection	12.11.5/12.11.3	Recent quaternary alluvial systems – Alluvial river and creek flats
ORU22	118,260	Environmental Protection	12.11.5/12.11.3	Recent quaternary alluvial systems – Alluvial river and creek flats
ORU23	6,201	Environmental Protection	12.11.5	Recent quaternary alluvial systems – Alluvial river and creek flats
Area	**1,981,771**			

Rehab. Unit	Area (m^2)	Corridor/ Protection type	RE Code(s)	Landzone/ Geology
Existing Assessable Koala Habitat Area (Outside of Offset Area)				
HRU1	31,875	Greenspace Corridor	12.9-10.4/12.9-10.12	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU2	2,947	Greenspace Corridor	12.9-10.4/12.9-10.12/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU3	116,097	Greenspace Corridor	12.3.11/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU4	47,894	Fauna Corridor Greenspace Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU5	6,788	Greenspace Corridor	12.9-10.17/12.9-10.2	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU6	26,102	Greenspace Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU7	1,684	Fauna Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU8	5,206	Fauna Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU9	2,935	Greenspace Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU10	13,511	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU11	19,528	Greenspace Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU12	3,128	Greenspace Corridor	12.9-10.4/12.9-10.12/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU13	42,093	Greenspace Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU14	910	Greenspace Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU15	62,944	Fauna Corridor Greenspace Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU16	29,486	Fauna Corridor Greenspace Corridor	12.3.11	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU17	19,638	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU18	19,604	Fauna Corridor Greenspace Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU19	29,070	Fauna Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU20	3,784	Fauna Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU21	5,688	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU22	14,158	Greenspace Corridor	12.3.11/12.3.6/12.3.7	Recent quaternary alluvial systems – Alluvial river and creek flats
HRU23	15,932	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks

Rehab. Unit	Area (m^2)	Corridor/ Protection type	RE Code(s)	Landzone/ Geology
HRU24	38,783	Environmental Protection	12.9-10.17/12.9-10.19	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU25	22,618	Environmental Protection	12.9-10.17/12.9-10.2/12.9-10.19	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU26	2,818	Environmental Protection	12.9-10.17/12.9-10.19	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU27	15,379	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU28	99,585	Fauna Corridor Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU29	27,237	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU30	15,378	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
HRU31	11,857	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
Total	**754,657**			
Total Area	**2,736,428**			

2.3 Crossing Rehabilitation Units

Rehabilitation and monitoring will also be undertaken where road and infrastructure traverses 'Existing Assessable Koala Habitat' or Offset Requirement Areas within the corridor network. Crossing rehabilitation units have been identified (refer to Figure 4) by overlaying the proposed internal road network with the Pre-Clearing Regional Ecosystem mapping (Queensland Government 2015), Existing Assessable Koala Habitat mapping and Offset Requirement area mapping within the Fauna Corridors, Greenspace Corridors and Environmental Protection Zones. Each crossing rehabilitation unit (CRU1 to CRU15) is a mapped polygon overlayed over Offset Rehabilitation Units and Habitat Rehabilitation Units. It is noted that these locations are indicative and may change with the final alignment of roads.

Table 3 presents a summary of the Crossing Rehabilitation Units, which are subject to rehabilitation actions outlined in this report.

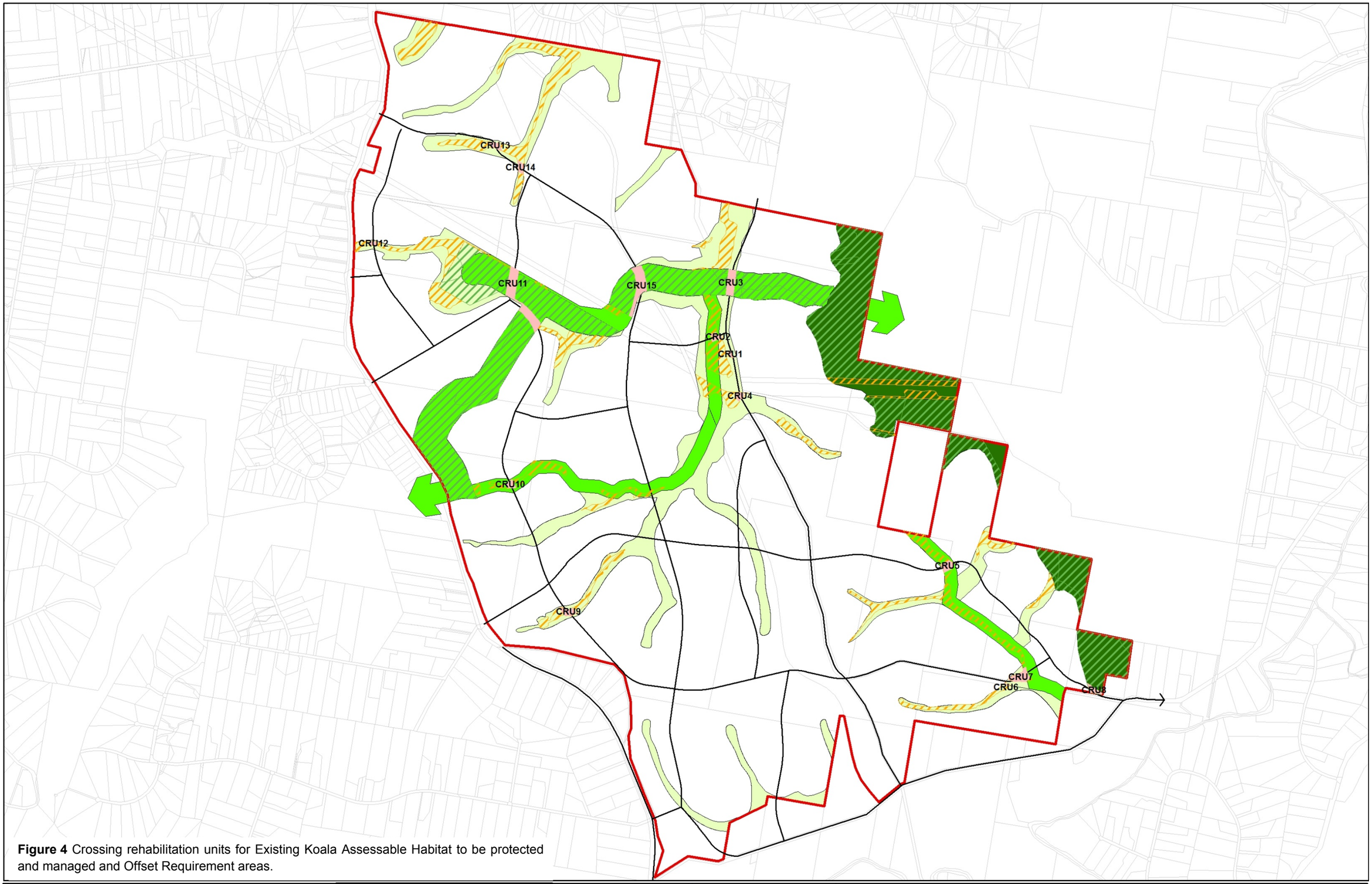

Figure 4 Crossing rehabilitation units for Existing Koala Assessable Habitat to be protected and managed and Offset Requirement areas.

NATURA CONSULTING

Source:	Rehabilitation Units: Natura Consulting 2015 Watercourses: Department of Environment and Resource Management Cadastre Boundary: Department of Natural Resources and Mines Corridors and Assessable Koala Habitat: Lend Lease / Austecology Internal Roads: Lend Lease
Desclaimer:	No warranty is given in relation the data (including accuracy, reliability, completeness, currency of suitability) and no liability is accepted (including without limitation liability in negligence) for any loss, damage or costs (including subsequent damage) relating to any use of the data. Data must not be used for direct marketing purposes or be used in breach of privacy laws.
File/Date:	Koala Habitat Rehabilitation Plan - Crossing Rehabilitation Units Date: 30/03/2015

N

0 250 500 1,000 1,500 2,000

Meters

Coordinate System: WGS 1984 Zone 56S Projection: Transerve Mercator

- Crossing Rehabilitation Unit (CRU 1 to CRU15)
- Habitat Rehabilitation Units (HRU1 to HRU31)
- Offset Rehabilitation Units (ORU1 to ORU23)
- Yarrabilba Priority Development Area
- Internal Roads

Corridor
- Greenspace Corridor
- Fauna Corridor
- Environmental Protection
- Cadastral Boundary

Crossing rehabilitation units within Offset Requirement areas and Asssessable Koala habitat to be protected and managed

Table 3 Road and infrastructure crossing rehabilitation units (CRU) traversing Offset Rehabilitation Units (ORU) and Habitat Rehabilitation Units (HRU).

Crossing Rehabilitation Unit	Area (m^2)	Offset Rehabilitation Unit (ORU) / Habitat Rehabilitation Unit (HRU)	Corridor/ Protection type	RE Code(s)	Landzone/ Geology
CRU1	1,369	HRU15	Greenspace Corridor	12.3.11/12.3.6/12.3.7	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU2	3,670	HRU15	Fauna Corridor Greenspace Corridor	12.3.11/12.3.6/12.3.7	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU3	12,578	ORU5, ORU6, ORU7, ORU9,	Fauna Corridor	12.3.11/12.3.6/12.3.7	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU4	3,347	HRU16	Greenspace Corridor	12.11.3	Metamorphic rocks - hills and lowlands on metamorphic rocks
CRU5	6,013	HRU28	Fauna Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU6	731	HRU29	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU7	10,045	HRU28	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU8	4,082	ORU22	Environmental Protection	12.11.5/12.11.3	Metamorphic rocks - hills and lowlands on metamorphic rocks
CRU9	5,542	HRU22, HRU23	Greenspace Corridor	12.9-10.17/12.9-10.2	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU10	3,555	HRU19	Fauna Corridor	12.3.11/12.3.6/12.3.7	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU11	31,324	ORU2, HRU4, HRU9	Fauna Corridor	12.3.11//12.3.7	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU12	1,775	HRU4	Greenspace Corridor	12.3.11/12.3.6/12.3.7	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU13	3,766	HRU3	Greenspace Corridor	12.3.11//12.3.7	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU14	3,496	HRU3	Greenspace Corridor	12.3.11//12.3.7	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks
CRU15	22,138	ORU5	Greenspace Corridor / Fauna Corridor	12.3.11/12.3.6/12.3.7	Fine grained sedimentary rocks - undulating country on fine grained sedimentary rocks

* Coordinate system WGS84 Zone 56S Projection: Transverse Mercator

2.4 Pre-clearing Regional Ecosystems Rehabilitation Units

A short description of the Pre-clearing Regional Ecosystems identified in the habitat rehabilitation units and crossing rehabilitation units is provided in Table 4

Table 4 Summary of Pre-clearing Regional Ecosystems within Offset Rehabilitation Units, Habitat Rehabilitation Units and Crossing Rehabilitation Units.

RE Code	RE short description (extract from Qld Herbarium RE Description Database	Vegetation Management Act class	Biodiversity status
12.3.6	*Eucalyptus tereticornis, Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland	Least concern	No concern at present
12.3.7	*Melaleuca quinquenervia* +/- *Eucalyptus tereticornis, Lophostemon suaveolens* open forest on coastal alluvial plains	Least concern	No concern at present
12.3.11	*Eucalyptus tereticornis* +/- *Eucalyptus siderophloia, Corymbia intermedia* open forest on alluvial plains	Of concern	Of concern
12.9-10.2	*Corymbia citriodora* subsp. *variegata* +/- *Eucalyptus crebra* open forest on sedimentary rocks	Least concern	No concern at present
12.9-10.4	*Eucalyptus racemosa* subsp. *racemosa* woodland on sedimentary rocks	Least concern	No concern at present
12.9-10.12	*Eucalyptus seeana, Corymbia intermedia, Angophora leiocarpa* woodland on sedimentary rocks	Endangered	Endangered
12.9-10.17	*Eucalyptus acmenoides, E. major, E. siderophloia* +/- *Corymbia citriodora* subsp. *variegata* woodland on sedimentary rocks	Least concern	No concern at present
12.9-10.19	*Eucalyptus fibrosa* subsp. *fibrosa* woodland on sedimentary rocks	Least concern	No concern at present
12.11.3	*Eucalyptus siderophloia, E. propinqua* +/- *E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides* open forest on metamorphics +/- interbedded volcanics	Least concern	No concern at present
12.11.5	*Corymbia citriodora* subsp. *variegata, Eucalyptus siderophloia, E. major* open forest on metamorphics +/- interbedded volcanics	Least concern	No concern at present

(Source: QLD Government 2015a)

3 Habitat Rehabilitation Management Plan

In accordance with the *EPBC* Act 1999 decision notice, this Koala Habitat Rehabilitation Management Plan has been formulated reflecting the onsite rehabilitation requirements of Fauna and Green Space Corridors, Regional Ecosystems, drainage lines and post development fauna movement pathways within Koala habitat areas on the site. This plan identifies areas of high significance for Koala habitat (identified in Figure 1 and 2 as Existing Assessable Koala habitat to be protected and managed and Offset Areas), identifies Koala habitat rehabilitation benchmarks and determines restoration actions to meet these benchmarks.

The management measures as part of this plan are structured as follows:

- Rehabilitation
- Performance indicators
- Monitoring
- Contingency measures
- Timeframe for implementation

3.1 Rehabilitation

Each rehabilitation unit is to be rehabilitated to a vegetation structure and species composition that is line with that of the appropriate pre-clearing RE (Identified in Table 5 and Table 6). The reference benchmark for rehabilitation of each rehabilitation unit is derived from the vegetation structure and species composition of the appropriate pre-clearing Regional Ecosystem (RE) (refer to Table 5 and Table 6). These benchmarks quantify average canopy cover, shrub cover, ground cover, species richness and average height of the canopy and have been sourced from the Queensland Herbarium (Queensland Government 2015). These technical descriptions are a compilation of data from multiple sites for canopy cover, shrub cover, and average stem density for each strata, groundcover and average species richness (Queensland Government 2015). Through establishing these benchmarks, a reasonable comparison can be made between the floristic composition and vegetation structure of a given rehabilitation unit and the appropriate pre-clearing RE.

3.1.1 Performance Indicators

The final benchmark for rehabilitation is derived from the definition of remnant vegetation under the *Vegetation Management Act 1999.* Vegetation can be mapped as remnant vegetation and associated essential habitat for Koalas if the canopy is 70% of the height, 50% of the cover and similar species composition of the appropriate pre-clearing RE (Queensland Government 2015). Therefore, the final benchmark for rehabilitation is 70% of the reference benchmark cover (for canopy, shrub and ground-layer) and 50% of the reference benchmark height (for canopy and shrub layer) of the appropriate RE.

Six rehabilitation performance indicators were selected:

1 Average canopy cover
2 Average height of canopy
3 Dominant canopy species
4 Average shrub cover
5 Average groundcover
6 Species richness
7 Weed cover

Weed cover needs to be considered for rehabilitation benchmarks for this site, particularly in the canopy where numerous exotic pine trees exist. Throughout the life of the development a weed cover of ≤5% is to be maintained.

The reference and final benchmark vegetation structure and species composition for each of the pre-clearing RE's identified within the mapped rehabilitation units is identified in Table 5 and Table 6 respectively. Note that exotic species identified in Table 6 are to assist with identification purposes only and are to be controlled and managed, not planted or assisted.

Rehabilitation units are to be managed and restored until they reach the final benchmark condition as identified in Table 5 and Table 6 and objectives of this Habitat Rehabilitation and Management Plan. The objectives of this plan are long term and are likely to require more than 15 years to be achieved, within each rehabilitation unit, after commencement of implementation.

Interim benchmarks are also provided whereby an assessment at regular intervals can be made on the progress of the rehabilitation/revegetation efforts towards achieving this plan's outcomes. Given this, adaptive management approaches can also be employed to redirect restoration approaches, in the event that interim benchmarks are not being met. Table 5 provides a summary of the timeframe to achieve the interim and final benchmarks.

For Interim Benchmark years 1 to 10, vegetation structure has been quantified from a cumulative growth curve (CGC), which for biological organisms including trees and shrubs is sigmoidal (Fenner School 2015). As the reference benchmarks applied for this report are at the Regional Ecosystem level and site data and long term tree and shrub growth curves are not available for Yarrabilba, we have derived general growth curves for each Regional Ecosystem. This is based on a sigmoidal growth curve, the average reference benchmark height of the stratum, the minimum height at which regrowth vegetation is considered to be of equivalent height as the RE (50% of reference benchmark height), and the average height of tubestock (20 cm) that is predominately used for revegetation in southeast Queensland.

The final benchmark at year 15 is 70% of the reference benchmark cover (for canopy, shrub and ground-layer) and 50% of the reference benchmark height (for canopy and shrub layer) of the appropriate pre-clearing RE.

Table 5 Reference, interim and final benchmark vegetation structure for each pre-clearing RE detailed for rehabilitation units (ORU and HRU) and crossing rehabilitation units (CRU).

Benchmark Condition (where rehabilitation units are treated individually, at least 70% of height and 50% of cover values to be attained within first 15 years of commencement of rehabilitation works)										
RE Code	**Name**	**Status (VMA)**	**Biodiversity Status**	**Habitat Rehabilitation Unit**			**Crossing Rehabilitation Unit**			
12.3.6	***Melaleuca quinquenervia* +/- *Eucalyptus tereticornis, Lophostemon suaveolens* open forest on coastal alluvial plains**	Least concern	No concern at present	ORU2, ORU4, ORU5, ORU7 HRU4, HRU6, HRU7, HRU8, HRU9, HRU11, HRU13, HRU14, HRU15, HRU18, HRU19, HRU22			CRU1, CRU2, CRU3, CRU10, CRU12, CRU15			
				Average Canopy Cover (%)	**Average Canopy Height (m)**	**Average Shrub Cover (%)**	**Average Shrub Height (m)**	**Average Ground cover (%)**	**Species Richness (av. +/- SD)**	
Interim Benchmark by 1 year				10.0	1.5	1.5	0.5	6.0		
Interim Benchmark by 2 years				14.0	3.0	2.0	0.8	10.0		
Interim Benchmark by 3 years				16.0	4.0	2.5	1.2	15.0		
Interim Benchmark by 5 years				22.0	6.0	3.0	1.4	20.0		
Interim Benchmark by 10 years				28.0	9.2	4.0	1.5	25.0		
Final Benchmark by 15 years				**30.5**	**10.7**	**4.45**	**1.6**	**29.2**	**-**	
Reference Benchmark (Pre-Clearing RE)				**60.9**	**15.3**	**8.9**	**2.3**	**58.4**	**33.3 +/- 10.5**	
12.3.7	***Eucalyptus tereticornis*, *Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland**	Least concern	No concern at present	ORU2, ORU4, ORU5, ORU6, ORU7 HRU3, HRU4, HRU6, HRU7, HRU8, HRU9, HRU11, HRU13, HRU14, HRU15, HRU18, HRU19, HRU22,			CRU1, CRU2, CRU3, CRU10, CRU11, CRU12, CRU13, CRU14, CRU15			
				Average Canopy Cover (%)	**Average Canopy Height (m)**	**Average Shrub Cover (%)**	**Average Shrub Height (m)**	**Average Ground cover (%)**	**Species Richness (av. +/- SD)**	
Interim Benchmark by 1 year				5.5	1.6	2.5	0.5	6.0		
Interim Benchmark by 2 years				6.0	2.9	3.0	0.8	7.0		
Interim Benchmark by 3 years				7.0	4.1	3.5	1.2	8.0		
Interim Benchmark by 5 years				9.0	6.2	4.0	1.4	10.0		
Interim Benchmark by 10 years				12.0	10.1	6.0	1.5	12.0		
Final Benchmark by 15 years				**13.3**	**13.6**	**6.6**	**1.6**	**14.4**	**-**	
Reference Benchmark (Pre-Clearing RE)				**26.6**	**19.4**	**13.2**	**2.3**	**28.7**	**52.8 +/- 7.5**	

Benchmark Condition (where rehabilitation units are treated individually, at least 70% of height and 50% of cover values to be attained within first 15 years of commencement of rehabilitation works)										
RE Code	**Name**	**Status (VMA)**	**Biodiversity Status**	**Habitat Rehabilitation Unit**			**Crossing Rehabilitation Unit**			
12.3.11	***Eucalyptus tereticornis* +/- *Eucalyptus siderophloia*, *Corymbia intermedia* open-forest on alluvial plains**	Of concern	Of concern	ORU2, ORU4, ORU5, ORU6, ORU7 HRU3, HRU4, HRU6, HRU7, HRU8, HRU9, HRU11, HRU13, HRU14, HRU15, HRU16, HRU18, HRU19,			CRU1, CRU2, CRU3, CRU10, CRU11, CRU12, CRU13, CRU14, CRU15			
				Average Canopy Cover (%)	**Average Canopy Height (m)**	**Average Shrub Cover (%)**	**Average Shrub Height (m)**	**Average Ground cover (%)**	**Species Richness (av. +/- SD)**	
Interim Benchmark by 1 year				7.0	1.6	2.0	0.4	1.5		
Interim Benchmark by 2 years				10.0	3.0	4.0	0.7	2.0		
Interim Benchmark by 3 years				12.0	4.2	5.0	1.1	3.0		
Interim Benchmark by 5 years				18.0	6.4	7.0	1.3	4.5		
Interim Benchmark by 10 years				22.0	10.7	9.0	1.5	7.0		
Final Benchmark by 15 years				**25.6**	**16.7**	**10.9**	**1.9**	**8.5**	**-**	
Reference Benchmark (Pre-Clearing RE)				**51.1**	**23.8**	**21.7**	**2.7**	**17**	**40.6 +/- 8.5**	
12.9-10.2	***Corymbia citriodora* subsp. *variegata* +/- *Eucalyptus crebra* open forest on sedimentary rocks**	Least concern	No concern at present	ORU1, ORU3, ORU4, ORU8, ORU12, ORU13, ORU14, ORU15, ORU17, ORU20 HRU2, HRU5, HRU10, HRU12, HRU17, HRU20, HRU21, HRU23, HRU27, HRU28, HRU29, HRU30, HRU31			CRU5, CRU6, CRU7, CRU9			
				Average Canopy Cover (%)	**Average Canopy Height (m)**	**Average Shrub Cover (%)**	**Average Shrub Height (m)**	**Average Ground cover (%)**	**Species Richness (av. +/- SD)**	
Interim Benchmark by 1 year				6.0	1.6	3.0	0.4	6.0		
Interim Benchmark by 2 years				10.0	2.9	4.0	0.7	7.0		
Interim Benchmark by 3 years				12.0	4.2	5.0	1.1	12.0		
Interim Benchmark by 5 years				18.0	6.3	7.0	1.3	18.0		
Interim Benchmark by 10 years				22.0	10.5	9.0	1.5	22.0		
Final Benchmark by 15 years				**26.8**	**15.5**	**10.8**	**1.8**	**23.6**	**-**	
Reference Benchmark (Pre-Clearing RE)				**53.5**	**22.2**	**21.6**	**2.5**	**47.2**	**28.2 +/- 7.7**	

Benchmark Condition (where rehabilitation units are treated individually, at least 70% of height and 50% of cover values to be attained within first 15 years of commencement of rehabilitation works)

RE Code	Name	Status (VMA)	Biodiversity Status	Habitat Rehabilitation Unit			Crossing Rehabilitation Unit		
12.9-10.4	***Eucalyptus racemosa subsp. racemosa* woodland on sedimentary rocks**	Least concern	No concern at present	HRU1, HRU2, HRU12					
				Average Canopy Cover (%)	**Average Canopy Height (m)**	**Average Shrub Cover (%)**	**Average Shrub Height (m)**	**Average Ground cover (%)**	**Species Richness (av. +/- SD)**
Interim Benchmark by 1 year				6.0	1.6	1.0	0.6	8.0	
Interim Benchmark by 2 years				7.0	3.0	2.0	1.0	10.0	
Interim Benchmark by 3 years				9.0	4.2	3.0	1.5	15.0	
Interim Benchmark by 5 years				12.0	6.3	4.0	1.8	20.0	
Interim Benchmark by 10 years				15.0	10.6	7.0	2.2	25.0	
Final Benchmark by 15 years				**19.0**	**16.2**	**7.9**	**2.9**	**30.0**	-
Reference Benchmark (Pre-Clearing RE)				**38.0**	**23.2**	**15.7**	**4.1**	**59.9**	**35.4 +/- 5.2**
12.9-10.12*	***Eucalyptus seeana, Corymbia intermedia, Angophora leiocarpa* woodland on sedimentary rocks**	Endangered	Endangered	HRU1, HRU2, HRU12					
				Average Canopy Cover (%)	**Average Canopy Height (m)**	**Average Shrub Cover (%)**	**Average Shrub Height (m)**	**Average Ground cover (%)**	**Species Richness (av. +/- SD)**
Interim Benchmark by 1 year				7.0	1.6	0.3	0.4	6.0	
Interim Benchmark by 2 years				10.0	2.9	0.5	0.8	10.0	
Interim Benchmark by 3 years				15.0	4.1	1.0	1.3	12.0	
Interim Benchmark by 5 years				20.0	6.2	1.5	1.7	20.0	
Interim Benchmark by 10 years				25.0	10.1	2.0	2.0	25.0	
Final Benchmark by 15 years				**31.0**	**13.4**	**3.4**	**2.5**	**36.2**	-
Reference Benchmark (Pre-Clearing RE)				**62.0**	**19.2**	**6.8**	**3.6**	**72.4**	**17.8 +/- 9.6**

Benchmark Condition (where rehabilitation units are treated individually, at least 70% of height and 50% of cover values to be attained within first 15 years of commencement of rehabilitation works)										
RE Code	**Name**	**Status (VMA)**	**Biodiversity Status**	**Habitat Rehabilitation Unit**			**Crossing Rehabilitation Unit**			
12.9-10.17	***Eucalyptus acmenoides, Eucalyptus major, Eucalyptus siderophloia +/- Corymbia citriodora subsp. variegata* woodland on sedimentary rocks**	Least concern	No concern at present	ORU1, ORU3, ORU4, ORU8, ORU9, ORU10, ORU11, ORU12, ORU13, ORU14, ORU15, ORU16, ORU17, ORU18, ORU20 HRU5, HRU10, HRU17, HRU20, HRU21, HRU23, HRU24, HRU25, HRU26, HRU27, HRU28, HRU29, HRU30, HRU31			CRU5, CRU6, CRU7, CRU9			
				Average Canopy Cover (%)	**Average Canopy Height (m)**	**Average Shrub Cover (%)**	**Average Shrub Height (m)**	**Average Ground cover (%)**	**Species Richness (av. +/- SD)**	
Interim Benchmark by 1 year				6.0	1.6	6.0	0.6	10.0		
Interim Benchmark by 2 years				10.0	3.0	7.0	1.0	20.0		
Interim Benchmark by 3 years				12.0	4.2	10.0	1.5	25.0		
Interim Benchmark by 5 years				18.0	6.4	14.0	1.8	30.0		
Interim Benchmark by 10 years				22.0	10.9	16.0	2.2	35.0		
Final Benchmark by 15 years				**27.2**	**18.2**	**20.0**	**2.8**	**43.9**	-	
Reference Benchmark (Pre-Clearing RE)				**54.3**	**26.0**	**40.0**	**4.0**	**87.8**	**36.5 +/- 15.1**	
12.9-10.19	***Eucalyptus fibrosa subsp. fibrosa* woodland on sedimentary rocks**	Least concern	No concern at present	ORU9, ORU14, ORU16 HRU24, HRU25, HRU26						
				Average Canopy Cover (%)	**Average Canopy Height (m)**	**Average Shrub Cover (%)**	**Average Shrub Height (m)**	**Average Ground cover (%)**	**Species Richness (av. +/- SD)**	
Interim Benchmark by 1 year				6.0	1.6	2.5	0.4	2.5		
Interim Benchmark by 2 years				7.0	3.0	4.0	0.7	3.0		
Interim Benchmark by 3 years				9.0	4.2	5.0	1.1	4.0		
Interim Benchmark by 5 years				12.0	6.3	7.0	1.3	6.0		
Interim Benchmark by 10 years				15.0	10.5	9.0	1.5	8.0		
Final Benchmark by 15 years				**20.9**	**15.75**	**9.55**	**1.68**	**8.2**	-	

Benchmark Condition (where rehabilitation units are treated individually, at least 70% of height and 50% of cover values to be attained within first 15 years of commencement of rehabilitation works)										
RE Code	**Name**	**Status (VMA)**	**Biodiversity Status**	**Habitat Rehabilitation Unit**			**Crossing Rehabilitation Unit**		
Reference Benchmark (Pre-Clearing RE)				**41.8**	**22.5**	**19.1**	**2.4**	**16.4**	**30.1 +/- 4.6**
12.11.3	***Eucalyptus siderophloia, E. propinqua* +/- *E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides* open forest on metamorphics +/- interbedded volcanics**	Least concern	No concern at present	ORU19, ORU21, ORU22			CRU4, CRU8		
				Average Canopy Cover (%)	**Average Canopy Height (m)**	**Average Shrub Cover (%)**	**Average Shrub Height (m)**	**Average Ground cover (%)**	**Species Richness (av. +/- SD)**
Interim Benchmark by 1 year				6.0	1.6	1.5	0.4	3.0	
Interim Benchmark by 2 years				10.0	3.0	2.0	0.7	5.0	
Interim Benchmark by 3 years				14.0	4.2	2.5	1.1	7.0	
Interim Benchmark by 5 years				20.0	6.4	4.0	1.3	10.0	
Interim Benchmark by 10 years				25.0	10.8	4.5	1.5	12.0	
Final Benchmark by 15 years				**31.1**	**17.6**	**5.3**	**1.7**	**15.4**	-
Reference Benchmark (Pre-Clearing RE)				**62.1**	**25.2**	**10.5**	**2.4**	**30.8**	**55.1 +/ 15.4**
12.11.5	***Corymbia citriodora* subsp. *variegata, Eucalyptus siderophloia, E. major* open forest on metamorphics +/- interbedded volcanics**	Least concern	No concern at present	ORU19, ORU21, ORU22, ORU23			CRU8		
Interim Benchmark by 1 year				6.0	1.6	0.5	0.4	8.0	
Interim Benchmark by 2 years				9.0	3.0	1	0.7	10.0	
Interim Benchmark by 3 years				12.0	4.2	1.5	1.1	14.0	
Interim Benchmark by 5 years				15.0	6.4	2	1.3	18.0	
Interim Benchmark by 10 years				18.0	10.8	2.5	1.5	20.0	
Final Benchmark by 15 years				**21.8**	**15.8**	**2.9**	**1.6**	**23.0**	-
Reference Benchmark (Pre-Clearing RE)				**43.5**	**22.5**	**5.8**	**2.3**	**46.0**	**48.0 +/ 12.3**

Adapted from Queensland Government (2015).* No pre-defined benchmarks for this RE are provided within the RE technical descriptions (Queensland Government 2015) and therefore, these numbers have been based on data collected in the field from previous assessments and reference sites within this RE type.

Table 6 Benchmark species lists for each pre-clearing RE.

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Canopy Layer (T1)										
Allocasuarina torulosa	X			X						
Alphitonia excelsa	X			X						
Alstonia constricta				X						
Angophora leiocarpa			X	**X**		**X**	**X**	**X**	**X**	X
Angophora woodsiana			X							X
Brachychiton populneus				X						
Banksia oblongifolia	X									
Casuarina cunninghamiana subsp. cunninghamiana		**X**								
Corymbia citriodora subsp. variegata			X	**X**		X	**X**	X	X	X
Corymbia henryi										X
Corymbia intermedia	**X**	X	**X**		**X**	**X**	**X**	**X**	X	**X**
Corymbia tessellaris		X	X	X						X
Corymbia trachyphloia subsp. trachyphloia					**X**					
Dendrophthoe vitellina			X							
Eucalyptus acmenoides							**X**	X	**X**	X
Eucalyptus biturbinata									**X**	
Eucalyptus carnea							**X**	X	**X**	**X**
Eucalyptus crebra				**X**						**X**
Eucalyptus fibrosa subsp. fibrosa								**X**		
Eucalyptus helidonica										X
Eucalyptus latisinensis	X									
Eucalyptus longirostrata								X		
Eucalyptus major								**X**	**X**	
Eucalyptus melanoleuca								X		
Eucalyptus melanophloia				X						
Eucalyptus microcorys	X				X				**X**	X
Eucalyptus moluccana				X			X			
Eucalyptus montivaga								X		
Eucalyptus pilularis					**X**					
Eucalyptus portuensis								**X**		
Eucalyptus propinqua					X				**X**	X
Eucalyptus racemosa subsp. racemosa						X				

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Eucalyptus resinifera					X					X
Eucalyptus seeana			X			**X**				X
Eucalyptus siderophloia			**X**	X		X	X		X	**X**
Eucalyptus sideroxylon								X		
Eucalyptus tereticornis	**X**	**X**	**X**	X		X	X		X	X
Eucalyptus tindaliae			X		**X**			X		**X**
Euroschinus falcatus var. falcatus		X								
Glochidion ferdinandi	X									
Glochidion sumatranum	X									
Lophostemon confertus	**X**				X				**X**	X
Lophostemon suaveolens		X	**X**							
Melaleuca bracteata		X								
Melaleuca fluviatilis		X								
Melaleuca quinquenervia	**X**		**X**							
Melaleuca salicina	X									
Parsonsia straminea	X									
Syncarpia glomulifera					**X**					
Waterhousea floribunda		X								
Sub-canopy (T2-T3)										
Acacia blakei subsp. blakei								X		
Acacia blakei subsp. diphylla								X		
Acacia concurrens			X							X
Acacia disparrima subsp. disparrima	X	X	**X**	X					**X**	**X**
Acacia fimbriata										X
Acacia glaucocarpa				X						
Acacia leiocalyx							X	X		
Acacia loroloba								X		
Acacia maidenii				X						
Acacia melanoxylon					X					
Alectryon reticulatus										
Allocasuarina luehmannii				X						
Allocasuarina littoralis	X		**X**		X			**X**		X
Allocasuarina torulosa				X	**X**			X	**X**	**X**
Alphitonia excelsa	**X**		X	X	**X**		**X**		X	

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Amyema miquelii									X	
Angophora leiocarpa			X	**X**			X	X		X
Angophora subvelutina		X			X					X
Angophora woodsiana			X					X		X
Backhousia myrtifolia										
Banksia integrifolia			X							
Banksia oblongifolia					X					
Aphananthe philippinensis		X								
Casuarina cunninghamiana subsp. cunninghamiana		**X**								
Casuarina glauca			X							
Celastrus subspicata				X						
*Cinnamomum camphora**			X							
Corymbia citriodora subsp. variegata				**X**			**X**	X	X	X
Corymbia henryi										X
Corymbia intermedia	X		**X**	X	**X**		**X**	X	X	X
Corymbia tessellaris		X	X	X						X
Cryptocarya triplinervis		X								
Cryptocarya triplinervis var. triplinervis		X								
Cupaniopsis anacardioides		X								
Diospyros australis		X								
Diplatia furcata		X								
Dockrillia bowmanii		X								
Drypetes deplanchei		X								
Elaeocarpus obovatus		X	X						X	
Endiandra discolor					X					
Endiandra sieberi					X					
Erythrina vespertilio									X	
Eucalyptus acmenoides							**X**		X	
Eucalyptus carnea									X	**X**
Eucalyptus crebra				**X**						X
Eucalyptus exserta								X		
Eucalyptus fibrosa subsp. fibrosa							X	**X**		
Eucalyptus helidonica										X
Eucalyptus longirostrata								X		

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Eucalyptus major				X				**X**		
Eucalyptus melanoleuca								X		
Eucalyptus melanophloia				X						
Eucalyptus microcorys					X				X	
Eucalyptus moluccana				X			X	X		
Eucalyptus montivaga								X		
Eucalyptus pilularis					X					
Eucalyptus propinqua									**X**	X
Eucalyptus resinifera					X					X
Eucalyptus seeana										X
Eucalyptus siderophloia			X	**X**	X		**X**		**X**	X
Eucalyptus sideroxylon								X		
Eucalyptus tereticornis			X	X			X			X
Eucalyptus tindaliae					X					X
Euroschinus falcatus var. falcatus		X								
Ficus adenosperma		X								
Ficus coronata			X							
Flindersia schottiana					X					
Geijera salicifolia		X								
Glochidion ferdinandi			X		**X**					
Glochidion sumatranum	X		X							
Jagera pseudorhus			X							X
Leptospermum polygalifolium										X
Lophostemon confertus				X	**X**			X	**X**	**X**
Lophostemon suaveolens	**X**	X	**X**		X	X	X		X	**X**
Macaranga tanarius		X								
Maclura cochinchinensis		X								
Mallotus philippensis		X							X	
Melaleuca bracteata		X								
Melaleuca fluviatilis		X								
Melaleuca linariifolia		X	X							
Melaleuca quinquenervia	**X**		**X**			X				
Melaleuca salicina			X		X					
Melaleuca saligna										X

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Melaleuca viminalis		X								
Notelaea longifolia			X	X						
Notelaea 32acrocarpa var. microcarpa		X								
Olea paniculata									X	
Pandorea pandorana									X	
Parsonsia straminea			X							
*Pinus elliottii**			X							
Pleiogynium timorense		X								
Polyscias elegans									X	
Rhodosphaera rhodanthema									X	
Syncarpia glomulifera					**X**					
Syzygium oleosum					X					
Waterhousea floribunda		X								
Shrub Layer (S1)										
Abutilon auritum		X								
Acacia amblygona				X						
Acacia binervata									X	
Acacia blakei subsp. diphylla								X		
Acacia complanata							**X**	**X**		
Acacia concurrens			X	X					X	**X**
Acacia decora				X						
Acacia disparrima subsp. disparrima	**X**	**X**	**X**	**X**	X		X	**X**	**X**	**X**
Acacia falcata				X	X			X		X
Acacia fimbriata			X	X				X		X
Acacia glaucocarpa				X						
Acacia implexa				X			X			
Acacia irrorata				X					**X**	
Acacia ixiophylla								X		
Acacia juncifolia								X		
Acacia leiocalyx		X	**X**	**X**	X		**X**	**X**		X
Acacia leiocalyx subsp. leiocalyx	X						**X**			
Acacia leptocarpa	X									
Acacia loroloba				X				X		
Acacia maidenii		X	X	X	X			X	X	X

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Acacia melanoxylon	X		X		X				X	
Acacia neriifolia				X						
Acacia oshanesii					X					
Acacia penninervis								X		
Acacia sertiformis								X		
Acalypha nemorum									X	
Acrotriche aggregata					X				X	
Alchornea ilicifolia		X								
Alchornea thozetiana		X								
Alectryon diversifolius				X						
Alectryon tomentosus		X								
Allocasuarina littoralis	X		X	X				**X**	X	X
Allocasuarina torulosa				X	X		X	X	**X**	X
Alphitonia excelsa	**X**		X	**X**	**X**		X	**X**	X	**X**
Alstonia constricta		X		X				X		
Alyxia ruscifolia								X		
Angophora leiocarpa			X	X			X			
Angophora subvelutina		X								
Angophora woodsiana										X
Aphananthe philippinensis		X								
*Argemone mexicana**		X								
*Asparagus africanus**			X							
Astrotricha latifolia				**X**				**X**	X	
Babingtonia similis										X
*Baccharis halimifolia**			X						X	
Banksia integrifolia			X							
Banksia oblongifolia					X					
Banksia spinulosa					X					
Banksia spinulosa var. collina								X		
Banksia spinulosa var. spinulosa					X					
Bertya cunninghamii		X								
Brachychiton populneus				X					X	
Brachychiton populneus subsp. *trilobus*									X	X
Brachychiton rupestris				X						

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Breynia oblongifolia		X	X	X					X	
Bursaria spinosa								X	X	
Cassinia compacta								X		
Cassinia quinquefaria								X		
Cayratia clematidea		X								
Celastrus subspicata								X		
Choretrum candollei				X				X		
*Cinnamomum camphora**			X						X	
Citrus australis				X						
*Citrus limon**		X								
Clematis glycinoides									X	
Clerodendrum floribundum			X		X			X	X	
Commersonia bartramia	X									
Corymbia citriodora subsp. variegata								X	X	X
Corymbia intermedia	X		X	X			X	X	X	X
Corymbia tessellaris			X	X						X
Corymbia trachyphloia subsp. trachyphloia								X		
Cupaniopsis anacardioides	X	X								
Cupaniopsis parvifolia		X		X						
Cryptocarya triplinervis		X								
Cyclophyllum coprosmoides	X						X			
Daviesia arborea									X	
Daviesia ulicifolia				X				X		
Daviesia villifera								X		
Denhamia pittosporoides								X		
Derris involuta									X	
Diospyros australis		X								
Diospyros geminata		X								
Diplatia furcata		X								
Dockrillia bowmanii		X								
Dodonaea lanceolata var. subsessilifolia		X								
Dodonaea triangularis								X		
Dodonaea triquetra			X		X				X	X
Drypetes deplanchei									X	

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Elaeocarpus reticulatus					X					
Elaeodendron australe									X	
Endiandra discolor					X					
Eremophila debilis				X						
Erythrina vespertilio									X	
Eucalyptus acmenoides								X	X	
Eucalyptus carnea									X	X
Eucalyptus crebra				**X**						X
Eucalyptus exserta	X							X		
Eucalyptus fibrosa subsp. fibrosa								X		
Eucalyptus helidonica										X
Eucalyptus major				X				X		
Eucalyptus melanoleuca								X		
Eucalyptus microcorys									X	X
Eucalyptus moluccana				X						
Eucalyptus montivaga								X		
Eucalyptus propinqua									X	X
Eucalyptus seeana										X
Eucalyptus siderophloia			X						X	X
Eucalyptus sideroxylon								X		
Eucalyptus tereticornis			X	X					X	X
Eucalyptus tindaliae										X
Eucalyptus tindaliae										X
Excoecaria dallachyana		X								
Exocarpus cupressiformis									X	
Exocarpus latifolius					X					
Ficus coronata		X								
Ficus fraseri		X								
Ficus opposita		X								
Flindersia australis				X						
Gahnia sieberiana					X					
Glochidion ferdinandi		X	X		**X**				X	
Glochidion lobocarpum		X								
Glochidion sumatranum	X		X		**X**					

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
*Gomphocarpus physocarpus**				X						
Goodenia ovata								X		
Grevillea banksii	X		X							
Grevillea robusta			X							
Hakea eriantha								X		
Hakea florulenta			X							
Hakea plurinervia					X					
Hodgkinsonia ovatiflora										X
Hovea acutifolia					X				X	
Hovea lorata				X						
Hovea pannosa								X		
Hibiscus heterophyllus					X				X	
Indigofera australis				X					X	
Jacksonia scoparia				X				X		X
Jagera pseudorhus										X
*Lantana camara**	**X**	**X**	**X**	**X**	**X**		X	X	**X**	**X**
Leptospermum polygalifolium	**X**		**X**					X		
Leptospermum semibaccatum					X					
Leptospermum trinervium					X					
Leucopogon juniperinus								X	X	
*Ligustrum sinense**			X						X	
Livistona australis					X					
Livistona decora	X									
Lophostemon confertus				X	**X**		**X**	X	**X**	**X**
Lophostemon suaveolens	**X**	X	**X**		X					X
Maclura cochinchinensis		**X**	X							
Mallotus philippensis		X								
Maytenus cunninghamii				X						
Maytenus bilocularis								X		
Maytenus silvestris									X	
Melaleuca bracteata		X								
Melaleuca linariifolia	X	X	X							
Melaleuca linariifolia var. trichostachya		X								
Melaleuca nodosa										X

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Melaleuca quinquenervia	X		X							
Melaleuca salicina			X						X	X
Melaleuca viminalis		X								X
Melastoma malabathricum subsp. malabathricum					X					
Melia azedarach		X								
Monotoca scoparia								X		
Murraya paniculata			X							
Myoporum montanum				X					X	
Myrsine variabilis			X					X	X	
Neolitsea australiensis		X								
Notelaea linearis								X		
Notelaea microcarpa								X		
*Ochna serrulata**					X		X			
Olea paniculata									X	
Olearia nernstii									X	
*Opuntia tomentosa**		X								
Ozothamnus diosmifolius										X
Pandorea pandorana									X	
Parsonsia straminea		X	X							
Passiflora aurantia								X		
*Passiflora suberosa**							**X**			
*Passiflora subpeltata**	X	X							X	
Persoonia iogyna									X	
Persoonia media									X	
Persoonia sericea				X				X		
Persoonia stradbrokensis			X		X					
Persoonia virgata					X					
Phyllanthus microcladus		X								
*Pinus elliottii**			X							
Pittosporum angustifolium				X						
Pittosporum ferrugineum		X								
Pittosporum revolutum			X							
Plantago debilis		X								
Pleiogynium timorense		X								

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Podolobium ilicifolium									X	
Polyscias elegans	X	X							X	X
Pomaderris queenslandica								X		
Psychotria daphnoides									X	
Psychotria loniceroides										X
Psydrax odorata								X		
Psydrax odorata forma buxifolia				X						
Pultenaea euchila				X						
Pultenaea microphylla								X		
Pultenaea paleacea			X							
Pultenaea spinosa										X
Pultenaea villosa					X			X		
Sarcochilus sp.									X	
*Schinus terebinthifolius**	X									
Senecio amygdalifolius									X	
Senna pendula var. glabrata	X		X		X					
Sida hackettiana			X							
*Sida rhombifolia**	X									
Smilax australis									X	
Solanum densevestitum									X	
Solanum ellipticum				X				X		
*Solanum mauritianum**	X									
*Solanum seaforthianum**				X						
Solanum stelligerum									X	X
*Solanum torvum**		X								
Stephania japonica			X							
Streblus brunonianus		X								
Swainsona galegifolia				X						
Syncarpia glomulifera					X					
Syzygium australe		X								
Tinospora smilacina		X								
Toona ciliata		X								
Trema tomentosa		X	X						X	X
*Triumfetta rhomboidea**										X

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Trochocarpa laurina									X	X
Trophis scandens subsp. scandens			X							
*Urena lobata**		X								
Wikstroemia indica				X					X	
Xanthorrhoea johnsonii				X				X		
Zieria collina									X	
Ground Layer (G)										
Abilgaardia vaginata	X		X							
Acacia amblygona								X		
Acacia concurrens	X		X							
Acacia disparrima subsp. disparrima	X	X	X		X					
Acacia ixiophylla								X		
Acacia leiocalyx	X		X					X		
Acacia loroloba								X		
Acacia maidenii		X					X			
Acacia melanoxylon					X					
Acacia penninervis					X					
Achyranthes aspera		X								
Acrotriche aggregata					X					
Adiantum aethiopicum		X								
Adiantum hispidulum		X								
*Ageratina riparia**			X							
*Ageratum houstonianum**	X	X	X				X			
Ajuga australis		X								
Alchornea ilicifolia		X								
Alchornea thozetiana		X								
Alloteropsis semialata	X		X		X		X		X	
Alphitonia excelsa	X	X	X				X			
Alstonia constricta		X								
*Alternanthera brasiliana**	X									
Alternanthera nana		X								
Alyxia ilicifolia subsp. magnifolia					X					
Alyxia ruscifolia subsp. ruscifolia		X								
*Amaranthus spinosus**		X								

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
*Ambrosia artemisiifolia**			X							
Angophora subvelutina		X								
Aristida calycina								X		X
Aristida calycina var. calycina			X						X	
Aristida lignosa								X		
Aristida personata		X								
Aristida queenslandica								X		
Aristida queenslandica var. dissimilis								X		
Aristida vagans		X		X			X	X		
Aristida warburgii			X							
*Aristolochia elegans**		X								
Aristolochia pubera		X	X							
Arundinella nepalensis		X	X		X			X	X	
*Asclepias curassavica**		X	X							
*Asparagus africanus**	X									
*Aster subulatus**	X									
Astrotricha latifolia					X			X		
Austrodanthonia sp.									X	
Austrostipa pubescens								X		
Austrostipa sp.									X	
Austrostipa rudis subsp. rudis								X		
*Axonopus compressus**		X								
*Axonopus fissifolius**		X								
*Baccharis halimifolia**	X				X					
Baloskion pallens			X							
Banksia robur	X									
Baumea articulata	X									
Baumea juncea	X									
Baumea rubiginosa	X									
*Bidens bipinnata**		X								
*Bidens pilosa**	X	X	X							
Billardiera scandens	X				X					
Billardiera scandens var. scandens					X					
Blechnum carilagineum					X					

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Blechnum indicum			X							
Boerhavia dominii		X								
Boronia glabra								X		
Bothriochloa decipiens				X						X
Bothriochloa decipiens var. decipiens		**X**								
Breynia oblongifolia	X	X	X		X		X	X		
Bridelia leichhardtii		X								
Brunoniella australis	X	X	X				X	X		
Bryophyllum sp.	X									
Bursaria spinosa								X		
Bursaria spinosa subsp. spinosa								X		
Caladenia catenata			X							
Calochlaena dubia			X		**X**			X		
Calotis dentex								X		
Capillipedium parviflorum									X	
Capillipedium spicigerum	X	X	X	X					X	X
Carex appressa									X	
Carex breviculmis									X	
Cassytha glabella	X				X					
Cassytha pubescens		X	X		X					
Casuarina cunninghamiana subsp. cunninghamiana		X								
Cayratia clematidea			X							
Centella asiatica	X	X	X							
Centipeda minima		X								
*Centratherum punctatum subsp. punctatum**	X									
Chamaecrista mimosoides		X								
Chamaecrista nomame			X							
*Chamaesyce hirta**		X								
Chamaesyce macgillivrayi		X								
Cheilanthes distans								X		
Cheilanthes sieberi	X	X	X				X	X		
Cheilanthes tenuifolia	X									
Chloris divaricata				X						
*Chloris gayana**	X		X							

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Chorizema parviflorum			X							
Christella dentata		X								
Christella hispidula		X								
Chrysocephalum apiculatum			X							
Chrysopogon filipes		X								
Chrysopogon oliganthus		X								
Chrysopogon sylvaticus							X	X	X	
*Cinnamomum camphora**					X					
*Cirsium vulgare**		X								
Cissus antarctica		X								
Clematis glycinoides		X								
Commelina diffusa	X	X	X					X		
Commelina lanceolata	X		X							
*Conyza sumatrensis**		X								
Corybas barbarae			X							
Corymbia tessellaris			X							
*Crassocephalum crepidioides**	X		X				X			
Crassula sieberiana subsp. sieberiana								X		
Crotalaria montana			X							
*Crotalaria spectabilis**		X								
Cryptocarya triplinervis var. triplinervis		X								
Cryptostylis erecta					X					
Cupaniopsis anacardioides			X							
Cupaniopsis parviflora		X								
Curculigo ensifolia			X							
Cyanthillium cinereum	X	X	X				X	X		
Cyclophyllum coprosmoides			X				X	X		
*Cyclospermum leptophyllum**		X								
Cymbopogon bombycinus		X								
Cymbopogon refractus		X	X	**X**	X		X	X	X	X
Cynodon dactylon var. dactylon	X	X								
Cyperus bowmanii							X			
Cyperus difformis	X	X								
Cyperus enervis									X	

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Cyperus fulvus		X								
Cyperus gracilis		**X**							X	
Cyperus haspan	X									
Cyperus javanicus	X	X								
Cyperus laevis									X	X
Cyperus pilosus	X	X								
Cyperus polystachyos	X									
Cyperus tetraphyllus									X	
Cyperus trinervis	X	X					X			
*Dactyloctenium aegyptium**		X								
Daviesia acicularis								X		
Daviesia umbellulata			X		X					
Desmodium brachypodum					X					
Desmodium gunnii			X				X			
Desmodium rhytidophyllum		X	X		X		X	X		
Desmodium varians			X							
Dianella brevipedunculata			X				X			
Dianella caerulea	X	X	X		X		X	X		
Dianella longifolia								X		
Dianella longifolia var. stupata								X		
Dianella rara			X							
Dianella revoluta			X					X		
Dichelachne micrantha									X	X
Dichondra repens		X								
Digitaria breviglumis							X			
*Digitaria ciliaris**		X								
*Digitaria didactyla**		X								
Digitaria longiflora			X							
Digitaria parviflora	X		X		X		**X**	X	X	X
Digitaria ramularis		X								
*Digitaria violascens**		X								
Diplocyclos palmatus subsp. palmatus		X								
Dipodium variegatum					X					
Dodonaea triangularis								X		

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Dodonaea triquetra					X					
Doodia caudata								X		
Doodia heterophylla					X					
*Drymaria cordata**		X								
Drypetes deplanchei		X								
Echinochloa telmatophila			X							
Echinopogon caespitosus var. caespitosus	X									
Eclipta prostrata		X								
Einadia hastata								X		
Elattostachys nervosa		X								
Eleocharis acuta	X									
*Eleusine indica**		X								
*Emilia sonchifolia**	X	X	X				X			
Endiandra sieberi					X					
Enneapogon lindleyanus								X		
Enteropogon paucispiceus								X		
Enteropogon unispiceus							X			
Entolasia stricta	X		X	**X**	X		**X**	**X**	**X**	**X**
Epacris microphylla			X							
Eragrostis brownii		X	X				X			X
Eragrostis spartinoides		X	X	X					X	X
*Eragrostis tenuifolia**		X								
Eremochloa bimaculata	X		X	**X**	X		X	X	X	X
Eriachne glabrata								X		
Eriachne pallescens	X									
Eriocaulon australe			X							
Erythrina vespertilio		X								
Euroschinus falcatus var. falcatus		X								
Eustrephus latifolius	X	X	X		X		X	X		
Evolvulus alsinoides		X								
Ficus fraseri		X								
Ficus opposita		X								
Ficus rubiginosa			X							
Fimbristylis cinnamometorum	X		X							

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Fimbristylis depauperata							X			
Fimbristylis dichotoma	X	X	X		X			X		X
Flemingia parviflora		X	X				X			
Gahnia aspera	X		X		X		X	X		
Galactia tenuiflora		X	X					X		
Geitonoplesium cymosum	X	X	X		X					
Geodorum densiflorum	X	X	X		X					
Glochidion ferdinandi	X	X	X				X			
Glochidion sumatranum	X		X							
Glycine clandestina	X		X		X			X		
Glycine clandestina var. clandestina		X			X		X			
Glycine clandestina var. sericea			X							
Glycine cyrtoloba							X			
Glycine tabacina		X								
Glycine tomentella		X	X							
*Gomphocarpus physocarpus**	X	X	X				X	X		
Gonocarpus chinensis subsp. verrucosus	X		X				X			
Gonocarpus micranthus subsp. ramosissimus			X							
Goodenia bellidifolia			X							
Goodenia bellidifolia subsp. argentea								X		
Goodenia delicata								X		
Goodenia hederacea								X		
Goodenia ovata								X		
Goodenia rotundifolia			X		X		X	X		
Grevillea leiophylla			X							
Grevillea robusta		X								
Grewia latifolia		X								
Gymnanthera oblonga		X								
Gymnostachys anceps					X			X		
Hakea florulenta	X		X							
Haloragis heterophylla							X			
Hardenbergia violacea								X		
*Heliotropium amplexicaule**		X								
Heteropogon contortus	X	X	X	**X**						X

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Hibbertia aspera					X					
Hibbertia scandens			X		X					
Hibbertia stricta								X		
Hibbertia vestita	X				X					
Homoranthus virgatus	X									
Hovea acutifolia					X					
Hybanthus enneaspermus		X								
Hybanthus monopetalus								X		
Hybanthus stellarioides			X		X		X	X		
Hydrocotyle tripartita	X		X							
Hypericum gramineum	X		X							
Hypochaeris microcephala var. albiflora		X								
*Hypochaeris radicata**					X					
Hypoxis pratensis	X		X							
Imperata cylindrica	**X**	X	**X**	**X**	**X**		X	X	**X**	**X**
Indigofera australis								X		
*Ipomoea cairica**		X								
Ischaemum australe var. australe	X									
*Jacaranda mimosifolia**			X							
Jacksonia scoparia								X		
Jagera pseudorhus		X			X					
Jasminum didymium subsp. racemosum								X		
Jasminum simplicifolium		X						X		
Juncus continuus		X								
Juncus kraussii	X									
Juncus polyanthemus			X							
Juncus usitatus	X									
Lagenophora moorei		X								
Lagenophora stipitata	X		X							
*Lantana camara**	X	X	X		X		X	X		
*Lantana montevidensis**		X								
Leersia hexandra		X								
Lepidosperma laterale	X		X		X			X	X	X
Lepidosperma lateral var. laterale								X		

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Lepironia articulata	X									
Leptospermum polygalifolium			X							
Leptospermum semibaccatum					X					
Leucopogon leptospermoides					X					
Leucopogon pimeleoides					X					
*Ligustrum sinense**			X							
Lindernia crustacea			X							
Lindsaea incisa			X		X					
Lissanthe strigosa								X		
Lissanthe strigose subsp. subulata								X		
Livistona australis					X					
Lobelia purpurascens	X	X	X		X		X			
Lomandra confertifolia			X		X					
Lomandra confertifolia subsp. pallida			X				X	**X**		
Lomandra filiformis			X					X		
Lomandra filiformis subsp. filiformis								X		
Lomandra hystrix	X	**X**								
Lomandra laxa			X		X		X			
Lomandra longifolia	**X**	X	**X**		X		X			
Lomandra multiflora			X					X		
Lomandra multiflora subsp. multiflora					X		X	X		
Lomatia silaifolia			X		X			X		
Lophostemon suaveolens		X	X					X		
Ludwigia octovalvis		X								
*Macfadyena unguis-cati**		X								
Maclura cochinchinensis		X	X							
Macroptilium atropurpureum		X								
Macrotyloma axillare			X							
Mallotus philippensis		X								
*Malvastrum americanum var. americanum**		X						X		
Malvastrum coromandelianum		X								
Marsdenia brevis								X		
Marsdenia fraseri								X		
Maytenus disperma		X								

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
*Mecardonia procumbens**		X								
*Megathyrsus maximus**	X	X	X						X	X
Melaleuca bracteata		X								
Melastoma malabathricum			X							
Melastoma malabathricum subsp. malabathricum	X									
Melia azedarach		X								
Melichrus urceolatus								X		
*Melinis minutiflora**									X	**X**
*Melinis repens**		X								X
Microlaena stipoides			X				X		X	X
Microlaena stipoides var. stipoides		X						X	X	
Mitrasacme alsinoides			X							
Monotoca scoparia					X			X		
Murdannia graminea	X		X				X			
Murraya paniculata		X								
Notelaea ovata			X							
Nyssanthes diffusa		X								
*Ochna serrulata**	X		X		X					
Olea paniculata		X								
Olearia nernstii								X		
Opercularia diphylla								X		
Oplismenus aemulus	X	**X**	X		X		X		X	
Oplismenus imbecillis			X		X				X	X
*Opuntia tomentosa**		X					X	X		
Ottochloa gracillima	**X**	X	**X**				**X**		X	
Ottochloa nodosa		X			**X**				X	
Oxalis chnoodes	X									
*Oxalis corniculata**		X			X					
Oxalis perennans			X							
Oxalis radicosa	X									
Oxalis rubens					X			X		
Panicum effusum			X	**X**	X		**X**		X	X
Panicum simile			X		X					
Parsonsia eucalyptophylla	X									

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Parsonsia straminea	X	X	X							
Paspalidium distans	X		X				X			
Paspalidium gausum			X							X
Paspalidium gracile	X		X						X	X
*Paspalum conjugatum**									X	
*Paspalum dilatatum**		X			X				X	
Paspalum longifolium	X									
Paspalum scrobiculatum	X		X						X	
*Paspalum urvillei**	X									
*Passiflora edulis**	X									
*Passiflora foetida**			X							
*Passiflora suberosa**	X	X	X		X		X			
*Passiflora subpeltata**	X	X	X					X	**X**	
Patersonia sericea var. sericea								X		
Pavetta australiensis var. australiensis		X								
Pennisetum alopecuroides		X								
Peripleura hispidula		X								
Persicaria hydropiper		X								
Persoonia cornifolia					X					
Persoonia media			X							
Persoonia sericea								X		
Persoonia virgate					X					
Petrophile canescens								X		
Philydrum lanuginosum	X									
Phyllanthus gunnii								X		
Phyllanthus mitchellii								X		
Phyllanthus virgatus	X	X	X		X		X	X		
Pimelea linifolia			X		X					
Plantago debilis		X								
Platylobium formosum					X					
Plectranthus parviflorus		X						X		
Pleiogynium timorense		X								
Poa cheelii									**X**	
Poa sieberiana								X		

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Polycarpaea corymbosa var. minor		X								
Polygala linariifolia							X			
*Polygala paniculata**			X							
Polymeria calycina	X	X	X		X					
Pomax umbellata					X			X		
Poranthera microphylla			X							
*Portulaca oleracea**		X								
*Praxelis clematidea**							X			
Pseuderanthemum variabile			X					X		
Psychotria loniceroides					X					
Pteridium esculentum	X	X	**X**		**X**					
Pterostylis nutans			X							
Pterostylis ophioglossa								X		
Pultenaea microphylla	X							X		
Pultenaea petiolaris								X		
Pultenaea retusa					X					
Pultenaea spinosa			X							
Pycnospora lutescens		X	X							
Rhynchosia minima		X								
*Richardia brasiliensis**		X	X							
*Rivina humilis**		X	X							
Rostellularia adscendens			X							
Rostellularia obtusa			X							
Rubus parvifolius			X							
Sacciolepis indica	X	X	X							
*Salvia coccinea**		X								
Sarga leiocladum			X						X	
Sarga plumosum		X								
*Schefflera actinophylla**			X							
*Schinus terebinthifolius**			X							
Schizaea bifida					X					
Schoenus apogon			X							
Scleria brownii		X								
Scleria levis			X		X					

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Scleria tricuspidata	X									
Scleria mackaviensis		X							X	X
Scleria sp.									X	
Scleria spacelata					X			**X**	X	
Scleria tricuspidata							X			
*Scoparia dulcis**	X									
Senna floribunda		X								
*Senna pendula var. glabrata**		X	X							
Seringia corollata								X		
*Sida cordifolia**		X								
Sida filiformis								X		
Sida hackettiana		**X**								
*Sida cordifolia**	X									
*Sida rhombifolia**		**X**	X							
Sigesbeckia orientalis		X	X					X		
Smilax australis		X	X							
Smilax glyciphylla			X		X					
Solanum americanum	X	X			X					
Solanum ellipticum								X		
*Solanum mauritianum**		X	X							
Solanum nemophilum								X		
Solanum nigrum	X	X	X							
*Solanum seaforthianum**	X	X	X							
Solanum stelligerum								X		
*Sonchus oleraceus**	X	X	X							
Sorghum x almum	X									
Sporadanthus caudatus			X							
Sporobolus creber		X								X
Sporobolus elongatus		X								
Sporobolus laxus		X								
Stellaria media		X								
Stephania japonica	X	X	X		X					
Stylidium laricifolium								X		
Syagrus romanzoffiana		X								

Species	Regional Ecosystem									
	12.3.6	12.3.7	12.3.11	12.9-10.2	12.9-10.4	12.9-10.12**	12.9-10.17	12.9-10.19	12.11.3	12.11.5
Syzygium australe		X								
Themeda triandra	**X**	X	**X**	**X**	**X**		**X**	**X**	**X**	**X**
*Tradescantia fluminensis**		X								
Trema tomentosa	X	X								
Tricoryne elatior			X							
*Tridax procumbens**		X								
Triglochin procerum	X									
Trophis scandens subsp. scandens		X	X							
Turraea pubescens		X								
*Urochloa decumbens**									X	X
*Urochloa mutica**			X							
Velleia spathulata	X									
*Verbena bonariensis**	X									
Viola banksii			X							
Viola hederacea			X		X					
Wahlenbergia gracilis		X					X			
Westringia eremicola								X		
Wikstroemia indica					X					
Xanthorrhoea johnsonii								**X**		
Xanthorrhoea latifolia					X		X			
*Xanthium occidentale**		X								
Xanthosia pilosa					X					
Xyris juncea	X									
Zieria minutiflora					X					
Zornia dyctiocarpa var. dyctiocarpa		X								

Source: Adapted from Queensland Government 2015. Note: * exotic species; **X =** dominant species; **Species list was not available for RE 12.9-10.12; Koala habitat and rehabilitation units (RU) and crossing rehabilitation units (CRU) within the each RE: **12.3.6**: ORU2, ORU4, ORU5, ORU7, HRU4, HRU6, HRU7, HRU8, HRU9, HRU11, HRU13, HRU14, HRU15, HRU18, HRU19, HRU22, CRU1, CRU2, CRU3, CRU10, CRU12, CRU15; **12.3.7**: ORU2, ORU4, ORU5, ORU6, ORU7, HRU3, HRU4, HRU6, HRU7, HRU8, HRU9, HRU11, HRU13, HRU14, HRU15, HRU18, HRU19, HRU22, CRU1, CRU2, CRU3, CRU10, CRU11, CRU12, CRU13, CRU14, CRU15; **12.3.11**: ORU2, ORU4, ORU5, ORU6, ORU7, HRU3, HRU4, HRU6, HRU7, HRU8, HRU9, HRU11, HRU13, HRU14, HRU15, HRU16, HRU18, HRU19, CRU1, CRU2, CRU3, CRU10, CRU11, CRU12, CRU13, CRU14, CRU15; **12.9-10.2**: ORU1, ORU3, ORU4, ORU8, ORU12, ORU13, ORU14, ORU15, ORU17, ORU20, HRU2, HRU5, HRU10, HRU12, HRU17, HRU20, HRU21, HRU23, HRU27, HRU28, HRU29, HRU30, HRU31, CRU5, CRU6, CRU7, CRU9; **12.9-10.4**: HRU1, HRU2, HRU12; 12.9-10.12: HRU1, HRU2, HRU12; **12.9-10.17**: ORU1, ORU3, ORU4, ORU8, ORU9, ORU10, ORU11, ORU12, ORU13, ORU14, ORU15, ORU16, ORU17, ORU18, ORU20, HRU5, HRU10, HRU17, HRU20, HRU21, HRU23, HRU24, HRU25, HRU26, HRU27, HRU28, HRU29, HRU30, HRU31, CRU5, CRU6, CRU7, CRU9; **12.9-10.19**: ORU9, ORU14, ORU16, HRU24, HRU25, HRU26; 12.11.3: ORU19, ORU21, ORU22, CRU4, CRU8 **12.11.5**: ORU19, ORU21, ORU22, ORU23, CRU8.

3.1.2 Rehabilitation Approach

Detailed site assessments and rehabilitation planning is to occur in preparation of the development of each stage at Yarrabilba. Within each stage, detailed rehabilitation planning is to occur for each rehabilitation unit, detailing:

- Results of site assessments for vegetation structure, composition, weed incursion
- Appropriate rehabilitation model which incorporates zones with site specific restoration actions
- Planting matrix (where planting is part of rehabilitation model)
- Weed management
- Management of rehabilitation zones
- Monitoring
- Assessment of performance indicators

A number of integrated approaches within each rehabilitation unit will assist with achieving rehabilitation objectives by streamlining works and management, implementing and documenting ecological changes (monitoring), and basing well founded principles to on-ground works. This integrated approach will assist with logistical issues associated with the delivery of implementing a practical restoration strategy due to the size of Yarrabilba. Restoration in each of the rehabilitation units may incorporate one or more of the following approaches:

1. **Natural regeneration** – this applies to relatively intact plant communities where recovery is automatic with the removal of the cause of the damage or disturbance e.g. after cyclonic events and bushfires (i.e. usually no human intervention is required).

2. **Assisted regeneration** – this approach is appropriate in relatively intact native plant communities where limited intervention such as weed control, track closure, erection of fencing, etc. is sufficient to restore the native vegetation through natural regeneration and successional processes.

3. **Reconstruction** – this approach is required in highly disturbed, modified and degraded areas where the potential for native plant regeneration is considered to be limited, such as heavily disturbed ecosystems. In these situations, native species are unlikely to return to the site without greater intervention, such as replanting, large scale weed control, drain restoration.

4. **Fabrication** (type conversion) – this approach is required where conditions are permanently changed and better adapted local systems can be constructed to restore integrity to the landscape (McDonald 1996).

The site requires rehabilitation techniques that use a combination of the above approaches. The approaches undertaken depend on the exact locality and the degree of modification to the environment (Hobbs and Cramer 2008), such as the installation of water treatment devices or artificial wetlands within riparian communities.

3.1.3 Weed management

Strategies for Weed Management

A major problem associated with many bushland areas in South East Queensland, especially within the urban landscape, is the distribution and abundance of weed infestations. '*Environmental weeds are plants, which through various methods of distribution and proliferation have become a threat to the survival of native plants and animals*' (Bushland Friendly Nursery Scheme 2001).

There are a number of weed species which occur over the site, potentially inhibiting succession from native seed banks through competition with native seedlings. Weed control is essential for

regeneration in these areas as the removal of invasive species reduces competition and will assist in germination from the natural seed bank.

The following table (Table 7) presents the dominant environmental weed species found on the site during the field assessment along with various ranks and scores according to local and state documentation. Table 8 provides general weed control measures for the site.

All of the rehabilitation units will require weed removal and the guidelines highlighted in Table 7 will be followed during this stage of works. During these works, the following objectives will be adhered to:

Objective 1: Prevention, Early Detection and Eradication

This management objective focuses on preventing the incursion and establishment of any weed species into areas where it is not yet established. In the event of an incursion that is attributable to the project activities, rapid management action will be implemented to prevent establishment. Monitoring of project work areas and access tracks is essential to allow early detection and management actions. Management will be undertaken as per the monitoring requirements outlined in this report.

Objective 2: Containment and Reduction

This management objective will be applied to areas where the target weed species has the potential to cause a high impact but has already established in the general area and is being actively contained by Lend Lease. Weed spread prevention measures will be implemented to reduce further spread and managing satellite infestations attributed to project activities.

Objective 3: Reduction through Routine Management

This management objective will be applied to areas where the target weed species is well established and is likely to only cause a moderate-to-low impact. Management will occur as part of general maintenance cycles and to reduce establishment during construction works.

Table 7 Weed species relevant to the project including species recorded within and adjacent to the project area, with potential to occur in the site, priority weeds in the region and additional declared weeds in the region.

Species	Common name	Status	Presence	Relevance					
				WONS	State Declaration	Local Council	Known to Occur	Known in Region	High Potential to Spread
Ageratum houstonianum	Blue Billy Goat Weed	Not declared	Within Site				X		
Ambrosia artemisiifolia	Annual ragweed	Class 2	Within Site				X		
Andropogon virginicus	Whiskey grass	Not declared	Within Site				X		
Bidens pilosa	Cobblers Pegs	Not declared	Within Site				X		
Cinnamomum camphora	Camphor laurel	Class 3	Within Site		X	X	X	X	X
Lantana camara	Lantana	Class 3	Within Site	X	X	X	X	X	X
Lantana montevidensis	Creeping Lantana	Class 3	Within Site	X	X	X	X	X	X
Melinis minutiflora	Molasses Grass	Not declared	Within Site				X		
Panicum maximum	Green Panic Grass	Not declared	Within site				X		
***Paspalum* spp.**	Paspalum	Not declared	Within site				X		
Passiflora subpeltata	White passionflower	Not declared	Within site						
Pinus ellotti	Slash Pine	Not declared	Within site				X		
Senna penula	Easter Cassia	Not declared	Within site				X		
Solanum chrysotrichum	Giant devil's fig	Not declared	Within site				X		
Solanum mauritianum	Wild Tobacco	No declared	Within site				X		
Sphagneticola trilobata	Singapore daisy	Class 3	Within site				X		

Source: Biosecurity Queensland (2013), Commonwealth Australia (2014).

Status: Declaration under Land Protection (Pest and Stock Route) Management Act 2002.

- Class 1 Pest plants are serious weeds that are either not present or not generally established in Queensland and have the potential to cause extreme damage to economy, social well-being and environment. All landholders are required by law to keep their land free of Class 1 pests.
- Class 2 Pest plants are generally established in Queensland and are responsible for the majority of economic and social impacts caused by weeds. Landholders are responsible for treating infestations to prevent spread to other properties and working towards removing the infestation.
- Class 3 Pest plants are environmental weeds generally well established in Queensland and are responsible for the majority of environmental impacts caused by weeds. The management objective of all C3 weeds is containment and reduction in and adjacent to Environmentally Significant Areas (ESAs) (The LP Act 2002 provides a list of criteria by which an ESA is determined)

Table 8 Weed removal/control methods within the protected areas.

Growth Form	Removal Techniques
Woody Stems e.g. Lantana, Camphor Laurel	Manual Small plants can be removed by hand using Soft Weed methodology. Exposure of rootstock to air is necessary to ensure full eradication. Failure to remove ALL of roots will result in regrowth. Herbicide *Up to 10 cm basal diameter* 1. Apply the cut, scrape and paint method using Glyphosate at a ratio of 1:1 to minimise erosion. Lop into 50cm pieces, leaving these on the ground to act as mulch. Regrowth of woody weeds shall be spot sprayed. *Greater than 10 cm basal diameter and inaccessible sites* Stem Injection Use stem injection method - at tree base drill holes at a 45 degree angle into the sapwood at 5 cm intervals. Inject herbicide into holes immediately before the plant cells close and translocation of herbicide ceases. Frill or Chip Cut into the sapwood with a chisel or axe. Fill cut with herbicide immediately with Glyphosate at a rate of 1:1 Repeat the process at 5 cm intervals around the tree. * For *Cinamomum camphora* cuts must overlap with no gaps in order to kill the hardwood. * Plants to be treated with herbicide should be healthy and actively growing. * Deciduous plants should be treated in Spring and Autumn when leaves are fully formed. * Multi-stemmed plants require injection below the lowest branch or treat each stem individually.
Bulbs, Corms or Tubers e.g. Ground Asparagus, Watsonia	Manual Dig down next to the stem until the bulb or tuber is reached. Remove plant and carefully bag the bulb or tuber. Herbicide Remove any seed or fruit and place in bag. With an herbicide applicator, apply to the stems and leaves using brush-off.
Soft Stems (no underground reproductive parts) e.g. Blue Billy-goat Weed, Lantana seedlings	Manual Gently remove any seeds or fruits and carefully place into a bag. Grasp stem at ground level. Rock plant backwards and forwards to loosen roots and pull out gently. Tap the roots to dislodge soil. Herbicide Directly apply to suitable species.

	Should only be used where plants are actively growing.
Underground Reproductive Structures -Taproots	Manual Gently remove and bag seeds or fruit. Loosen soil around taproot with suitable implement. Grasp stem at ground level and gently pull out plant. Tap the roots to dislodge soil. * Not suitable for Paddy's Lucerne or *Ochna serrulata* and many others - use with caution.
Vines, Runners and Scramblers	Manual Locate a runner; gently pull it along the ground. Roll the runners up for easy removal. Continue doing this until all the runners have been rolled up. Small fibrous roots growing from the runners can be cut with a knife. Locate the main root system whilst removing the runners. Remove it manually. Do not leave any bits of stem or large roots, as these may re-shoot. Bag or compost the runners/roots and any other reproductive parts. Herbicide With a knife, scrape 15 to 30 cm of the stem to reach the layer below the bark/outer layer. A maximum of half the stem diametre should be scraped. Large stems (>1 cm) will require two scrapes opposite each other. Immediately apply herbicide along the length of the scrape. Vines can be left hanging in trees after treatment.
Rhizomes e.g. Asparagus Fern	Manual Remove and bag stems with seeds and fruit. Grasp the leaves or stems together so that the base of the plant is visible. Insert a knife at an angle close to the crown and cut through all the roots around the crown. All vegetative materials shall be left in situ.

Notes:

- Hand removal is recommended where possible and practical except where it may lead to soil destabilisation along creeks and drainage lines.
- Non-herbicide removal should be used where possible adjacent to native species to minimise damage. Suitable methods including digging, crowning or hand pulling.
- Where herbicide application is required:
  1. Broad-scale application is not permitted within drainage lines;
  2. Glyphosate Bioactive or equivalent is to be used within 30 m of water bodies as it is identified as more "frog friendly" than other herbicides;
  3. Quantities of herbicide need to be controlled and all care be taken to prevent runoff or excess use;
  4. Always read the lab to ensure the herbicide is used safely and no certificate is required for use; and
  5. Herbicides use should be undertaken during periods of weed growth or as per manufactures specifications.
- Herbicide use is **not permitted**
  1. During windy periods;
  2. Prior to rain forecast or 6 hours after rain,
  3. Broadly/recklessly in areas where native vegetation dominants.
- If in doubt whether plants are weed or native, confirmation prior to conducting weed removal is required e.g. from *Environmental Weed Guide* (free from GCCC), Department of Natural Resources Pest Fact Sheets and *Common Weeds of Northern NSW Rainforest* (The Big Scrub Rainforest Landcare Group, 1998).

3.1.4 Planting

Where revegetation is to take place in rehabilitation units where a reconstruction or fabrication approach is required, plantings are to be of local provenance and significant species should be included in the planting matrix. General steps to be undertaken for successful revegetation are outlined below and must be adhered to during rehabilitation works. These steps will enhance the success of revegetation and will promote the objectives of rehabilitation.

Although the following provides a general guideline it should be noted that a detailed rehabilitation plan for each stage of the development is required to determine the location, density and species matrix required for successful rehabilitation in each rehabilitation unit.

General notes:

- The Habitat Rehabilitation Management Plan must be read in conjunction with the Operational Works Decision Notice and Conditions as issued by Economic Development Queensland (EDQ), along with approved drawing packages:
  - Electrical
  - Civil
  - Refer to Engineers Drawings for all, Civil, Structural and Services.
- Setting out:
  - All revegetation work shall be carried out by an experienced and qualified Contractor with knowledge of local and exotic species identification.
  - Contractor is to verify all set out and dimensions prior to proceeding with the works.
  - Supplementary planting shall take into account site suitability for natural regeneration and must not be conducted in such a way as to cause damage to naturally regenerating habitat.
  - Locate and peg all underground services and adjust planting set out if necessary for adequate clearances.
  - Works to be carried out in accordance with approved specifications and details.
- Prestart:
  - Before work commences the subcontractor is to organise a pre-start meeting with Lend Lease's appointed Environmental Scientist to establish scope of work and clarify any issues.
- Site works:
  - Remove all unwanted materials within all Habitat Rehabilitation areas from site.
  - Control weeds and prepare the site for planting.
  - Suitable planting medium may need to be provided in some circumstances such as denuded or eroded areas.
  - Water Restrictions may apply - 'No potable water to be used for landscaping'.
  - Trucked water to be supplied by contractor.
- Levels:
  - Except where indicated or specified, finished surface levels are to be flush with adjacent surfaces. Ensure grades are evenly transitioned.
- Safety:
  - Contractor to maintain safe access through site at all times. Ensure all excavation points are fully protected at all times.
- Services:
  - It is the Rehabilitation Contractor's responsibility to confirm with authorities and civil contractor the location of all underground services prior to commencement. Repair any damage to services without delay or cost.
- Plant set out and stock:
  - All plant stock to be verified by Lend Lease's appointed Environmental Scientist for stock quality and size, and set out prior to planting.

  - Acquire native species or seeds from local nursery where plant stock is sourced from the local area (local provenance).
  - Substitutions are not to be made without written approval.
  - Set out of mass planted areas (where not detailed):
    - Plants to be set out in swathes of single species of large numbers of plants.
    - Swathes to be set out in naturalistic elongated forms/shapes
    - Swathes of species to be prearranged to provide contrast in size, shape form, texture and colour.
  - Lend Lease's appointed Environmental Scientist to discuss and verify on site a sample section of planting set out prior to contactor proceeding to set out and complete planting.
- Standards:
  - Works to be carried out in accordance with relevant Australian and Industry Standards, unless directed otherwise.
- Site inspections:
  - Inspections by Lend Lease's appointed Environmental Scientist will be carried out to an agreed programme during implementation of the works.
- Fencing:
  - Supply and install Koala exclusion fencing as per the endorsed Koala Management Plan Yarrabilba UDA (Austecology 2012) drawings.
  - All works to comply with all relevant Australian Standards.
- Consolidation:
  - Establishment period: 12 months from practical completion.
  - On-maintenance period: up to 14 years from completion of establishment period.
  - Maintenance shall include watering, weeding, fertilising, pest and disease control, pruning, edging, mowing and monitoring as per the following:
    - Watering: during establishment period water every second or third day to maintain soil moisture; once weekly during the maintenance period.
    - Fertilising: as required where plants are not responding to slow release fertiliser applied at planting.
    - Weeding: as required to prevent weed competition and seeding.
    - Re-mulching: as required to maintain consistent depth.

Plant condition, selection and care

The selection and care of plants is to be undertaken as follows:

- Planted species are to incorporate those identified in Table 8 of this report as being dominant in individual pre-clearing RE's, with preference given to Koala food shelter and food trees (refer to Table 9).
- Plants are to be vigorous, well established, hardened off, consistent with site species or variety, free from disease and insect pests, with large root systems and no evidence of having been restricted or damaged.
- Plants are to be planted immediately after delivery to the site. If this is not possible, they should be stored in the shade and watered sufficiently during the day.
- All specimens used for revegetation within rehabilitation areas shall be of local provenance (i.e. sourced from genetic stock located within a 2 km radius or catchment area of the subject site).
- Preference should be given to seed sourced from vegetation collected from the site prior to harvesting works.
- A minimum 90% survival rate should be achieved.

Table 9 Koala habitat and food tree planting palette within individual Regional Ecosystems.

Species	Regional Ecosystem									
	12.3.6	**12.3.7**	**12.3.11**	**12.9-10.2**	**12.9-10.4**	**12.9-10.12**	**12.9-10.17**	**12.9-10.19**	**12.11.3**	**12.11.5**
Canopy Trees (T1)										
Corymbia citriodora subsp. variegata			X	**X**		**X**	**X**	X	X	X
Corymbia intermedia	**X**	X	**X**		**X**		**X**	**X**	X	**X**
Corymbia trachyphloia subsp. trachyphloia										
Eucalyptus acmenoides							**X**	X	**X**	X
Eucalyptus carnea							**X**	X	**X**	**X**
Eucalyptus major								**X**		
Eucalyptus microcorys	X				X			**X**	X	
Eucalyptus moluccana							X			X
Eucalyptus pilularis										
Eucalyptus propinqua									**X**	X
Eucalyptus resinifera					X					X
Eucalyptus siderophloia			**X**	X	X	X	X		X	**X**
Eucalyptus tereticornis	**X**	**X**	**X**	X	X	X	X		X	X
Lophostemon confertus	X				X				**X**	X
Melaleuca quinquenervia	**X**		**X**		X					

Source: Adapted from Queensland Government (2015). Note: **Bold** values symbolise the dominant species within that vegetative stratum.

Koala habitat and rehabilitation units (RU) and crossing rehabilitation units (CRU) within the each RE:

12.3.6: ORU2, ORU4, ORU5, ORU7, HRU4, HRU6, HRU7, HRU8, HRU9, HRU11, HRU13, HRU14, HRU15, HRU18, HRU19, HRU22, CRU1, CRU2, CRU3, CRU10, CRU12, CRU15; **12.3.7**: ORU2, ORU4, ORU5, ORU6, ORU7, HRU3, HRU4, HRU6, HRU7, HRU8, HRU9, HRU11, HRU13, HRU14, HRU15, HRU18, HRU19, HRU22, CRU1, CRU2, CRU3, CRU10, CRU11, CRU12, CRU13, CRU14, CRU15; **12.3.11**: ORU2, ORU4, ORU5, ORU6, ORU7, HRU3, HRU4, HRU6, HRU7, HRU8, HRU9, HRU11, HRU13, HRU14, HRU15, HRU16, HRU18, HRU19, CRU1, CRU2, CRU3, CRU10, CRU11, CRU12, CRU13, CRU14, CRU15; **12.9-10.2**: ORU1, ORU3, ORU4, ORU8, ORU12, ORU13, ORU14, ORU15, ORU17, ORU20, HRU2, HRU5, HRU10, HRU12, HRU17, HRU20, HRU21, HRU23, HRU27, HRU28, HRU29, HRU30, HRU31, CRU5, CRU6, CRU7, CRU9; **12.9-10.4**: HRU1, HRU2, HRU12; 12.9-10.12: HRU1, HRU2, HRU12; **12.9-10.17**: ORU1, ORU3, ORU4, ORU8, ORU9, ORU10, ORU11, ORU12, ORU13, ORU14, ORU15, ORU16, ORU17, ORU18, ORU20, HRU5, HRU10, HRU17, HRU20, HRU21, HRU23, HRU24, HRU25, HRU26, HRU27, HRU28, HRU29, HRU30, HRU31, CRU5, CRU6, CRU7, CRU9; **12.9-10.19**: ORU9, ORU14, ORU16, HRU24, HRU25, HRU26; 12.11.3: ORU19, ORU21, ORU22, CRU4, CRU8

12.11.5: ORU19, ORU21, ORU22, ORU23, CRU8.

Plant placement and protection

Plants are to be placed in the revegetation area and protected as follows:

- Supplementary planting should take into account the existing community structure.
- Planting should be carried out during suitable weather conditions to minimise the risk of loss of newly establishing plants through drought or by floodwaters.
- Weed removal methods must not pose a threat to vegetation community structure or existing Koala habitat.
- In revegetation areas, plants are to be spaced no less than 5 m apart.
- Planting ratios will vary between RE's, Rehabilitation Units and specific areas however, the following guide should be followed:
  - Canopy trees (Koala food and habitat trees): 70% of planting
  - Shrubs and understory: 10% of planting
  - Ground layer: 20% of planting.

3.2 Monitoring

The following comprehensive monitoring program will be implemented to capture baseline data prior to and during vegetation management treatments being applied and during the period of rehabilitation implementation. Adaptive management strategies will be used and where a treatment does not produce the desired result it will be identified and/or modified. There are many different types and levels of monitoring that can be used for identifying change in vegetation communities. These include assessing parameters such as presence/absence, growth, percentage of cover, total biomass, species richness etc.

For this monitoring program, a minimum of two monitoring sites per rehabilitation unit is sufficient to identify any major changes and to provide a 'snap shot' of ecological conditions. Monitoring in this way will allow the ongoing collection of information to demonstrate the effectiveness of habitat rehabilitation efforts, and the frequency of monitoring activities will enable management prescriptions to be adjusted to bring about any necessary changes and corrective actions (adaptive management).

3.2.1 Sites

Vegetation monitoring will occur in a network of 148 sample sites with:

- 2 sample sites Crossing Rehabilitation Units and within Rehabilitation Units <50,000 m^2;
- 3 sample sites within Rehabilitation Units >50,000 m^2 but <150,000 m^2; and
- 4 sample sites within Rehabilitation Units >200,000 m^2.

Monitoring site locations have been identified in Figure 5, however flexibility will remain to adjust the final locations of the monitoring sites and priority will be given to areas within each rehabilitation unit that require the most significant amount of rehabilitation work.

Figure 5 Monitoring site locations.

Source:	Rehabilitation Units: Natura Consulting 2015 Watercourses: Department of Environment and Resource Management Cadastre Boundary: Department of Natural Resources and Mines Corridors and Assessable Koala Habitat: Lend Lease / Austecology Internal Roads: Lend Lease
Desclaimer:	No warranty is given in relation the data (including accuracy, reliability, completeness, currency of suitability) and no liability is accepted (including without limitation liability in negligence) for any loss, damage or costs (including subsequent damage) relating to any use of the data. Data must not be used for direct marketing purposes or be used in breach of privacy laws.
File/Date:	Koala Habiat Rehabilitation Plan - Monitoring sites for Offset Rehabilitation Units, Habitat Rehabilitation Units and Crossing Rehabilitation Units Date: 30/03/2015

N

0 250 500 1,000 1,500 2,000

Meters

Coordinate System: WGS 1984 Zone 56S Projection: Transerve Mercator

- Monitoring sites
- Crossing Rehabilitation Unit
- Habitat Rehabilitation Units
- Offset Rehabilitation Units
- Yarrabilba Priority Development Area
- Internal Roads

Corridor

- Greenspace Corridor
- Fauna Corridor
- Environmental Protection
- Cadastral Boundary

Monitoring sites for Offset Requirement areas and Asssessable Koala habitat to be protected and managed

The following methodology, for photo point monitoring and 100 m transects, will be applied to monitor at each site.

3.2.2 Photo point monitoring

The final location of each monitoring site within its representative rehabilitation unit will be identified by GPS coordinates and direction (bearing). Photo point monitoring sites are located at the start of each monitoring site. On the ground, each site will be permanently marked by two steel pickets placed approximately 10 m apart. A third picket will be placed 100 m from the first picket to represent the end of the monitoring site.

For each site, a permanently marked photo point will be established at the first marker picket and photographing towards the second marker along the relevant compass bearing, with the site information recorded on a board and second marker in the lower centre foreground. The information board must be used when recording photo point records from each site and must clearly describe the:

- Site number
- Rehabilitation Unit number
- Date

3.2.3 Transect and quadrat monitoring

Quantitative site data, including the attributes of species richness, percentage foliage cover for the ground layer, shrub and canopy layers, canopy height, and weed prevalence are to be collected from field transects and quadrats established at each of the monitoring sites:

Fixed transects will be permanently established lines located by use of metal pickets, metal tags and GPS:

- A 100 m transect will be placed between the first and third positioning metal pickets.
- Quadrats will be placed along the transect:
  - 50 x 10 m plots will be positioned at the transect start (0 m)
  - 1 x 1 m subplots will be position at 0 m, 10 m, 20 m, 30 m and 40m. Adjustments can be made for each subplot if its positioning is placed over a trunk, fallen tree, roots etc.

Given the above, each monitoring site will have the following information collected (Table 10). This benchmark monitoring process will be undertaken, immediately prior to initiation of works (0 months – baseline), and at the following intervals for each rehabilitation unit: 6 months, 1 year, 18 months, 2 years, 2.5 years, 3 years, 4 years, 5 years, 10 years and 15 years. Reporting from each of the monitoring events shall be provided to the Department of Environment within 4 weeks of completion of monitoring.

Table 10 Data collected at monitoring sites.

Method of collection	Data collected
50 m x 10 m quadrat (plot)	Species richness (including weeds), tubestock survival, height of each canopy species
100 m transect	Canopy species cover, shrub cover
Five 1 x 1 m quadrats (subplot)	Percentage cover in ground layer (excluding weeds but including regenerating native canopy cohorts)

3.3 Rehabilitation of Road Crossings

Road mortality has been attributed as a major factor contributing to the decline of many species (van der Ree *et al.* 2008). Overpasses and underpasses can be an effective tool in ensuring safe passage of wildlife between areas of high habitat value, without them succumbing to the effects of traffic pressures. The design of safe passage for fauna will be required for fauna corridor crossings within Yarrabilba. The Koala Management Plan Yarrabilba UDA (Austecology 2012) provides guidelines for these designs which will be assessed at the Context Plan stage.

3.4 Contingency Measures and Corrective Actions

3.4.1 Meeting benchmarks

During the course of monitoring, if Interim Benchmarks are not being met, the timeframes to achieve the Final Benchmarks will be reviewed and extended, whereby Lend Lease will continue to undertake rehabilitation works with continued monitoring until the Final Benchmarks are met. The review of the success of meeting Interim Benchmarks will be undertaken at each monitoring event and reported on. Where the extension of rehabilitation works is required for particular Rehabilitation Units, discussions will be undertaken with the Department of Environment, to ensure that any additional requirements are also highlighted and addressed.

3.4.2 As constructed data

Constructed data and surveyed boundaries will be provided for each rehabilitation unit, within three months of completion of earthworks. This will be undertaken to test and demonstrate compliance within the offset area (at least 195 ha) requirement.

Following discussions with project officer Karina Richards from the Queensland Assessment Section Environmental Assessment and Compliance Division, Department of the Environment in November 2014, boundary lines of the mapped rehabilitation area identified as 'Existing Assessable Koala Habitat to be protected and managed' are permitted to be amended on site:

- Within mapping scale limitations of the original landscape scale mapping (i.e. up to 25 m); and
- Following detailed site surveys; and
- Where there is an opportunity to retain koala food or shelter trees outside of the 'Existing Assessable Koala Habitat to be protected and managed' area and/or where encroachment within the scale limitations of the mapping is also permitted within the 'Existing Assessable Koala Habitat to be protected and managed' area where there are no koala food or shelter trees.

Additionally, amendments to the boundary lines are to comply with approved buffer and corridor widths of the approved Koala Management Plan (refer to Figure 1) (Austecology 2012), the Fauna Corridor Infrastructure Master Plan (Natura Consulting 2011) and within the total Offset Area (at least 195 ha, refer to Figure 2), as specified in the EPBC approval/conditions (30 November 2014). Where amendments to the boundary lines of the 'Existing Assessable Koala Habitat to be protected and managed' have been undertaken within the mapping scale limitations, as outlined above, compliance with the approved documentation will be demonstrated in the 'as constructed data'.

4 Rehabilitation Staging Plan

The Yarrabilba Urban Development is a staged development which will be undertaken over approximately thirty years. As rehabilitation works are tied to the roll-out of construction, any planting will be commenced in conjunction with the construction for each stage. Figure 6 presents an indicative staging plan for the development, which may be amended based on market demand, site constraints etc.

It is proposed that weed control measures be undertaken ahead of the construction staging, as the land owner has obligations under other legislation that requires the management of weeds on site. All weed management will be undertaken in accordance with this report, and other relevant approved documentation, and will be implemented in a manner that is consistent with the conservation of Koala habitat and other ecological values. A summary of staging of detailed rehabilitation planning, rehabilitation works, monitoring, taking into consideration the staging plan for the development, is provided in Table 11.

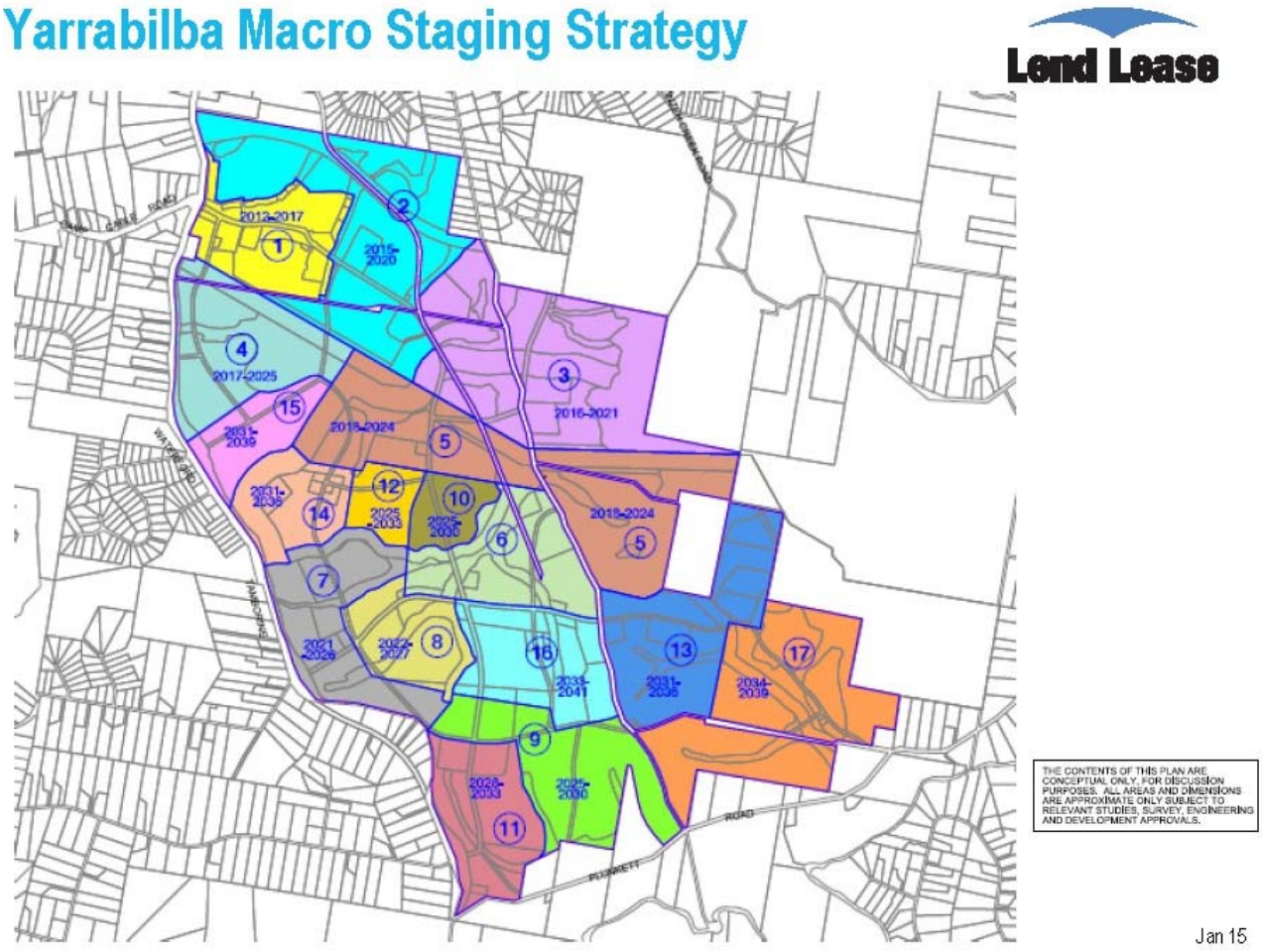

Figure 6 Indicative rehabilitation staging.

Table 11 Summary of Staging of Koala Habitat Rehabilitation and Management*.

Development Stage	Year of Construction	Detailed Rehabilitation Plan	Rehabilitation		Commencement of Monitoring Interim and Final Benchmark	Commencement of Assessment Against Benchmarks	Assessment of Final Benchmark	Contingency Measures Implemented	Responsible Party
			Weed Control	Infill Planting					
1	Not part of EBPC Referral Area								
2	2015 - 2020	2015	Commenced	2016	2015	2016	2030	Implemented where necessary after assessment of each Interim Benchmark and Final Benchmark	Lend Lease
3	2016 - 2021	2017	2017	2018	2017	2018	2032		
4	2017 - 2025	2018	2018	2019	2018	2019	2033		
5	2018 - 2024	2017	2017	2018	2017	2018	2032		
6	2019 - 2026	2018	2018	2019	2018	2019	2033		
7	2021 - 2026	2019	2019	2020	2019	2020	2034		
8	2022 - 2027	2020	2020	2021	2020	2021	2035		
9	2025 - 2030	2020	2020	2021	2020	2021	2035		
10	2025 - 2030	2021	2021	2022	2021	2022	2036		
11	2026 - 2033	2022	2022	2023	2022	2023	2037		
12	2025 - 2033	2022	2022	2023	2022	2023	2037		
13	2031 - 2036	2023	2023	2024	2023	2024	2038		
14	2031 - 2036	2023	2023	2024	2023	2024	2038		
15	2031 - 2039	2024	2024	2025	2024	2025	2039		
16	2033 - 2041	2024	2024	2025	2024	2025	2039		
17	2034 - 2039	2025	2025	2026	2025	2026	2040		

***all figures in this table are indicative and may be subject to change based on market demand and site constraints.**

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