KUR-World

Appendix 5

Flora and Fauna

Environmental Impact Statement

Environmental Approval & Compliance Solutions

KUR-World Flora and Fauna Technical Report

Reever and Ocean Developments Pty Ltd

Document Control Summary

NRA Environmental Consultants

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Report Summary	
Key Words	Reever and Ocean Developments Pty Ltd, KUR-World Integrated Eco-Resort, Flora, Fauna, EIS, Environmental Impact Statement
Abstract	This technical report presents the results of the baseline terrestrial flora and vertebrate fauna surveys to inform the KUR-World Integrated Eco-Resort Environmental Impact Statement. Potential impacts associated with the proposed development project are described and measures to avoid or minimise impacts are recommended.

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1. Introduction

1.1 Project context

The KUR-World Project is an 'Integrated Eco-Resort' proposed on an approximately 680 ha[1] site near Myola in north-east Queensland (hereafter referred to as the project area). The proposed development was deemed a 'Controlled Action' under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) in June 2016, and a 'Coordinated Project' under the Queensland *State Development and Public Works Organisation Act* 1971 in July 2016. The 'Coordinated Project' declaration requires that an Environmental Impact Statement (EIS) be prepared. The final Terms of Reference (TOR) for the EIS were issued in October 2016.

The following report addresses specific TOR items relating to terrestrial flora and fauna.

1.1.1 Project description

KUR-World Integrated Eco-Resort will include a combination of short-term and permanent residential options, as well as education, recreation, wellbeing/rejuvenation and rural tourism facilities. The Master Plan (Version G, 29 September 2017) features four sequential development stages over 7.5 years, commencing in 2018 (**Figure 1**). These stages are as follows.

Stage 1A (2018):

- Farm Theme Park and Equestrian Centre (Phase 1)
- Residential Precinct: Queenslander Lots (21 lots)
- Organic Produce Garden
- Services and Infrastructure (Phase 1)
- Environmental Area (Phase 1).

Stage 1B (2019-2020):

- Farm Theme Park and Equestrian Centre (Phase 2)
- Residential Precinct: Lifestyle Villas (56 lots)
- Open Space
- KUR-Village (Phase 1)
- Four Star Business and Leisure Hotel and Function Centre (Phase 1, 60 rooms)
- Residential Precinct: Premium Villas (39 lots)
- Rainforest Education Centre and Adventure Park
- Services and Infrastructure (including a wastewater treatment plant, access road from Mount Haren Road to Rainforest Education Centre) (Phase 2)
- Environmental Area (Phase 2).

Stage 2 is planned to start immediately after the completion of Stage 1 and will continue for two years from 2021 to 2022. Stage 2 will include:

- KUR-Village (Phase 2)
- Four Star Business and Leisure Hotel and Function Centre (Phase 2, 210 rooms)

[1] This is the total property area, including proposed access road area.

- Sporting Precinct
- Golf Club House and Function Centre
- Golf Course
- Residential Precinct: Premium Villas (154 lots and 60 units)
- Services and Infrastructure (Phase 3)
- Environmental Area (Phase 3).

Stage 3 is planned to start immediately after the completion of Stage 2 and will continue for one year from 2023 to 2024. Stage 3 will include:

- Health and Wellbeing Retreat (60 rooms)
- Residential Precinct: Premium Villas (93 lots)
- Five-Star Eco-Resort (200 rooms)
- KUR-World Campus
- Services and Infrastructure (Phase 4)
- Environmental Area (Phase 4).

1.1.2 Site description

The project area is located near Myola in the Mareeba Shire, approximately 2.5 km west of the Kuranda business precinct and 20 km north-west of the Cairns business precinct (**Figure 2**). The project area is comprised of 12 lots (**Table 1**; **Figure 3**) and gazetted road easements (undeveloped). All lots are zoned as 'rural' (MSC 2017).

Table 1: Lots comprising the project area

Lot[A]	Area (ha)
Lot 22 N157227	37.26
Lot 1 RP703984	16.19
Lot 2 RP703984	48.31
Lot 17 N157227	57.71
Lot 18 N157227	63.01
Lot 19 N157452	39.60
Lot 95 N157452	34.05
Lot 20 N157423	70.62
Lot 131 N157491	64.75
Lot 129 NR456	65.89
Lot 43 N157359	64.51
Lot 290 N157480	64.75

A: Tenure data at the time of reporting and sourced from Queensland Department of Natural Resources and Mines (DNRM). An application to combine certain lots and remove road easements has been submitted to DNRM (*pers. comm.* Stephen Whitaker, Planner, Cardno, 11 October 2017).

Current development in the project area comprises a homestead, cattle yards, animal enclosures, unsealed vehicle tracks, a farm dam and a weir on Haren Creek. New fencing has been constructed since 2014 and a number of paddocks established. Cattle have access to creeks for watering.

The northern portion of the project area contains low undulating rises dissected by steep gullies. Elevation in this area varies between 340 m and 360 m (Australian Height Datum, AHD). This portion of the property has been used for cattle grazing since the early to mid-20th century and remains in use for this purpose. Historical aerial photography shows that the

majority of this northern portion was largely or partially cleared of woody vegetation on a number of occasions from the 1940s to the early 1990s. During the 1990s, regrowth vegetation began to re-establish. In 2014, approximately 46 ha of this regrowth vegetation was cleared to reinstate pasture. A time series of aerial photography is provided in **Appendix A**.

The southern portion of the project area is variable in topography, containing areas of gently to steeply inclined terrain, and dissected by a number of gullies and small streams. Elevation varies between 340 m and 440 m AHD. Remnant vegetation dominates this area. Historical aerial photographs indicate localised and episodic vegetation clearing events, though regrowth vegetation has since established over most of the previously cleared land. A network of All-terrain Vehicle (ATV) tracks occur near the south-eastern boundary. A paintball business operates near the southern boundary.

Four streams and their associated tributaries are present in the project area. The two largest streams are Owen Creek (runs along the western boundary) and Haren Creek (runs through the centre of the project area and joins Owen Creek in the north-west of the project area). The project area contains parts of the headwaters for Warril and Cain Creeks (**Figure 3**). Owen Creek, Warril Creek and Cain Creek enter the Barron River approximately 1 km north of the project area.

1.2 Bioregional context

The project area is located within the Macalister Subregion of the Wet Tropics Bioregion (**Figure 2**). The Bioregion contains rugged rainforest mountains, with extensive plateau areas to the west of the range and low-lying coastal plains to the east (Goosem *et al.* 1999). The Macalister Subregion is comprised of an undulating tableland bounded by a steep dissected escarpment falling to a narrow coastal plain. Metasediments characterise the Macalister Subregion with rainforests and woodlands the dominant vegetation patterns (Goosem *et al.* 1999). The Subregion is generally drier, and contains a lower proportion of cooler higher altitude environments, than the Subregions to the north and south.

Across the Wet Tropics Bioregion rainforest broadly occurs as a north-south band along and near the coastal range system. The project area occurs along the western edge of this band of rainforest, where the vegetation transitions into Eucalypt forest and woodlands (**Figure 4**). The Wet Tropics World Heritage Area (WTWHA) covers part of the rainforest in the region, its closest point being approximately 2 km to 4 km east, north and south-east of the project area (**Figures 2** and **4**). The north-south band of rainforest, and the WTWHA, narrows in the vicinity of Kuranda (and by default the project area) (**Figure 4**). For this reason, all remnant rainforests in this area are considered important for maintaining north-south connectivity.

The region is also of conservation value from an evolutionary perspective (Moritz *et al.* 2009). Throughout history rainforests in the Wet Tropics have experienced cycles of contraction and expansion in response to changing climatic conditions. Periods of rainforest contraction isolated many wildlife populations to small, mostly montane refugia (Nix 1991). A major disjunction was centred on the Black Mountain Corridor (**Figures 2** and **4**), separating multiple small refugia in the north from larger refugial areas in the central Wet Tropics (Moritz *et al.* 2009). A suture zone is thought to have formed across a broad area, encompassing Kuranda, 7,500-600 years ago when rainforest expanded and the previously separated lineages came back into contact (Hoskin *et al.* 2011). These climatic shifts and suture zones can promote genetic and phenotypic divergence, and potentially speciation (Phillips *et al.* 2004; Moritz *et al.* 2009; Hoskin *et al.* 2011). The Kuranda Tree Frog (*Litoria*

myola), which occurs in the Kuranda area, is one of the better-known examples of speciation in response to these evolutionary processes (Hoskin 2007).

1.3 Scope – Flora and Fauna Technical Report

The scope of works for the terrestrial flora and vertebrate fauna technical report is based on the requirements of the *Terms of Reference for an Environmental Impact Statement: KUR-World Integrated Eco-Resort, October 2016* (TOR) and the NRA Environmental Consultants (NRA) proposal dated 2 December 2016. This technical report provides information to inform the following items from the TOR[2].

- ***11.14**. Using maps, illustrate the context of the project site in relation to surrounding vegetation, areas of essential habitat, wetlands, watercourses and drainage features, ecological communities and wildlife habitat corridors. The location of flora and fauna found on the site and in immediate surrounds should be shown on maps in relation to their habitat and connectivity in the landscape. Include maps showing areas of:*
  - *(a) mapped regulated vegetation, as shown on the regulated vegetation management map, over the subject and adjoining lots*
  - *(b) mapped as concern regional ecosystems on the vegetation management supporting map, essential habitat on the essential habitat map and wetlands on the vegetation management wetlands map.*

- ***11.15**. Describe the likely impacts on the biodiversity and natural environmental values of affected areas arising from the construction and operation of the project. Take into account any proposed avoidance and/or mitigation measures and enhancements proposed.*
- ***11.16**. The assessment should include, but not be limited to, the following key elements:*
  - *(a) matters of state environmental significance and national environmental significance*
  - *(b) terrestrial and aquatic ecosystems (including groundwater-dependent ecosystems) and their interaction, including with ground and surface water hydrology and the quality of controlled and potentially uncontrolled discharges*
  - *(c) biological diversity including listed flora and fauna species and location of any known or potential habitat, and regional ecosystems including the location and extent of any endangered and of concern regional ecosystems*
  - *(d) evidence of the height of the tallest vegetation adjacent to the proposed infrastructure*
  - *(e) the existing integrity of ecological processes, including habitats of threatened, near-threatened or special least-concern species*
  - *(f) the integrity of landscapes and places, including wilderness and similar natural places*
  - *(g) actions of the project that require an authority under the Nature Conservation Act 1992 and Water Act 2000 (for example, riverine protection permits) and/or would be assessable development for the purposes of the Vegetation Management Act 1999 (VMA) or the EP Act*
  - *(h) acute or chronic, low-level exposure to contaminants or the bio-accumulation of contaminants*

[2] Items relating directly to aquatic ecosystems (surface and groundwater dependent) and to bushfire assessment and management, are outside the scope of this technical report.

(i) impacts on native fauna due to proximity to the site and site impacts

(j) construction and operational impacts (e.g. lighting, noise, waste, increased visitation, traffic management).

- ***11.17**. Propose practicable measures for protecting or enhancing natural values, and assess how the nominated quantitative indicators and standards may be achieved for nature conservation management. In particular, address measures to protect or preserve any matters of state or national environmental significance. Measures should include but not be limited to:*

  (a) *maintenance of functional corridors into the future to enable the dispersal of rainforest biota and their genes between northern and southern rainforest strongholds, north and south of the Barron river.*
- ***11.18**. Assess the need for fire breaks and safety buffer zones and provide details on the retention, rehabilitation or planting of movement corridors.*
- ***11.19**. Demonstrate that the development will avoid waterways, drainage features and wetlands or propose measures to mitigate the impacts of development on these features. Include mitigation strategies for construction, operation and maintenance phases.*
- ***11.20**. Assess the likely effectiveness of proposed buffer zones around waterways and draining features and wetlands on the site to avoid land degradation, maintain ecological processes and prevent the loss of biodiversity. Demonstrate how buffers will protect bank stability and aquatic terrestrial habitat.*
- ***11.21**. Describe how the achievement of the objectives would be monitored and audited, and how corrective actions would be managed.*
- ***11.23**. Describe what the impacts of pets (dogs, cats etc.) will be on threatened and rainforest dependent biota and how this will be mitigated.*
- ***12.7**. Propose detailed measures to control and limit the introduction and spread of pests and weeds on the project site and adjacent areas. This includes declared plants under the Biosecurity Regulation 2016, weeds of national significance, and designated pests under the Public Health Act 2005. All proposed measures must be in accordance with any relevant biosecurity surveillance or prevention program authorised under the Biosecurity Act 2014. Particular reference must be made to regional threats such as Yellow Crazy Ants and Electric Ants.*

1.4 Important terminology

In this report, the 'project area' refers to all land parcels directly affected by the KUR-World Project. It includes 12 lots and three access points, with a fourth access (from Mount Haren Road to the 'Rainforest Education Centre and Adventure Park') under consideration (**Figure 1**).

Threatened and Near Threatened (T&NT) flora and fauna species are as listed under the Queensland *Nature Conservation Act* 1992 (NC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). Migratory fauna are as listed under the EPBC Act. The abbreviation 'T/NT&M' refers to EPBC Act and NC Act-listed Threatened, Near Threatened and Migratory fauna. Species and community status is as listed in the legislation on 31 August 2017.

As per EHP (2014), the terms 'local area' and 'region', when used generally, refer to areas within approximately 5 km and 20 km of the project area respectively. Exceptions apply when these terms are used in combination with a specific locality descriptor (*eg* Kuranda area means the locality as per government mapping).

Regional Ecosystems (REs) are vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil (Sattler & Williams 1999). Each RE is given a three-part code (*eg* 7.11.1); each part is defined as follows.

- The first part of the code refers to the bioregion. The project area is located in the Wet Tropic Bioregion which corresponds with the code '7'.
- The second part of the code refers to the landzone. Landzone '11' is the only landzone present on the project area and corresponds with 'hills and lowlands on metamorphic rocks'.
- The third part of the code is the ecosystem number and denotes different vegetation types. There are various vegetation types present on the project area. Different community variants may exist for certain vegetation types. These community variants are denoted by a postscript a, b, c, *etc.* For example, RE 7.11.1a and RE 7.11.1b are vegetation community variants of the same parent RE 7.11.1. Legislative and conservation status is defined at the parent RE level.

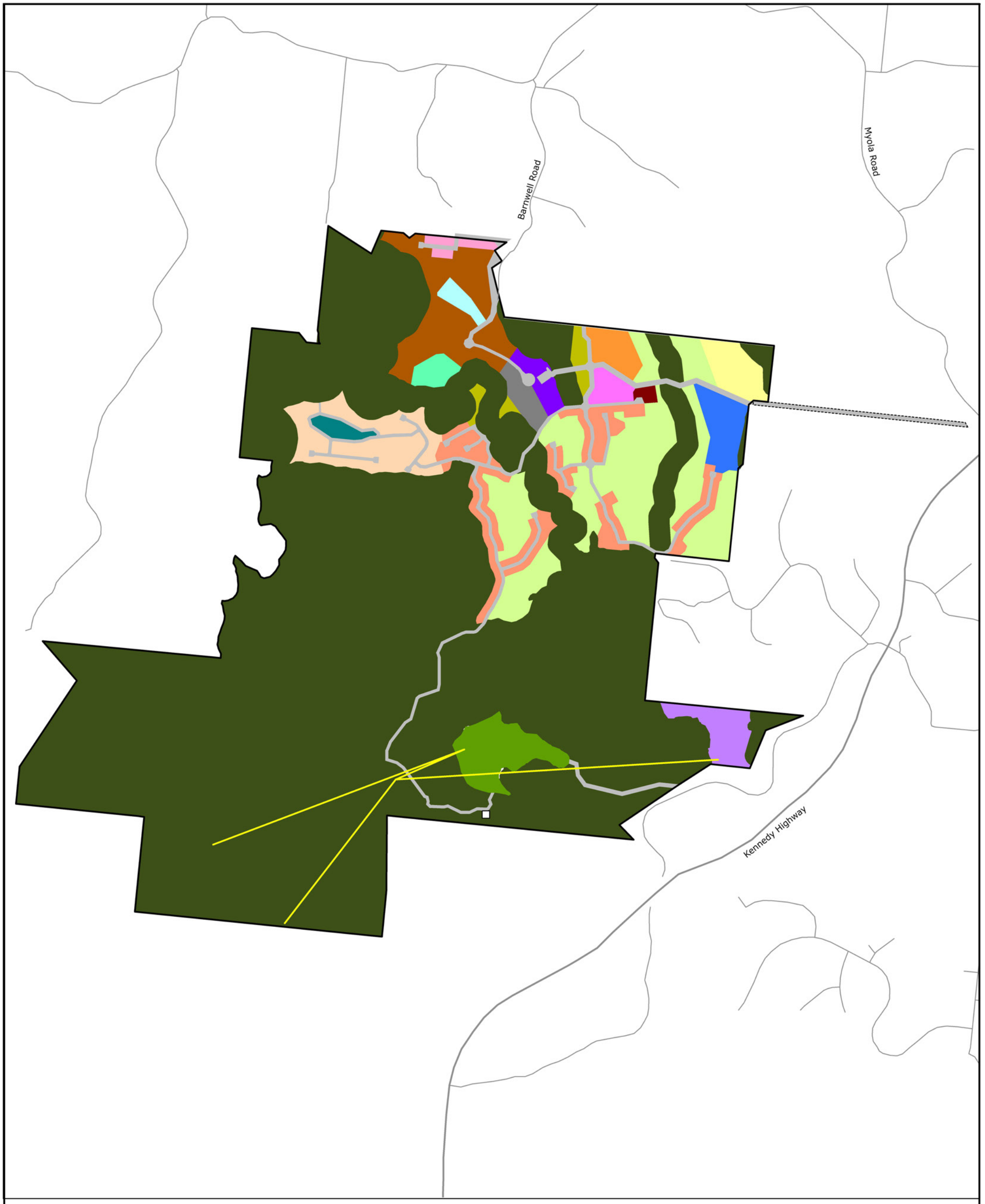

Figure 1: Schematic project layout for proposed Kur-World development

Project: KUR-World Flora and Fauna Technical Report

KUR-World project area
Proposed access road

KUR-World Masterplan Revision G

- Lifestyle Villas
- Queenslander Lots
- Premium Villas
- KUR-Village
- Five Star Eco Resort
- Golf Course
- Golf Clubhouse and Function Centre
- Business and Leisure Hotel and Function Centre
- Health and Wellbeing Retreat
- Sporting Precinct
- Farm Theme Park and Equestrian Centre
- KUR-World Campus
- Rainforest Education
- Open Space
- Produce Garden
- Glamping
- Service / Infrastructure
- Road
- Dam
- Helipad
- Environmental Area
- Zip line options

Major roads
Local roads

N

0 0.5 1

Kilometres

Source:
© State of Queensland (Department of Natural Resources and Mines) 2017.
Updated data available at http://qldspatial.information.qld.gov.au/catalogue//

NRA Ref: 424102.01
Date: November 2017

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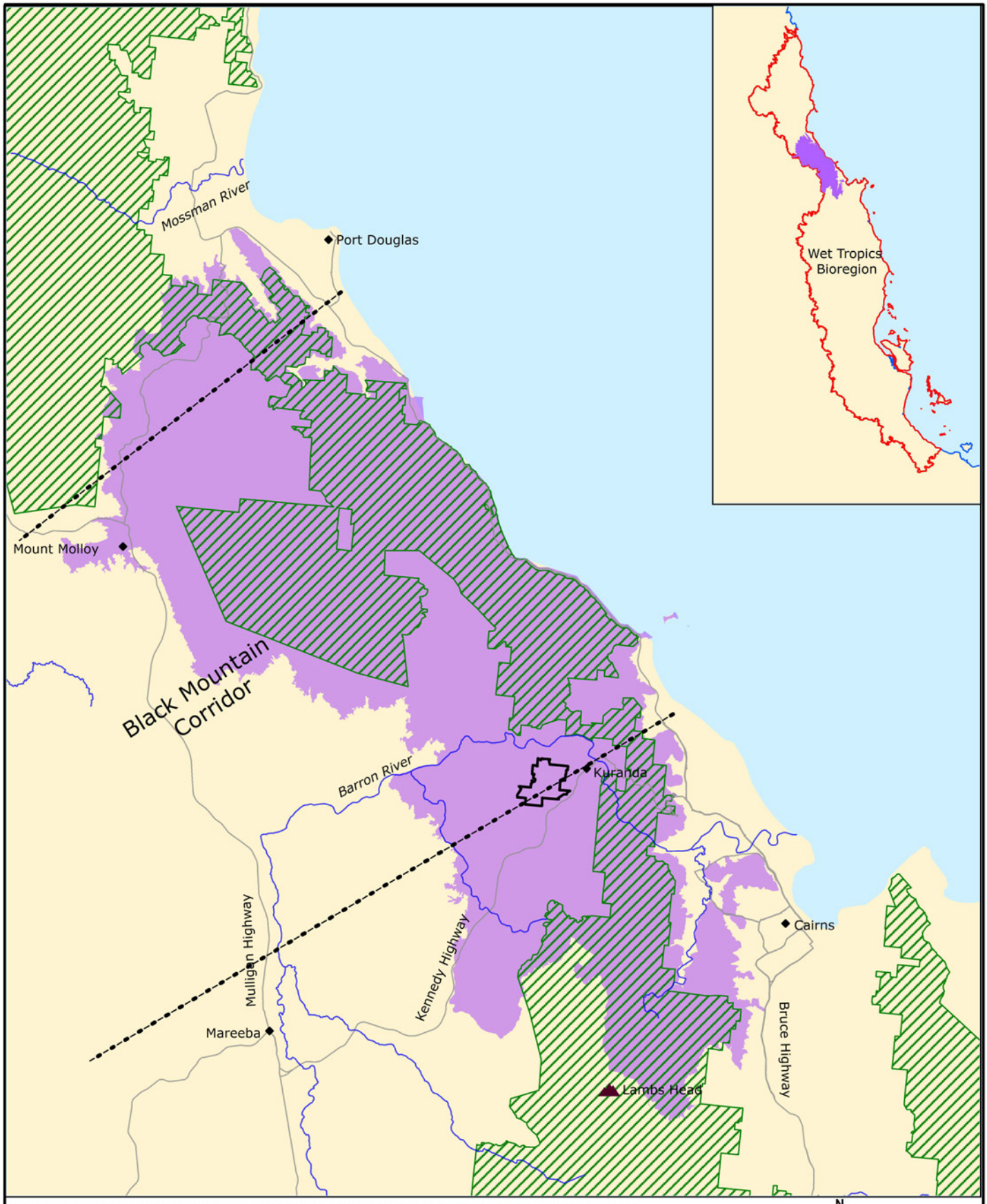

Figure 2: Location and geographic context of the KUR-World project area
Project: KUR-World Flora and Fauna Technical Report

- KUR-World project area
- Wet Tropics Bioregion
- Macalister sub-region
- Wet Tropics World Heritage Area
- Black Mountain Corridor north and south boundaries
- Major drainage
- Major roads

N

0 5 10
Kilometres

Source:
© State of Queensland (Department of Environment and Resource Management) 2010 , © State of Queensland (Department of Natural Resources and Mines) 2014, © State of Queensland (Department of Natural Resources and Mines) 2017.

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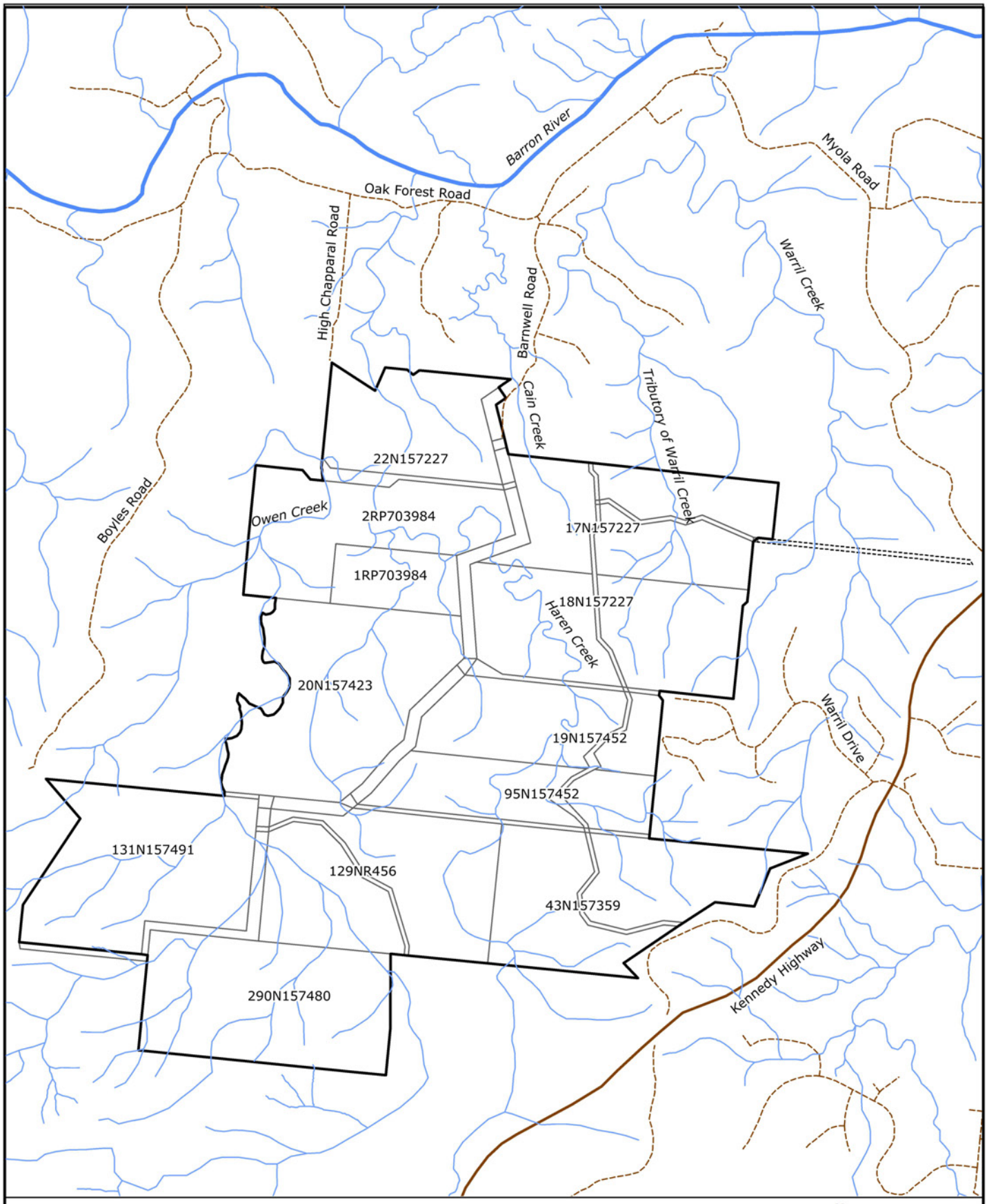

Figure 3: KUR-World project area cadastral boundaries
Project: KUR-World Flora and Fauna Technical Report

KUR-World project area
Proposed access road
Lot boundary
Major drainage
Minor drainage
Major roads
Local roads

N

0 500 1000
metres

Source:
© State of Queensland (Department of Natural Resources and Mines) 2014, © State of Queensland (Department of Natural Resources and Mines) 2017, Reever & Ocean Developments Pty Ltd

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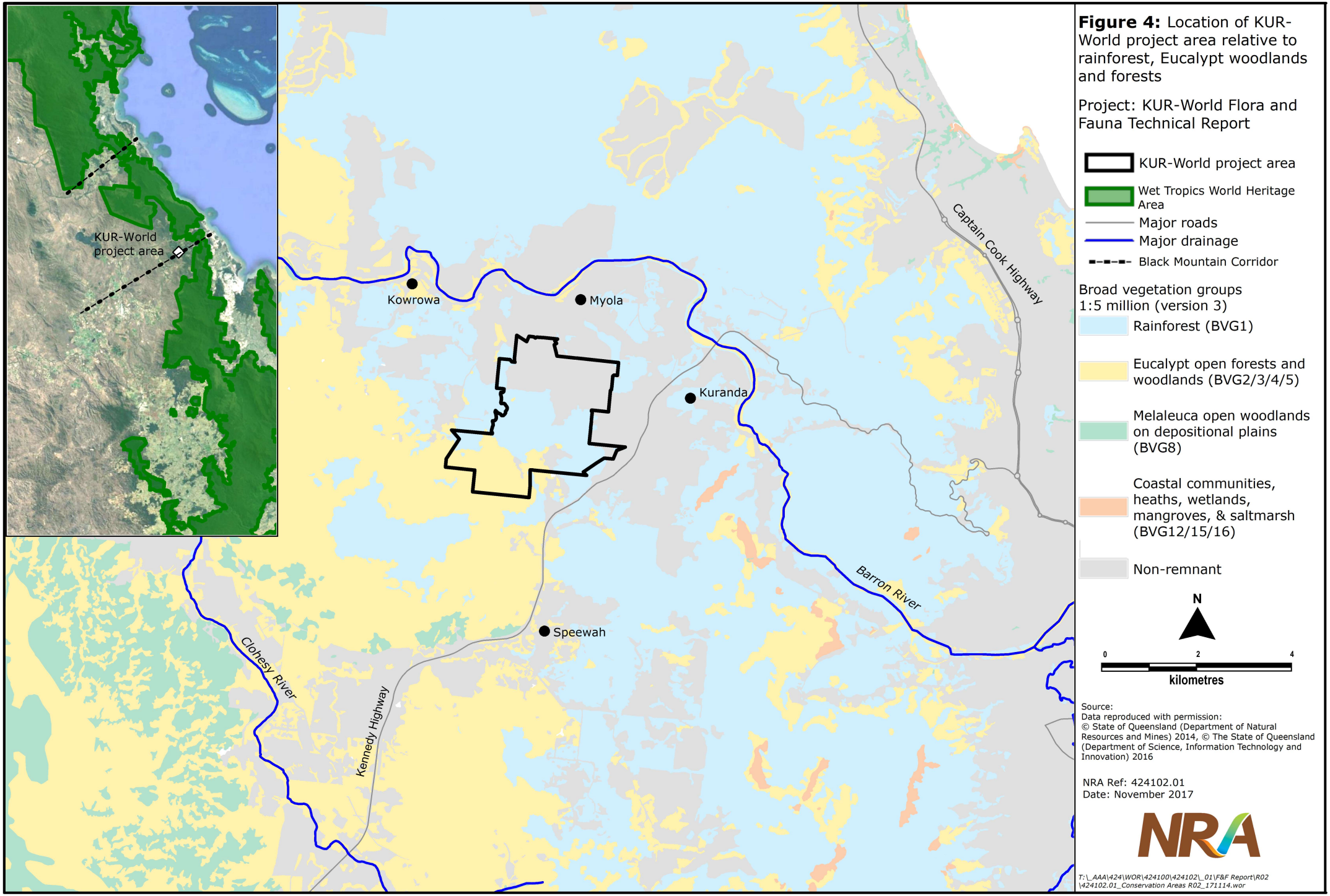

Figure 4: Location of KUR-World project area relative to rainforest, Eucalypt woodlands and forests

Project: KUR-World Flora and Fauna Technical Report

KUR-World project area

Wet Tropics World Heritage Area

Major roads

Major drainage

Black Mountain Corridor

Broad vegetation groups 1:5 million (version 3)

Rainforest (BVG1)

Eucalypt open forests and woodlands (BVG2/3/4/5)

Melaleuca open woodlands on depositional plains (BVG8)

Coastal communities, heaths, wetlands, mangroves, & saltmarsh (BVG12/15/16)

Non-remnant

N

0 2 4

kilometres

Source:
Data reproduced with permission:
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2. Potentially Relevant Legislation

Commonwealth and State legislation specify the manner in which developments can be carried out and the permit requirements for particular activities. Legislation that is potentially relevant to the project, from a flora and fauna perspective, is summarised below. This information is largely based on the Queensland Government Department of Environment and Heritage Protection's (EHP's) *EIS Information Guideline – Flora and Fauna* (EHP 2016a).

2.1 State (Queensland) legislation

Nature Conservation Act 1992 (NC Act)

The NC Act is the principal legislation that provides for the protection of native flora and fauna (protected wildlife). The NC Act is administered by the Department of National Parks, Sport and Racing (NPSR) and EHP. Under the NC Act, native wildlife (flora and fauna) is classified into different categories of conservation significance in recognition of how threatened it is and what action needs to be taken to protect it. These categories are relevant to significant residual impact and environmental offset determinations under the Queensland *Environmental Offsets Act* 2014 (EO Act). Certain authorisations or permits under the NC Act are required prior to clearing listed threatened plant species, interfering with an animal breeding place, or removing protected animals unless the activity is exempt.

Vegetation Management Act 1999 (VM Act)

The Queensland *Vegetation Management Act* 1999 (VM Act) is administered by the Department of Natural Resources and Mines (DNRM). The VM Act, in conjunction with the *Sustainable Planning Act* 2009 (SP Act), regulates the clearing of woody native vegetation in Queensland. The VM Act's objectives include the conservation of remnant Regional Ecosystems (REs), prevention of the loss of biodiversity, maintenance of ecological processes, and conservation of vegetation in areas of high nature conservation value or lands vulnerable to land degradation. The VM Act classes are relevant to significant residual impact and environmental offset determinations under the EO Act.

Environmental Offsets Act 2014 (EO Act)

The EO Act, *Environmental Offsets Regulation* 2014 (EO Reg), and associated policies and guidelines provide a framework for defining the offset obligations where significant residual impacts to Matters of State Environmental Significance (MSES), Matters of National Environmental Significance (MNES) or Matters of Local Environmental Significance (MLES) occur.

Biosecurity Act 2014 (Biosecurity Act)

The Queensland *Biosecurity Act* 2014 (Biosecurity Act) provides the framework and powers for the management of biosecurity matters, including pest plants and animals. The Biosecurity Act came into effect on 1 July 2016 and replaced the Queensland *Land Protection (Pest and Stock Route Management) Act* 2002 (LP Act). Under the Biosecurity Act, everyone has a general biosecurity obligation (GBO) which is defined as follows.

- Take all reasonable and practical steps to prevent or minimise each biosecurity risk.
- Minimise the likelihood of the risk causing a biosecurity event and limit the consequences of such an event.
- Prevent or minimise the adverse effects the risk could have and refrain from doing anything that might exacerbate the adverse effects.

The *Declared Pest Classes* under the LP Act have been replaced under the Biosecurity Act by *Prohibited Matters* and *Restricted Matters*. *Prohibited Matters* are diseases and exotic pest species that are not found in Queensland that, if they were to enter, would seriously impact society, the economy and the environment. *Restricted Matters* are diseases or pest species already found in Queensland that may result in adverse effects on a biosecurity consideration if conditions or restrictions under the Biosecurity Act were not imposed.

2.2 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
The objectives of the EPBC Act are to:

- provide for the protection of the environment, especially MNES
- conserve Australian biodiversity
- provide a streamlined national environmental assessment and approvals process
- enhance the protection and management of important natural and cultural places
- control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife
- promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources
- recognise the role of Indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity
- promote the use of Indigenous people's knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.

The EPBC Act focuses Australian Government interests on the protection of MNES, with the States and Territories having responsibility for matters of state and local significance. The nine MNES are:

- world heritage properties
- national heritage places
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

Actions that will or may have a significant impact on MNES should be referred to the Commonwealth Department of the Environment and Energy (DoEE) for assessment under the EPBC Act.

3. Methods

3.1 Overview

The baseline terrestrial flora and fauna study was primarily conducted between January and June 2017. The study was informed by field surveys and reviews of existing information. The study methods are described below.

3.2 Flora methods

3.2.1 Desk-based review

The results of the desk-based review informed the design of the field surveys and predictions regarding the presence or potential presence of flora values. The following are the primary information sources that were consulted.

- Results from searches of the following databases:
  - EPBC Act Protected Matters Search Tool (DoEE 2017a). An EPBC Act Protected Matters Report was generated for the area within a 10 km radius of point -16.8306, 145.6032 (**Appendix B**).
  - EHP Wildlife Online database (EHP 2017a). Report was generated for the area within a 10 km radius of point -16.8306, 145.6032 (**Appendix C**).
  - Atlas of Living Australia search (ALA 2017). Review of specific species records and a database search within a 5 km radius of point -16.8306, 145.6032 (**Appendix C**).
- Regional Ecosystem (RE) mapping (Version 8.0) (DNRM 2017a; **Figure 5**) and VM Act Regulated Vegetation mapping (DNRM 2017b).
- NC Act Protected Plants Flora Survey Trigger Maps (EHP 2016b; **Appendix D**).
- *Detailed surface geology - Queensland* (DNRM 2011).
- Matters of State Environmental Significance Environmental Report (EHP 2017b; **Appendix E**) for a 2 km search area radius around point -16.8306, 145.6032.
- Reports relevant to flora values of the project area: Astrebla (2015a-b; **Appendix F**); Hoskin (2016, 2017; **Appendix G**).
- Aerial imagery available via Google Earth and Queensland Globe[3], and QImagery[4].

3.2.2 Field surveys

The NRA field survey was conducted over multiple mobilisations. The initial survey was conducted between 18 and 22 January 2017. Following the surveys, the preliminary results were reviewed to identify data deficiencies. Follow up surveys occurred between May and September 2017. Approximately 14 days were devoted to the field flora survey.

Regional Ecosystem mapping and assessments

The desk-based review identified a variety of vegetation communities across the project area. RE mapping (DNRM 2017a, Version 8.0; **Figures 5** and **6**), in conjunction with aerial

[3] Accessed January to September 2017, https://www.business.qld.gov.au/running-business/support-assistance/mapping-data-imagery/maps/queensland-globe.
[4] Accessed January to September 2017, https://qimagery.information.qld.gov.au.

imagery, was used to plan the field surveys. The intention was to visit all identifiable vegetation types within the study area.

To help verify the RE mapping across the project area, 19 secondary and 29 quaternary vegetation assessments were used following the method of Neldner *et al.* (2017a). The RE underlying each assessment site according to DNRM (2017a) RE mapping is summarised in **Table 2**. The locations of vegetation assessment sites are shown on **Figure 6**. Forested areas mapped by DNRM (2017a) as non-remnant vegetation were assessed.

Table 2: Vegetation assessment sites and corresponding Regional Ecosystem according to DNRM (2017a) mapping

Assessment Type [A]	Regional Ecosystem (RE) [B]						
	7.11.1	7.11.7	7.11.13	7.11.33[D]	7.11.44	7.11.51	Non-remnant
Secondary vegetation assessment sites	2	5	2	1	2	2	5
Quaternary vegetation assessment sites	4[C]	2	1	1	2	0	19
Total number of assessment sites	6[C]	7	3	2	4	2	24
Area (ha) within project area	12	259	19	11	43	70	263

A: Assessment type as described in Neldner *et al.* (2017a).

B: As shown on Version 8.0 RE mapping (DNRM 2017a).

C: Three sites were near the project area and used as reference sites.

D: DNRM (2017a) mapped as present, though not found on project area.

Flora species inventory

An inventory of flora species encountered was maintained during field surveys. General field search areas are shown on **Figure 6**. Plants that could not be readily identified in the field were collected (a sample of diagnostic plant parts) for later identification.

Threatened and Near Threatened flora

The desk-based assessment determined that eight T&NT flora species are known to occur locally based on database search results (EHP 2017a; ALA 2017). The Protected Matters Search Tool predicted the potential occurrence of a further 16 species. Field surveys were designed to ensure time was spent searching in all identifiable vegetation types, and the range of conditions in which each vegetation type occurred. Specific effort was devoted to searches for T&NT plants in areas of potentially suitable habitat.

Targeted searches for T&NT plants occurred previously in select areas of the project area; this work is reported in Astrebla (2015b). The search areas applied during these surveys are shown on **Figure 6** and the results are incorporated herein. A copy of Astrebla (2015b) is provided as **Appendix F**.

Non-native flora species

Effort was devoted to searching for non-native plant species and recording their abundance or extent. Search areas included locations that have a higher probability of harbouring weed species such as waterways, stock waterpoints, roads/tracks, forest/pasture edges and areas of historical ground disturbance.

Figure 5: DNRM Regional Ecosystem (Version 8.0) mapping

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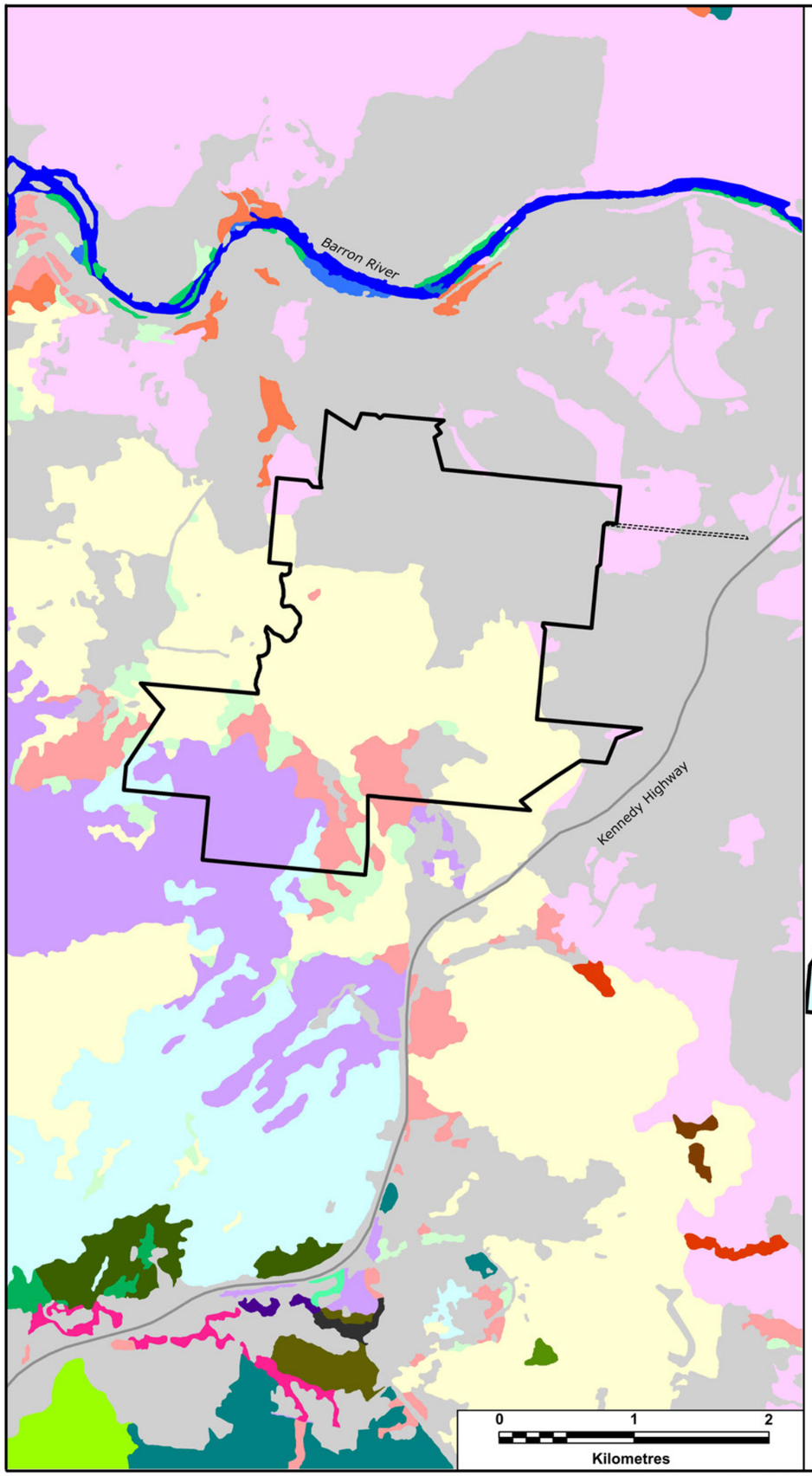

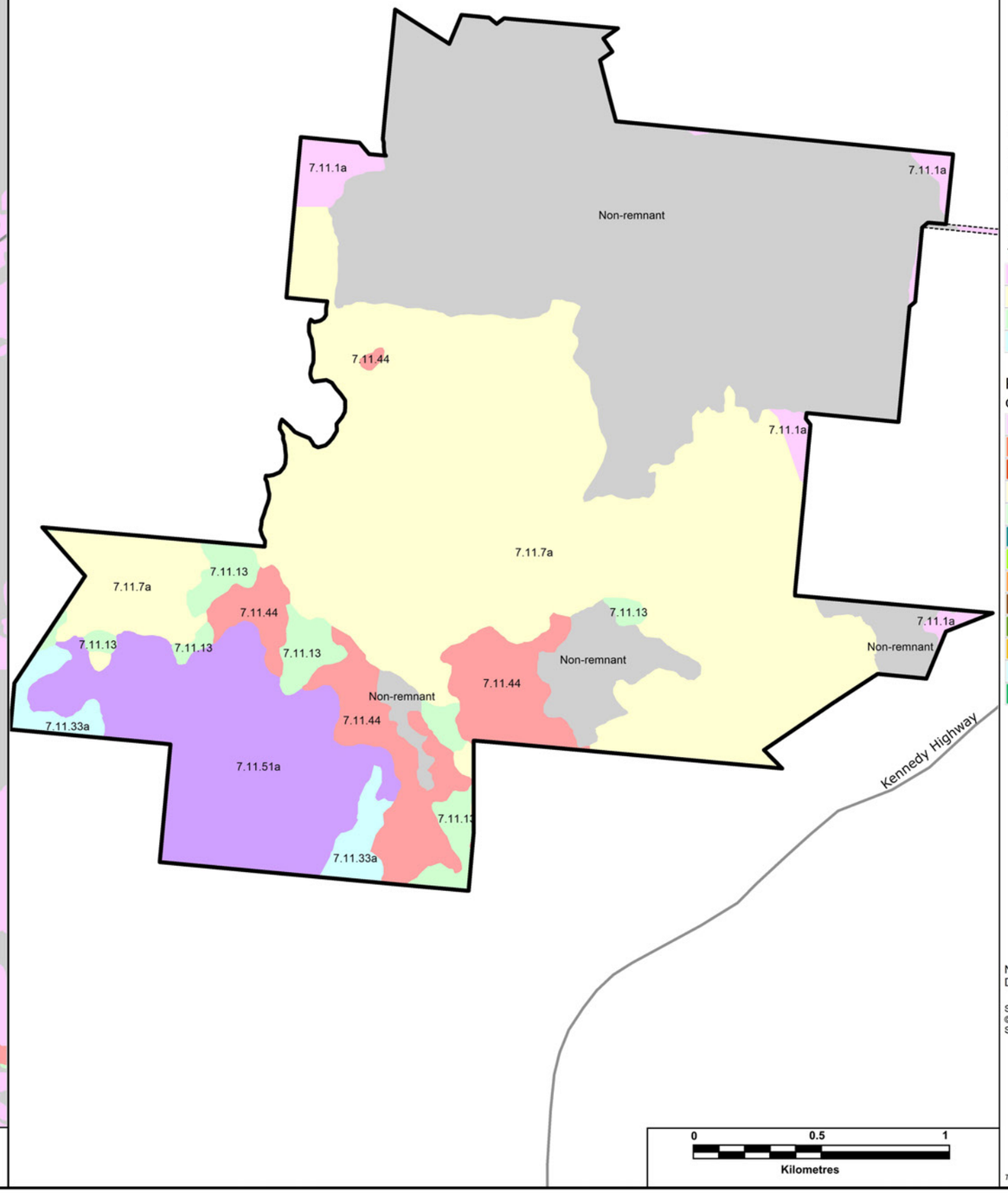

KUR-World project area

Proposed access road

Major roads

Regional Ecosystems DNRM Version 8.0 that occur within the KUR-World project area

- 7.11.1a
- 7.11.7a
- 7.11.13
- 7.11.33a
- 7.11.44
- 7.11.51a
- Non-remnant

Regional Ecosystems DNRM Version 8.0 outside of the KUR-World project area

- 7.11.1
- 7.11.5
- 7.11.6
- 7.11.7
- 7.11.13
- 7.11.19
- 7.11.21
- 7.11.26
- 7.11.28
- 7.11.31
- 7.11.32
- 7.11.33
- 7.11.35
- 7.11.41
- 7.11.44
- 7.11.51
- 7.3.10
- 7.3.19
- 7.3.20
- 7.3.25
- 7.3.26
- 7.3.28
- 7.3.38
- 7.3.43
- 7.3.45
- Non-remnant

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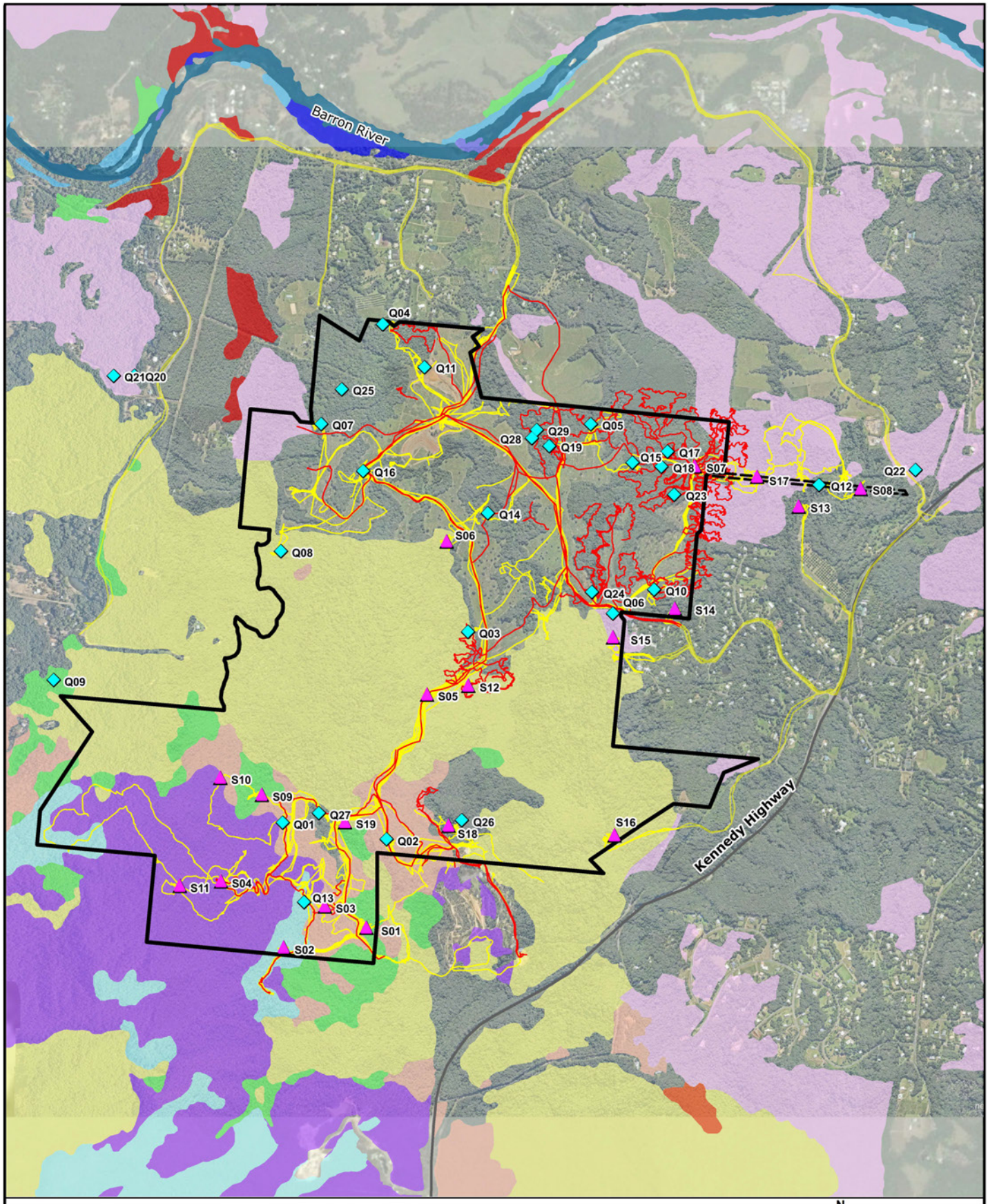

Figure 6: NRA field flora assessment locations

Project: KUR-World Flora and Fauna Technical Report

- KUR-World project area
- Proposed access road
- Major roads
- Astrebla (2015) survey tracks
- NRA survey tracks 2017

Vegetation Assessment Sites

- Quaternary survey
- Secondary survey

Regional Ecosystems DNRM Version 8.0

- 7.11.1
- 7.11.5
- 7.11.6
- 7.11.7
- 7.11.13
- 7.11.31
- 7.11.33
- 7.11.35
- 7.11.44
- 7.11.51
- 7.3.10
- 7.3.25
- 7.3.26
- 7.3.28
- No Fill Non-remnant

N

0 500 1000 metres

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3.3 Fauna methods

3.3.1 Desk-based review

The results of the desk-based review informed the design of the field surveys and predictions regarding the presence or potential presence of fauna values. The following are the primary information sources that were consulted.

- Results from searches of the following databases.
  - EPBC Act Protected Matters Search Tool (DoEE 2017a). An EPBC Act Protected Matters Report was generated for the area within a 10 km radius of point -16.8306, 145.6032 (**Appendix B**).
  - EHP Wildlife Online database (EHP 2017a). Report was generated for the area within a 10 km radius of point -16.8306, 145.6032 (**Appendix H**).
  - Atlas of Living Australia search (ALA 2017). Review of specific species records and a database search within a 5 km radius of point -16.8306, 145.6032 (**Appendix H**).
- Regional Ecosystem (RE) mapping (Version 8.0) (DNRM 2017a; **Figure 5**) and Broad Vegetation Groups (BVG) mapping (Version 3) (DSITI 2016; **Figure 7**).
- Hoskin's (2016, 2017; **Appendix G**) reports on the presence of threatened frogs in the study area.
- Aerial imagery available via Google Earth and Queensland Globe[5]), and QImagery[6].

3.3.2 Field surveys

The field fauna survey program involved two independent studies, as follows.

1. A baseline terrestrial vertebrate fauna survey (hereafter, 'baseline fauna survey') conducted in general accordance with the approach described in Eyre *et al.* (2014). The survey included targeted sampling for T/NT&M fauna species, with the exception of threatened frogs.
2. A specialised survey for threatened stream-dwelling frogs.

The baseline fauna survey involved systematic sampling at formal survey sites, targeted sampling (using a subset of techniques) for specific species and/or at specific areas of interest, and continuous observation. As per advice contained in Eyre *et al.* (2014), surveys were timed to occur in the early wet and early dry seasons. The survey schedule is summarised below.

- **Early wet season (EWS)**. The EWS survey occurred over five days in January 2017. A three-person team of ecologists was devoted to the task.
- **Early dry season (EDS)**. The majority of the EDS survey work occurred over six days in May 2017. The survey team comprised four ecologists during the first and final day of the survey, and two ecologists for the remainder of the time. Additional acoustic bat detection/recording occurred in June 2017.

Surveys for threatened frogs occurred over eight days in January 2016 (reported in Hoskin 2016) and over nine days between February and March 2017 (reported in Hoskin 2017). The survey was conducted by James Cook University (NRA assisted parts of 2017 surveys). The

[5] Accessed January to September 2017, https://www.business.qld.gov.au/running-business/support-assistance/mapping-data-imagery/maps/queensland-globe.
[6] Accessed January to September 2017, https://qimagery.information.qld.gov.au.

approach and results of the 2016 and 2017 studies are incorporated herein (part of the 'targeted survey assessment' program). The full report is provided in **Appendix G**.

Baseline fauna survey

The following was considered when selecting formal survey sites.

- Preliminary development plans.
- Broad Vegetation Group (BVG 1:2M) mapping (DSITI 2016; **Figure 7**); both remnant and pre-clearing data was consulted.
- Field observations of habitat types and condition.
- Site accessibility and other matters relating to animal welfare considerations (relevant to trapping).

Three formal survey sites were selected following consideration of the above. The locations of these survey sites are shown on **Figures 8** and **9**, and are briefly described below.

- **Site 1**. This site provided the best opportunity for sampling in BVG 2 which is defined by DSITI (2016) as '*Complex to simple, semi-deciduous mesophyll to notophyll vine forest, sometimes with Araucaria cunninghamii (hoop pine)*'. While the site is mapped as non-remnant vegetation, it contains regrowth that is in an advanced stage of development. The only remnant patches of BVG 2 mapped by DSITI (2016) in the project area were small (see **Figure 7**) and/or logistically impractical to access for the trapping program.
- **Site 2**. Site 2 was located in BVG 9 which is defined by DSITI (2016) as '*Moist to dry eucalypt open forests to woodlands usually on coastal lowlands and ranges*'. On the project area, both the open forest and woodland spectrums of BVG 9 are present. Site 2 resembled the open forest variant of BVG 9.
- **Site 3**. Site 3 was located in BVG 5 which is defined by DSITI (2016) as '*Notophyll to microphyll vine forests, frequently with Araucaria* spp*. or Agathis* spp. *(kauri pines)*'.

The same three formal survey sites were sampled during the EWS and EDS surveys. Each site was sampled for five consecutive days during each survey. Surveillance cameras, Elliot, funnel and pit traps were deployed at each site for the duration of the survey period. A 30 m by 20 m drift fence arranged in a T-shape was used at each site to assist with the funnel and pit trapping. Timed nocturnal searches (spotlighting), diurnal searches and bird surveys were undertaken at each site. Bat detectors/recorders were deployed at each site for a minimum of three nights per survey. Survey effort afforded to each site is described in **Table 3**.

Targeted survey techniques were employed to supplement the baseline inventory and to assist with the detection of T/NT&M species. The effort devoted to targeted surveys is described in **Table 4**. Sampling locations are shown on **Figures 8** and **9**.

An inventory of incidental sightings was maintained during each survey. The baseline fauna survey (described above) was the primary method used to assess the presence of non-native terrestrial vertebrate fauna.

Frog surveys

Surveys for Threatened frogs were conducted along streams between 21 and 28 January 2016, and in 2017 between 24 and 26 February, 2 and 4 March, and 16 and 18 March. A desk-based review of available information informed the survey plan. Search areas in 2017 were refined based on accumulated site knowledge. Sites were typically visited in the late afternoon to assess habitat, and to search for eggs and tadpoles. Surveys for adult frogs occurred between approximately 1830 hours and 2330 hours, and consisted of walking a pre-

defined section of stream and searching for frogs using a low power head-torch and by listening for their calls. Each survey was performed by a two to three-person survey team. Regular forays were made away from the creek to survey for wildlife in the rainforest surrounding the creeks and gullies. An incidental fauna species list was maintained during the course of the survey program. The locations of palms in the *Archontophoenix* genera were recorded whenever encountered. Survey locations and effort are shown on **Figure 10**. A more detailed description of the field methods is available in Hoskin (2016, 2017) (**Appendix G**).

3.4 Biosecurity matters

Desk-based and field assessments were undertaken to ascertain the potential and actual biosecurity matters relevant to the KUR-World project area. Data sources utilised in the desk-based assessments and the methods used to detect non-native species are described in **Section 3.2.1** and **Section 3.3.1**. In addition to this work, searches for evidence of the following were made.

- Searches for plant dieback were made whilst conducting the flora survey.
- The desk-based review identified the potential presence of exotic ants known collectively as 'tramp ants'[7]. Two species of 'tramp ant', Yellow Crazy Ants (*Anoplolepis gracilipes*) and Electric Ants (*Wasmannia auropunctata*), are of particular concern due to their current and former presence in the Kuranda area and the threat they pose to the human population and natural environment. Searches for 'tramp ants' were made opportunistically during the baseline fauna survey. In addition, the KUR-World property and a raw materials supplier used by the proponent were inspected by Biosecurity Queensland on 21 November 2016. A follow up inspection of the property, including the use of sniffer dogs, occurred on 4 and 5 May 2017.

[7] Known as 'tramp ants' due to their ability to spread by hitching a ride to new locations.

Table 3: Survey effort employed at formal survey sites during the Early Wet Season (EWS) and Early Dry Season (EDS) baseline fauna surveys

Survey Type		Formal		Formal		Formal		Description
Site Name		Trap Site 1 (BVG2[A])		Trap Site 2 (BVG9)		Trap Site 3 (BVG5)		
Season		EWS	EDS	EWS	EDS	EWS	EDS	
Survey Method	Unit							
Camera traps	Trap nights	8	8	8	8	8	8	Early Wet Season: Chicken frame placed in front of cameras as bait. Early Dry Season: Chicken necks placed in front of cameras as bait.
	(#traps/nights)	(2/4)	(2/4)	(2/4)	(2/4)	(2/4)	(2/4)	
Elliot traps	Trap nights	80	80	80	80	80	80	Bolus of rolled oats, peanut butter, vanilla essence, honey and vegetable oil used as bait. Traps checked and closed early morning, reopened/re-baited late afternoon.
	(#traps/nights)	(20/4)	(20/4)	(20/4)	(20/4)	(20/4)	(20/4)	
Funnel traps	Trap nights	24	24	24	24	24	24	Checked at minimum early morning, mid-day and late afternoon.
	(#traps/nights)	(6/4)	(6/4)	(6/4)	(6/4)	(6/4)	(6/4)	
Pitfall trap	Trap nights	16	16	16	16	16	16	Checked at minimum early morning, mid-day and late afternoon.
	(#traps/nights)	(4/4)	(4/4)	(4/4)	(4/4)	(4/4)	(4/4)	
Spotlighting	Person minutes	60	60	60	70	60	130	Early Wet Season: Three persons searching for 20 minutes at each site. Early Dry Season: Two persons searching for 15 to 30 minutes, on two to three separate nights per site.
Diurnal active searches	Person minutes	75	60	60	60	60	60	Targeting reptiles, amphibians and small mammals. Early Wet Season: One or two persons searching for 15 to 30 minutes, on two separate days per site. Early Dry Season: Two persons searching for 15 minutes, on two separate days per site.
Timed bird surveys	Person minutes	40	60	35	55	40	55	Early Wet Season: Seven or eight separate surveys, each five-minutes duration and spanning morning to afternoon. Early Dry Season: Eleven or twelve separate surveys, each five-minutes duration and spanning morning to afternoon.

Survey Type		Formal		Formal		Formal		Description
Site Name		Trap Site 1 (BVG2[A])		Trap Site 2 (BVG9)		Trap Site 3 (BVG5)		
Season		EWS	EDS	EWS	EDS	EWS	EDS	
Survey Method	Unit							
Passive bat detection – Anabat (A) / Songmeter (S)	Trap nights	3(A)	2(S)	3(A)	3(A)	3(S)	1(S)	Early Wet Season and Early Dry Season: Passive sampling with one detector at each formal survey site. In the EDS, the Songmeters at Sites 1 and 3 malfunctioned and sampling effort was reduced. The reduced effort at Site 3 was offset by active sampling (**Table 4**, BVG5).
Call playback	Minutes	5	5	5	5	5	5	The calls of Masked Owl (*Tyto novaehollandiae kimberli*) and Rufous Owl (*Ninox rufa*) were played at each site for 5 minutes prior to and/or during spotlighting.

A: Site 1 was located in a forested area of non-remnant vegetation. The pre-clearing Broad Vegetation Group (BVG) corresponding with this site was BVG2.

Table 4: Targeted fauna survey effort employed during the Early Wet Season (EWS) and Early Dry Season (EDS) baseline fauna surveys

Survey Type		Targeted		Targeted		Targeted		Targeted		Targeted		Description
Site Name		BVG9		BVG5		BVG2		Pasture Areas		Riparian & Streams		
Season or Year		EWS	EDS	EWS	EDS	EWS	EDS	EWS	EDS	2016	2017	
Survey Method	Unit											
Camera traps	Trap nights[A]	30	122[A]	12	132[A]	-	-	-	-	-	-	Early Wet Season: Chicken frame and sardines used as bait at BVG9 and BVG5 respectively. Early Dry Season: At BVG9 sites, bolus of rolled oats, peanut butter, sardines and truffle oil used as bait for first seven nights, then added chicken necks for final four nights. At BVG5 sites, chicken necks used as bait for entire period.
	(#traps/nights[A])	(10/3)	(14/11[A])	(6/2)	(12/11[A])							

Survey Type		Targeted		Targeted		Targeted		Targeted		Targeted		Description
Site Name		BVG9		BVG5		BVG2		Pasture Areas		Riparian & Streams		
Season or Year		EWS	EDS	EWS	EDS	EWS	EDS	EWS	EDS	2016	2017	
Survey Method	Unit											
Spotlighting (mostly terrestrial habitats)	Person minutes	105	30	90	100	-	-	-	-	-	-	Early Wet Season: Two sites in BVG9 and two sites in BVG5 were surveyed (**Figure 8**). Early Dry Season: Transect along unsealed vehicle track (**Figure 9**).
Spotlighting (mostly riparian/stream habitats)	Nights	-	-	-	-	-	-	-	-	8	9	Targeted surveys in January 2016 and February/March 2017 for threatened stream-dwelling frogs, and incidental observations of all fauna (**Figure 10**). Reported in Hoskin (2017) (**Appendix G**).
Targeted diurnal searches	Person minutes	-	30	-	-	-	-	-	-	-	-	Targeting reptiles, amphibians and small mammals. Early Dry Season: South-western corner of study area where habitat resembled the woodland spectrum of BVG2.
Timed bird surveys	Person minutes	-	10	-	-	-	-	30	60	-	-	Early Wet Season: Two surveys in north-eastern paddock and forest edges (**Figure 8**). Early Dry Season: Three surveys in north-eastern paddock and forest edges (**Figure 9**). In BVG2, two separate 5 minute surveys in habitat that resembled the woodland spectrum of BVG2.

Survey Type		Targeted		Targeted		Targeted		Targeted		Targeted		Description
Site Name		BVG9		BVG5		BVG2		Pasture Areas		Riparian & Streams		
Season or Year		EWS	EDS	EWS	EDS	EWS	EDS	EWS	EDS	2016	2017	
Survey Method	Unit											
Transect searches for scats and tracks	Kilometres	1.12	3.44	6.07	3.21	5.71	2.7	-	-	-	-	Targeting Southern Cassowary (any sign), dog/dingo scat and Tramp Ants. Early Wet Season: Searches along forest edges and sections of track network in or near rainforest (**Figure 8**). Early Dry Season: As per EWS though also searches in a forested area (**Figure 9**).
Diurnal surveys for raptors from slow-moving vehicle	Kilometres	-	-	-	-	-	-	15	15	-	-	Dedicated scan of skyline for raptors when driving through Open Pasture to check trap sites. Conducted daily - at minimum early morning, mid-day and late afternoon. Two to three observers at <15 km/hr.
Active bat detection – Anabat(A) / Songmeter(S)	Minutes	35(A)	15(A)	30(A)	95(A)	-	-	70(S)	-	-	-	Active sampling by one or two persons whilst walking or from slow moving vehicle (**Figure 8** and **9**).

Survey Type		Targeted		Targeted		Targeted		Targeted		Targeted		Description
Site Name		BVG9		BVG5		BVG2		Pasture Areas		Riparian & Streams		
Season or Year		EWS	EDS	EWS	EDS	EWS	EDS	EWS	EDS	2016	2017	
Survey Method	Unit											
Passive bat detection – Anabat(A) / Songmeter(S)	Nights	-	-	1	-	-	11	2	-	-	-	Early Wet Season: One detector placed along stream near harp trap (BVG5) (**Figure 8**). Two detectors deployed at separate locations in open pasture areas (**Figure 8**): (a) the southern-most paddock; (b) near the homestead where there is artificial lighting. Early Dry Season: Along a stream (BVG2) (**Figure 9**).
Harp trap	Trap nights	-	1	1	4	-	2	-	-	-	-	Early Wet Season: Sampling along a stream (**Figure 8**). Early Dry Season: Sampling along a stream (BVG5) and forested tracks (BVG9 and BVG2) (**Figure 9**).

A: Some cameras malfunctioned. The 'trap nights' shown in the table is the period of active camera detection. At both BVG9 and BVG5, detection nights ranged from 1 to 11 (median = 11). The median number of detection nights is shown in above table for 'nights'.

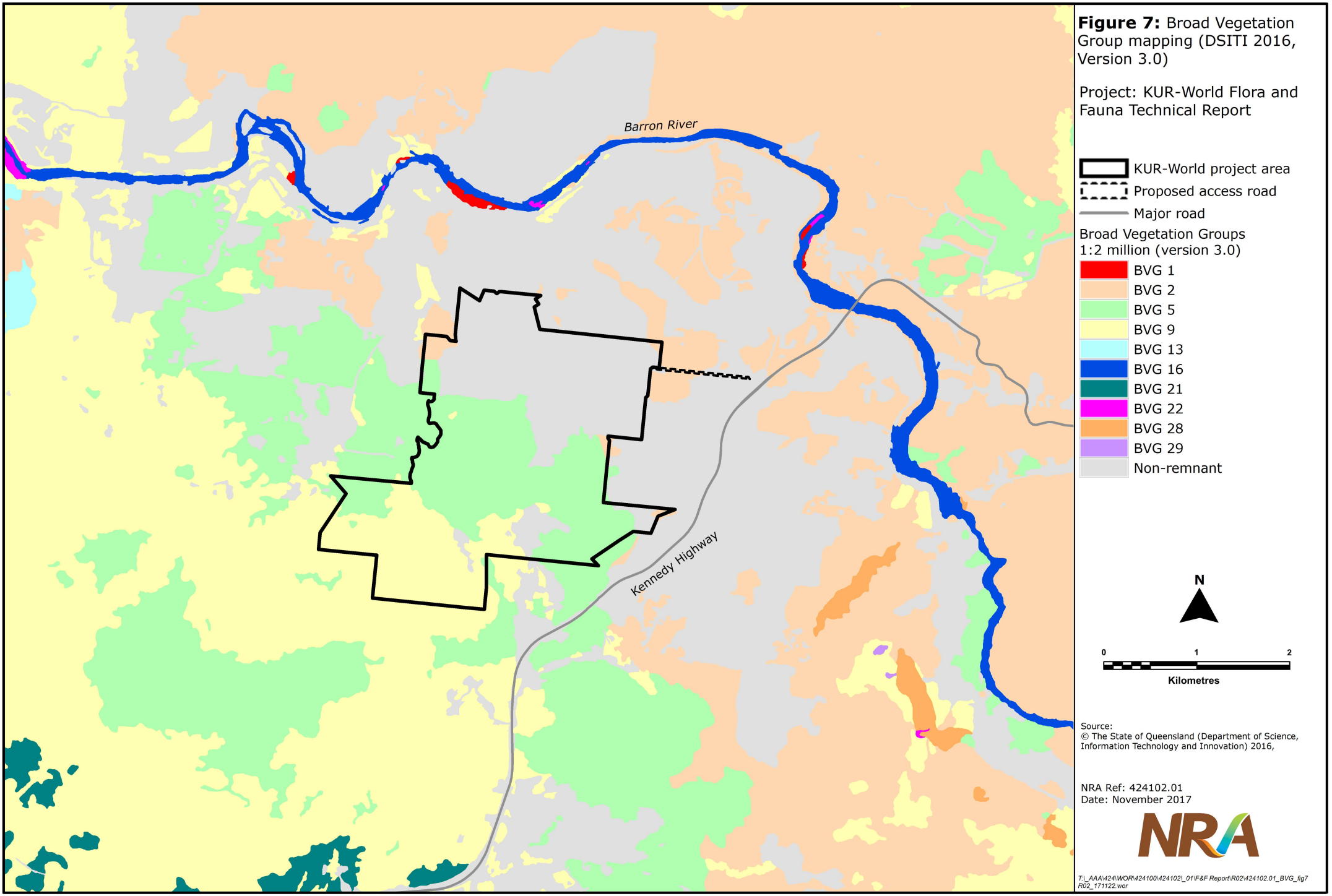

Figure 7: Broad Vegetation Group mapping (DSITI 2016, Version 3.0)

Project: KUR-World Flora and Fauna Technical Report

KUR-World project area
Proposed access road
Major road

Broad Vegetation Groups
1:2 million (version 3.0)

- BVG 1
- BVG 2
- BVG 5
- BVG 9
- BVG 13
- BVG 16
- BVG 21
- BVG 22
- BVG 28
- BVG 29
- Non-remnant

N

0 1 2
Kilometres

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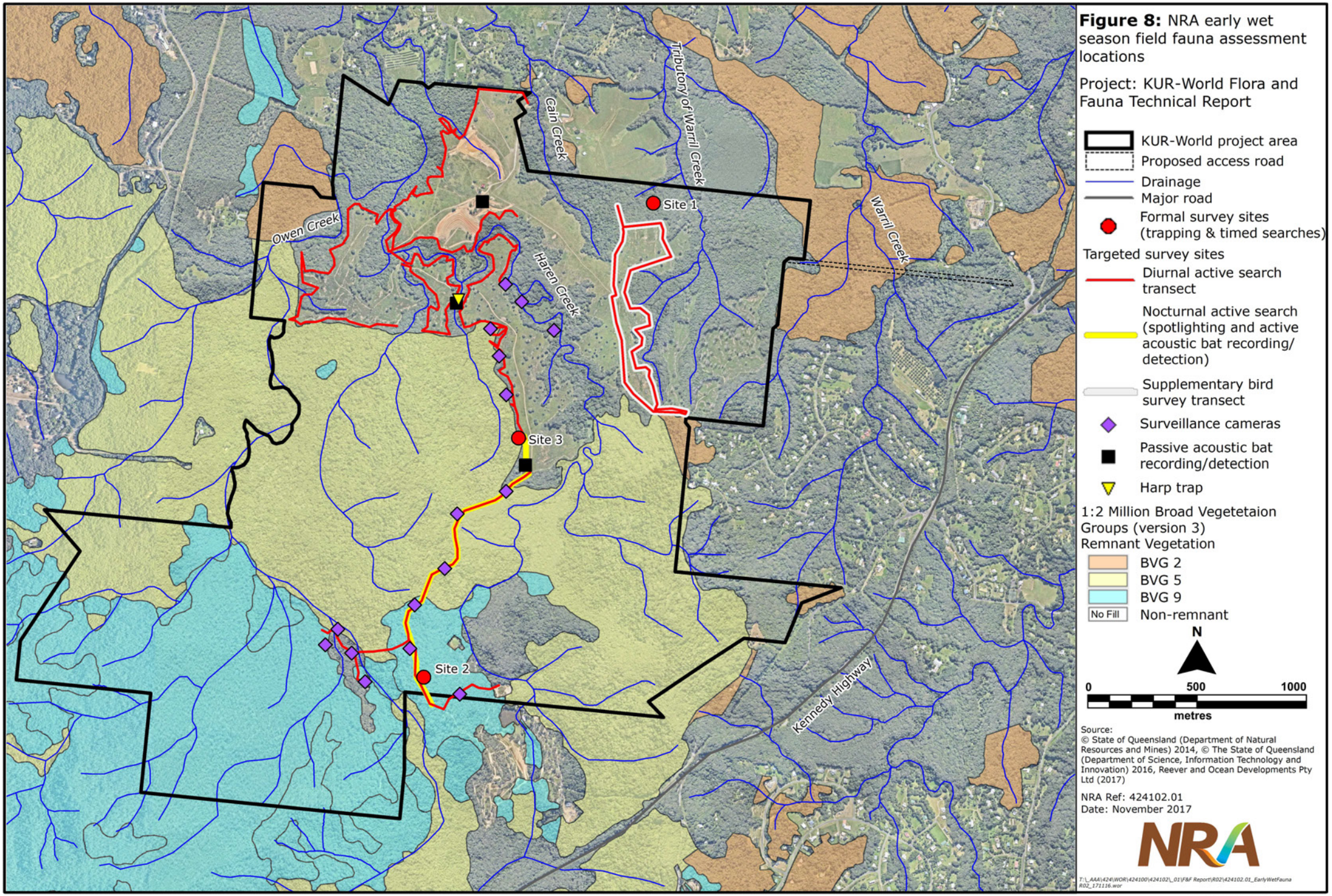

Figure 8: NRA early wet season field fauna assessment locations

Project: KUR-World Flora and Fauna Technical Report

KUR-World project area
Proposed access road
Drainage
Major road
Formal survey sites (trapping & timed searches)

Targeted survey sites
Diurnal active search transect
Nocturnal active search (spotlighting and active acoustic bat recording/ detection)
Supplementary bird survey transect
Surveillance cameras
Passive acoustic bat recording/detection
Harp trap

1:2 Million Broad Vegetetaion Groups (version 3)
Remnant Vegetation
BVG 2
BVG 5
BVG 9
No Fill Non-remnant

N

0 500 1000
metres

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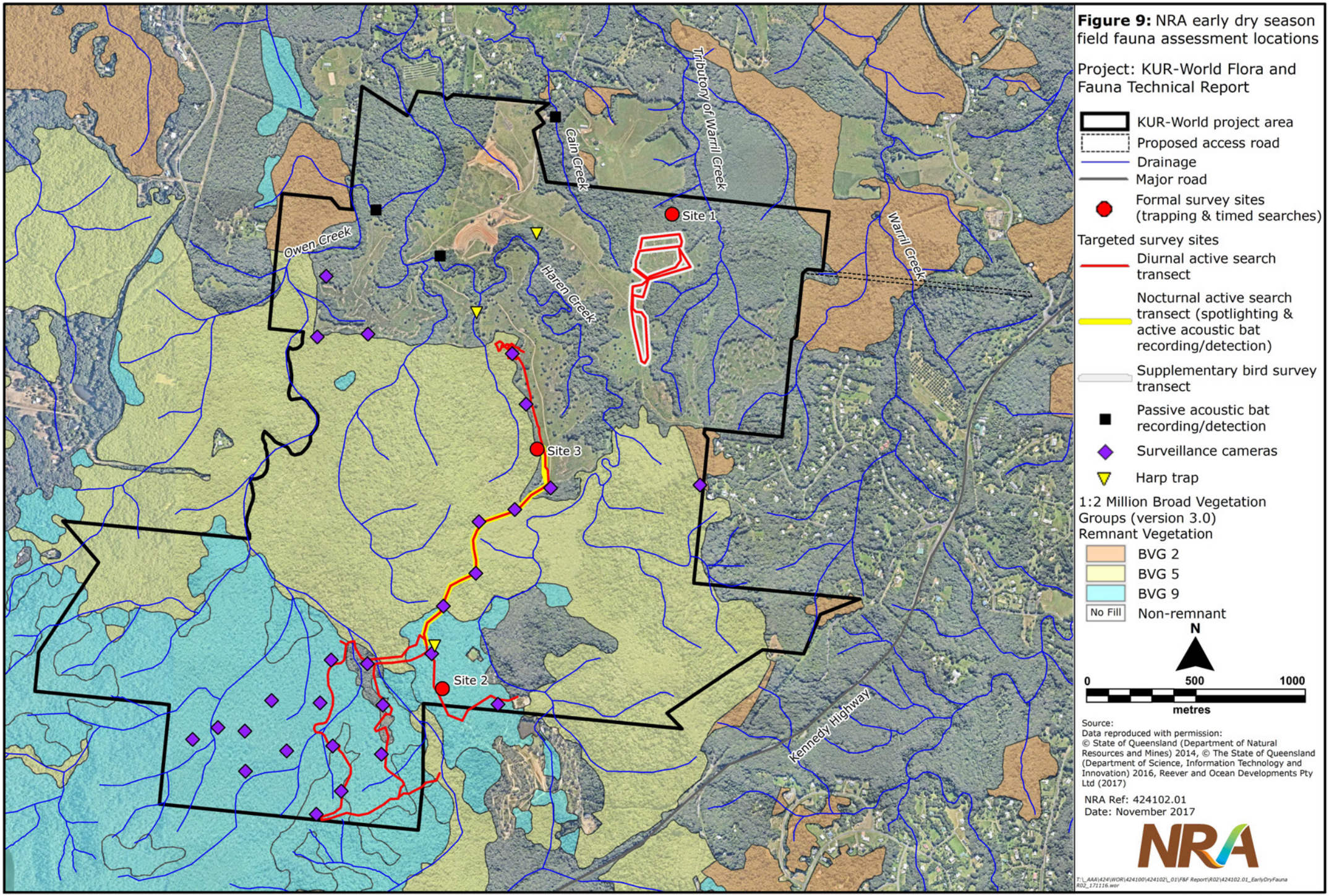

Figure 9: NRA early dry season field fauna assessment locations

Project: KUR-World Flora and Fauna Technical Report

KUR-World project area
Proposed access road
Drainage
Major road
Formal survey sites (trapping & timed searches)

Targeted survey sites
Diurnal active search transect
Nocturnal active search transect (spotlighting & active acoustic bat recording/detection)
Supplementary bird survey transect
Passive acoustic bat recording/detection
Surveillance cameras
Harp trap

1:2 Million Broad Vegetation Groups (version 3.0)
Remnant Vegetation
BVG 2
BVG 5
BVG 9
No Fill — Non-remnant

N

0 500 1000
metres

Source:
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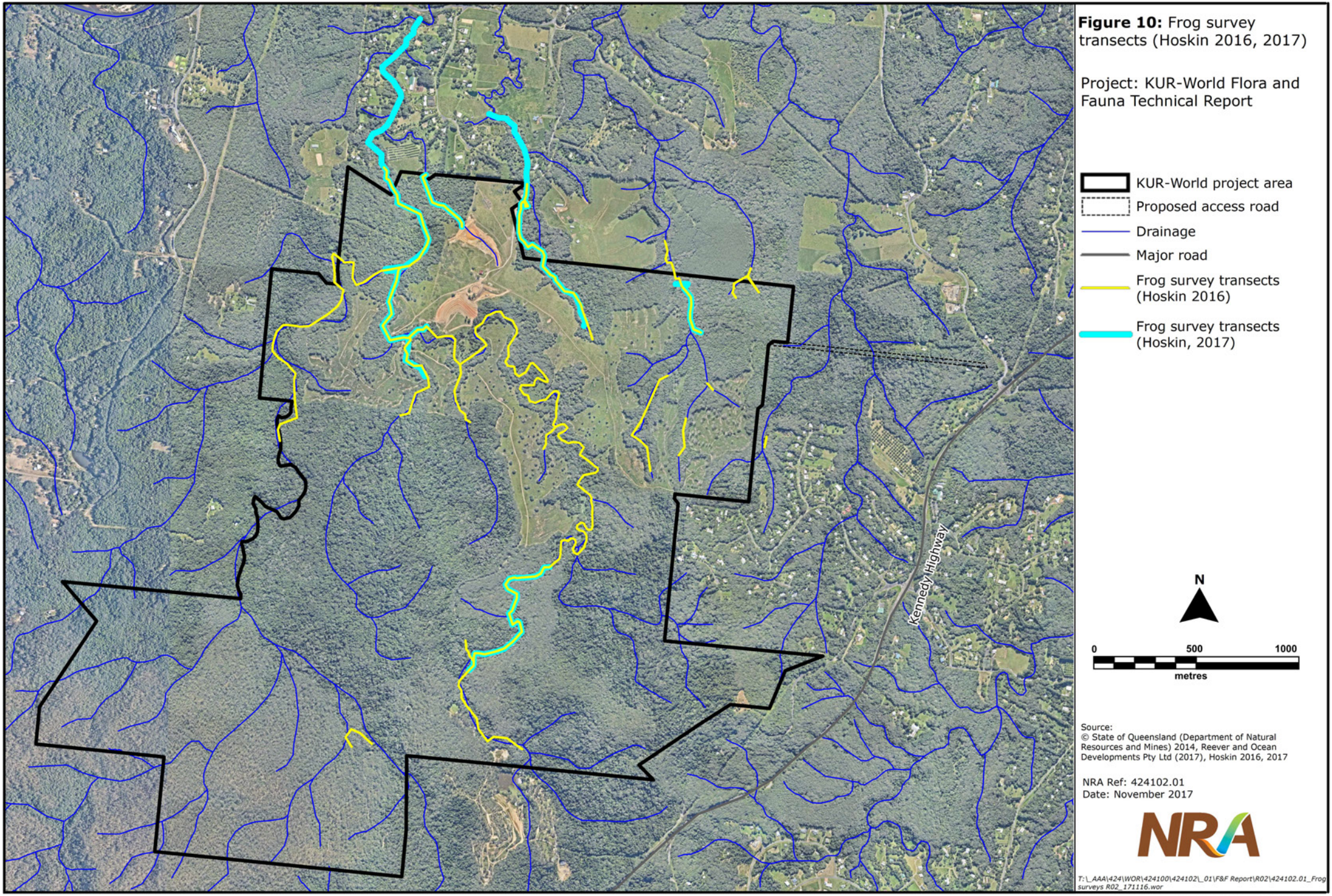

Figure 10: Frog survey transects (Hoskin 2016, 2017)

Project: KUR-World Flora and Fauna Technical Report

- KUR-World project area
- Proposed access road
- Drainage
- Major road
- Frog survey transects (Hoskin 2016)
- Frog survey transects (Hoskin, 2017)

Source:
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3.5 Habitat condition assessments

Habitat condition was assessed with reference to Wannan (2009). The criteria forming the basis for the assessment are presented in **Table 6**.

Table 6: Habitat integrity rating used to assess habitat condition[A]

Rating	Structure & Floristics	Weed Invasion	Woody Vegetation (Tree Layer)	Herbaceous Vegetation (Shrub & Ground Layers)	Physical Disturbance
1	Intact or almost so	Minimal/absent	Intact	90-100% native cover	Minimal/nil
2	Substantially intact	Low levels	Intact	70-90% native cover	Low
3	Partially intact	Moderate levels	Intact	>50% native cover	Moderate
4	<50% cover of native species & richness much reduced	>50% cover of weeds	Upper strata moderate – high cover	With <50% native cover	High
5	Grossly modified	Very high cover	Scattered dominants of upper strata persisting	Understorey and ground cover >90% exotic	High to very high
6	Plantations of exotic or native vegetation				

A: Source Wannan (2009).

4. Results

4.1 Survey conditions

The project area was not affected by severe weather events or fires during, or in the months prior to, the field surveys.

Tropical cyclones and storms regularly occur in the region. The most recent cyclones to affect the Kuranda district were Severe Tropical Cyclone (STC) Ita (April 2014), STC Yasi (February 2011) and STC Larry (March 2006). According to Bureau of Meteorology cyclone track data, the Kuranda district generally experienced gale force winds from STC Ita and STC Larry, and very destructive winds from STC Yasi.

According to fire scar mapping (NAFI 2017), the most recent fire to affect the project area was in 2012. This fire affected the south-west of the project area, and was part of a broader fire that covered areas to Barron River in the north and Clohesy River in the west. Prior to this, fires had affected similar parts of the project area in 2009, 2007 and 2003 (only post-2000 data is available). The aforementioned fires in the project area affected communities mapped as BVG 9, and along the edge of some areas mapped as BVG 5.

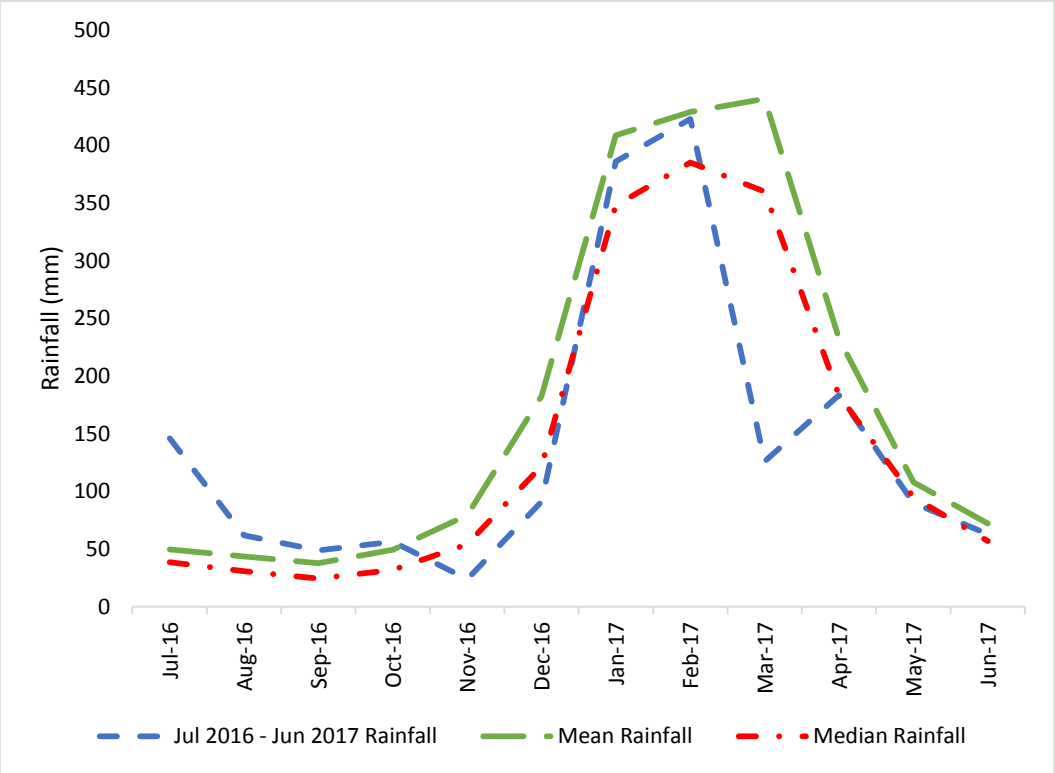
4.1.1 Weather

The Bureau of Meteorology (BoM) collects rainfall data at stations near the project area. The closest is the Kuranda Railway Station weather station (031036) which is approximately 2.5 km from the eastern boundary of the project area. Rainfall data from the Kuranda Railway Station is shown on **Graph 1**. The 2016/17 wet season, and rainfall in the period leading up to the survey program, was generally below average.

The temperature range during each baseline fauna survey event according to data collected at the Kuranda Railway Station weather station (031036) is described below.

- Early Wet Season survey (January 2017).
  - Daily maximum temperature range: 31.0 °C to 33.0 °C.
  - Daily minimum temperature range: 21.5 °C to 23.5 °C.
- Early Dry Season survey (May 2017).
  - Daily maximum temperature range: 26.5 °C to 27.0 °C.
  - Daily minimum temperature range: 18.5 °C to 19.5 °C.

Weather conditions were generally suitable for flora and fauna survey work. With regard to fauna, conditions during the EWS survey were warm, humid and followed a period of sustained rainfall. 318 mm of rainfall occurred in the 14 days prior to the EWS survey and 32 mm of rainfall occurred during the first two days of survey. Conditions during the EDS survey were mild in temperature and relatively dry. 26 mm of rainfall occurred in the 14 days prior to the EDS survey and no rainfall occurred during the survey.



Graph 1: Monthly rainfall prior to and during the field surveys and long-term mean rainfall (1896 – present) from Kuranda Railway Station weather station (BOM Station 031036)

Source: www.bom.gov.au.

4.2 Flora

4.2.1 Threatened Ecological Communities

The EPBC Protected Matters Report (**Appendix B**) indicates the potential presence of the listed Threatened Ecological Community (TEC) *Broad leaf tea-tree (Melaleuca viridiflora) woodlands in high rainfall coastal north Queensland*. This TEC is not present within the project area.

4.2.2 Regional Ecosystem mapping

Existing mapping

REs mapped by DNRM (2017a) across the project area are shown on **Figure 5**. The REs present in this area are described in **Table 7** along with their status. RE status is listed with reference to the following, and is current as of 31 August 2017.

- The EPBC Act, which lists Threatened Ecological Communities (TECs) as Vulnerable, Endangered or Critically Endangered.
- The VM Act, which categorises REs based on the remaining extent of the RE in the bioregion. REs are listed as Endangered, Of Concern or Least Concern.
- The Biodiversity Status of the REs according to EHP. The Biodiversity Status is based on the extent of the REs in the bioregion, their condition and the presence of threatening processes. REs are listed as Endangered, Of Concern or No Concern at Present.

The DNRM (2017a) RE mapping shows that the majority (approximately 60%) of the project area contains remnant vegetation. This remnant vegetation area is dominated by complex notophyll vine forests (approximately 63%) and eucalypt open forest or woodland (approximately 35%). These areas of mapped remnant vegetation predominantly occur across the southern two-thirds of the property. A small area of mesophyll vine forest (approximately 3%) is mapped in the northern third of the property.

The DNRM (2017a) RE mapping shows that non-remnant vegetation mostly occurs in the northern third of the property, though small areas of non-remnant vegetation are also mapped in the southern portion. These areas of non-remnant vegetation contain forested areas and areas devoid of woody vegetation. The forested areas are regrowth vegetation as mapped by DNRM (2017a) to have not met the criteria for remnant vegetation. The cleared areas mostly contain improved pasture and areas recently cleared of woody vegetation for the purpose of establishing pasture. Historical aerial photography shows that vegetation clearing in this northern portion occurred across multiple episodes commencing prior to the 1940s and continuing until the early 1990s (historical aerial imagery provided in **Appendix A**).

Field results

The RE mapping over the study area is generally reliable for its intended use, although the boundaries between many RE types are ambiguous. Differences in the DNRM (2017a) mapping are described below. The differences pertain to how RE types are assigned to specific polygons/areas, and to the differentiation between remnant and non-remnant vegetation. Data collected at vegetation assessment sites are provided in **Appendix I**.

The differences observed for RE type designations are described below.

- *Eucalyptus reducta* open forest to woodland (RE 7.11.33a) is not present in areas assessed within the project area. This RE has been mapped by DNRM (2017a) along parts of the southern boundary of the project area. The areas mapped as RE 7.11.33a are more closely aligned with RE 7.11.51a (*Corymbia clarksoniana, Eucalyptus tereticornis, E. drepanophylla* woodland, low woodland to open forest with *Allocasuarina torulosa*,

Allocasuarina littoralis, Lophostemon suaveolens, Acacia cincinnata, A. flavescens, Banksia aquilonia, Xanthorrhoea johnsonii. Metamorphics). RE 7.11.51a is a common component of the Eucalypt woodlands on the crests and upper slopes in the southern portion of the project area. It intergrades with RE 7.11.44 (Eucalyptus *tereticornis* open forest to woodland on coastal metamorphic foothills) on the lower slopes.

  - The mapping has been revised to show RE 7.11.51a in the areas mapped by DNRM (2017a) as RE 7.11.33a (**Figure 11**).

- Areas of RE 7.11.13 (*Corymbia torelliana* open forest, usually with a vine forest element, on metamorphics) were difficult to identify within the notophyll vine forest complexes within the southern portion of the study area. *Corymbia torelliana* (Cadaghi) exists in small patches though rarely as part of an identifiably separate RE. The community is potentially transitioning into RE 7.11.7a.
  - No revision to the DNRM (2017a) mapping is shown.

The northern third of the property contains forested areas mapped by DNRM (2017a) as non-remnant vegetation. Based on data collected by NRA, these areas include patches that do not satisfy the criteria for remnant vegetation, patches that satisfy the criteria for remnant vegetation and patches that are borderline between satisfying and not satisfying the criteria. The boundaries between these condition states are not clearly discernible in some areas, notably in the north-eastern corner of the project area where a mosaic of condition states exist. The following was undertaken to inform the extent of remnant vegetation in these areas.

- As per the VM Act, to qualify as remnant vegetation the predominant vegetation canopy of the subject areas was required to: (a) be >70% of the height and >50% of the cover of the undisturbed height and cover of the relevant RE, and (b) be dominated by species characteristic of the vegetation's undisturbed canopy.
- Pre-clearing RE mapping was reviewed and identified that RE 7.11.1a formerly occurred across the northern portion of the site. Patches of RE 7.11.1a still occur in areas adjacent to the areas mapped by DNRM (2017a) as non-remnant vegetation.
- Based on field observations, most of the forested areas mapped as non-remnant vegetation satisfied the criterion for >50% cover and for dominant species as per the description for RE 7.11.1b. Canopy height was the primary delimiting factor (between areas of non-remnant and remnant vegetation).
- Consultation with the Queensland Herbarium determined that no reference site data was available for RE 7.11.1. The following informed decisions about the canopy height for reference state communities of RE 7.11.1.
  - ***Literature review***. Occurrences of RE 7.11.1 on the project area correspond with Tracey (1982) Type 5b (Complex Notophyll Vine Forest) and Neldner *et al.* (2017b) BVG 2a (Complex evergreen notophyll vine forests frequently with *Araucaria cunninghamii* from foothills to ranges). Tracey (1982) describes the canopy as '… uneven, 25-45m, with many tree layers.' Neldner *et al.* (2017b) describe the canopy as 'dense' and 'usually at least 25 m tall'.
  - ***Field reference data***. Three sites within the project area mapped as remnant RE 7.11.1a were assessed along with three sites near, though outside, the project area (sites S15, S17, Q06, Q20, Q21 and Q22; **Figure 6**). These six sites were chosen because they were readily accessible, contextually relevant, and on balance, represented the 'best on offer' in terms of potential reference sites in the local area. The canopy (Tree 1 layer) height at these sites ranged between 20 m and 35 m. At some sites the canopy varied in height. The average and median of the minimum canopy heights were 25 m and 26 m respectively (n = 6).

  - ***Conclusion***. Based on the above, it was concluded that the minimum tree canopy height for RE 7.11.1 was 25 m. To qualify as remnant vegetation, the vegetation canopy of the subject areas had to exceed 17.5 m (*ie* 70% of 25 m).
- Many areas along Haren Creek and in the north-east of the project area were found to be borderline in terms of satisfying the 17.5 m height threshold and there was no discernible pattern in contemporary aerial images to separate the remnant vegetation patches from the non-remnant. Review of historical aerial imagery identified potential correlation between contemporary remnant vegetation with the vegetation extents existing on-site in 1994. The 1994 aerial imagery subsequently informed mapping of the contemporary remnant vegetation extents.

The revisions to the RE mapping with respect to the above are shown on **Figure 11**. The identified remnant extents match the description for RE 7.11.1b (**Table 7**).

Mapping by DNRM (2017a) shows two patches of non-remnant vegetation in the south of the study area (**Figure 5**). They are described below as the eastern and western patches. The DNRM (2017a) mapping over these patches was assessed against field data and aerial photography interpretation.

- The extent of non-remnant vegetation in the western patch is not as extensive as shown on DNRM (2017a) mapping. The revisions to the RE mapping are described below and are shown on **Figure 11**.
  - Aerial photography shows that the western portion of this patch was not cleared between 1951 and present time. RE 7.11.7a is more appropriate for this area.
  - The eastern portion of this patch contains areas of non-remnant vegetation (associated with a paintball facility) and remnant areas of RE 7.11.44. The boundaries between these condition states are difficult to discern. Generally, the taller and better developed forest (corresponding with remnant vegetation) occurs in gullies and away from the paintball facility.
- The extent of non-remnant vegetation in the eastern patch is not as extensive as shown on DNRM (2017a) mapping. Aerial photography shows that vegetation clearing occurred prior to 1970s in the general vicinity of this patch, and the area was still quite open in the early 1990s (possibly in response to vegetation thinning and fire). Currently, the canopy is relatively open in many portions of this patch, though it appears that the death of large Acacias has caused most of the canopy gaps. Tall rainforest trees and large-stemmed lianas are present. These attributes suggest that most of this patch contains vegetation approaching its climax condition state. In **Figure 11**, the areas of better developed forest have been mapped as RE 7.11.7b (Complex notophyll vine forests (with emergent *Agathis robusta*) recovering from disturbance, with *Acacia* spp. canopy or emergents. Foothills and uplands on metamorphics, of the moist rainfall zone).

Table 7: Regional Ecosystems (Version 8.0) mapped by DNRM (2017a) over the project area, their status and spatial extents

Regional Ecosystem	Short Description	Status[A]			Area (ha)[B]	
		EPBC Act	VM Act	EHP Biodiversity	DNRM 2017a	NRA Revised
7.11.1	7.11.1: Simple-complex mesophyll to notophyll vine forest on moderately to poorly drained metamorphics (excluding amphibolites) of moderate fertility of the moist and wet lowlands, foothills and uplands. 7.11.1a: Mesophyll vine forest. Lowlands and foothills on metamorphics. Very wet and wet rainfall zones. 7.11.1b: Mesophyll vine forest recovering from disturbance, with *Acacia* spp. canopy or emergents. Lowlands and foothills on metamorphics, of the very wet and wet rainfall zones[C].	NL	LC	NC	12	49
7.11.7	7.11.7: Complex notophyll vine forest with Agathis robusta emergents on foothills and uplands on metamorphics 7.11.7a: Complex notophyll vine forests (with emergent *Agathis robusta*). Foothills and uplands of areas excluding the Seaview Range Subregion. Moist rainfall zone. 7.11.7b: Complex notophyll vine forests (with emergent *A. robusta*) recovering from disturbance, with Acacia spp. canopy or emergents. Foothills and uplands on metamorphics, of the moist rainfall zone[C].	NL	LC	NC	259	265
7.11.13	*Corymbia torelliana* open forest, usually with a vine forest element, on metamorphics	NL	OC	E	19	19
7.11.33	7.11.33: *Eucalyptus reducta* open forest to woodland on metamorphics. 7.11.33a: *Eucalyptus reducta* open forest to woodland. Metamorphics.	NL	OC	OC	11	0
7.11.44	*Eucalyptus tereticornis* open forest to woodland on coastal metamorphic foothills.	NL	OC	OC	43	47

Regional Ecosystem	Short Description	Status[A]			Area (ha)[B]	
		EPBC Act	VM Act	EHP Biodiversity	DNRM 2017a	NRA Revised
7.11.51	7.11.51: *Corymbia clarksoniana* and/or *Eucalyptus drepanophylla* open forest to woodland on metamorphics. 7.11.51a: *Corymbia clarksoniana*, *Eucalyptus tereticornis*, *E. drepanophylla* woodland, low woodland to open forest with *Allocasuarina torulosa*, *Allocasuarina littoralis*, *Lophostemon suaveolens*, *Acacia cincinnata*, *A. flavescens*, *Banksia aquilonia*, *Xanthorrhoea johnsonii*. Metamorphics.	NL	LC	OC	70	81
Non-rem	Non-remnant	-	-	-	263	212

A: Status according to EHP's Biodiversity Status, VM Act and EPBC Act. Categories comprise: Endangered (E), Of Concern (OC), Least Concern (L), No Concern at Present (NC) and Not Listed (NL).

B: Area estimates are rounded to the nearest whole number. Values calculated based on DNRM (2017a) mapping (**Figure 5**) and revised mapping based on the results of the current study (**Figure 11**).

C: Identified in NRA revised mapping only.

4.2.3 Flora species

Database searches identified the presence of 976 flora species (including subspecies and varieties) within the respective search areas (**Appendix C**). Field surveys identified 395 flora species representing 106 families in the project area. The dominant plant families were Myrtaceae (31 species or 8% of total plant species richness), Fabaceae (22 species or 6% of total plant species richness) and Sapindaceae (17 species or 4% of total plant species richness). A list of these species is provided in **Appendix J**. Conditions were generally favourable during the field surveys for surveying and identifying plants.

4.2.4 Threatened and Near Threatened flora species

Field surveys undertaken by NRA located two T&NT species; Daintree Gardenia (*Randia audasii*) and Slender Ginger (*Alpinia hylandii*). Another T&NT species, Myola Palm (*Archontophoenix myolensis*), has been provisionally identified on-site during the current and previous studies (Astrebla 2015a; Hoskins 2016, 2017). Information relating to these species is provided below.

- Daintree Gardenia (*Randia audasii*) (NC Act Near Threatened). A single mature plant was recorded in RE 7.11.7a (**Figure 12**). A targeted search was conducted in the vicinity but no more specimens of this taxon were located. *Randia* and the closely related genus *Gardenia* normally occur as scattered individuals, thus a wider search may locate more individual specimens of *R. audasii*.
- Slender Ginger (*Alpinia hylandii*) (NC Act Near Threatened). Three small patches of this plant were found in the northern portion of the project area (**Figure 12**).
- Myola Palm (*Archontophoenix myolensis*) (NC Act and EPBC Act Endangered). All of the *Archontophoenix* plants found in the project area were either young plants or plants not in flower. This circumstance precludes definitive identification to species level. However, for the purposes of this report all potential specimens are being treated as Myola Palm. Palms tentatively identified as Myola Palms are shown on **Figure 12**. All were recorded along drainage lines, the species' preferred habitat.

Database searches identified the presence of many other T&NT flora species within the respective search areas (**Appendices B** and **C**). The likely presence of these species on the project site was assessed using information obtained during the desk-based review and field survey. The results of this assessment are provided below.

- Probable occurrence:
  - *Crepidomanes majoriae* (NC Act Vulnerable). Potentially suitable habitat is present. Targeted searches were made along a number of streams in RE 7.11.1a and RE 7.11.7a but no specimens were found.
  - *Diplazium cordifolium* (NC Act Vulnerable). Potentially suitable habitat is present. In spite of the habitat being present (RE 7.11.1a) and targeted searches along streams, no individuals of this taxon were recorded during the survey.
  - Endlicher's Filmy Fern (*Polyphlebium endlicherianum*) (NC Act Vulnerable; EPBC Act Endangered). Potentially suitable habitat is present. Targeted searches were made along a number of streams in RE 7.11.1a and RE 7.11.7a but no plants were found.
  - Smooth-bark Rose Apple (*Syzygium hodgkinsoniae*) (NC Act and EPBC Act Vulnerable). Potentially suitable habitat is present. Targeted searches were made along a number of streams in RE 7.11.1a and RE 7.11.7a but no plants were found.

  - Velvet Jewel Orchid (*Zeuxine polygonoides* Syn, *Rhomboda polygonoides*) (NC Act and EPBC Act Vulnerable). Potentially suitable habitat is present. This species favours rocky moss-covered stream banks and in litter on large boulders. Targeted searches were made along a number of streams in RE 7.11.1a but no plants were found.
- Possible:
  - Rat's Tail Tassel-fern (*Phlegmariurus filiformis*) (NC Act and EPBC Act Endangered). High-canopy epiphyte in montane rainforest. RE 7.11.1a is possibly suitable habitat though no plants of this taxon were recorded during the survey.
  - *Cajanus mareebensis* (NC Act and EPBC Act Endangered). Although habitat for this taxon is present in the survey area (RE 7.11.44), this taxon was not recorded during the survey.

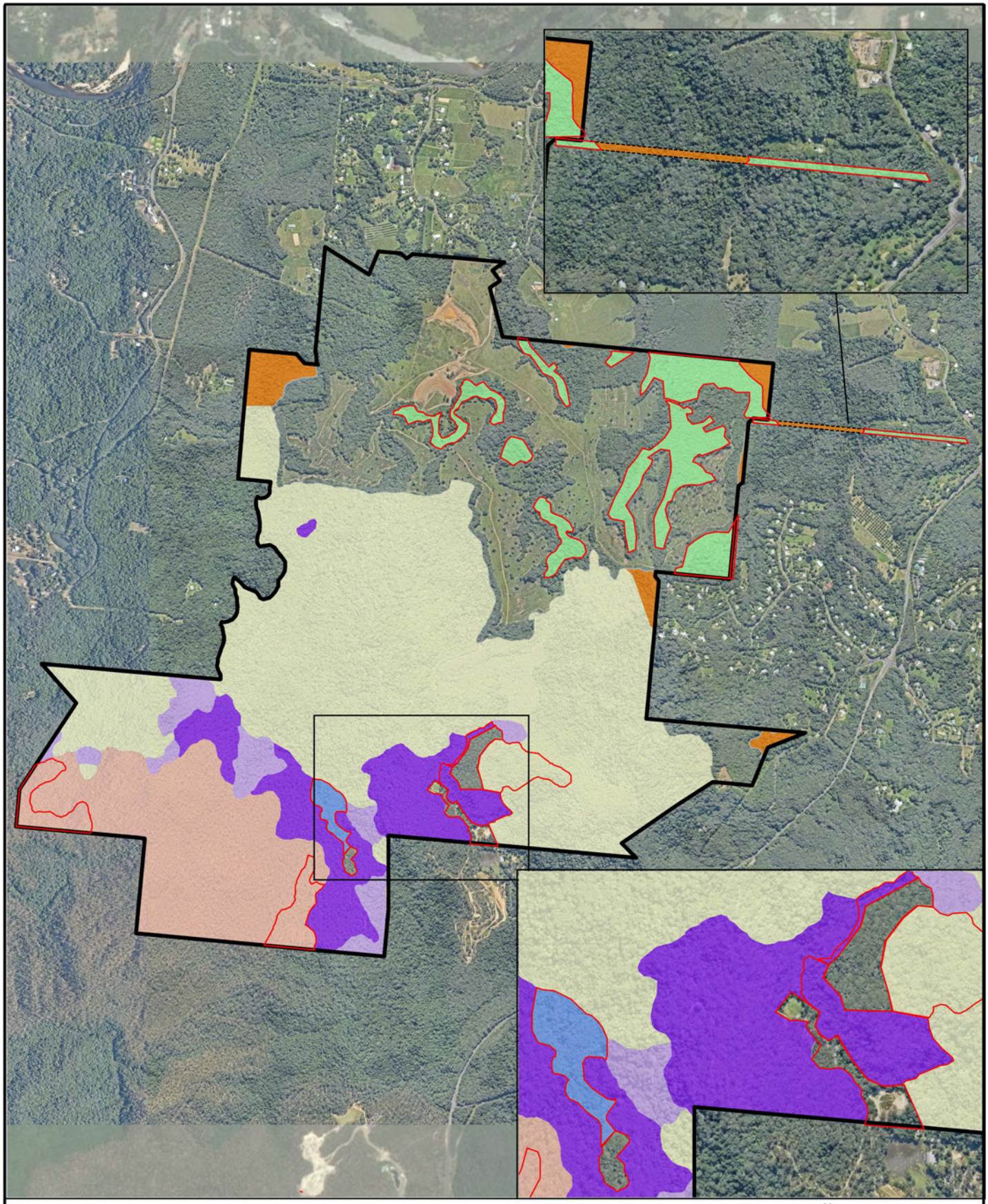


Figure 11: Revisions to DNRM Regional Ecosystem mapping
Project: KUR-World Flora and Fauna Technical Report

Regional Ecosystems
DNRM version 8.0 (with revisions)

- 7.11.13
- 7.11.1a
- 7.11.1b
- 7.11.44
- 7.11.51a
- 7.11.7a
- 7.11.7b
- No Fill — Non-remnant
- Areas where map revisions were implemented

- KUR-World project area
- proposed access road

N

0 500 1000
metres

Source:
NRA, © State of Queensland (Department of Natural Resources and Mines) 2014, © State of Queensland (Department of Natural Resources and Mines) 2017, Reever and Ocean Developments Pty Ltd (2017)

NRA Ref: 424102.01
Date: November 2017

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Recommended print size: A4

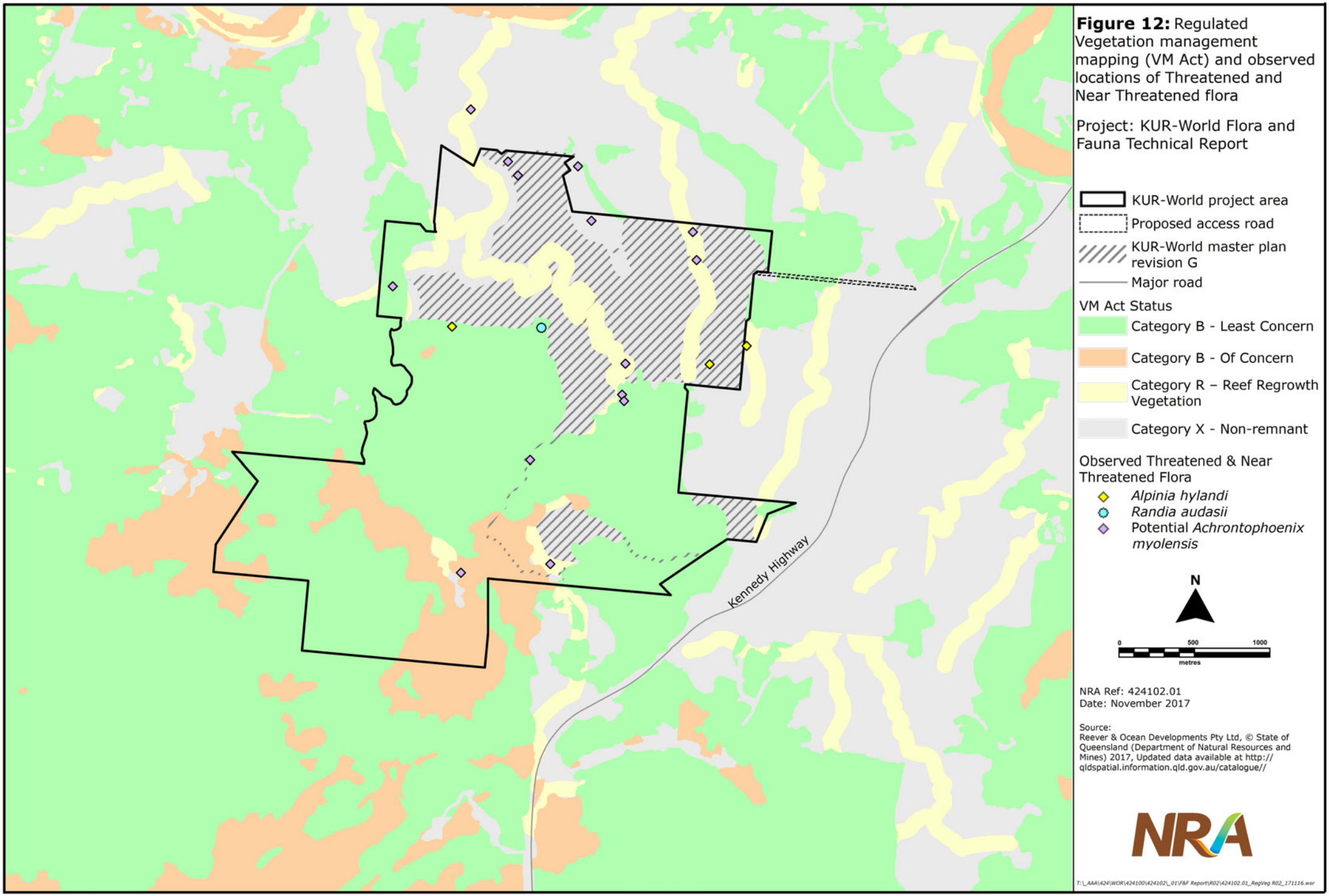

Figure 12: Regulated Vegetation management mapping (VM Act) and observed locations of Threatened and Near Threatened flora

Project: KUR-World Flora and Fauna Technical Report

NRA Ref: 424102.01
Date: November 2017

Source:
Reever & Ocean Developments Pty Ltd, © State of Queensland (Department of Natural Resources and Mines) 2017, Updated data available at http://qldspatial.information.qld.gov.au/catalogue//

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Recommended print size: A4

4.3 Fauna

4.3.1 Fauna habitats

Habitat types

Four general habitat types were identified on the project area. These habitat types are listed below with reference to the corresponding BVGs (1:2M).

- **Open Pasture** – Corresponds with the non-forested areas of non-remnant vegetation.
- **Mesophyll to Notophyll Vine Forest (MNVF) –** Corresponds with BVG 2 (Complex to simple, semi-deciduous mesophyll to notophyll vine forest, sometimes with *Araucaria cunninghamii* (Hoop Pine) and forested sections of non-remnant vegetation (DNRM 2017a) in the northern portion of the project area (shown as BVG 2 on pre-clearing BVG mapping).
- **Notophyll to Microphyll Vine Forest (NMVF) –** Corresponds with BVG 5 (Notophyll to microphyll vine forests, frequently with *Araucaria* spp. or *Agathis* spp. (Kauri Pines)).
- **Eucalypt Open Forest to Woodland (EOFW) –** Corresponds with BVG 9 (Moist to dry eucalypt open forests to woodlands usually on coastal lowlands and ranges).

The above habitat types are described below and the corresponding BVGs are shown on **Figure 7**. The descriptions are specific to the conditions observed on the project area. All habitats occur over metamorphic geologies. Non-native plant species are denoted with the '*' symbol.

Open Pasture

The Open Pasture habitat type refers to the non-forested areas of the property and covers approximately 97 ha (14% of project area). These areas mostly support a mid-dense to dense grassland dominated by non-native pasture plants. Small areas of development and infrastructure are also present (*eg* homestead, cattle yards, animal shelters, access tracks and paddock fencing). *Brachiaria decumbens** (Signal Grass) is the dominant pasture plant. The non-native Snakeweed, *Sida rhombifolia** (Common Sida), *Stylosanthes scabra** (Shrubby Stylo), *Hyptis capitata** (Buttonweed), *Ageratum conyzoides** (Billygoat Weed), *Ageratum houstonianum** (Blue Billygoat Weed) and *Mimosa pudica** (Sensitive Weed) are also common especially in the more recently established (*circa* 2014) pasture areas. Permanent water is present in the form of a stock dam in the north of the project area. Water is also present along forested streams that bisect the habitat (described below under Mesophyll to Notophyll Vine Forest).

The extent of this habitat type on the project area has changed over time. Aerial photography indicates that pasture was established on the project area during and/or prior to the 1940s. Substantial vegetation clearing occurred in the 1970s and pasture was established across most of the northern third of the project area (**Appendix A**). Within this area, cycles of regrowth re-establishment and vegetation clearing ensued over the following decades. The most recent clearing event occurred in 2014, when approximately 46 ha of woody regrowth were cleared to reinstate pasture.

Mesophyll to Notophyll Vine Forest (MNVF)

The MNVF habitat type refers to the areas mapped as BVG 2 and the forested areas in the northern portion of the site mapped by DNRM (2017a) as non-remnant vegetation. It covers approximately 123 ha (18%) of the project area. MNVF primarily occurs between approximately 330 m and 380 m ASL and the underlying landform comprises gently undulating hills. Within the project area, MNVF has similar habitat characteristics to NMVF, a major difference being that MNVF occurs in the lower and less rugged section of the

landscape. Subtle variations in flora species composition and dominance also exist between MNVF and NMVF.

The MNVF habitat type occurs in a variety of forms reflecting the disturbance history. The main difference in terms of floristics relates to the relative dominance of early-succession tree species, notably Acacias, versus later-succession rainforest tree species. The main difference in terms of structure relates to the height of the canopy layer and the degree of subcanopy development.

Habitats of this type within the project area encompass a near-complete spectrum of the aforementioned floristic and structural condition states. The climax state community, where the tree canopy is generally above 25 m and later-succession rainforest species dominate multiple tree layers, is uncommon on the project area and corresponds with the areas mapped by DNRM (2017a) as remnant vegetation (shown on **Figure 7** as BVG 2). The majority of MNVF on the project area is in a transitional state of succession where patches dominated by later-succession rainforest species occur within a general matrix of early-succession tree species. Canopy heights and subcanopy development in these patches of transitional community are variable, ranging from recent regrowth to a near-climax state of condition. The boundaries between these condition states are often ambiguous. In the absence of natural and anthropogenic disturbances these communities will continue their transition towards the climax state. A larger variety of fauna is likely to benefit from the climax state community relative to newly established regrowth. All condition states contribute to habitat diversity at the landscape scale.

Notable habitat resources in this habitat type includes a high density and diversity of flowering and fruiting plants, dense to dappled shade, a ground layer with dense coverage of leaf litter and low abundance of ground stratum plants, multi-layered tree stratums and tree hollows. The latter two attributes are more common in the more advanced regrowth and climax community states. Water resources include 1st and 2nd order streams and unmapped gullies. A weir across the lower section of Harem Creek has resulted in a near-permanent, and relatively deep, pool immediately upstream of the dam wall and assists in maintaining year-round water flows below the weir. Upstream of the weir, and all other streams, support ephemeral flows. The larger systems support pools well into the dry season of most years.

Weeds are present and are abundant in some areas, notably along forest edges and certain gullies, and near tree canopy gaps. Lantana*, Sky Flower* and Giant Bramble (*Rubus alceifolius**) are the dominant weed species. While these weed occurrences detract from the habitat integrity, their presence may benefit, or have a net-neutral effect, on some fauna species.

Impacts from cattle are evident primarily along forest edges and along stream sections where riparian forest is absent or narrow. Observed impacts include grazing and trampling of vegetative cover, and pugging of stream banks. The activities of Feral Pigs (*Sus scrofa*) are also evident in some areas and the species is likely causing similar impact. These impacts are contributing sediment to the receiving aquatic environment. The soils and subsoils in the project area have moderate to high erodibility and pose a fine sediment export risk. Steeply sloping land and high rainfall erosivity increase the potential for soil erosion. This makes creeks susceptible to sediment inputs from accelerated soil erosion.

Notophyll to Microphyll Vine Forest (NMVF)

The NMVF habitat type refers to the areas mapped as BVG 5 and primarily occurs between approximately 350 m and 400 m ASL. It covers approximately 303 ha (45%) of the project area. The landform includes low hills and steeply incised gullies.

The range of floristic and structural condition states of this habitat on the project area is similar to that described for MNVF. However, in contrast to MNVF the majority of NMVF on the project area is at, or nearing, the climax state community. Earlier successional stage forest is present and dominates areas near existing access tracks and eastern portions of the mapped area of BVG 5. Some of the Acacia dominated forest is shown as non-remnant vegetation on DNRM (2017a) mapping (**Figure 6**). Approximately 25 ha of Acacia dominated forest in this habitat type are shown as remnant vegetation on DNRM (2017a) mapping.

The notable habitat resources in this habitat type are similar to that described for MNVF. The main difference is that streams tend to be more ephemeral in NMVF relative to the MNVF. Weed occurrence in NMVF is also similar to that described for MNVF, though Sky Flower is less common in NMVF.

The NMVF habitat on the project area is in generally better condition than the MNVF. Relative to MNVF, the NMVF has a lower edge to area ratio, greater connectivity to habitats on adjacent lands and a higher proportion of habitat that is remote from human settlement.

Eucalypt Open Forest to Woodland (EOFW)

The EOFW habitat occurs in the south-west of the project area and corresponds with the areas mapped as BVG 9. It covers approximately 156 ha (23%) of the project area. The landform is hilly and undulating. Elevation ranges between 350 m and 440 m ASL.

Within the project area, this habitat type ranges in structural formation from Eucalypt open woodland to closed forest (where Eucalypts are co-dominant with rainforest plants). The former mostly occurs in patches along the south-western boundary of the project area and the latter mostly occurs in roughly-linear patches along the boundary of NMVF. Between these areas Eucalypt woodland to open forest is generally present. Fire history is a major influence on the distribution of these forest types.

The habitat generally supports two to three tree layers +/- an emergent layer, a shrub layer and a variable ground layer (generally sparsely vegetated though dense patches are present). Away from the boundary of NMVF the gullies are more densely vegetated in comparison to the more sparsely vegetated ridgelines. Fire-sensitive plants are more prominent in the gullies (*cf* ridgelines).

Eucalypts (*Eucalyptus* spp. and *Corymbia* spp.) are characteristic species of EOFW. Cadaghi (*Corymbia torelliana*) predominantly occurs near the boundary of NMVF. The other Eucalypts are more cosmopolitan and include Clarkson's Bloodwood (*Corymbia clarksoniana*), Forest Red Gum (*Eucalyptus tereticornis*), Moreton Bay Ash (*Corymbia tesselaris*) and Narrow-leaf Ironbark (*Eucalyptus crebra*). A small patch (<5 ha) of Rosegum (*Eucalyptus grandis*) is also present. Other common trees and shrubs include Acacias (*A. mangium, A. crassicarpa, A. melanoxylon*), Forest Sheoak (*Allocasuarina torulosa*), Swamp Mahogany (*Lophostenom suaveolens*), Weeping Paperbark (*Melaleuca leucadendra*), Hard Cheesewood (*Alstonia muelleriana*), Soap Tree (*Alphitonia petriei* and *A. excelsa*) and Basswood (*Polyscias australiana* and *P. elegans*). The ground layer was generally sparse, and mostly <50% cover. Grassy patches (>50% cover) are present. Grasses were present (mostly Blady Grass *Imperata cylindrica*, Reed Grass *Arundinella nepalensis*, Kangaroo Grass *Themeda triandra*, Shotgrass *Paspalidium distans* and Wavyleaf Basketgrass *Oplismenus undulatifolius*) though varied in relative dominance to non-grass plants (*eg* Large Seeded Gahnia *Gahnia aspera*, Bamboo Blue Flax Lily *Dianella bambusifolia* and *Phyllanthus* sp.).

Notable habitat resources in this habitat type include a high density and diversity of flowering and fruiting plants, variable levels of light/shade, a ground layer that generally has a high cover of leaf litter and/or plants (including grasses), multi-layered tree stratums, fallen trees and coarse woody debris and tree hollows. Fallen trees and coarse woody debris are uncommon and there is no rocky outcropping despite the hilly terrain. Water resources include 1st and 2nd order streams and unmapped gullies. All support ephemeral flows. The second order stream retains pools well into the dry season of most years.

Weeds are present and are abundant in some areas, notably along gullies. Lantana* and Giant Bramble* are the dominant weed species. While these weed occurrences detract from the habitat integrity, their presence may benefit, or have a net-neutral effect, on some fauna species.

No evidence of cattle was observed in this habitat. ATV tracks near the southern-most boundary are the most obvious forms of disturbance. These tracks are unsealed and traverse sections of rugged terrain. It appears that various forms of small vehicles use these tracks and some areas are possibly used for horse riding. A paint-ball tourism venture operates in the south of the project area.

Habitat condition

The results of habitat condition assessments are presented in **Table 8** and indicate that habitat integrity was generally moderate to high across forested sections of the site. The main threatening processes and disturbances are summarised as follows.

- The MNVF has a high edge to area ratio. This situation exposes remnant habitats to various edge effects including elevated levels of light penetration, weed ingress and wind exposure.
- Livestock are most active in areas adjacent to and along the edges of MNVF. Livestock grazing and ground disturbance through hoof action is decreasing ground cover and reducing surface soil stability along forest edges and near streams. This action, especially when combined with high rainfall, is contributing sediment (and any associated contaminants, *eg* nutrients and metals) to the aquatic receiving environment. The soils and subsoils in the project area have moderate to high erodibility and pose a fine sediment export risk. Steeply sloping land and high rainfall erosivity increase the potential for soil erosion. This makes creeks susceptible to sediment inputs from accelerated soil erosion.
- Weeds such as Lantana* and Giant Bramble* are ubiquitous in most habitats on-site. Sky Flower is also prevalent, especially in MNVF. While these weed occurrences detract from the habitat integrity, their presence may benefit, or have a net-neutral effect, on some fauna species. Many other weed species are present though pose minor threat to forested habitats.
- Many of the forested habitats show signs of cyclone damage (*eg* damaged tree canopies and canopy gaps created by tree fall). The damage is more pronounced in the northern portion of the project area and along the edge of cleared land.
- The unsealed track network in the EOFW is a potential sediment source for the aquatic receiving environment. If uncontrolled, public access to this track network increases the risk of weed invasion.

Table 8: Habitat condition observed across the study area[A]

Habitat Type	Structure & Floristics	Weed Invasion	Woody Vegetation (Tree Layer)	Herbaceous Vegetation (Shrub & Ground Layers)	Physical Disturbance
Open Pasture	6 (improved pasture)	3 (moderate)	N/A	N/A	3 (moderate), though 4 (high) near stock water and feed points
MNVF	3 (partially intact)	3 (moderate)	1-3 (intact) to 4 (moderate to high cover)	2 (70-90% native cover)	3 (moderate)
NMVF	2 (substantially intact)	2 (low)	1-3 (intact)	2 (70-90% native cover)	2 (low)
EOFW	2 (substantially intact)	2 (low)	1-3 (intact)	2 (70-90% native cover)	2 (low)

[A] Refer to **Table 6** for complete description of categories. Categories range from 1 (best) to 6 (worst).

Landscape context and connectivity

The project area is situated on the western fringe of the Kuranda township, with the localities of Myola and Kowrowa occurring to the north and north-west respectively (**Figure 13**). Residential areas occur along the eastern, northern and western sides of the project area though most properties are relatively large acreage blocks (mostly above 5,000 m^2). Some of the surrounding areas were historically cleared for farming, especially areas to the north and east of the project area (see aerial photography in **Appendix A**). Urban expansion has occupied some of the historically cleared land and encroached into previously forested land. This history of rural and urban development is reflected in the RE mapping with much of the land to the east and north of the project area mapped by DNRM (2017a) as non-remnant vegetation (**Figure 5**). From a habitat perspective the remnant vegetation layer provides an incomplete appraisal as many areas mapped as non-remnant vegetation are forested regrowth and have retained values for wildlife. The relative value of these areas of regrowth varies according to the species involved and site-specific context, though in some instances this regrowth is of high conservation value and supports T/NT&M species.

The project area occurs in a broad section of landscape where north-south connectivity for certain rainforest fauna is relatively limited. One habitat corridor occurs in rainforest in the vicinity of Barron River Falls, approximately 3 km east of the project area (**Figure 13**). The Barron River and steeply incised gorge is the main feature interrupting north-south connectivity through this section. The river and gorge would not pose a significant barrier to most volant fauna though may inhibit north-south movement of many ground-dwelling species, including Southern Cassowary (*Casuarius casuarius johnsonii*). The other rainforest corridor(s) occurs through the general Kuranda-Myola-Kowrowa area (**Figure 13**). The Barron River upstream of Kuranda contains river sections where waters are relatively shallow and stream banks are not steeply incised. These stream sections potentially pose less of a barrier to movement of all fauna relative to the Barron Gorge section. While all remaining rainforest habitats through the Kuranda-Myola-Kowrowa area contribute to north-south connectivity across the Barron River, habitats along the western portion of this area are less fragmented and contain a lower density of human settlement and infrastructure, potentially offering higher quality corridor values than the more urbanised and fragmented eastern portion (**Figure 13**). The project area contributes to both the western and eastern portions of this corridor, though its contribution to the western portion is more substantial. Habitat connectivity south of the project area is partially compromised by the Kennedy

Highway (mostly affecting non-volant fauna) and a patchwork of low density housing (potentially affecting all fauna) (**Figure 13**).

The area of Eucalypt woodland-open forest west of the project area (**Figure 4**) may also be an important north-south corridor for a variety of wildlife, especially for species that prefer sclerophyll habitats. Attributes contributing to the values of this corridor include the large size of the remnant forest patch, presence of rainforest patches and ecotone areas (which may act as refugia and/or increase the diversity of resources), topographic variation (which can buffer the impacts of certain threatening processes), and presence of large watercourses (*eg* Clohesy River and Groves Creek). The south-western edge of the project area contributes a relatively small portion of habitat to this corridor. Formartine Forest Reserve, which adjoins the southern boundary of the project area (**Figure 13**), forms a large part of the corridor. The Kennedy Highway and low-density housing in the vicinity of the highway partially compromise connectivity to the south of Formartine Forest Reserve.

The corridors described above, and to which the project area contributes, are potentially important to a multitude of wildlife, including high profile threatened species. For example, the rainforest corridors and ecotone areas may be important for the Southern Cassowary (discussed further in **Section 4.3.2**) and the sclerophyll corridor and ecotone areas may be important for Northern Quoll (*Dasyurus hallucatus*), and at least historically for Northern Bettong (*Bettongia tropica*). The potential importance of these corridors to wildlife is recognised in various forums including the *Mareeba Shire Council Planning Scheme* (MSC 2017), which maps an 'ecological corridor' and 'habitat linkage' through the project area and surrounding land, and the *Wet Tropics Conservation Strategy 2004* (WTMA 2004) which describes 'Kuranda Envirolink' as a priority 1 corridor linking Rainy Mountain (north of Barron River) to Barron Gorge National Park (occurs north and south of the Barron River). WTMA (2004) describes 'Kuranda Envirolink' as a 'vital cassowary habitat and wildlife corridor [that] includes both remnant rainforest and sclerophyll communities'.

4.3.2 Native fauna species

The Wildlife Online and Atlas of Living Australia database searches returned 523 terrestrial vertebrate species for the applied search areas (**Appendix H**). The EPBC Act Protected Matters Search Tool identified the known or potential presence of 25 Threatened and 22 Migratory terrestrial vertebrate species or their habitat within the applied search area (**Appendix B**). These results do not necessarily mean the identified species are likely to occur in the project area. This is in part because the database search areas encompassed habitats dissimilar to that found on the project area (*eg* coastal habitats near Cairns) and databases such as the Protected Matters Search Tool use a coarse scale predictive function for certain species.

One hundred and seventy-three (173) terrestrial vertebrate fauna species, representing 76 families, were recorded on the project area across all fauna studies (**Table 9**; **Appendix K**). One hundred and forty-nine (149) of these were identified during the 2017 baseline fauna survey. These totals include micro-bat species that were tentatively identified based on their calls. The suite of species recorded is a sub-set of the complete species assemblage that is likely to occur in the project area and is representative of the survey effort and conditions prior to and during the surveys.

In the forested habitats, fauna species richness was highest in the Eucalypt Open Forest to Woodland (EOFW) habitat and lowest in the Mesophyll to Notophyll Vine Forest (MNVF) habitat (**Table 10**). Relevant to this comparison is that sampling effort was similar, though not identical, between habitat types. Systematic sampling did not occur in the Open Pasture

and species counts for this habitat are not shown in **Table 10**. Based on site knowledge, species richness would be much lower in Open Pasture relative to the forested habitat types.

Table 9: Summary of fauna species richness recorded per group during 2017 field survey program

	Baseline Fauna Survey [A]		All NRA Studies [B]	Other Sources [C]	Total (All Sources/Studies)
	EWS	EDS			
Amphibians	7	4	14	14	14
Birds	68	74	91	48	103
Mammals	27	26	35	7	35
Reptiles	12	10	17	12	21
Total	**114**	**114**	**157**	**81**	**173**

A: Fauna recorded during early wet season (EWS) and early dry season (EDS) baseline fauna surveys. The combined total was 149 species.

B: Fauna recorded by NRA during baseline fauna surveys and incidentally during other tasks.

C: Fauna recorded by Hoskin (2017) and Ebner and Vallance (2017).

Table 10: Species richness recorded in each forested habitat type during the baseline fauna survey program [A]

	MNVF		NMVF		EOFW	
	Site 1	All	Site 3	All	Site 2	All
Amphibians	EWS: 3 EDS: 2	EWS: 3 EDS: 2	EWS: 1 EDS: 0	EWS: 1 EDS: 2	EWS: 2 EDS: 1	EWS: 2 EDS: 1
Birds	EWS: 21 EDS: 23	EWS: 21 EDS: 23	EWS: 22 EDS: 29	EWS: 23 EDS: 25	EWS: 27 EDS: 27	EWS: 27 EDS: 32
Mammals	EWS: 1 EDS: 4	EWS: 1 EDS: 4	EWS: 7 EDS: 4	EWS: 14 EDS: 13	EWS: 5 EDS: 12	EWS: 12 EDS: 20
Reptiles	EWS: 5 EDS: 3	EWS: 5 EDS: 3	EWS: 5 EDS: 2	EWS: 7 EDS: 4	EWS: 2 EDS: 3	EWS: 4 EDS: 5
Total	**EWS: 30** **EDS: 32**	**EWS: 30** **EDS: 32**	**EWS: 35** **EDS: 35**	**EWS: 45** **EDS: 44**	**EWS: 36** **EDS: 43**	**EWS: 45** **EDS: 58**

A: Fauna recorded during early wet season (EWS) and early dry season (EDS) baseline fauna surveys. Site numbers refer to locations where systematic sampling occurred (*eg* trapping and timed searches) (**Figures 8** and **9**). The category 'All' comprises the results from trap sites plus results from targeted survey work. Sampling effort was not identical between sites; however, sampling effort was similar sites where systematic sampling occurred (*ie* Sites 1 to 3).

Threatened and Near Threatened Fauna

Eight T&NT fauna species were recorded during the field surveys; these species and their legislative status are listed below.

- Kuranda Tree Frog (*Litoria myola*). Endangered NC Act and EPBC Act.
- Gouldian Finch (*Erythrura gouldiae*). Endangered NC Act and EPBC Act.
- Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus*). Endangered NC Act, Vulnerable EPBC Act.
- Greater Large-eared Horseshoe Bat (*Rhinolophus philippinensis*). Endangered NC Act, Vulnerable EPBC Act.
- Spectacled Flying-fox (*Pteropus conspicillatus*). Vulnerable NC Act and EPBC Act.
- Tapping Green-eyed Frog (*Litoria serrata*). Vulnerable NC Act.
- Macleay's Fig-parrot (*Cyclopsitta diophthalma macleayana*). Vulnerable NC Act.
- Tube-nosed Insectivorous Bat (*Murina florium*). Vulnerable NC Act.

Information relating to these species is provided below. Information is also provided for the Endangered (NC Act and EPBC Act) Southern Cassowary (*Casuarius casuarius johnsonii*), and the Red Goshawk (*Erythrotriorchis radiatus*) which is listed as Endangered and Vulnerable under the NC Act and EPBC Act respectively. Non-definitive evidence of Southern Cassowary and Red Goshawk presence was recorded on the project area and discussion is warranted given the potential interest associated with these species.

Kuranda Tree Frog

The Kuranda Tree Frog was described in 2007 (Hoskin 2007), and together with the Tapping Green-eyed Frog, was formerly part of *Litoria genimaculata*. The Kuranda Tree Frog inhabits rainforests and breeds in streams, with breeding males being most active near riffles and small cascades (Hoskin 2012). Breeding males spend most of their time near streams, though females, subadults and non-breeding males use rainforest away from streams. The species forages in trees, and is thought to favour mid and upper forest levels (Hoskin 2007).

The core areas of habitat for this species on the project area have been established via surveys over two years (**Figure 14**) (streams and forests within 100 m of the centre-line of streams where Kuranda Tree Frog was recorded). The population is a breeding population. Breeding populations also occur in the downstream receiving environment along Owen, Cain and Warril Creeks (**Figure 14**; also Hoskin 2017, **Appendix G)**. The project area is the top of the catchment for these creeks and no populations occur higher in the catchment.

The Kuranda Tree Frog population on the project area (**Figure 14**) is estimated as 65 adults along Owen and Haren Creeks, plus five to 10 adults along Cain Creek (Hoskin 2017). A number of assumptions underpin these estimates, and Hoskin (2017) cautions that the estimates are 'coarse'. The area may support 50 to 100 breeding adults (Hoskin 2017).

The species is highly restricted in distribution, being limited to 10 breeding populations in the Kuranda area and numbering approximately 750 adults (Hoskin 2017). This means all remaining populations are of very high conservation significance. The very limited extent of occurrence and small population size renders the species highly vulnerable to population decline and extinction.

Hoskin (2017) used the above coarse estimates to contextualise the relative importance of the Kuranda Tree Frog population residing on the project area (**Figure 14**).

- The project area supports approximately 50% of the Owen/Haren Creek population, and 50% of the Cain Creek population.
- The Owen/Haren Creek population, encompassing the project area and downstream (*ie* off-site) to the Barron River, is the third largest of all known populations. The Cain Creek population is one of many relatively small populations.
- The project area supports approximately 10% of the entire adult population of the species (*ie* 10% of the global population).

The above estimates are specific to the project area (**Figure 14**). The entire receiving environment (*ie* on-site plus downstream of the project area) may support approximately 47% of the entire adult population of the species (*ie* 47% of the global population).

Gouldian Finch

The Gouldian Finch inhabits open grassy woodlands within the vicinity of water (Higgins *et al*. 2006). They feed almost exclusively on grass seed, being reliant on a particular suite of grass species (Garnett *et al*. 2011; Dostine *et al*. 2001; O'Malley 2006). When breeding, they favour ridges and foothills that have hollow-bearing Eucalypts (for nesting) and suitable

grasses (especially native Sorghums (*Sorghum/Sarga* spp.), and Spinifex (*Triodia* spp.), and that are within 4 km of water (Higgins *et al*. 2006; Dostine *et al*. 2001; O'Malley 2006). Birds disperse after breeding, preferring flatter parts of the landscape and feeding on a wider variety of grasses (ranging from Spinifex to softer annual or perennial grasses) (Maute & Legge 2012; Garnett *et al*. 2011). When not breeding, most movements are within 10 km of water though individuals may disperse more widely (Higgins *et al*. 2006).

Historically the species was widespread in northern Australia. The subsequent decline was precipitous, and the species now persists in a much reduced part of its former range (Higgins *et al*. 2006; Maute & Legge 2012; Garnett *et al*. 2011). The species is apparently present in very low numbers at a few sites in north Queensland.

A single Gouldian Finch was recorded in the north-east of the project area in early January 2017 (**Figure 15**). Dedicated bird surveys conducted near the sighting location during the January and May 2017 fauna surveys did not re-sight the species (see 'supplementary bird survey transects' on **Figures 8** and **9**, and 'timed bird surveys' **Table 4**). The nearest known population is approximately 20 km west of the project area and is the product of a captive breeding program at the Mareeba Tropical Savanna and Wetland Reserve. The Gouldian Finch seen on the project area was either a vagrant or an aviary escapee. Viable habitat for the species does not occur on the project area.

Bare-rumped Sheathtail Bat

The Bare-rumped Sheathtail Bat (BrS Bat) is a poorly known species primarily found from near-coastal areas of north-eastern Queensland, and in the monsoonal tropics of the Northern Territory and Kimberley region of Western Australia (Milne *et al.* 2009; Woinarski *et al.* 2014). The species also occurs extralimitally from Solomon Islands to India (Churchill 2008). It is insectivorous and, in Australia, it appears to preferentially forage above the tree canopy and mostly in Eucalypt forests and woodlands (Woinarski *et al.* 2014). In Australia, it has been recorded roosting in tree-hollows (Churchill 2008; Compton & Johnson 1983; Murphy 2002), though outside of Australia it is known to roost in buildings and rocky crevices. Only a few roost sites have been documented for this species in Australia, with the species being recorded roosting in Poplar Gum (*Eucalyptus platyphylla*), Darwin Stringybark (*E. tetrodonta*) and Weeping Tea-tree (*Melaleuca leucadendra*). The roosts were in long, wide hollows in the trunks of the trees opening directly to the outside environment (Dennis 2012a; Milne *et al.* 2009; Compton & Johnson 1983; Churchill 2008; Murphy 2002).

Until 2016, the BrS Bat was listed as Critically Endangered under the EPBC Act (currently listed as Vulnerable). Recent taxonomic work and advancements in the ability to detect the species indicate that the species is more common than previously thought. This situation is reflected in the most recent conservation status assessment (*ie* non-statutory) conducted by Woinarski *et al.* (2014) who list the species as Near Threatened.

During the EWS fauna survey on the project area, a 'definite' vocalisation was recorded in the vicinity of the homestead and a 'possible' vocalisation was recorded along a tributary of Haren Creek (**Figure 15**). It is likely to forage above all habitats on the project area (including Open Pasture) and surrounding region. Potential roost sites may occur on the project area, primarily in the EOFW where tall hollow-bearing Eucalypts occur. Limited data is available on the species' occurrence in the local area or region. The project area may be towards the western edge of its distribution.

Greater Large-eared Horseshoe Bat

The Greater Large-eared Horseshoe Bat (GLH Bat) is a poorly known species that mainly occurs in the near-coastal areas of north-eastern Queensland, with disjunct populations

occurring farther inland where there are suitable cave systems (Pavey & Kutt 2008). It is insectivorous, and is found in a variety of habitats including rainforest, riparian forests, Eucalypt open forests and woodlands (Woinarski *et al.* 2014). It is thought to roost in tree-hollows and vegetation, creek banks, road culverts, rock piles and caves (Churchill 2008; Woinarski *et al.* 2014).

The conservation status of the species is uncertain due to a lack of information; however, Woinarski *et al.* (2014) report 'some evidence' of a decline and assessed the species as Near Threatened (non-statutory listing).

During the 2017 EDS fauna survey, a vocalisation was recorded along Haren Creek (**Figure 15**). It is likely to forage in all habitats on the project area and similar habitats in the surrounding region. It is possibly most active along forest edges, streams and near breaks in vegetation cover such as tree falls. Potential roost sites may occur on the project area, being most likely in the EOFW where tall hollow-bearing Eucalypts occur. Limited data is available on the species' occurrence in the local area or region. The project area may be towards the western edge of its core (*ie* near-coastal) distribution.

Spectacled Flying-fox

Spectacled Flying-foxes occur in north-east Queensland, New Guinea and some of its nearshore islands. Its core distribution in Queensland is associated with rainforest north of Ingham to Cape York, with outlier records from a few inland localities (Churchill 2008; Woinarski *et al.* 2014). The species feeds on the fruit of many species, pollen, nectar and leaves. Foraging may occur in rainforest or nearby Eucalypt or Melaleuca forest to open woodlands, in mangroves, urban areas and orchids (Dennis 2012b; Churchill 2008; Woinarski *et al.* 2014). Telemetry work suggests foraging mostly occurs in open forest with animals seeking mass flowering events in preference to dispersed fruit and flowering events in rainforest (Westcott *pers. comm.* in Woinarski *et al.* 2014). The species roosts communally in 'camps', usually in rainforest, though a small number of camps occur in urban areas amongst clumps of large trees.

The Spectacled Flying-fox has a relatively large population size (Woinarski *et al.* 2014) though is apparently declining (Westcott *et al.* 2015). The most recent species conservation status (*ie* non-statutory) assessment determined that the species was Near Threatened, with its future status being 'Conservation Dependent' (Woinarski *et al.* 2014), *ie* maintenance or improvement on this status is reliant on ongoing conservation measures.

A small number of individuals were recorded on the project area during the 2017 EWS fauna survey program (**Figure 15**). All forested habitats on the project area and in the surrounding region are suitable foraging habitat. No flying-fox roosts/camps were recorded on the project area. The species is possibly less common in the local area during the cooler months.

Tapping Green-eyed Frog

The Tapping Green-eyed Frog is very similar in ecology to the Kuranda Tree Frog (*see* descriptions above for Kuranda Tree Frog; also Vanderduys 2012 and Hoskin & Hero 2008). Unlike the Kuranda Tree Frog, the Tapping Green-eyed Frog is widespread across the Wet Tropics and present in a broad altitudinal range (0-1,300 m ASL) (Hoskin & Hero 2008). There are two genetic lineages of Tapping Green-eyed Frog in the Wet Tropics; described as northern and southern lineages (Hoskin 2007; Hoskin & Hero 2008). The two lineages overlap and hybridize in the central Wet Tropics. The northern lineage is dominant in the Kuranda-Myola area. An isolated population of the southern lineage was also present in the Kuranda-Myola area and speciation in this isolated population gave rise to the Kuranda Tree Frog (Hoskin 2007).

Alford *et al.* (2004) assessed the conservation status (non-statutory) of *Litoria genimaculata*, which includes the contemporary Tapping Green-eyed Frog of eastern Australia and the closely related New Guinea taxon, as Least Concern and with a decreasing population trend. This assessment should be viewed with caution given its broad coverage (Australian and New Guinean taxa). The Tapping Green-eyed Frog declined in the 1990s, with the chytridiomycete fungus identified as the most likely proximate cause of decline (Alford *et al.* 2004). The decline was not as severe as that recorded for some other stream-dwelling frog species (McDonald & Alford 1999), and Tapping Green-eyed Frog populations have potentially recovered to pre-decline levels (Alford *et al.* 2004). The Tapping Green-eyed Frog is relatively common locally and regionally.

The Tapping Green-eyed Frog is present along most streams on the project area, including some of the unmapped gullies. Breeding potentially occurs along all drainage lines where flowing water is present, including some of the unmapped gullies. Breeding adults are likely to occur at highest density along the better formed streams (*cf* small gullies) and where forest cover beside the stream is well-developed and extensive. On the project area, breeding adults may occur in the counter scenarios though probably at lower density and frequency. Non-breeding adults and immature Tapping Green-eyed Frogs may occur in forests adjacent to all streams and gullies. Cain Creek and the lower reaches of Haren/Owen Creek are an exception to the above described patterns of occurrence – the Kuranda Tree Frog is common at these locations and the Tapping Green-eyed Frog occurs at lower densities. Core habitat for the species on the project area is shown on **Figure 16** and comprises streams and forests within 100 m of the centre-line of streams[8]. Field observations were used to delineate non-breeding habitat and habitat shared with Kuranda Tree Frog (**Figure 16**).

Macleay's Fig-parrot

The Macleay's Fig-parrot is a subspecies that is endemic to the Wet Tropics, preferring lowland rainforest though present up to 1,200 m ASL (Higgins 1999; Heinsohn 2012). It is occasionally seen and breeds in parks and gardens (Heinsohn 2012; Nielsen 2015) where there are clumps of tall trees. The species predominantly forages upon the fruits of *Ficus* spp. but will eat the fruits of other plants, nectar and insect larvae (Higgins 1999; Heinsohn 2012). Eggs are laid in self-excavated tree hollows in rainforest and woodlands near rainforest. The species roosts communally in tall trees (Heinsohn 2012).

Macleay's Fig-parrots were seen overflying the project area during the 2017 fauna survey program (**Figure 15**). All forested habitats on the project area and in the surrounding region may constitute suitable habitat, with the exception of the younger, Acacia dominated, regrowth of MNVF and NMVF which is suboptimal. The subspecies is likely to have declined in response to historical broadscale clearing for agriculture though the decline has probably abated. It is relatively common locally and regionally, being regarded as Least Concern by Garnett *et al.* (2011) (a non-statutory listing).

Tube-nosed Insectivorous Bat

The Tube-nosed Insectivorous Bat occurs in north-east Queensland and extralimitally in New Guinea and eastern Indonesia (Churchill 2008; Clague 2012). Two populations occur in north-east Queensland, one centred on Iron Range (Cape York) and the other occurring across the Wet Tropics. It inhabits lowland and upland rainforest and Eucalypt tall open forest where it primarily forages on insects in the canopy and subcanopy (Churchill 2008;

[8] Buffer based on ecologically similar Kuranda Tree Frog and determined in consultation with Conrad Hoskin.

Clague 2012). It roosts in a variety of settings that provide cover, *eg* amongst foliage, tree hollows and disused scrubwren or fernwren nests (Churchill 2008; Clague 2012).

The conservation status of the species is uncertain due to a lack of information; however, Woinarski *et al.* (2014) assessed the species as Near Threatened (non-statutory listing) due to 'its small area of occupancy and some potential threats'.

A male Tube-nosed Insectivorous Bat was captured along a tributary of Haren Creek during the 2017 EWS fauna survey (**Figure 15**). It may occur in any of the forested habitats on the project area or surrounding region. The species is known to occur in the region though there is insufficient data to determine relative abundance or patterns of occurrence.

Red Goshawk

The Red Goshawk occurs across coastal and subcoastal northern Australia (Kimberley Division of Western Australia to northern Northern Territory and North-west Highlands of Queensland) and eastern Australia (Cape York to south-east Queensland). It is occasionally recorded (mainly from gorge country) in central Australia and western Queensland (Czechura 2012). The preferred habitat for the Red Goshawk is open forest and woodland that support a mosaic of vegetation types (Czechura 2012; Garnett *et al.* 2011). Nesting usually occurs in tall (> 20 m) emergent trees that are near (< 1 km) to permanent freshwater (streams and wetlands) (Aumann & Baker-Gabb 1991). It mainly preys on medium to large birds (waterfowl, parrots, pigeons, kookaburras and large passerines), and rarely takes mammals, reptiles and small animals. Limited data is available on movements, though studies in the Northern Territory found adult movements away from nesting sites are mostly <10 km (Czechura 2012). Young Red Goshawks may disperse more broadly and have been recorded several hundred kilometres outside of their breeding range (Marchant & Higgins 1993).

Because of the species' inconspicuousness, the population size may have previously been underestimated (Garnett *et al.* 2011). The most recent conservation assessment (non-statutory) listed it as Near Threatened (Garnett *et al.* 2011).

A bird thought to be a juvenile Red Goshawk was seen gliding just above canopy height in the EOFW habitat. The uncertainty was due to the brevity of the sighting, and the fact that the species has physical traits in common with other raptor species. The underparts of the bird seen over the project area were rich rufous in colour, and the underwing was lightly barred with dark wing tips (outer primaries). The bird was large and gliding just above the canopy on relatively flat-angled wings.

The species is wide-ranging, especially juvenile birds, and reliable records away from popular bird-watching haunts are uncommon. This is partly due to the low density at which the species occurs, its relatively cryptic behaviour and the fact that it can be difficult to identify. This situation makes predictions about species occurrence difficult. There are sighting records for the species in the local area, though the sightings are infrequent which may suggest a non-permanent presence. On available information, the species may forage over all forested habitat types of the project area though EOFW is likely to be preferred and the species' presence is likely to be temporary and irregular.

Southern Cassowary

The Southern Cassowary occurs in north-eastern Queensland, New Guinea and some its nearshore islands. The subspecies *C. c. johnsonii* occurs only in Australia, with one population in the Wet Tropics and at least one other on north-eastern Cape York. It inhabits rainforest areas that are capable of producing a year-round supply of fleshy fruit, their

primary food source (Stocker & Irvine 1983; Marchant & Higgins 1990; Bradford *et al.* 2008; Garnett *et al.* 2011). They may also use nearby Eucalypt woodlands and forests, mangroves and exotic fruit plantations (Garnett *et al.* 2011). They require daily access to fresh water for drinking and bathing (Bentrupperbaumer 1998; Buosi 2012). Adult Southern Cassowary are generally solitary, maintaining dynamic and overlapping territories (Campbell *et al.* 2012; Buosi 2012; Garnett *et al.* 2011). Eggs are laid in rudimentary nests on the ground and are usually sheltered amongst low-growing and dense vegetation (Bentrupperbaumer 1998).

NRA (2006) and Westcott *et al.* (2014) contain information to help contextualise the Southern Cassowary population with reference to the project area and immediate surrounds. NRA (2006) identified 21 subpopulations in the Wet Tropics, and the Kuranda-Myola area was part of the 'Atherton Tableland Subpopulation'. This subpopulation supported one of the largest and most fragmented areas of habitat (relative to the other subpopulations). Westcott *et al.* (2014) estimated the size of the Southern Cassowary population in the Wet Tropics at a subregion level (note: the subpopulations/subregions identified by NRA 2006 and Westcott *et al.* 2014 differ). The Kuranda-Myola area was part of the 'Kuranda' subregion and described as approximately 12,000 ha in size and encompassing the area west of the range between the Black Mountain corridor in the north to Lambs Head in the south (**Figure 2**). The 'Kuranda' subregion was ranked 11th and 15th highest in density and abundance (respectively) of Southern Cassowary out of the 21 identified subregions. Westcott *et al.* (2014) estimate that the 'Kuranda' subregion supports 21 Southern Cassowary. The age class to which this estimate pertains was not stipulated though it is assumed to include adult and independent subadult birds. The Westcott *et al.* (2014) population estimate for the region is similar to that derived from the Kuranda Conservation Cassowary Identification Project which relies on data submitted by the public.

No definitive evidence of Southern Cassowary presence was found on the project area during the 2017 field survey program. Based on experience at other sites in the Wet Tropics the survey effort was sufficient to discount the possible presence of a permanent and high-density population. The possibility that Southern Cassowary use the project area intermittently, and/or use peripheral areas of the project area that were not directly surveyed, cannot be discounted. Non-definitive evidence of Southern Cassowary was recorded at two locations (**Figure 15**); they were considered a low probability of belonging to the species (described below).

- At one location, there were three seedling clusters approximately circular in shape. These seedling clusters are similar to that which sometime form from old Southern Cassowary dung. Similar seedling clusters of varying size and irregular in shape were found nearby and there was insufficient basis to definitively attribute the seedling clusters to Southern Cassowary.
- At the second location, there were multiple piles of seeds along a short section of Haren Creek. The piles were relatively small (approximately 3 cm to 7 cm in diameter), quite flattened and the seeds were not masticated. The piles were similar in appearance to old dung belonging to subadult or juvenile Southern Cassowary. Near these seed piles was Feral Pig dung (based on size, shape and texture of dung) that contained similar seeds to that which occurred in the aforementioned seed piles. The seeds in the Feral Pig dung were not masticated. On this basis, the seed piles were more likely to have been desiccated Feral Pig dung.

The climax community states of MNVF and NMVF on the project area are suitable habitat for Southern Cassowary. The more advanced stages of regrowth are also generally suitable though the young regrowth is suboptimal. All regrowth is currently on a trajectory of

improvement in terms of suitability for Southern Cassowary. While superficially these blocks of forest appear continuous, many sections are bisected by steeply incised gullies some of which are near-impenetrable with dense vegetation. These circumstances will impede Southern Cassowary movements. It was beyond the scope of this study to establish the degree to which pathways are impeded (it could range from minor to substantial levels of impediment). The salient observation is that not all of the mapped areas of MNVF and NMVF would be suitable and available habitat in their current form. Accessibility across these areas for Southern Cassowary will likely improve over time if forests are left undisturbed.

Anecdotal reports indicate that Southern Cassowary are occasionally (not regularly) seen on lands to the immediate south (between Kennedy Highway and project area), north (between Barron River and project area) and west (vicinity of Boyles Road) of the project area (**Figures 3** and **13**). The infrequency of sightings suggests that permanent or high-density populations do not occur in these areas. Database records[9] and anecdotal reports suggest the species is regularly seen along the Barron River and to the north and east of this area (*eg* many sightings along Black Mountain Road), and south of the Kennedy Highway near Kuranda. The species is also seen along the Kuranda Range Road (approximately 4 km east of project area). A survey in the Kuranda area by Moore and Moore (1999) approximately 20 years ago depicts a similar species distribution; notably, they documented the presence of a Southern Cassowary in the south-west of the project area (in NMVF).

The apparent absence of resident Southern Cassowary population on and immediately adjacent to the project area is perplexing given the presence of apparently suitable habitat in this area. The species absence, or intermittent occurrence, on the project area and immediately surrounding lands is potentially the result of contemporary and historical circumstances. Historically, large portions of land on and to the north and east of the project area was cleared (*eg see* photographs in **Appendix A**) and subsequently settled. The combination of habitat loss and fragmentation, and indirect threats associated with human settlements (*eg* vehicle collisions, dog attacks) would have greatly reduced the viability of remaining habitats for Southern Cassowary. While some areas are recovering (*ie* vegetation regrowth), other areas have since been lost and indirect threats to Southern Cassowary have possibly increased over time with urban intrusion. The combined effect is that the Southern Cassowary has possibly been unable to re-establish a permanent presence. Of relevance is that Moore and Moore (1999) described collision with vehicles, dog attacks and hand feeding as the primary threats to Southern Cassowary in the Kuranda area. The management of dog attack near the Boyles Road and Owen Creek area (within and adjacent to the project area; **Figure 3**) was one of the areas specifically mentioned as needing dog management. A pack of approximately six wild dogs (resembling dingoes in appearance) was recorded in the project area during the 2017 fauna survey program. They were recorded in the north of the site in Open Pasture and along forest edges (MNVF and NMVF), and in the south near to the track network (NMVF and EOFW). These wild dogs are potentially hampering the recolonisation of the project area by Southern Cassowary.

The effectiveness of the habitat corridors, and the likelihood of regular Southern Cassowary presence on the project area and on surrounding lands, will rely on the retention of habitats in key areas and substantial community-wide efforts to reduce the indirect threats associated with vehicles collisions and dog attack (hand feeding Southern Cassowary magnifies these

[9] The following databases were consulted: Atlas of Living Australia, Wildlife Online, EHP Cassowary Incident Database and Kuranda Conservation Cassowary Identification Project (via meeting 14 September 2017 between Neil Boland, NRA, and Jax Bergersen, Kuranda Conservation).

threats). Complete mitigation of these risks is unlikely and it may be that the broad area will act as a population sink and/or only ever support a transient population. While not ideal, this level of success may still contribute to gene flow north-south across the Barron River and be of net conservation value. The more lightly populated and less fragmented western portion of the corridor (**Figure 13**) probably presents the best opportunity for achieving this. These views are slightly more optimistic than that offered by Moore and Moore (1999) who contended that encouraging Southern Cassowary to the 'Kuranda Envirolink'[10] corridor was unlikely to succeed and thus would subject the species to unnecessary risks. Further, Moore and Moore (1999) were of the belief that neither the Kennedy Highway nor Barron River crossings were desirable or practicable as permanent crossing points for Southern Cassowary.

In summary, the better developed areas of MNVF and NMVF, and parts of EOFW, are potential habitat for Southern Cassowary and the species is likely to occur on the project area on at least an intermittent basis. While habitats on and near the project area are generally improving in suitability, other threatening processes are active and inhibit the establishment of a permanent and appreciable Southern Cassowary population.

Other Threatened and Near Threatened Fauna predicted to occur

A list of the T&NT fauna species not recorded during field surveys though identified in the database search areas is provided in **Table 11**. The likelihood of these species occurring on the project area was assessed with reference published information about the ecology and distribution of each species, and the habitat types and conditions observed on-site. Based on this assessment 12 species may occur on the project area and one species is likely to occur on the project area; these species and their legislative status are listed below.

- Likely to occur.
  - Southern Cassowary (southern population) (*Casuarius casuarius johnsonii*). Endangered NC Act and EPBC Act.
- May occur.
  - Australian Lacelid (*Litoria dayi*). Endangered NC Act and EPBC Act.
  - Northern Bettong (*Bettongia tropica*). Endangered NC Act and EPBC Act.
  - Northern Quoll (*Dasyurus hallucatus*). Endangered EPBC Act.
  - Red Goshawk (*Erythrotriorchis radiatus*). Endangered NC Act, Vulnerable EPBC Act.
  - Semon's Leaf-nosed Bat (*Hipposideros semoni*). Endangered NC Act, Vulnerable EPBC Act.
  - Masked Owl (northern) (*Tyto novaehollandiae Kimberli*). Vulnerable NC Act and EPBC Act.
  - Greater Glider (*Petauroides Volans*). Vulnerable NC Act and EPBC Act.
  - Ghost Bat (*Macroderma gigas*). Endangered NC Act, Vulnerable EPBC Act.
  - Grey Falcon (*Falco hypoleucos*). Vulnerable, NC Act.
  - Blue-faced Parrot-finch (*Erythrura trichroa*). Near Threatened NC Act.
  - Diadem Leaf-nosed Bat (*Hipposideros diadema reginae*). Near Threatened NC Act.
  - Lumholtz's Tree-kangaroo (*Dendrolagus lumholtzi*). Near Threatened NC Act.

[10] The location of the 'Kuranda Envirolink' corridor is variously defined though is similar to the eastern portion of the Kuranda-Myola-Kowrowa rainforest corridor as shown on **Figure 13**.

The Australian Lacelid, Red Goshawk, Northern Quoll, Ghost Bat, Grey Falcon and Lumholtz's Tree-kangaroo are likely to be non-resident on the project area – their presence is more likely to be intermittent. The presence of Southern Cassowary is also likely to be intermittent (*see* discussion above). The pattern of occurrence of the remaining species is difficult to predict due to limited information on species distribution and/or ecology – their occurrence may range from frequent to intermittent (**Table 11**).

Special Least Concern fauna

The following Special Least Concern (NC Act) fauna were recorded on the project area.

- Short-beaked Echidna (*Tachyglossus aculeatus*).
- Spectacled Monarch (*Symposiachrus trivirgatus*).
- Rufous Fantail (*Rhipidura rufifrons*).

The above bird species are listed as Special Least Concern because they are Migratory-listed fauna under the EPBC Act. They are discussed in the following section.

The Short-beaked Echidna was recorded during both the EWS and EDS fauna surveys on surveillance cameras in NMVF and EOFW. The species may occur in any of the forested areas on the project area and no specific areas of importance for the species are identifiable. It is likely to be common locally and regionally.

Migratory fauna

The Spectacled Monarch was recorded in all forested habitat types and during both the EWS and EDS fauna surveys. The Rufous Fantail was recorded in the EDS survey and only in MNVF and EOFW, though it may also occur in NMVF. Both species are relatively common locally and regionally. The Spectacled Monarch is likely to maintain a permanent or frequent presence on the project area, whereas the Rufous Fantail is a passage migrant and more likely to occur in the cooler months.

Database searches returned a further 35 Migratory-listed fauna. The majority of these are coastal or wetland species that are unlikely to occur on the project area due to the absence of suitable habitat. Species that may, or are likely to, occur are described below.

- Likely to occur.
  - White-throated Needletail (*Hirundapus caudacutus*). Likely to occasionally forage above the project area, being most common in the summer months. Seen in the local area (off-site) during the 2017 EWS fauna survey. No specific areas of importance for the species are identifiable on the project area.
  - Fork-tailed Swift (*Apus pacificus*). Likely to occasionally forage above the project area, being most common in the summer months. No specific areas of importance for the species are identifiable on the project area.
  - Black-faced Monarch (*Monarcha melanopsis*). A relatively common species that is likely to occur in any of the forested habitats on the project area, predominantly in the summer months.
- May occur.
  - Oriental Cuckoo (*Cuculus optatus*). An uncommon non-breeding migrant to Australia. Occasionally seen in Wet Tropics. May on rare occasion occur in the project area, preferring the EOFW habitat.
  - Barn Swallow (*Hirundo rustica*). An uncommon non-breeding migrant to Australia. Occasionally seen in Wet Tropics. May occasionally forage above the project area. No specific areas of importance for the species are identifiable on the project area.

- Eastern Osprey (*Pandion cristatus*). There are limited areas of open water on the project area and the species may at most overfly the project area intermittently. No specific areas of importance for the species are identifiable on the project area.
- Glossy Ibis (*Plegadis falcinellus*). Small numbers of the species may on rare occasion, and temporarily, use Open Pasture areas.

The project area may occasionally, and temporarily, support ecologically significant proportions of White-throated Needletail and Fork-tailed Swift populations based on national threshold values described in DoE (2015). There is insufficient data to assess the likelihood of the project area supporting ecologically significant proportions of the other Migratory species listed above. Based on the 2017 survey results, and the observed conditions on-site, the project area is probably unlikely to support ecologically significant proportions of other Migratory species. The possible exception is the Spectacled Monarch which may at times come close to the national threshold values described in DoE (2015).

Table 11: Likelihood of occurrence (in project area) of Threatened and Near Threatened[1] fauna species identified via database searches though not recorded during field surveys

Species Name	Common Name	Status[1]		Database Record[2]		Likelihood of Occurrence in Project Area[3]
		NC Act	EPBC Act	Local Area	Region	
Litoria dayi	Australian Lacelid	E	E	✓	✓	**MAY OCCUR.** Preferred habitat centred on fast-flowing rocky streams in rainforest, sometimes slow moving sandy streams, and encompassing riparian vegetation (Hoskin & Hero 2008; Vanderduys 2012). Not found on project area following dedicated surveys for threatened stream-dwelling frogs over two years/seasons though sections of Owen, Haren and Warril Creeks potentially contain suitable habitat (Hoskin 2016, 2017). A 'locally significant' population occurs in the downstream receiving environment along Warril Creek (Hoskin 2017). Species declined markedly in late 1980s and may be recovering in Kuranda region (Hoskin 2017). In short to medium term, remote chance of species migrating upstream into project area, at least temporarily, during higher rainfall cycles. Over long term, habitats currently unoccupied by the species and that are connected to existing populations (including but not limited to the project area) may become important for species recovery.
Litoria nannotis	Waterfall Frog	E	E	✓	✓	**UNLIKELY.** Preferred habitat centred on fast-flowing rocky streams in rainforest and adjacent wet sclerophyll forest, being most common near riffles and in splash zone of waterfalls and cascades (Hoskin & Hero 2008; Vanderduys 2012). Optimal habitat is absent on project area.
Litoria nyakalensis	Mountain Mistfrog	E	CE	-	-	**UNLIKELY.** Preferred habitat centred on fast-flowing rocky streams in rainforest and adjacent sclerophyll forest, being most common near riffles and cascades (Hoskin & Hero 2008; Vanderduys 2012). Formerly occurred above 380 m ASL. Optimal habitat is absent on project area. Species not seen since the 1990s.
Litoria rheocola	Common Mistfrog	E	E	✓	✓	**UNLIKELY.** Preferred habitat similar to Mountain Mistfrog. Pattern of decline similar to Australian Lacelid. Optimal habitat is absent on project area. Locally known from one site east of Kuranda (Hoskin 2017).
Taudactylus acutirostris	Sharp Snouted Dayfrog	PE	EX	-	-	**UNLIKELY.** Preferred habitat along and near rainforest streams (Hoskin & Hero 2008; Vanderduys 2012). Formerly occurred above 380 m ASL. Species not seen since the 1990s.

Species Name	Common Name	Status[1]		Database Record[2]		Likelihood of Occurrence in Project Area[3]
		NC Act	EPBC Act	Local Area	Region	
Erythrotriorchis radiatus	Red Goshawk	E	V	✓	✓	**MAY OCCUR.** A wide-ranging species inhabiting woodlands and forests, particularly tall forests in areas of high rainfall (Woinarski 2007), and ideally with intact forest or woodland and a mosaic of vegetation types and permanent water, particularly riverine forests (Marchant & Higgins 1993; DERM 2009). May forage over all forested habitat types of project area though presence likely to be temporary and irregular. A juvenile Red Goshawk may have been seen flying over EOFW in the south-west of the project area. The sighting was very brief and this precluded definitive identification.
Esacus magnirostris	Beach Stone-curlew	V	-	**?**	✓	**UNLIKELY.** A coastal species. The database record from the local area is likely to be erroneous. Optimal habitat is absent on project area.
Casuarius casuarius johnsonii	Southern Cassowary (southern population)	E	E	✓	✓	**LIKELY**. Suitable habitat present on project area (centred on MNVF and NMVF), and while many areas are potentially suboptimal they appear to be on a trajectory of improvement. Field survey found no firm evidence of species presence on project area and suggests occurrence is at most intermittent and/or low density. Discussed further in **Section 4.3.2**.
Erythrura trichroa	Blue-faced Parrot-finch	NT	-	**?**	✓	**MAY OCCUR.** Thought to prefer grassy habitats along forest edges (Higgins *et* al. 2006; Forshaw & Shephard 2012). Relative importance of forest areas uncertain though species will take refuge, and is thought to roost, in rainforest. Patches of suitable habitat present along edges of MNVF and NMVF, and in EOFW. A database record dated 1770 for species in the local area is dubious.
Falco hypoleucos	Grey Falcon	V	-	✓	✓	**MAY OCCUR.** Core range is arid and semi-arid inland Australia (Marchant & Higgins 1993). Vagrant to Wet Tropics (Nielsen 2015). Presence on project area likely to be highly sporadic and temporary, and generally avoiding MNVF and NMVF.
Eclectus roratus	Eclectus Parrot	V	-	**?**	**?**	**UNLIKELY.** Endemic to rainforest on north-eastern Cape York Peninsula (Higgins 1999). Project area well outside species range. Database records either erroneous or of aviary escapees.

Species Name	Common Name	Status[1]		Database Record[2]		Likelihood of Occurrence in Project Area[3]
		NC Act	EPBC Act	Local Area	Region	
Turnix olivii	Buff-breasted Button-quail	E	E	**?**	✓	**UNLIKELY.** Species ecology poorly known. Mostly reported in stony and/or grassy woodlands and forests. Sparsely wooded, well-drained, slightly sloping bases of hills where *Melaleuca viridiflora* and/or *M. minutifolia* is present appears critical in breeding season (Mathieson & Smith 2012). Optimal habitat is absent on project area. The database record for species in local area intersects rainforest and presumably of low location precision. May occur in habitats to the west of the project area.
Tyto novaehollandiae kimberli	Masked Owl (northern)	V	V	✓	✓	**MAY OCCUR.** Inhabits riparian forest, rainforest, open forest, Melaleuca swamps and the edges of mangroves, as well as along the margins of sugar cane fields (Higgins 1999; Nielsen 2015; Storr 1977, 1980). Project area within species range and all habitats (including Open Pasture) are potentially suitable. Species potentially occupies large home ranges and occurs at low densities making it difficult to detect.
Rostratula australis	Australian Painted Snipe	V	E	-	✓	**UNLIKELY.** Occurs in a wide variety of permanent and ephemeral wetlands, preferring open freshwater wetlands with fringing vegetation (Higgins & Davies 1996). Optimal habitat is absent on project area.
Dasyurus hallucatus	Northern Quoll	LC	E	-	✓	**MAY OCCUR.** Occurs most commonly around rocky escarpments but also found in Eucalypt forest and woodland and around human settlements (Oakwood 2008). Anecdotal reports of species presence in local area. EOFW within project area is potential suboptimal habitat. More suitable habitat may occur to west of project area. Species may occasionally range across project area though is unlikely to maintain a permanent presence.
Dasyurus maculatus gracilis	Spotted-tailed Quoll	E	E	-	-	**UNLIKELY.** Confined to continuous tracts of structurally complex mountain vine forests and adjacent tall Eucalypt forests, being most abundant >600 m ASL (Burnett 2012). No database records for species in local area or region though species likely to be present in the latter. Optimal habitat is absent on project area.

Species Name	Common Name	Status[1]		Database Record[2]		Likelihood of Occurrence in Project Area[3]
		NC Act	EPBC Act	Local Area	Region	
Hipposideros diadema reginae	Diadem Leaf-nosed Bat	NT	-	-	✓	**MAY OCCUR.** Known to use a variety of forested habitat types and range of roost sites (*eg* caves, disused buildings, road culverts) (Churchill 2008; Pavey *et al.* 2008). Project area within species range and all forested habitats are potentially suitable. Outside Australia species known to roost in large hollow trees and forest canopy (Pavey *et al.* 2008); on this basis roost sites may occur on-site.
Hipposideros semoni	Semon's Leaf-nosed Bat	E	V	-	-	**MAY OCCUR.** Known to use a variety of forested habitat types and range of roost sites (*eg* caves, disused buildings, road culverts) (Churchill 2008; Hall 2008). Species distribution poorly known. No database records for species in region, though species may be present. All forested habitats on project area are potentially suitable. Roost sites may occur on-site (*eg* tree hollows).
Dendrolagus lumholtzi	Lumholtz's Tree-kangaroo	NT	-	✓	✓	**MAY OCCUR.** Primarily occurs in high altitude rainforest, particularly around the Atherton Tablelands within rainforest on basalt soils (Johnson & Newell 2008). Anecdotal reports of at least historical presence in Myola area. Habitat within project area suboptimal though species may occur intermittently and temporarily.
Macroderma gigas	Ghost Bat	E	V	✓	✓	**MAY OCCUR.** Inhabits a variety of forested habitat types with distribution influenced by presence of suitable roost sites (caves, mines and deep rock fissures) (Churchill 2008; Richards *et al.* 2008). Project area within species range and all forested habitats are potentially suitable. Roost sites unlikely to occur on project area.
Mesembriomys gouldii rattoides	Black-footed Tree-rat	LC	V	-	✓	**UNLIKELY.** Inhabits tropical woodlands and open forests, apparently preferring tall open forest on deep loamy soils, supporting a moderately dense understorey of shrubs and small trees (Rankmore & Friend 2008). Optimal habitat is absent on project area though may occur to the west.
Phascolarctos cinereus	Koala	V	V	-	-	**UNLIKELY.** Inhabits Eucalypt forests and woodlands, in the north preferring to feed on Red Gums (*Eucalyptus camaldulensis* and *E. tereticornis*) (Martin *et al.* 2008). Optimal habitat is absent on project area.

Species Name	Common Name	Status[1]		Database Record[2]		Likelihood of Occurrence in Project Area[3]
		NC Act	EPBC Act	Local Area	Region	
Bettongia tropica	Northern Bettong	E	E	**?**	✓	**MAY OCCUR.** Inhabits grassy Eucalypt forests, and mostly in association with granitic soils (Winter *et al.* 2008) – though low soil nutrient availability possibly has stronger (*cf* geology) influence on species presence. Habitat ranges from very tall, Eucalypt open forests that abut rainforest to drier Eucalypt woodlands (Winter *et al.* 2008). Database records for species in region and local area, though local record has a 10 km accuracy. Modelling by Butler and Laidlaw (2012) indicates the nearest suitable habitat occurs approximately 5 km west of project area (near Clohesy River). The EOFW in the south-west of the project area contains patches of potentially suitable habitat. Small cone-shaped holes in the ground consistent with the diggings created by Northern Bettong were observed in the EOFW; however, they are indistinguishable from diggings by Rufous Bettong (*Aepyprymnus rufescens*) (which may be present) and difficult to distinguish from the diggings created by bandicoots (Northern Brown Bandicoot, *Isoodon macrourus*, and Northern Long-nosed Bandicoot, *Perameles pallescens*; both present in area). Habitat suitability may be deteriorating in response to rainforest expansion and woody vegetation thickening in the lower tree layers. Cockatoo Grass (*Alloteropsis semialata*), a critical food source, also appears to be rare in this area. The species presence is difficult to predict. Its potential to occur at very low density in the project area cannot be discounted; however, camera trapping did not confirm species presence and a permanent and/or regular occurrence is not anticipated. The EOFW in the south-west of the project area and west to Clohesy River may act as a corridor for north-south movements. The value or effectiveness of this corridor is unclear; it could assist with gene flow between southern and northern populations and/or could act as a population sink.
Petauroides volans	Greater Glider	V	V	-	✓	**MAY OCCUR.** Inhabits Eucalypt forests and woodlands, being most abundant in taller, montane Eucalypt forests where tree hollows are abundant (Woinarski *et al.* 2014). EOFW within project area may be suitable. More suitable habitat may occur to west of project area.
Xeromys myoides	Water Mouse	V	V	-	-	**UNLIKELY.** A coastal species. Optimal habitat is absent on project area.

Species Name	Common Name	Status[1]		Database Record[2]		Likelihood of Occurrence in Project Area[3]
		NC Act	EPBC Act	Local Area	Region	
Crocodylus porosus	Estuarine Crocodile	V	-	✓	✓	**UNLIKELY.** In Queensland, the species is usually restricted to coastal waterways and floodplain wetlands. Populations may also be found hundreds of kilometres upstream (Read *et al.* 2004). Optimal habitat is absent on project area.

1: Status of Threatened and Near Threatened species as listed under the Queensland *Nature Conservation Act* 1992 (NC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). Categories comprise: Least Concern (LC), Near Threatened (NT), Vulnerable (V), Endangered (E), Critically Endangered (CE), Presumed Extinct (PE) and Extinct (EX).

2: Species records accessed via EHP's Species Profile Search (https://environment.ehp.qld.gov.au/species-search) and Atlas of Living Australia (https://www.ala.org.au) [accessed 12/9/17]. Local scale/area and regional scale/area refers to records within 5 km and 20 km of project area respectively.

3: Likelihood of occurrence is based on published species distribution and ecology, and observed conditions on project area. A database record from the search area does not necessarily mean that the species is considered likely to occur on the project area. The categories applied comprise: 'Likely', May Occur' or 'Unlikely'.

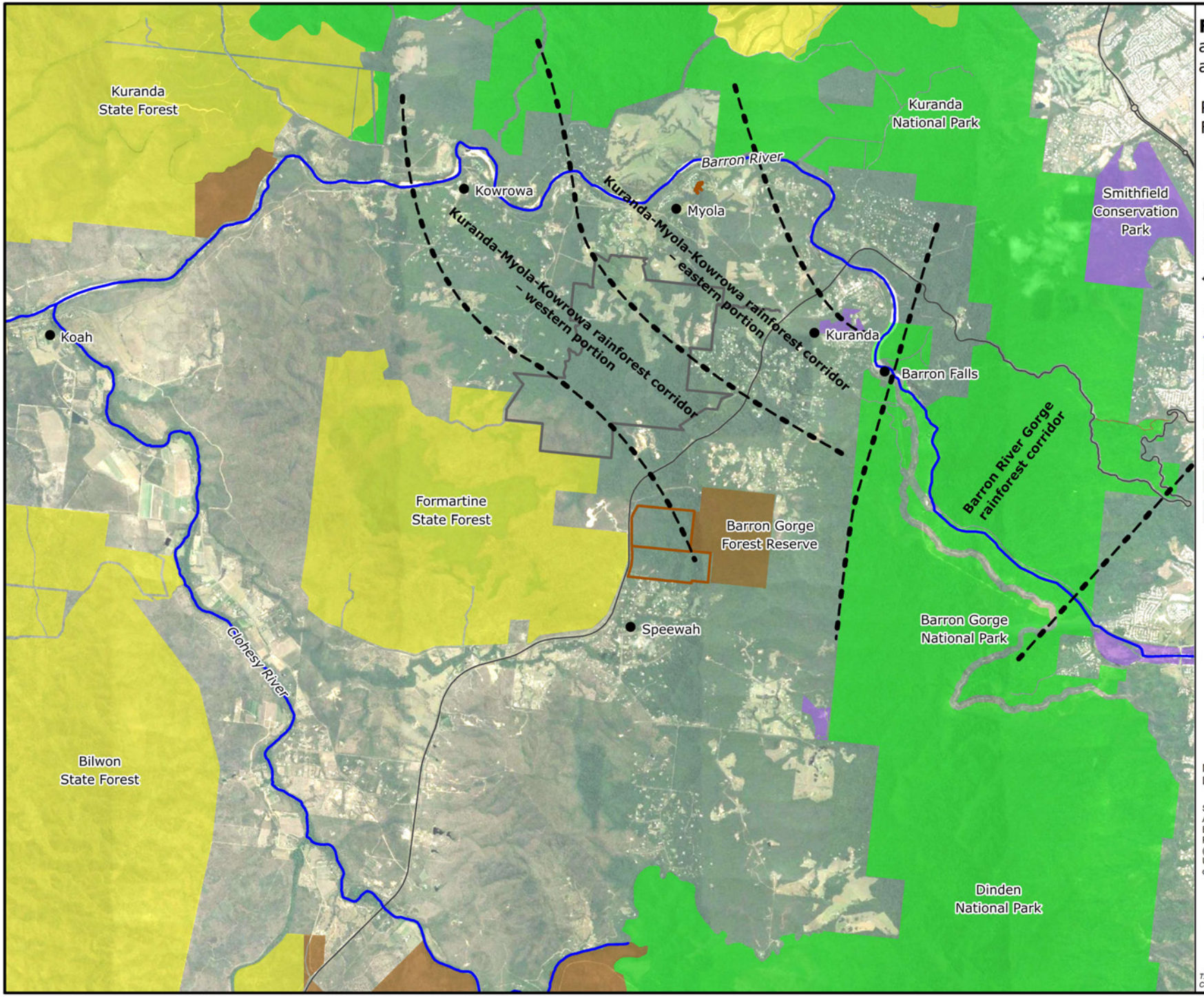

Figure 13: Landscape context and connectivity for rainforest areas

Project: KUR-World Flora and Fauna Technical Report

- KUR-World project area
- Proposed access road
- Rainforest corridor boundaries
- Major roads
- Drainage
- Nature refuge

Protected Areas

- Conservation Park
- Forest Reserve
- National Park
- State Forest

N

0 2 4

Kilometres

NRA Ref: 424102.01
Date: November 2017

Source:
Australian Government Department of the Environment and Energy, © State of Queensland (Department of Natural Resources and Mines) 2014, © State of Queensland (Department of National Parks, Sport and Racing) 2017. Updated data available at http://qldspatial.information.qld.gov.au/catalogue//., Google Earth

NRA

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Recommended print size: A4

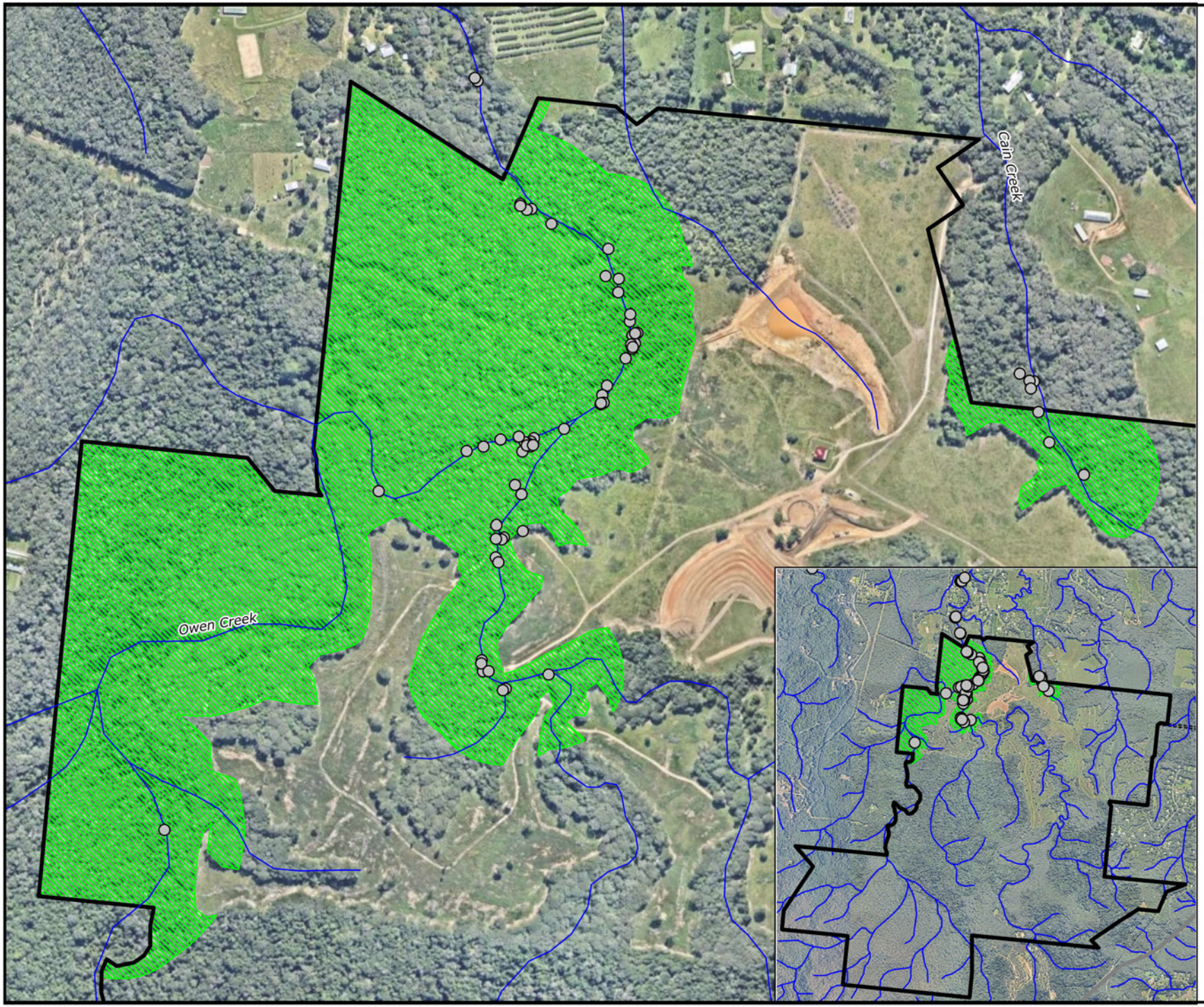

Figure 14: Field sightings and verified core habitat for *Litoria myola*

Project: KUR-World Flora and Fauna Technical Report

- KUR-World project area
- Proposed access road
- Drainage
- Major road
- Verified Kuranda Treefrog habitat (Hoskin 2017)
- Kuranda Tree Frog sightings (Hoskin 2017)

N

0 250

Metres

Source:
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NRA Ref: 424102.01
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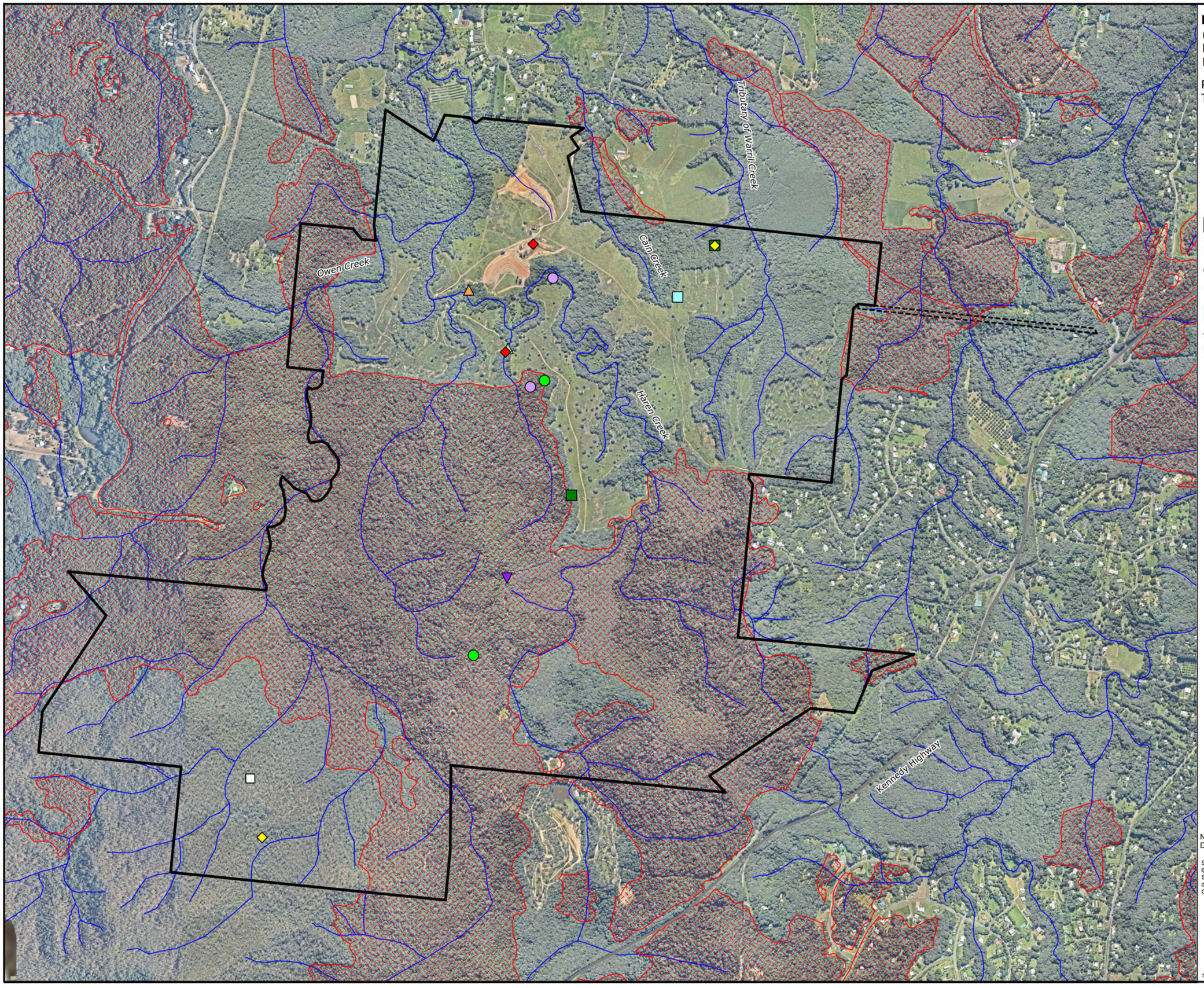

Figure 15: Essential habitat mapping (VM Act) and observed locations of listed Threatened, Near Threatened and Migratory fauna (excluding amphibians)

Project: KUR-World Flora and Fauna Technical Report

- KUR-World project area
- Proposed access road
- Road
- Drainage
- Essential Habitat (VM Act) - Southern Cassowary

Threatened, Near Threatened & Migratory Listed Fauna Observations

- Bare-rumped Sheathtail Bat (definite and possible acoustic record)
- Double-eye Fig Parrot (approximate location)
- Gouldian Finch
- Greater Large-eared Horseshoe Bat (definite acoustic record)
- Rufous Fantail
- Southern Cassowary (possible scat)
- Spectacled Flying-fox (approximate location)
- Spectacled Monarch
- Tube-nosed Insectivorous Bat
- Red Goshawk

N

0 100 300 500
METRES

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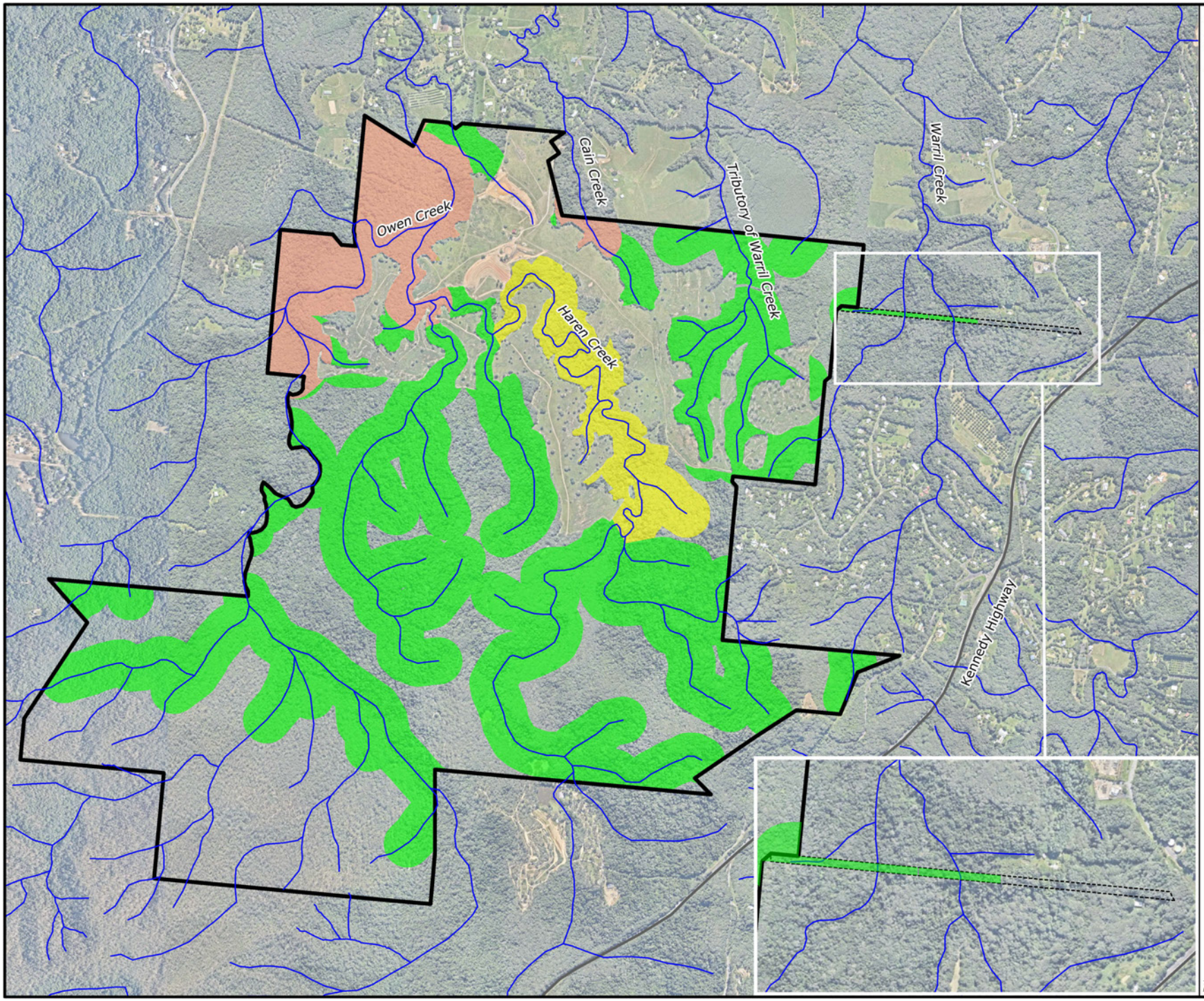

Figure 16: Predicted and verified core habitat for *Litoria serrata*

Project: KUR-World Flora and Fauna Technical Report

KUR-World project area

Proposed access road

Drainage

Major road

Litoria serrata Predicted and Verified Habitat

Predicted non-breeding habitat

Predicted breeding and non-breeding habitat

Verified habitat (breeding and non-breeding) shared with *Litoria myola*

N

0 500 1000

metres

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4.4 Biosecurity

4.4.1 Non-native flora species

Forty-three (43) non-native flora species, hereafter weeds, were identified during field surveys (**Table 12**) and represent approximately 11% of all flora species recorded across the project area. This proportion of weed species is less than that documented for the Macalister Biogeographic Subregion (of the plant species documented for the subregion approximately 13% are weeds[11]). The weeds recorded in the project area pose varying levels of threat in terms of their invasiveness, potential for spread and their potential to cause environmental, social and economic impacts. The status and relative threat posed by each species was assessed with reference to the following as shown in **Table 12**.

- Weeds of National Significance (WoNS).
- Queensland *Biosecurity Act* 2014 (Biosecurity Act).
- The *Wet Tropics Management Plan* 1998.
- Mareeba Shire Council Local Area Pest Management Plan 2015 to 2020.

Nationally Significant Weeds

At the Commonwealth level, the Federal Government maintains a list of WoNS[12]. An intergovernmental agreement between the Federal Government and the State and Territory governments has been established to manage WoNS through species-specific strategic plans. A National Management Group/Steering Committee oversees the implementation of the goals and actions of the WoNS strategic plans. State and Territory Governments are responsible for implementing the plans and reporting progress to the Steering Committee.

Two WoNS were recorded during the field survey (**Table 12)**; *Dolichandra unguis-cati** (Cat's Claw Creeper), and *Lantana camara** (Lantana).

State Significant Weeds

In Queensland, the Biosecurity Act provides the framework and powers for the management of biosecurity matters, including pest plants. The Biosecurity Act came into effect on 1 July 2016 and replaced the Queensland *Land Protection (Pest and Stock Route Management) Act* 2002 (LP Act). Landholders are required to comply with the general biosecurity obligation (GBO) which is defined under the Biosecurity Act as follows.

- Take all reasonable and practical steps to prevent or minimise each biosecurity risk.
- Minimise the likelihood of the risk causing a biosecurity event and limit the consequences of such an event.
- Prevent or minimise the adverse effects the risk could have and refrain from doing anything that might exacerbate the adverse effects.

The *Declared Pest Classes* under the LP Act have been replaced under the Biosecurity Act by *Prohibited Matters* and *Restricted Matters*. *Prohibited Matters* are diseases and exotic pest species that are not found in Queensland, though if it were to enter, would seriously impact society, including the economy and the environment. *Restricted Matters* are diseases or pest species already found in Queensland that may result in adverse effects on a biosecurity consideration if conditions or restrictions under the Act were not imposed. There

[11] Plant species richness information taken from https://wetlandinfo.ehp.qld.gov.au [accessed 26 August 2017].

[12] This list comprises 32 species and is available via Australian Weeds Committee (http://weeds.ala.org.au/WoNS/).

are seven categories of *Restricted Matter* and a species may fall under more than one category.

Four *Restricted Matter* species were observed during the field survey (**Table 12**), all of which are Category 3 species: Cat's Claw Creeper*, Lantana*, *Spathodea campanulate** (African Tulip), and *Sphagneticola trilobata** (Singapore Daisy).

Under Division 2 of the Biosecurity Act, obligations relating to distributing[13] or disposing of Category 3 *Restricted Matter* are as follows.

- A person who has Category 3 *Restricted Matter* in the person's possession or under the person's control must not distribute or dispose of the restricted matter unless the distribution or disposal is:
  - performed in the way prescribed under a regulation; or
  - authorised under a restricted matter permit; or
  - performed by an authorised officer in the performance of the authorised officer's functions under this Act; or
  - for the purpose of the Board of the Queensland Museum, or the Queensland Herbarium, identifying the restricted matter; or
  - for the purpose of identifying the restricted matter by, or at the request of, a government entity with expertise in the identification of the restricted matter; or
  - for a purpose prescribed by regulation.

Locally and Regionally Significant Weeds

Local and regional pest management documents provide a resource for determining the significance of weed species at more localised scales. Relevant to the project area are the Mareeba Shire Council Pest Management Plan (2015-2020) (hereafter MSC PMP) (MSC undated) and the Queensland *Wet Tropics Management Plan* 1998 (hereafter WTMP). The MSC PMP is applicable to the Mareeba Shire Council Local Government Area and lists weeds that are notifiable if found, that are under active surveillance and control, and that are environmental weeds. The WTMP is applicable to the Wet Tropics World Heritage Area though is relevant to the entire Wet Tropics Bioregion. Schedule 2 of the WTMP lists 'undesirable plants'.

- **MSC PMP**. Lantana* is the only weed species found in the project area during the field survey which is listed as a 'Priority Plant for Impact Reduction' (**Table 12**).
- **WTMP**. Twelve (12) weed species found in the project area during the field survey are listed as 'Undesirable Plants' under Schedule 2 of the WTMP (**Table 12**). African Tulip*, *Bambusa vulgaris** (Common Bamboo), *Centrosema mole** (Common Centro), *Coffea Arabica** (Arabica Coffee), *Duranta erecta** (Sky Flower), Lantana*, *Megathyrsus maximus** (Guinea Grass), *Melinis minutiflora** (Molasses Grass), *Passiflora foetida** (Stinking Passionflower), *Pinus caribaea** (Caribbean Pine), *Psidium guajava** (Guava) and Singapore Daisy*.

[13] The Queensland *Biosecurity Act* 2014, defines '*distribute'* as:
- giving the restricted matter or thing to another person
- selling or trading in the restricted matter or thing
- releasing the restricted matter or thing into the environment.

Table 12: Weed species recorded on the Kur-World project area

Scientific Name	Common name	Status[A]			Occurrence		Comments
		Biosecurity Act 2014	WoNS	WTMP Undesirable Plant	Localised or Widespread	Abundant or Sparse	
Ageratum conyzoides	Billygoat Weed	-	-	-	Widespread	Abundant	Mostly observed in pasture areas and forest fringes.
Ageratum houstonianum	Blue Billygoat Weed	-	-	-	Widespread	Abundant	Mostly observed in pasture areas and forest fringes.
Ardisia crenata[B]	Coral Berry	-	-	-	Localised	Sparse	
Bambusa vulgaris	Common Bamboo	-	-	Yes	Localised	Sparse	Observed at the edge of riparian forest adjacent to produce gardens.
Bidens pilosa	Cobbler's Pegs	-	-	-	Localised	Sparse	Mostly observed in pasture areas and forest fringes.
Brachiaria decumbens	Signal Grass	-	-	-	Widespread	Abundant	Mostly observed in pasture areas.
Centrosema molle	Common Centro	-	-	Yes	Localised	Sparse	Forest edges and some pasture areas.
Citrus x jambhiri	Lemon	-	-	-	Localised	Sparse	
Coffea arabica	Arabica Coffee	-	-	Yes	Localised	Sparse	Mostly observed in forested areas.
Crassocephalum crepidioides	Redflower Ragleaf	-	-	-	Widespread	Sparse	
Crotolaria pallida	Rattlepod	-	-	-	Localised	Sparse	
Delonix regia	Poinciana	-	-	-	Localised	Sparse	Near the homestead.
Desmodium tortuosum	Beggarweed	-	-	-	Localised	Sparse	
Dolichandra unguis-cati[B]	Cat's Claw Creeper	Category 3	Yes	-	Localised	Abundant	Single large infestation found on outer edge of riparian area south-west of the homestead.
Duranta erecta	Sky Flower	-	-	Yes	Widespread	Abundant	Mostly observed in regrowth forest. Has formed large thickets within regrowth vegetation adjacent to creeks and gullies in the northern portion of the site.
Hyptis capitata[B]	Buttonweed	-	-	-	Widespread	Abundant	

Scientific Name	Common name	Status[A]			Occurrence		Comments
		Biosecurity Act 2014	WoNS	WTMP Undesirable Plant	Localised or Widespread	Abundant or Sparse	
Lantana camara	Lantana	Category 3	Yes	Yes	Widespread	Abundant	Mostly observed in forested areas. Found within woodlands in the southern portion of the site and in disturbed areas within vine forest regrowth. Listed in MSC PMP as a 'Priority Plant for Impact Reduction'.
Macroptilium atropurpureum	Siratro	-	-	-	Widespread	Sparse	
Mangifera indica	Mango	-	-	-	Widespread	Sparse	
Megathyrsus maximus[B]	Guinea Grass	-	-	Yes	Widespread	Abundant	Mostly near streams and gullies where there has been previous disturbance.
Melinis minutiflora	Molassus grass	-	-	Yes	Widespread	Sparse	
Melinis repens		-	-	-	Widespread	Sparse	
Mimosa pudica	Sensitive Weed	-	-	-	Widespread	Abundant	Mostly observed in pasture areas.
Passiflora foetida	Stinking Passionflower	-	-	Yes	Widespread	Sparse	
Pinus caribaea	Caribbean Pine	-	-	Yes	Localised	Abundant	Patches occur in the southern portion of the project area.
Polygala paniculata	Island Snake-root	-	-	-	Widespread	Abundant	Mostly observed in pasture areas and present in forested areas.
Psidium cattleianum	Cherry Guava	-	-	-	Widespread	Sparse	
Psidium guajava	Guava	-	-	Yes	Widespread	Sparse	
Rubus alceifolius[B]	Giant Bramble	-	-	-	Widespread	Abundant	Mostly observed in pasture areas and present in forested areas. Has formed dense thickets within regrowth vegetation adjacent to creeks and gullies in the northern portion of the site.
Selaginella kraussiana	African Clubmoss	-	-	-	Localised	Sparse	
Senna septemtrionalis	Smooth Senna	-	-	-	Localised	Sparse	
Sida rhombifolia	Common Sida	-	-	-	Widespread	Sparse	

Scientific Name	Common name	Status[A]			Occurrence		Comments
		Biosecurity Act 2014	WoNS	WTMP Undesirable Plant	Localised or Widespread	Abundant or Sparse	
Solanum mauritianum[B]	Wild tobacco	-	-	-	Widespread	Sparse	Mostly observed in pasture areas but also present in forest.
Solanum torvum	Devil's Fig	-	-	-	Widespread	Abundant	Present along forest edges and in pasture areas.
Spathodea campanulata	African Tulip	Category 3		Yes	Localised	Sparse	Two trees observed in pasture areas.
Spermacoce alata	Borreria	-	-	-	Widespread	Sparse	
Spermacoce remota	Woodland False Buttonweed	-	-	-	Widespread	Sparse	
Sphagneticola trilobata	Singapore Daisy	Category 3		Yes	Localised	Abundant	An area of Singapore Daisy was detected within a clearing adjacent to the southern boundary of the project area.
Stachytarpheta jamaicensis[B]	Snakeweed	-	-	-	Widespread	Abundant	Mostly observed in pasture areas and forest fringes.
Stylosanthes scabra	Shrubby Stylo	-	-	-	Widespread	Abundant	Mostly observed in pasture areas
Syagrus romanzoffiana	Queen Palm	-	-	-	Localised	Sparse	
Triumfetta rhomboidea	Chinese Burr	-	-	-	Widespread	Sparse	Mostly observed in pasture areas.
Urena lobata	Pink Burr	-	-	-	Widespread	Sparse	Mostly observed in pasture areas.

A: Status according to the Queensland *Biosecurity Act* 2014, and species listed under the schedules for Weeds of National Significance (WoNS) and Wet Tropics Management Plan 1998 (WTMP).

B: Undesirable Plant in the Proposed Amendment to Schedule 2 of the WTMP.

4.4.2 Non-native fauna species

Feral Pig (*Sus scrofa*) and Cane Toad (*Rhinella marina*) were the only non-native fauna definitively recorded during the fauna survey program. Neither species was noticeably abundant. Feral Pigs are listed as Categories 3, 4 and 6 *Restricted Matter* under the Biosecurity Act. Cane Toads are recognised as '*invasive biosecurity matter'* though are not listed as *Restricted Matter*.

Dogs (*Canis* sp.) were also recorded on the project area; however, it was not possible to confirm if they were wild domestic dogs (*Canis lupus familiaris*), Dingoes (*Canis lupus dingo*) and/or hybrids. One dog had a collar which suggests it is/was domesticated or semi-domesticated. All were tan, except one dog which was brindled, and superficially resembled what are popularly regarded as Dingoes. Dingoes are regarded as native wildlife under the NC Act. Wild domestic dogs are Categories 3, 4 and 6 *Restricted Matter* under the Biosecurity Act, and Dingo are Categories 3, 4, 5 and 6 *Restricted Matter*.

The *Restricted Matter* Biosecurity Act categories mentioned above are defined as follows.

- Category 3 – A person who has Category 3 *Restricted Matter* in the person's possession or under the person's control must not distribute or dispose of the *Restricted Matter* unless the distribution or disposal meets the requirements of the Act.
- Category 4 – A person must not move, or cause or allow to be moved, Category 4 *Restricted Matter*, unless the moving is for the purposes of its identification by, or at the request of, a relevant entity as defined by the Act.
- Category 5 – A person must not keep in the person's possession or under the person's control Category 5 *Restricted Matter*, unless the keeping is for the purposes of its identification by, or at the request of, a relevant entity as defined by the Act.
- Category 6 – A person must not give food to a Category 6 *Restricted Matter* unless the feeding is carried out in preparation for, or in the course of, lawfully baiting, trapping or shooting the Category 6 *Restricted Matter*.

4.4.3 Other biosecurity Issues

No other biosecurity issues were identified during the field survey program (aquatic pests are addressed in NRA 2017, noting that three non-native fish species – Guppies (*Poecilia reticulata*), Platys (*Xiphophorus maculatus*) and Swordtails (*Xiphophorus helerii*) were recorded in field surveys (NRA 2017)). Biosecurity issues for the local area identified during the desk-based review are discussed below.

Invasive ants

Yellow Crazy Ant (*Anoplolepis gracilipes*) and Electric Ant (*Wasmannia auropunctata*) are known from the region. They can have severe impacts on a range of ecological processes and lead to significant loss of biodiversity.

- **Yellow Crazy Ant**. In 2013, a Yellow Crazy Ant infestation was found in the Russett Park area near Myola and has now become established over approximately 27 ha (Wet Tropics 2017a). Russett Park is located approximately 1.5 km north of the project area on the northern side of the Barron River. The Yellow Crazy Ant Eradication Program is currently in its 2nd year of implementation.

- **Electric Ants**. An Electric Ant infestation was detected in Kuranda in 2011. The Queensland Department of Agriculture and Fisheries (DAF) has implemented a treatment program. Kuranda continues to be high risk area with plant swapping thought to be a major cause of the spread of the species (DAF 2014). Biosecurity Zone Kuranda 1, which includes properties on Barnwell Road, Monaro Close and High Chaparral Road plus areas along the southern banks of the Barron River is within 300 m of the project site boundary.

Asian Honey Bee

Asian Honey Bees (*Apis cerana*) were first detected in 2007 in Cairns and are now found from Cairns' northern beaches south to Innisfail and on the Atherton Tablelands. They compete with managed European Honey Bees for floral resources and rob honey from managed hives, which may cause hives to die from starvation. Asian Honey Bees are a natural host for Varroa Mites (*Varroa jacobsoni*), a major threat to Australia's honey bee industry (Wet Tropics 2017b). The project area is within the Asian Honey Bee known infestation area (DAF 2016).

Phytopthera and Myrtle Rust

Phytopthera cinnamomi and other species of *Phytophthora* are responsible for economic losses amounting to tens of millions of dollars annually in forestry, horticultural and agricultural activities. In natural ecosystems it poses a serious threat to the conservation of native plant species by attacking healthy plant tissue and causing a subsequent physiological disruption of vascular activity. In susceptible plant species, infection may quickly result in dieback of foliage and eventual death.

Phytophthora are known to occur across extensive areas of rainforest in northern Queensland, including sites at Kuranda where *P. cinnamomi* was detected in soil under rainforest. Logging and road construction has been implicated in outbreaks of infestations and patch deaths with possibly secondary spread by Feral Pigs (Gadek 1998).

Myrtle rust is a disease caused by the exotic fungus *Puccinia psidii.* Myrtle rust threatens trees and shrubs in the Myrtaceae family of plants which includes Australian natives including *Melaleuca* spp., *Eucalyptus* spp., *Angophora* spp., and *Corymbia* spp. The disease can cause deformed leaves, heavy defoliation of branches, reduced fertility, dieback, stunted growth, and plant death. Myrtle rust spores can be spread easily via contaminated clothing, hair, skin and personal items, infected plant material, equipment as well as by insect/animal movement and wind dispersal. These characteristics make it extremely difficult to control and impossible to eradicate from natural settings.

It is established along the east coast of Australia from southern New South Wales to far north Queensland with impacts recorded across a range of ecosystems (DoEE 2017b). It was detected in Cairns in 2011.

Dieback potentially attributable to *Phytopthera* or Myrtle Rust was not observed within the project area.

Chytrid fungus

Eight species of wet tropics stream-dwelling frogs have experienced population declines, some associated with an infectious disease of amphibians (*chytridiomycosis*) caused by the fungus *Batrachochytrium dendrobatidis* (Woodhams & Alford 2005). All declines have occurred at sites above 400 m elevation, but the chytrid fungus has never been shown to cause population declines at sites below 400 m (Alford 2010). The chytrid fungus is likely to

be present in the Kuranda region and on the project area. All streams within the project area are lower than 400 m elevation and the risk posed by the chytrid fungus to frogs on the project area is therefore reduced.

Spores of the chytrid fungus are transported via water and wet soil. Wet or muddy boots and tyres, and other equipment, may be contributing to the spread of the disease, as may feral and native animals (Wet Tropics 2017c).

4.5 Matters of State Environmental Significance

Matters of State Environmental Significance (MSES) mapping (EHP 2017b) is shown on **Figure 17** and shows the following MSES present within the project area.

- **Regulated Vegetation**. Comprising Great Barrier Reef Regrowth Watercourse (Category R) vegetation and REs listed as Of Concern (Category B) under the VM Act.
  - Category R vegetation occurs along forested streams that are shown on DNRM (2017a) RE mapping as non-remnant vegetation. As described in **Section 4.2.2**, some of these areas meet the criteria for remnant vegetation. The revised RE types on these sections of remnant vegetation comprise RE 7.11.1b in the northern portion of the project area, and RE 7.11.7b and RE 7.11.44 in the south of the project area (**Figure 11**). RE 7.11.1b and RE 7.11.7b have a Least Concern VM Act status, while RE 7.11.44 is Of Concern.
  - DNRM (2017a) mapping shows the following VM Act Of Concern REs on the project area: RE 7.11.13, RE 7.11.33 and RE 7.11.44. RE 7.11.33 was not found on the project area during field surveys, and in the revisions in **Section 4.2.2** these areas are mapped as the VM Act Least Concern 7.11.51 (RE 7.11.51 is not MSES). Revised mapping from the current study (**Figure 11**) increased the extent of RE 7.11.44.
- **Wildlife habitat**. Essential Habitat for the Endangered (NC Act) Southern Cassowary is mapped over most DNRM (2017a) remnant vegetation areas of the project area (**Figure 15**). The revisions shown on **Figure 11** increase the extent of Essential Habitat for Southern Cassowary, and by default MSES for wildlife habitat.

4.6 Matters of National Environmental Significance

The following Matters of National Environmental Significance (MNES), as they relate to terrestrial flora and fauna, were identified as present on the project area.

- **EPBC Act Endangered species**. A breeding population of Kuranda Tree Frog occurs along certain streams in the north of the project area (**Figure 14**). The Bare-rumped Sheathtail Bat was recorded on the project area and may forage above all habitats on the project area (including Open Pasture) and EOFW may contain roosting habitat.
- **EPBC Act Vulnerable species**. The Greater Large-eared Horseshoe Bat may occur in most habitats on the project area (except Open Pasture away from forest edges), with core habitat potentially occurring along forest edges, streams and near breaks in vegetation cover such as tree falls. EOFW may contain roosting habitat for the species. The Spectacled Flying-fox may forage in all habitats on the project area (except Open Pasture), and the areas of EOFW may contain optimal foraging resources. No flying-fox camps occur on the project area.
- **EPBC Act Migratory species**. Spectacled Monarch and Rufous Fantail may occur in most habitats on the project area (except Open Pasture).

Non-definitive records of the following MNES were also recorded on the project area.

- Non-definitive evidence of the EPBC Act Endangered Southern Cassowary was recorded on the project area. There is historical evidence of the species on the project area and the area contains potential habitat. Existing threatening processes are possibly inhibiting the establishment of a permanent and appreciable population on and directly adjacent to the project area.
- The EPBC Act Endangered Red Goshawk (a juvenile bird) was possibly sighted in EOFW habitat in the south-west of the project area. The uncertainty is due to the brevity of the sighting. The species may forage over all forested habitat types of the project area, though EOFW is likely to be preferred, and its presence is likely to be temporary and irregular.
- The EPBC Act Endangered Myola Palm may occur along forested streams on the project area. Mature and fruiting plants are required to confirm the identification of these individuals. Its presence has been confirmed in the downstream (off-site) receiving environment (Warril Creek).

The following MNES were not recorded on the project area though are predicted to occur.

- Threatened fauna species:
  - that may occur, or are likely to occur, on a temporary and/or intermittent basis (Australian Lacelid, Ghost Bat and Northern Quoll); and
  - whose pattern of occurrence is difficult to predict due to limited information on species distribution and/or ecology – their occurrence may range from frequent to intermittent (Semon's Leaf-nosed Bat, Masked Owl, Northern Bettong and Greater Glider).
- Migratory fauna species that:
  - are likely to occur regularly (Black-faced Monarch); or
  - may occur, or are likely to occur, occasionally (White-throated Needletail, Fork-tailed Swift and Barn Swallow); or
  - may occur intermittently (Oriental Cuckoo, Eastern Osprey and Glossy Ibis)
- Threatened flora species considered to have a ‘probable’ likelihood of occurrence (Endlicher’s Filmy Fern, Smooth-bark Rose Apple and Velvet Jewel Orchid) and ‘possible’ likelihood of occurrence (Rat’s Tail Tassel-fern and *Cajanus mareebensis*).

Potential habitat for the above MNES collectively covers all forested sections of the project area, including forested areas mapped (DNRM 2017a) as non-remnant vegetation[14]. The possible exceptions to this are the Glossy Ibis that may on rare occasion, and temporarily, forage in Open Pasture, and the Masked Owl that may occasionally forage along forest edges. Forested streams are of highest conservation value as these areas are known to support breeding populations of EPBC Act Threatened frogs and are potentially core habitat for EPBC Act Threatened Myola Palm and micro-bats. EOFW in the southern portion of the project area is potentially important as it may contain foraging and roosting habitat for a variety of Threatened fauna.

[14] Core habitat for each species is described in **Table 14** (Threatened plants), **Table 15** (Threatened and Migratory fauna.

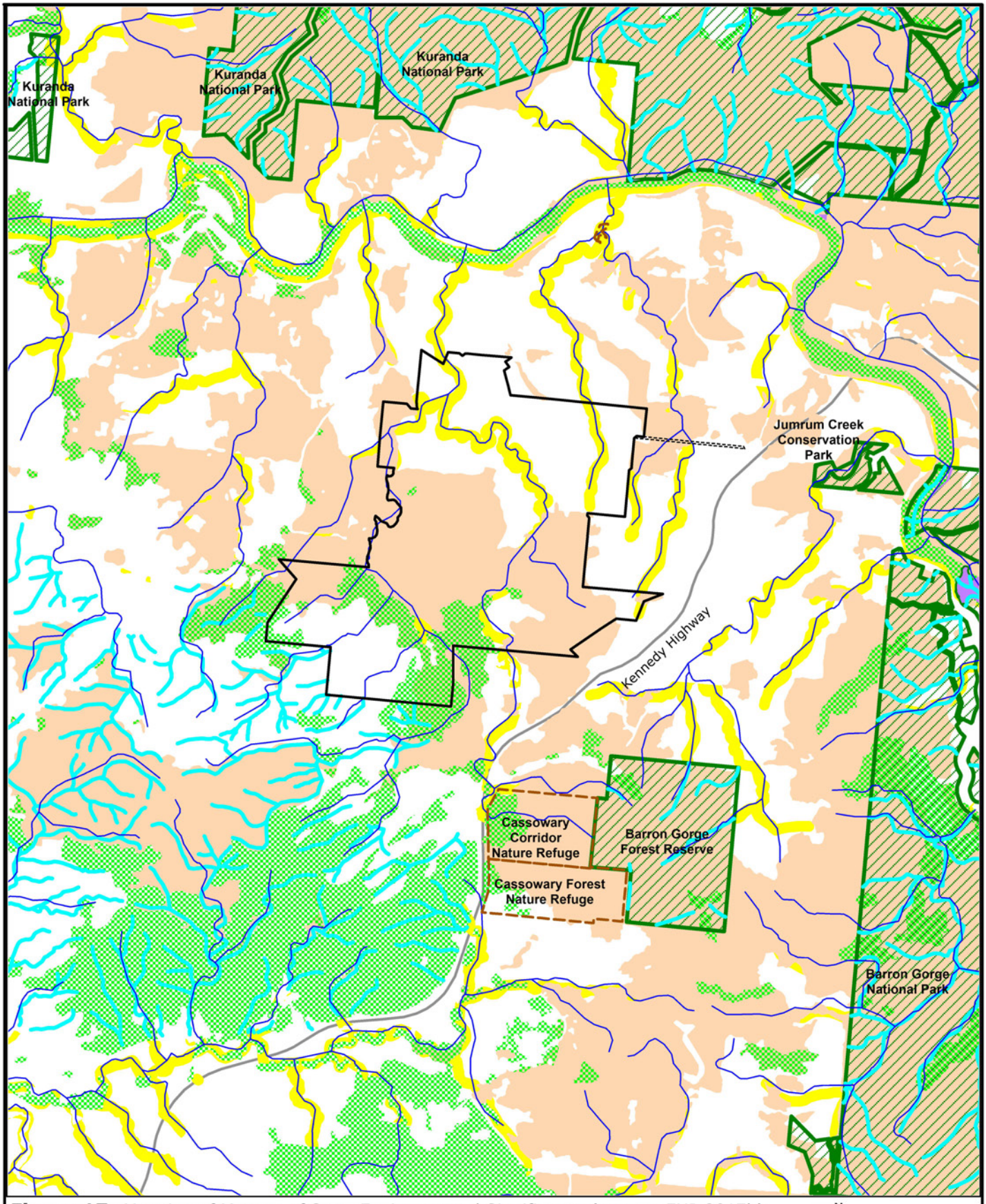

Figure 17: Mapping of Matters of State Environmental Significance (source: EHP 2017b)

Project: KUR-World Flora and Fauna Technical Report

KUR-World project area

Proposed access road

Major roads

MSES

Regulated vegetation intersecting a watercourse

High ecological value watercourse

Nature refuge

Protected areas

Wildlife habitat and essential habitat

High ecological value wetland

Regulated vegetation category R

Regulated vegetation category B

N

0 2.5

Kilometres

Source:
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5. Potential Impacts and Mitigation Measures

5.1 Proposed action and threats

The proposed KUR-World Integrated Eco-Resort comprises a combination of short-term and permanent residential options, facilities for education, recreation, wellbeing/rejuvenation, rural tourism, and, supporting infrastructure including site access. Specific development components are listed below and shown on **Figure 1**.

- KUR-Village and associated facilities.
- Residential Precinct: 21 Queenslander Lots, 286 Premium Villas, 56 Lifestyle Villas.
- Four Star Business and Leisure Hotel and Function Centre (270 rooms).
- Health and Wellbeing Retreat (60 rooms).
- Five-Star Eco-Resort (200 rooms).
- KUR-World Campus (330 rooms).
- Farm Theme Park and Equestrian Centre (accommodation for 110 persons).
- Rainforest Education Centre and Adventure Park (accommodation for 350 persons).
- Sporting Precinct.
- Golf Club House and Function Centre.
- Golf Course.
- Organic Produce Garden.
- Environmental Area.
- Open Space.
- Services and Infrastructure (including wastewater treatment plant, roads).

The project has the potential to result in a range of direct and indirect threats to the flora and fauna values. The potential Project-related impacts are described and quantified below.

5.2 Flora

5.2.1 Summary of values

Regional Ecosystems and Ecological Communities

DNRM (2017a) has mapped six REs over the project area (**Table 13**; **Figure 5**). Field surveys determined that one RE type was not present, and identified the presence of RE 7.11.1b and RE 7.11.7b which are community variants not shown on DNRM (2017a) mapping. The REs confirmed as present on the project area (**Figure 11**) and listed as Of Concern, Endangered or Critically Endangered under State legislation or policy, or Commonwealth legislation are listed below.

- **EPBC Act**. Nil Threatened Ecological Communities (TECs) occur on project area.
- **VM Act**. Of Concern RE 7.11.13 and RE 7.11.44.
- **EHP Biodiversity Status**. Endangered RE 7.11.13, and Of Concern 7.11.44 and RE 7.11.51.

Threatened and Near Threatened flora

Two NC Act Near Threatened flora species were recorded on the project area and an Endangered (NC Act and EPBC Act) species is assumed to occur (**Table 14**; **Figure 12**). A further seven T&NT species are predicted to occur (**Table 14**).

5.2.2 Existing threats

Vegetation communities on the project area generally have moderate to high levels of habitat integrity. The following threatening processes are active.

- Vegetation in the northern portion of the project area has a high edge to area ratio making it vulnerable to various 'edge effects' including elevated levels of light penetration, weed ingress and wind exposure.
- Livestock grazing and ground disturbance through hoof action is decreasing ground cover and reducing surface soil stability along forest edges, their impacts being most pronounced where patches of remaining vegetation are narrow (*eg* along some streams).
- Many weed species occur on the project area and pose a threat to habitat integrity. Within the forested areas the dominant weeds are Lantana*, Giant Bramble* and Sky Flower*, though the latter species primarily occurs in the northern portion of the project area. A patch of Cat's Claw Creeper* is also present. If left uncontrolled, this species poses a serious threat to forest areas.
- Many of the forested habitats show signs of cyclone damage (*eg* damaged tree canopies and canopy gaps created by tree fall). The damage is more pronounced in the northern portion of the project area and along the edge of cleared land.
- The unsealed track network in the EOFW is a potential sediment source for the aquatic receiving environment. Further, uncontrolled public access to this track network increases the risk of weed invasion.

5.2.3 Potential impacts

The proposed development poses a direct threat and a range of indirect threats to flora values. Direct threats, in the form of authorised vegetation clearing, will be most pronounced during the construction phase. Indirect threats refer to those secondary threats that may occur as a result of the development. Their impacts may extend beyond the development footprint and throughout the operational life of the project. Potential project-related direct and indirect threats are described below.

Direct threats

Regional Ecosystems and Ecological Communities

The project has been designed to predominantly occur in non-remnant vegetation as shown on DNRM (2017a) mapping (**Figure 5**). Clearing extents associated with the proposed development, using DNRM (2017a) and NRA revised mapping (**Figure 11**), are shown in **Table 13**. Clearing extents were calculated based on the following assumptions.

- For the following infrastructure, the clearing extent was assumed to be the development footprint derived from architectural layouts (received 21 September 2017[15]) plus a buffer to represent potential ancillary clearing necessary for construction. Buffers were applied as follows.

[15] Email from Nathan Lee-Long (ARUP) to Neil Boland (NRA), 21 September 2017.

  - 10 m buffer around Five Star Resort, Health and Well Being Retreat, KUR-Village, Four Star Business and Leisure Hotel and Function Centre, KUR-World Campus, Farmstay Accommodation (part of Farm Theme Park and Equestrian Centre), Golf Club House and Function Centre, Rainforest Education Centre and Adventure Park and Sporting Precinct.
  - 5 m buffer around five yoga meditation huts that are auxiliary infrastructure for the Health and Well Being Retreat.
- For the following items it was assumed that clearing extents would be limited to the mapped development footprint, or development precincts where clearing extents were not defined (**Figure 1**): Golf Course, Services/Infrastructure, Roads, Premium Villas, Lifestyle Villas, Queenslander Lots and Access Roads (via Myola Road and via Mount Haren Road).
- It was assumed that woody vegetation clearing would not be required for the Environmental Area, Glamping Area (part of the Rainforest Education Centre and Adventure Park) and Zip Line (**Figure 1**).

The proposed clearing will result in the direct loss of the following values (rounded to nearest whole number).

- **EPBC Act**. Nil loss of TECs.
- **VM Act**.
  - According to DNRM (2017a) mapping, development is proposed over REs of the following status: 3 ha Least Concern and 1 ha Of Concern.
  - According to NRA revised mapping, development is proposed over REs of the following status: 30 ha Least Concern and 3 ha Of Concern.
- **EHP Biodiversity Status**.
  - According to DNRM (2017a) mapping, development is proposed over REs of the following status: 3 ha No Concern at Present and 1 ha Of Concern.
  - According to NRA revised mapping, development is proposed over REs of the following status: 30 ha Least Concern, 3 ha Of Concern and <1 ha Endangered.

Table 13: Clearing extents associated with the proposed KUR-World development plan

Regional Ecosystem Code	Status[A]			Potential Impact Area (ha) & Proportion (%)[B]	
	EPBC Act	VM Act	EHP Biodiversity	DNRM (2017a)	NRA (this study)
7.11.1a-b	NL	LC	NC	1 (7%)	21 (43%)
7.11.7a-b	NL	LC	NC	2 (1%)	9 (3%)
7.11.13	NL	OC	E	0	<1 (<1%)
7.11.33	NL	OC	OC	0	0
7.11.44	NL	OC	OC	1 (2%)	3 (6%)
7.11.51a	NL	LC	OC	0	0
Total Remnant Vegetation				4 (1%)	33 (7%)
Total Non-remnant Vegetation				167 (63%)	138 (65%)

A: Status according to EHP's Biodiversity Status, VM Act and EPBC Act. Categories comprise: Endangered (E), Of Concern (OC), Least Concern (L), No Concern at Present (NC) and Not Listed (NL).

B: Area estimates are rounded to the nearest whole number. They are estimates because area determinations are based on work that involves the interpretation of aerial photographs that are rectified for use, the delineation of boundaries between vegetation communities may not be precise, and that delineation is defined by a line on a map, the width of which also constitutes a source of imprecision. Values calculated based on DNRM (2017a) mapping (**Figure 5**) and revised mapping derived from the current study (**Figure 11**). Proportions shown in parenthesis are the area of RE lost relative to what currently exists on the project area.

Threatened and Near Threatened flora

The proposed development has the potential to result in the direct loss of T&NT plants and their habitat. One T&NT species, the Near Threatened (NC Act) Slender Ginger, was found within the proposed development area (in the north east of project area; **Figure 12**). Myola Palm also occurs within the proposed project area, though this species occurs along streams and is unlikely to be directly affected by clearing. The potential loss of core habitat for T&NT species known or predicted to occur on the project area is shown in **Table 14**.

Table 14: Threatened and Near Threatened flora known or predicted to occur on the project area, their status, potential habitat and potential impact area

Species	Presence[A]	Status[B]		Potential Core Habitat (Regional Ecosystem)[C]	Potential Impact Area (ha) & Proportion (%)[D]	
		NC Act	EPBC Act		DNRM (2017a)	NRA Revised
Daintree Gardenia (*Randia audasii*)	Verified	NT	-	RE 7.11.1.	1 (7%)	21 (43%)
Slender Ginger (*Alpinia hylandii*)	Verified	NT	-	RE 7.11.1.	1 (7%)	21 (43%)
Crepidomanes majoriae	Probable	V	-	RE 7.11.1.	1 (7%)	21 (43%)
Endlicher's Filmy Fern (*Polyphlebium endlicherianum*)	Probable	V	E	RE 7.11.1.	1 (7%)	21 (43%)
Rat's Tail Tassel-fern (*Phlegmariurus filiformis*)	Possible	E	E	RE 7.11.1.	1 (7%)	21 (43%)
Diplazium cordifolium	Probable	V	-	RE 7.11.1 (streams)	1 (7%)	21 (43%)
Myola Palm (*Archontophoenix myolensis*)	Verified[E]	E	E	RE 7.11.1, RE 7.11.7 (streams).	3 (1%)	30 (10%)
Smooth-bark Rose Apple (*Syzygium hodgkinsoniae*)	Probable	V	V	RE 7.11.1, RE 7.11.7 (streams).	3 (1%)	30 (10%)
Velvet Jewel Orchid (*Zeuxine polygonoides* Syn, *Rhomboda polygonoides*)	Probable	V	V	RE 7.11.1, RE 7.11.7 (streams).	3 (1%)	30 (10%)
Cajanus mareebensis	Possible	E	E	RE 7.11.44.	1 (2%)	3 (6%)

A: Either 'Verified' as present during current study, or, predicted to have a 'Probable' or 'Possible' presence on project area.

B: Status of Threatened and Near Threatened species as listed under the Queensland *Nature Conservation Act* 1992 (NC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). Categories comprise: Near Threatened (NT), Vulnerable (V) and Endangered (E).

C: Habitats, as represented by Regional Ecosystems (REs), the species is most likely to occur in. Based on the parent RE (vegetation community variations not stated). Species typically associated with streams are indicated.

D: Area estimates are rounded to the nearest whole number. They are estimates because area determinations are based on work that involves the interpretation of aerial photographs that are rectified for use, the delineation of boundaries between vegetation communities may not be precise, and that delineation is defined by a line on a map, the width of which also constitutes a source of imprecision. Values calculated based on DNRM (2017a) mapping (**Figure 5**) and revised mapping based on the results of the current study (**Figure 11**). Proportions shown in parenthesis are the area of RE lost relative to what currently exists on project area.

E: Assumed present. Taxonomy of plants on project area is unresolved.

Indirect threats

Potential indirect threats to flora values associated with urban developments may include the following.

- Edge effects.
  - Clearing and subsequent development could result in changes to wildlife communities and environments along, and extending out from, the edge of disturbance. These changes are collectively referred to as 'edge effects' and there have been multiple studies investigating their impact (*eg* Goosem & Turton 2000; Pohlman 2006; Goosem & Tucker 2013). For the current situation 'edge effects' could include immediate (post-clearing) and ongoing changes to micro-climate and soil condition, and ultimately may change the composition and dominance of species using the affected area. For the current situation it is not possible to accurately predict and quantify the distance from the proposed area of clearing where 'edge effects' will result in a material change to the environment. However, based on our observations at similar developments in the region, changes to intact closed forest environments (where the majority of clearing is proposed) are readily apparent at distances from the disturbance edge of approximately 1.5 times the height of the forest canopy.
  - The roughly linear nature of the clearing, particularly along road easements, may act to funnel winds along the edges of disturbance. While any retained trees and dwellings (when built) will have a mitigating affect, the net result is that trees along the disturbance edge may be exposed to slightly greater wind velocities than what they currently experience. This may reduce the health of trees along the disturbance edge and contribute to the loss of at least a small proportion of trees over the long-term. These losses are likely to be episodic (*eg* in response to gale force winds) and be offset to some degree by natural recruitment/regeneration processes.
  - 'Edge effects' can sometimes create conditions that favour non-native (weed and pest animal) species, or disturbance-adapted native species. The net effect sometimes being a subset of the biota in the 'edge effect' area that differs (species composition and dominance) from that which existed in the pre-impact environment.
- Inappropriate excavation or earthworks practices, during construction and/or operation, resulting in erosion and vegetation loss.
- Inappropriate vegetation clearing practices, during construction and/or operation, resulting in the inadvertent loss of vegetation (directly or indirectly due to erosion).
- Fugitive dust smothering vegetation, reducing plant health in the immediate receiving environment. This impact is most likely during the construction phase.
- Release of contaminated waters, excessive nutrients or hazardous substances to the natural environment resulting in reduced plant health, habitat degradation, habitat modification and/or loss of vegetation.
- Urban developments, during construction and operation, have the potential to result in new biosecurity incursions and/or contribute to the spread of existing infestations. Reduced habitat quality is a potential consequence of both scenarios.

It is not possible to quantify the potential magnitude of impact that may result from the above indirect threats. Some indirect threats are likely to be short-term and very localised in spatial extent (*eg* fugitive dust) whereas others, if not properly managed, may cause severe and/or irreversible impacts at the site, local and regional scales (*eg* biosecurity incursions).

5.2.4 Recommended management measures

The below list presents recommended mitigation measures based on project details available at the time of preparation of this report. These recommendations will be reviewed, revised and augmented as required. The following recommendations are specific to flora, though many are applicable to other terrestrial ecological values.

Recommendation 1: Destroy existing infestation of Cat's Claw Creeper* and monitor the area for re-emergence or recovery of the species. Re-treat as required to achieve eradication.

Recommendation 2: Prior to clearing woody vegetation (remnant or non-remnant) conduct surveys for T&NT plants in accordance with the Queensland Protected Plant Survey Guidelines [note: some of this work is complete; *see* Astrebla (2015b)]. Subsequent management of any T&NT plants threatened by development should occur in accordance with relevant legislation.

Recommendation 3: Minimise vegetation clearing extent via planning and implementation of systems/controls during construction (*eg* permit to clear system and clearly marking clearing extents prior to disturbance). This includes clearing for new roads and bridges.

Recommendation 4: Implement systems to prevent unauthorised vegetation clearing throughout the operational life of the development.

Recommendation 5: Develop and implement a rehabilitation plan. The plan should be prepared by a suitably qualified person and be appropriate for the setting (*ie* consider project and activity-related threats and all values of the receiving environment). All areas in the Environmental Area currently devoid of native vegetation should be rehabilitated to natural conditions. Areas disturbed during construction that are not needed for the operation phase should be rehabilitated as soon as they become available.

Recommendation 6: Develop and implement a project-specific biosecurity management plan (construction and operation phases). The plan should include methods for prevention of introduction and/or spread of weeds, pests and pathogens, inspections/monitoring and control. The plan should be developed by a suitably qualified person and be appropriate for the setting (*ie* consider project-related threats, local/regional threats and all values of the receiving environment).

Recommendation 7: Develop and implement an appropriate project-wide landscaping plan (construction and operation phases). The plan should provide guidance on plant species selection and describe limitations or precautions with regard to the receiving environment (*eg* limitations or issues when landscaping in or near habitats for threatened stream-dwelling frogs). The plan should be developed by, or reviewed by, a suitably qualified person(s) to ensure it is appropriate for the setting (*ie* consider activity-related threats and all values of the receiving environment).

Recommendation 8: Develop and implement a fire management plan (construction and operation). The plan should include methods for prevention of uncontrolled wildfire and emergency response.

Recommendation 9: Develop and implement a stormwater management plan designed to achieve no adverse change in the environmental values of the aquatic receiving environment. The management plan should include a monitoring program capable of detecting change in key indicators (*ie* indicators that are specific to potential project-related contamination sources and specific to known values of the receiving environment). The sampling regime should be sufficient to detect changes in key indicators and allow/provide for a timely management response.

Recommendation 10: The wastewater treatment system, inclusive of effluent irrigation (if this occurs), should be designed and managed so as to achieve no adverse change in the environmental values of the aquatic receiving environment.

Recommendation 11: Manage run-off or wash-down water from animal enclosures/stables to avoid contamination of the aquatic receiving environment.

Recommendation 12: Irrigation practices should be managed to reduce the run-off of irrigated water or the infiltration of potentially contaminated water (*eg* nutrients, pesticides, herbicides) to groundwater.

Recommendation 13: Develop and implement a dust management plan (construction).

Recommendation 14: Develop and implement Erosion and Sedimentation Control Plans (ESCPs) for each area of construction and for the operational phase, inclusive of certification of the plans by a Certified Professional in Erosion and Sediment Control (CPESC) or equivalent. ESCPs should be designed with the objective of achieving no adverse impact on the aquatic receiving environment.

Recommendation 15: Develop and implement a management plan for the storage and handling of chemicals and hazardous substances (construction). The management plan should consider storage of minimum necessary volumes, emergency response training, procedures and controls in the event of an inadvertent release of chemicals or hazardous substances.

Recommendation 16: Design plans for communal building and infrastructure facilities should consider the potential need for storage and handling of chemicals and hazardous substances.

Recommendation 17: Training and site inductions to increase environmental awareness, identification of project-related threats and management requirements/obligations (construction and operation).

Recommendation 18: Feral pigs should be managed to reduce numbers and limit access to creeks across the project area.

Recommendation 19: Prevent cattle access to creeks via fencing and the provision of off-creek watering points.

Recommendation 20: Implement and appropriately resource (capital, labour, time, equipment) a management system to ensure that recommendations presented in this report, and any subsequent flora and fauna assessments, are implemented. The system should identify lines of responsibility/accountability and encompass the life of project (construction and operation).

5.3 Fauna

5.3.1 Summary of values

Fauna habitats

Four terrestrial fauna habitats occur on the project area, as follows.

- Open Pasture.
- Mesophyll to Notophyll Vine Forest (MNVF).
- Notophyll to Microphyll Vine Forest (NMVF).
- Eucalypt Open Forest to Woodland (EOFW).

NMVF and EOFW are the dominant habitat types and cover approximately 45% and 23% of the project area respectively. The MNVF habitat type, in the northern portion of the project area, ranges from relatively young regrowth through to a climax community condition states. All habitats are likely to be of value to a specific faunal assemblage, and some habitats are known and predicted core habitat for specific T/NT&M fauna.

Threatened, Near Threatened & Migratory fauna

Eight T&NT species and two EPBC Act Migratory species were recorded on the project area and a further 13 T&NT species and seven EPBC Act Migratory species have the potential to occur (**Table 15**). These species vary in their potential patterns of occurrence as summarised below.

- Species that are likely to maintain a regular and/or permanent presence on the project area include:
  - T&NT Kuranda Tree Frog, Bare-rumped Sheathtail Bat, Greater Large-eared Horseshoe Bat, Spectacled Flying-fox, Tapping Green-eyed Frog and Macleay's Fig-parrot (all species recorded on the project area); and
  - Migratory-listed Spectacled Monarch and Rufous Fantail (recorded on project area), and species predicted to occur (not recorded) Black-faced Monarch, White-throated Needletail and Fork-tailed Swift.

- Species that are likely to be non-resident on the project area, and whose presence is likely to be intermittent, include (not recorded on project area):
  - T&NT Southern Cassowary, Australian Lacelid, Red Goshawk, Northern Quoll, Ghost Bat, Grey Falcon and Lumholtz's Tree-kangaroo; and
  - Migratory- listed Oriental Cuckoo, Barn Swallow, Eastern Osprey and Glossy Ibis.
- Species for which there is insufficient knowledge to predict patterns of occurrence, and whose occurrence may range from regular to intermittent include:
  - T&NT Tube-nosed Insectivorous Bat (recorded on the project area); and species predicted to occur (not recorded) Northern Bettong, Semon's Leaf-nosed Bat, Masked Owl, Greater Glider, Blue-faced Parrot-finch and Diadem Leaf-nosed Bat.

5.3.2 Existing threats

As described in **Section 5.2.2**, vegetation communities on the project area generally have moderate to high levels of habitat integrity. The threatening processes relevant to fauna are as described in **Section 5.2.2** for flora, plus the following.

- Certain activities associated with the existing landuse have, and/or have the potential to, decrease surface soil stability and contribute sediment (and associated contaminants) to the aquatic receiving environment. These activities include livestock grazing (which reduces ground vegetative cover) and ground disturbance through hoof action, the formation and maintenance of unsealed roads, recent vegetation clearing to reinstate pasture and the recent construction of a farm dam. The soils and subsoils in the project area have moderate to high erodibility and pose a fine sediment export risk. Steeply sloping land and high rainfall erosivity increase the potential for soil erosion. This makes creeks susceptible to sediment inputs from accelerated soil erosion. Sedimentation in the aquatic receiving environment has the potential to decrease the condition and viability of in-stream breeding habitats for threatened stream-dwelling frogs such as the Kuranda Tree Frog and Tapping Green-eyed Frog.
- Feral Pigs are present on the project area and in forests in the catchment above the project area. Their digging and wallowing in riparian areas poses a similar threat to that described above for livestock grazing.
- Certain activities and conditions (current and historic) in the catchment above the project area are contributing sediment to streams flowing through the project area. Potential sources include a paintball facility encompassing the bed and banks of Haren Creek, and a quarry and unsealed vehicle tracks in the Owen Creek catchment.
- NRA (2017) reported that water quality in creeks of the project area exceeded a number of water quality objectives (WQOs), including physico-chemical properties, nutrients (forms of nitrogen and phosphorus), metals and metalloids, major and minor ions and alkalinity indicators. Exceedances of WQOs were also recorded at monitoring sites upstream of the project area, at sites adjacent to and downstream of the project area, and at sites in the Barron River, upstream of where waters from the project area enter the Barron River. The circumstances described in the above bullet points are contributing to these exceedances. The major impact on water quality is the release of sediment-laden waters increasing the load of total suspended solids and associated parameters, including turbidity, metals and nutrients (NRA 2017).
- There is no active fire management plan in place and this may be encouraging forest expansion at the expense of woodlands in the south-west of the project area. This is tentatively identified as a potential threat as the expansion of forest will benefit certain fauna and disadvantage others. Management of this area should be guided by knowledge of what fauna occurs in the Eucalypt open forest and woodlands to the west of the project area, and specifically whether any significant populations are present in that area and the habitat preferences of those populations. The potential risks to aquatic receiving

environment (and key values, *eg* threatened stream-dwelling frogs) associated with erosion and sedimentation (post-fire) should also be considered.

- Wild dogs (*Canis* sp.) occur on the property and free-ranging domestic dogs have the potential to occur. The impacts of dogs on the local biota is difficult to predict. They may be having net negative, net positive or net neutral effects depending on the species in question. For example, wild dogs will hunt small and medium-sized animals though may also suppress or alter the activities of other predators such as Feral Cats (*Felis catus*). Wild dogs pose a threat to the Southern Cassowary and have probably contributed to their local demise.

5.3.3 Potential impacts

The proposed development poses direct threats and a range of indirect threats to fauna values. These threats are described below. The fauna species (and populations) that are potentially most vulnerable to the direct and indirect threats (and resulting impacts) are those that:

- are permanent, frequent or regular inhabitants of the site
- are sensitive to the threats posed by the action[16]
- have core, limiting or critical habitat within the receiving environment of impact.

Direct threats

Direct threats comprise the loss of habitat (and subsequent displacement of wildlife), and direct mortality or harm during clearing and excavation works. With respect to habitat loss, it is the loss of core, limiting, or critical habitat that poses the greatest direct threat. Habitats in the local area are frequently exposed to catastrophic weather events (*eg* severe tropical cyclones) and therefore supporting or marginal habitats may also be important when core, limiting or critical habitats are unavailable.

The potential magnitude of direct harm to T/NT&M fauna, or fauna more generally, as a consequence of vegetation clearing and excavation cannot be quantified. The potential magnitude of harm is likely to be proportional to the scale of habitat loss. Controls should be implemented during construction works to reduce the potential for harm. The Tapping Green-eyed Frog is the most susceptible T/NT&M species to this threat because it has core habitat in proposed impact areas and it has limited ability to rapidly vacate impact areas.

The potential magnitude of core habitat loss for T/NT&M species as a consequence of the proposed development is shown in **Table 15**. Potential core habitat loss has been calculated using data layers as follows.

- Core habitat mapping for Kuranda Tree Frog (**Figure 14**) and Tapping Green-eyed Frog (**Figure 16**) as described in **Section 4.3.2**.
- BVG mapping (1:2M) based on DSITI (2016) (**Figure 7**). This mapping excludes regrowth vegetation deemed by DSITI (2016) to not meet the criteria for remnant vegetation.
- NRA habitat mapping where all forested areas based on aerial photograph interpretation are treated as potential habitat. Pre-clearing BVG mapping was used to delineate distributions of BVG types. This mapping includes habitats ranging from early successional to climax community condition states.

[16] Due to biology (including life history), behaviour and/or population size.

Table 15: Threatened, Near Threatened and Migratory-listed species known or predicted to occur on the project area, their status, potential core habitat and potential impact area

Species	Status[A]		Core Habitat[B]	Predicted Occurrence[C]	Potential Impact Area (ha)[D]	
	NC Act	EPBC Act			NRA Habitat Mapping[E]	DSITI (2016) Habitat Mapping
Kuranda Tree Frog	E	E	MNVF (streams for breeding) (**Figure 14**)	Regular / resident	0	N/A
Tapping Green-eyed Frog	V	-	MNVF and NMVF (streams for breeding) (**Figure 16**)	Regular / resident	59 (16%)	N/A
Bare-rumped Sheathtail Bat	E	V	EOFW	Regular / resident	6 (4%)	1 (1%)
Greater Large-eared Horseshoe Bat	E	V	MNVF, NMVF and EOFW	Regular / resident	87 (15%)	6 (1%)
Spectacled Flying-fox	V	V	MNVF, NMVF and EOFW	Regular / resident	87 (15%)	6 (1%)
Macleay's Fig-parrot	V	-	MNVF, NMVF and EOFW	Regular / resident	87 (15%)	6 (1%)
Spectacled Monarch	SL	M	MNVF, NMVF and EOFW	Regular / resident	87 (15%)	6 (1%)
Black-faced Monarch	SL	M	MNVF, NMVF and EOFW	Regular / resident	87 (15%)	6 (1%)
Rufous Fantail	SL	M	MNVF, NMVF and EOFW	Regular / resident	87 (15%)	6 (1%)
White-throated Needletail	SL	M	Above (airspace) all habitats	Regular / resident	Nil	Nil
Fork-tailed Swift	SL	M	Above (airspace) all habitats	Regular / resident	Nil	Nil
Greater Glider	V	V	EOFW	Uncertain	6 (4%)	1 (1%)
Blue-faced Parrot-finch	NT	-	EOFW	Uncertain	6 (4%)	1 (1%)
Northern Bettong	E	E	EOFW	Uncertain	6 (4%)	1 (1%)
Tube-nosed Insectivorous Bat	V	-	MNVF, NMVF and EOFW	Uncertain	87 (15%)	6 (1%)
Semon's Leaf-nosed Bat	E	V	MNVF, NMVF and EOFW	Uncertain	87 (15%)	6 (1%)
Masked Owl	V	V	MNVF, NMVF and EOFW	Uncertain	87 (15%)	6 (1%)
Diadem Leaf-nosed Bat	NT	-	MNVF, NMVF and EOFW	Uncertain	87 (15%)	6 (1%)
Southern Cassowary	E	E	MNVF and NMVF	Intermittent	80 (19%)	5 (2%)
Lumholtz's Tree-kangaroo	NT	-	MNVF and NMVF	Intermittent	80 (19%)	5 (2%)

Species	Status[A]		Core Habitat[B]	Predicted Occurrence[C]	Potential Impact Area (ha)[D]	
	NC Act	EPBC Act			NRA Habitat Mapping[E]	DSITI (2016) Habitat Mapping
Australian Lacelid	E	E	MNVF (streams for breeding)	Intermittent	0	N/A
Northern Quoll	LC	E	EOFW	Intermittent	6 (4%)	1 (1%)
Red Goshawk	E	V	EOFW	Intermittent	6 (4%)	1 (1%)
Grey Falcon	V	-	EOFW	Intermittent	6 (4%)	1 (1%)
Oriental Cuckoo	SL	M	EOFW	Intermittent	6 (4%)	1 (1%)
Glossy Ibis	SL	M	Open Pasture	Intermittent	84 (87%)	N/A
Ghost Bat	E	V	MNVF, NMVF and EOFW	Intermittent	87 (15%)	6 (1%)
Eastern Osprey	SL	M	MNVF, NMVF and EOFW	Intermittent	87 (15%)	6 (1%)
Barn Swallow	SL	M	Above (airspace) all habitats	Intermittent	Nil	Nil

A: Status of Threatened, Near Threatened and Migratory species as listed under the Queensland *Nature Conservation Act* 1992 (NC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). Categories comprise: Least Concern (LC), Special Least Concern (SL), Migratory (M), Near Threatened (NT), Vulnerable (V) and Endangered (E).

B: Predicted core habitat for each species on project area. Core habitat does not necessarily encompass the full range of habitats in which a species may occur; for most species on the project area, all forested habitat types will be of some potential value. See **Section 4.3.2** for further detail.

C: Predicted occurrence based on published information on species distribution and ecology, and observed conditions on-site. Categories comprise: 'Regular / resident', 'Intermittent' and 'Uncertain'. See **Section 4.3.2** for further detail.

D: Based on direct loss of predicted core habitat. They are estimates because area determinations are based on work that involves the interpretation of aerial photographs that are rectified for use, the delineation of boundaries between vegetation communities may not be precise, and that delineation is defined by a line on a map, the width of which also constitutes a source of imprecision. All areas that are currently forested, including forested areas of non-remnant vegetation, are treated as potential habitat. Area estimates are rounded to the nearest whole number. Proportions shown in parenthesis are the area of habitat lost relative to what currently exists on the project area.

E: Revised habitat mapping is where all forested areas are treated as potential habitat. Pre-clearing BVG mapping was used to delineate distribution of BVG types. Specific mapping and decisions rules were used for Kuranda Tree Frog (**Figure 14**) and Tapping Green-eyed Frog (**Figure 16**).

Indirect threats

Indirect threats refer to those secondary threats that may occur as a result of the development. Their impacts may extend beyond the development footprint and some may persist throughout the operational life of the project. Potential indirect threats to fauna values associated with urban developments may include the following.

- All indirect threats described for flora (see **Section 5.2.3**) are applicable to fauna in that plant communities are a component of fauna habitat.
- Sedimentation and contamination of waterways resulting in reduced water quality and condition of in-stream habitats.
- Alteration of surface hydrology (*ie* changing drainage, the locations where surface water occurs and altered environmental flows).
- Direct and/or secondary poisoning of wildlife due to 'pest' control programs (lethal or sub-lethal impacts).
- Altered fauna communities in response to artificial lighting and changes to the acoustic environment.

- Increased number of cats and dogs and subsequent incidence of attacks on native wildlife, and/or alteration of natural behaviours of native wildlife due to the presence of cats and dogs.
- Increased chance of wildlife colliding with vehicles.
- Increased number of human-wildlife interactions. These may have negative effects on some wildlife *eg* some wildlife are shy of humans and may vacate an area.
- Increased levels of habitat fragmentation *ie* changed fauna behaviours in response to human presence and/or physical habitat loss.

It is not possible to quantify the potential magnitude of impact that may result from the above indirect threats. Some indirect threats are likely to be short-term and very localised in spatial extent (*eg* fugitive dust) whereas others, if not properly managed, may cause severe and/or irreversible impacts at the site, local and regional scales (*eg* biosecurity incursions) (**Table 16**). The fauna species (and populations) that are potentially most vulnerable to the indirect threats (and resulting impacts) are those that:

- are permanent, frequent or regular inhabitants of the site (*see* **Table 15**).
- are sensitive to the threats posed by the action[17]
- have core, limiting or critical habitat within the receiving environment of impact.

The fauna species predicted to have an intermittent occurrence on the project area, and whose core habitats or areas of activity are likely to be remote to the main area of potential indirect threats, comprise: White-throated Needletail, Fork-tailed Swift, Greater Glider, Northern Bettong, Lumholtz's Tree-kangaroo, Northern Quoll, Red Goshawk, Grey Falcon, Ghost Bat, Oriental Cuckoo and Barn Swallow. These species are least vulnerable to the potential indirect threats of the project. The Kuranda Tree Frog and Tapping Green-eyed Frog are the most vulnerable in that they have critical habitat in the immediate receiving environment and are sensitive to most of the potential identified indirect threats.

Table 16: Potential indirect threats (in the absence of mitigation) to fauna

Indirect Threat	Potential Spatial Scale of Impact [A]	Potential Temporal Scale of Impact [B]	Comments
Habitat loss due to uncontrolled clearing, excavation, or other physical disturbance.	Site-specific.	Medium (assuming some natural regeneration) to long-term.	Standard controls can reduce likelihood of impact. Some impacts reversible.
Habitat degradation: edge effects.	Site-specific.	Short to long-term.	Most pronounced along disturbance edges and likely to vary spatially and temporally.
Habitat degradation: biosecurity ingress and proliferation.	Mostly site-specific; however, potential for local or regional scale impacts.	Long-term.	Standard controls can reduce likelihood of impact, and in most cases, reduce spatial and temporal scale of impact.
Habitat degradation: fugitive dust.	Site-specific.	Short-term.	Standard controls can reduce risk.

[17] Due to biology (including life history), behaviour and/or population size.

Indirect Threat	Potential Spatial Scale of Impact [A]	Potential Temporal Scale of Impact [B]	Comments
Sedimentation and contamination.	Mostly site-specific; however, potential for local scale impacts.	Short to long-term depending on severity.	Standard controls can reduce likelihood of impact.
Alteration of surface hydrology.	Mostly site-specific; however, potential for local scale impacts.	Short to long-term.	Standard controls can reduce risk.
'Pest' control programs.	Mostly site-specific; however, potential for local or regional scale impacts.	Long-term.	Threats difficult to monitor and control during operational life of project.
Artificial lighting and anthropogenic noise.	Site-specific.	Long-term.	Standard controls can reduce likelihood of impact.
Domestic cats and dogs.	Site-specific.	Long-term.	Standard controls can reduce likelihood of impact. Some controls difficult to enforce.
Collision with vehicles.	Mostly site-specific; however, potential for local or regional scale impacts.	Long-term.	Standard controls can reduce likelihood of impact.
Human-wildlife interactions	Site-specific.	Long-term.	Standard controls can reduce likelihood of impact. Some controls difficult to enforce.
Habitat fragmentation.	Site-specific and local scale.	Long-term.	Sensitive planning can reduce impacts.

[A] Spatial scale categories comprise: site-specific (*ie* project area), local area (*eg* within 5 km of project area) and regional (*eg* within 20 km of project area).

[B] Temporal scale categories comprise: short-term (1 to 5 years), medium-term (5 to 30 years) and long-term (>30 years).

Some of the indirect threats are of particular interest due to their potential influence on T/NT&M species, and are discussed below.

Sedimentation and contamination

Sedimentation and contamination of the aquatic receiving environment poses a threat to a wide variety fauna. Within the current context, fauna with aquatic life-history stages are most vulnerable to the potential threats posed by sedimentation. Contamination poses a threat to a wider variety of fauna and has the potential to impact fauna both directly via contact and/or uptake of contaminants, and indirectly by impacting prey species (or food resources). With respect to T/NT&M species, stream-dwelling frog species are most at risk because significant life-cycle stages (including breeding and development of young) are centred on the aquatic environment and important populations occur near to the proposed development area.

A broad range of substances potentially hazardous to fauna may be used during, or be a by-product of, the construction phase and operational life of the project. These may include fuels, lubricants, cleaning products, herbicides, pesticides, fertilisers, effluent *etc*. When released to the environment these substances can have a range of lethal and/or sublethal[18]

[18] Examples of sublethal impacts include reduced health (which in turn can negatively affect the ability to care for young and avoid predators), rates of development and reproductive output.

impacts on fauna populations. The sensitivity of many fauna species, including Tapping Green-eyed Frog, Kuranda Tree Frog and Australian Lacelid (should they occur), to the wide-spectrum of contaminants potentially associated with urban developments (construction and operation) is poorly known. Even if toxicity thresholds were known, it would be difficult to predict particular outcomes from hypothetical contamination events due to the complexity of the systems involved. Impacts could feasibly range from relatively benign, localised and short-term impacts, to severe impacts that result in long-term population declines (or localised extinctions).

Sedimentation of the aquatic receiving environment may occur during, and as a consequence of, activities conducted during the construction phase and operational life of the project. Fine sediments have the potential to cover, and decrease the quality of, in-stream substrates where frog tadpoles feed and eggs are deposited. Higher sediment loads have potential to smother stream beds, including interstitial spaces, thereby decreasing habitat availability and quality. In the most severe cases, sediment inputs have the potential to alter flows, and smother/remove shallow riffles where species like the Kuranda Tree Frog, Tapping Green-eyed Frog and Australian Lacelid breed. In certain circumstances, changes in stream geomorphology may also encourage the establishment of different plant and aquatic faunal assemblages, including assemblages that compete or prey on T&NT frogs; *eg* the formation of pools, as a consequence of sedimentation, can encourage the presence of predatory fish, such as the exotic Tilapia, which prey on frogs. The potential magnitude of impact associated with sedimentation is similar to that described above for contamination; *ie* impacts may range from relatively benign to severe depending on the circumstances.

Stream-dwelling frogs in the local area were exposed to, and recovered from, potential sedimentation events and habitat loss associated with historical broad-scale clearing (notably in the 1970s; *see* aerial images **Appendix A**). This demonstrates resilience. The presence of relict frog populations in the local area, favourable weather patterns and absence of a debilitating disease outbreak potentially contributed to this resilience.

Alteration of surface hydrology

As per contamination and sedimentation, the alteration of surface hydrology poses a threat to a wide variety of fauna, though with respect to T/NT&M species, stream-dwelling frog species are the most at risk. The construction phase and operational life of urban environments have the potential to alter surface hydrology in the following ways.

- Sedimentation can alter flow regimes by changing the geomorphology of stream beds.
- Stream alignments are sometimes changed to accommodate specific development items and/or to address stormwater management issues.
- Surface water and groundwater is sometimes used (*eg* for irrigation) during the construction phase and/or during the operational life of urban developments. This extraction of water can reduce water available for natural systems.
- Urban developments are generally designed to re-direct water efficiently away from developed land into the receiving environment. This rapid redirection of water is aided by the presence of hard surfaces. Often the net result is that water leaves the land surface in shorter pulse events relative to that which would have occurred if the same land was in its natural forested state. These conditions may, in certain scenarios, reduce the duration over which streams receive recharging waters and reduce the period that streams support surface water flows. Both the pulse event (which flushes out the system) and the shortened period of water flow can reduce the timeframe available for breeding stream-dwelling frogs.
- In addition to altered hydrology, urban water runoff can have decreased water quality that can impact on receiving environment values.

Pest control programs

Urban environments, regardless of their location, usually contain a range of native and exotic vertebrate and invertebrate species widely regarded as pests due to their real or perceived threat to property and/or public health and well-being. A variety of pesticides and chemicals may be employed for the control of pest and nuisance species.

Pesticides and certain chemicals have the potential to impact native wildlife when the substance is consumed directly, consumed indirectly (*eg* grooming after being in contact with a contaminant) or absorbed (*eg* due to direct contact). This uptake has the potential for lethal or sublethal impacts on the affected animal. Such chemicals also have the potential to alter prey assemblages, which can have complex and cascading impacts across multiple trophic levels. The ultimate impact of pesticide and chemical use is influenced by a multitude of factors, and the magnitude of impact on a given fauna species at the population level can be difficult to predict. The threat is potentially relevant to all T/NT&M species known or predicted to occur on the project area, though non-carnivorous species are at lower risk of impact (*ie* Spectacled Flying-fox, Macleay's Fig-parrot, Greater Glider, Blue-faced Parrot-finch, Northern Bettong, Southern Cassowary and Lumholtz's Tree-kangaroo).

Artificial lighting and altered acoustic environments

Artificial lighting in urban environments, particularly when it is applied extensively and intensively, can alter the physiology and behaviour of many fauna species. With respect to behavioural changes, some species may avoid the artificially illuminated space over the short or long term, and other species may be attracted to the insects that congregate around the lights. Physiological responses to artificial lighting is poorly known for most Australian fauna species. Nocturnal species are probably most sensitive, and impacts can range from short term (*eg* where lighting reduces the dark-adapted state of their sight) to longer-term and more complex changes (*eg* altered reproductive cycles). Overall, some fauna species will be negatively impacted by the altered light conditions, some will benefit and some species will be largely unaffected. Artificial lighting in unlikely to impact most of the T/NT&M species known or predicted to occur on the project area. T/NT&M faunal groups potentially most vulnerable, due to their potential proximity and biology, are frogs (adult and larval) and micro-bats. Potential impacts can be reduced via directional lighting and by maintaining vegetated buffers along important habitats (*eg* streams used for breeding and flyways).

Urban environments contain a range of noise sources not found in natural systems. Anthropogenic noise sources have the potential to cause noise-related hearing damage and behavioural changes (in response to acoustic interference or masking) to some fauna. The potential for noise-induced hearing damage to fauna is most likely during the construction phase, and less likely once the urban space is built. Behavioural changes in response to anthropogenic noise may occur during the construction phase and the operational life of the project; however, impacts during the construction phase are of lower concern because they are likely to be temporary and affect a small number of individuals (as opposed to populations). Noise generated during the operational life of the project may affect many fauna species. The degree of impact will vary according to species and noise source. For susceptible fauna, anthropogenic noise may reduce their ability to hear predators and reduce their ability to communicate with conspecifics. These conditions can make individuals more vulnerable to predation, increase their stress levels and reduce their fitness. With respect to T/NT&M species, the frogs and smaller forest-dwelling bird species are the most vulnerable due to their biology and their potential proximity to noise sources. The effects of noise are likely to attenuate rapidly through dense forest so potential impacts are expected to be localised.

Domestic cats and dogs

Domestic cats and dogs pose a threat to a variety of native wildlife both directly via predation, and indirectly via competition, behavioural exclusion and as vectors for disease. Their impacts are usually most intense within the urban space in which they live; however, the area of potential impact increases when they are permitted (deliberately and/or inadvertently) to roam outside of the urban space. Predicting the potential impact of free-roaming domestic cats and dogs is difficult. Wild dogs are present on the project area and will likely kill or harass domestic cats or dogs venturing out of the urban space. If the wild dog population is destroyed, or suppressed, domestic cats and dogs may encroach into the vacated space. Domestic cats and dogs, notably when free-ranging, pose a threat to most wildlife, including T&NT species, with the exception of species that spend most of their time high in forest canopies or in the airspace above. As described earlier, wild dogs could be inhibiting a more permanent presence of Southern Cassowary. Free-ranging domestic dogs have the potential to pose a similar threat.

Vehicle collisions and impacts

Vehicle traffic is a known cause of death and injury to fauna. All faunal groups are susceptible to this impact, though the risk to high flying bird and mammal species is much lower. The risk to fauna posed by vehicle traffic will be higher in the areas near to intact forest, and especially in the areas where forest occurs on both sides of the road and the forest patch is large and/or used as a movement corridor. With respect to T/NT&M species, vehicle strike poses the greatest potential risk to the Tapping Green-eyed Frog and the Southern Cassowary. This is because they are ground-dwelling, potentially have core habitat in the areas where access roads are planned and are known to move across roads when ranging through their habitat. Roadkill is the major cause of Cassowary mortality in the Wet Tropics area (NRA 2006) and a major threat to the species (Latch 2007).

Human-wildlife interactions

Some fauna will avoid interaction or proximity to people, or environments where people frequent. The threat posed by human presence is expect to be localised to the development area and immediate surrounds.

The proposed development will increase human presence on the site and some people may be inclined to use the nearby streams for recreational purposes. This activity has the potential to degrade the quality of aquatic habitats for frogs and their young, *eg* by trampling and disturbing stream beds, or by introducing pollutants such as insect repellents and sunscreens to the water.

Habitat fragmentation

The proposed development has maximised the use of existing areas of disturbance, and vegetation clearing to support development will not result in substantial changes in the degree of physical habitat fragmentation. Vegetation clearing in the north-east of the project area will increase fragmentation in that general area (at the site scale), and further reduce the degree of habitat connectivity through the eastern portion of the Kuranda-Myola-Kowrowa rainforest corridor (**Figure 13**). Vegetation clearing associated with the proposed development will have negligible impact on the western portion of this corridor and negligible impact on the north-south connectivity that occurs through Eucalypt woodland-open forest to the west of the project area.

The proposed development also has the potential to decrease connectivity indirectly. As discussed above, various aspects of the urban environment (*eg* noise, light, domestic cats and dogs *etc*) have the potential to discourage or suppress the presence of certain fauna and/or the health of populations that occur. When these threats occur adjacent to wildlife corridors

they can reduce the functionality or value of the affected corridors. Within the current context, riparian forests are potentially of greatest importance (currently and post-development) for providing habitat connectivity and specific effort should be taken to maintain their value as effective corridors.

The proposed access roads will increase fragmentation at the site and local area scales. This may happen directly as a consequence of habitat loss, and indirectly as a result of the secondary impacts that occur as a result of roads (*eg* edge effects, vehicle strike, acoustic interference). The potential magnitude of impact is increased by the fact that the roads are passing through forest patches that are relatively large in size and in good condition (including areas at or near climax community states). Patches like these are of high conservation value because of the fauna populations they sustain and they can be particularly important in landscapes recovering from disturbance. The direct and indirect threats associated with these roads have the potential to impede the establishment of a more permanent presence of the Southern Cassowary.

Biosecurity incursions or proliferation

Urban developments have the potential to result in new biosecurity incursions and/or contribute to the spread of existing biosecurity threats. These biosecurity events can occur during construction and throughout the operational life of urban development projects. Exotic plants, animals (vertebrate and invertebrate) and pathogens all have the potential to impact fauna populations. Impacts may occur directly (*eg* predation or infection) or indirectly via impacts on habitats or critical resources.

As discussed earlier, invasive ants (*eg* Yellow Crazy Ant and Electric Ant) are a significant threat to fauna in the local area. While invasive ants were not found on the project area, they are present in the local area and region, and there are numerous pathways for invasion into the project area during construction and throughout the operational life of the project. Some of these pathways are difficult to effectively manage. If invasive ants were to establish in the project area they could be difficult to eradicate and could have a devastating impact on fauna in the vicinity of the infestation. Invasive ants pose a threat to most fauna groups, including most T/NT&M species known or predicted to occur.

Unsuitable fire regimes

The possibility for unsuitable fire regimes requires discussion, though it is not necessarily an indirect threat associated with the project. The potential relevance to the project is that a Zip Line is proposed through a section of EOFW, and the presence of this infrastructure may influence how the area is managed with respect to fire; *ie* public safety and asset protection may influence fire regimes.

Fires are most likely to affect EOFW and in areas where EOFW intergrades with rainforest (MNVF and NMVF). More specifically, fire patterns will influence where the boundary between EOFW and rainforest lies, and the characteristics of vegetation within the intergrade areas. Many faunal and floral assemblages prefer a specific fire pattern. Within the project area, there is no specific fire pattern that will benefit all species. Further, there is insufficient information to identify a fire pattern that will result in a net conservation benefit and any such decision would ultimately be value-based (*eg* to enhance species richness *vs* to protect species X, Y and Z).

Deciding on what fire pattern is best, from a net conservation benefit perspective, should be informed by knowledge of what species and communities occur in open forests and woodlands to the west of the project area. For example, if significant conservation values are present in EOFW west of the project area, and these values outweigh conservation values

associated with rainforest, then a fire regime that encourages EOFW may be preferred (or vice versa). The potential presence of Northern Bettong in EOFW west of the project area is of relevance to this assessment. The assessment and design of fire plans should also consider the risks associated with erosion post-fire, and the subsequent discharge of sediment laden water into streams – this process has the potential to impact upon stream-dwelling frogs in the downstream receiving environment.

5.3.4 Recommended management measures

The below list presents recommended mitigation measures based on project details available at the time of preparation of this report. These recommendations will be reviewed, revised and augmented as required. The following recommendations are specific to fauna, though many are applicable to other terrestrial ecological values. Most of the recommendations relating to flora are applicable to fauna and are not repeated below.

Recommendation 21: Reduce the extent of fauna habitat loss in the north-east of the project area. The primary objectives for habitat retention should be to: (a) reduce net Tapping Green-eyed Tree Frog habitat loss; (b) reduce net MNVF habitat loss; and (c) retain a forest corridor along the Warril Creek tributary. The recommended areas for habitat retention are shown on **Figure 18**. Similar results can be achieved with different configurations. Any adjustment in the configuration of retained habitats should optimise protection of habitats where Tapping Green-eyed Frog occur at high densities, which in the north-east of the project area corresponds with the downstream reach of the Warril Creek tributary.

Recommendation 22: Restore riparian vegetation along Haren Creek, Owen Creek, Cain Creek and the tributary of Warril Creek. The recommended areas for habitat restoration are shown on **Figure 18** (approximately 12 ha). Habitat restoration should aim to improve the condition of riparian habitats for fauna and be of a habitat type that reflects pre-clearing conditions.

Recommendation 23: Where clearing within Tapping Green-eyed Frog habitat cannot be avoided, manage bank stability and stormwater discharge to ensure no adverse change in the environmental values of the aquatic receiving environment. The use of vegetative buffers and engineering solutions should be considered.

Recommendation 24: Measures to protect water quality should be integrated into project Erosion and Sediment Control Plans (ESCPs), Storm Water Management Plans and Surface Water Monitoring Programs (SWMPs).

Recommendation 25: Inspect disturbance areas for roosting or nesting fauna prior to clearing. If nesting or roosting fauna are found, clearing at that location should cease until the appropriate management and approval requirements are ascertained and implemented. A fauna spotter/catcher is to be present during clearing activities.

Recommendation 26: Woody vegetation clearing should occur progressively to give animals that survive the tree-felling activity a chance to move out of the area. This is especially important in areas of potential Tapping Green-eyed Frog habitat (**Figure 16**).

Recommendation 27: During the construction phase, develop and implement controls relating to noise management (including: maintain vehicles and machinery according to manufacturer specifications; fit and maintain appropriate mufflers on machinery used on-site).

Recommendation 28: Lighting in public spaces should be designed to minimise artificial light impacting natural habitats, in particular avoid artificial light impacts on riparian habitats. The use of lighting shields, directional lighting, timers and motion-sensors should be considered.

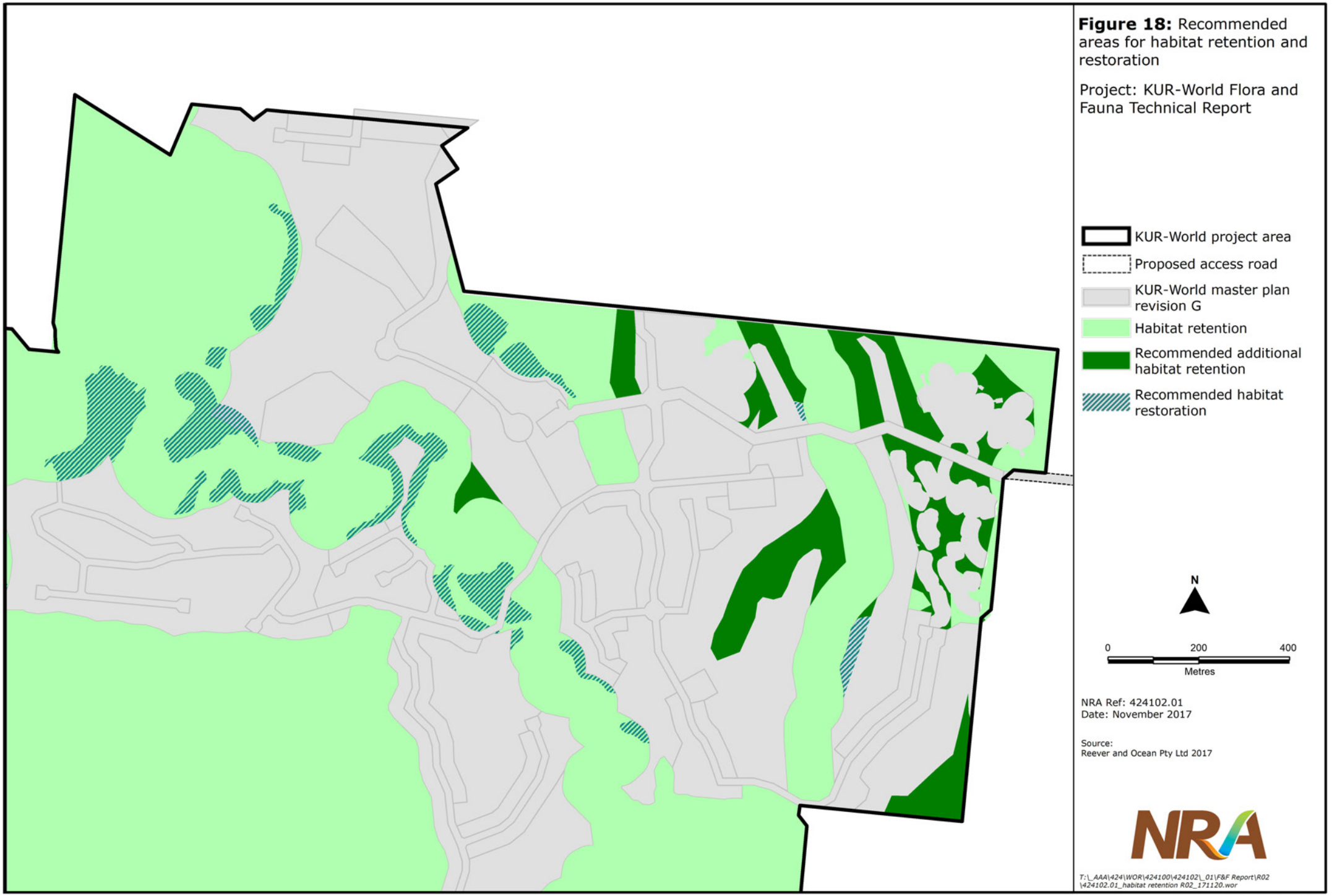

Figure 18: Recommended areas for habitat retention and restoration

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Recommendation 29: Pathways through the development area should be designed to prevent pedestrian access to core Kuranda Tree Frog habitat (**Figure 14**), and areas immediately upstream of this habitat (nominally 1 km from mapped habitat).

Recommendation 30: Roads through forest areas, notably the proposed access roads, should be designed to minimise the barrier effects to fauna movements and to reduce the likelihood of fauna being hit by vehicles. A suitably qualified and experienced ecologist should be involved with the designs. All fauna groups should be considered, though specific attention should be given to threatened stream-dwelling frogs and Southern Cassowary. Clearing widths (construction and operation) should be kept as low as possible and strategies to reduce the impact of light and acoustic pollution, especially near streams, should be incorporated into designs. Bridges should be used over larger streams, and designed to permit fauna movements (including Southern Cassowary) and minimise ground disturbance. A maximum 50 km/hour speed limit should apply to the access roads, though the need for further speed reductions, and speed reduction furniture, should be considered during the design phase (*eg* lower speeds due to poor line of sight along roadways).

Recommendation 31: The Rainforest Education Centre and Adventure Park (inclusive of the Zip Line) should be designed so as to result in minimal clearing of woody vegetation, especially remnant vegetation.

Recommendation 32: The project biosecurity management plan (Recommendation 6) should include specific focus on protecting riparian habitats, in particular core habitat for Kuranda Tree Frog (**Figure 14**).

Recommendation 33: The use of toxic baits to control feral vertebrate pests is discouraged. Toxic baits should only be considered if the potential for non-target impacts on native fauna has been properly assessed (*eg* by a suitably qualified person) and if strategies to negate non-target impacts are available and implemented. For example, toxic baiting of wild dogs may pose a threat to Northern Quoll, and the use of rodenticides can result in secondary poisoning (*ie* kill or harm) higher order predators (*eg* Masked Owl).

Recommendation 34: All management and monitoring plans relating to the aquatic environment should consider the requirements of Kuranda Tree Frog and Tapping Green-eyed Frog. Populations of Kuranda Tree Frog in the entire receiving environment (*ie* on and off-site) should be considered.

Recommendation 35: Prohibit cat ownership and limit dog ownership to certified assistance dogs. The rules regarding pet ownership should include proper containment within place of residence. All rules should be enforceable and monitored.

Recommendation 36: The development should include a community/public education program so that all residents and visitors are aware of the sensitivity of the receiving environment, and aware of any relevant rules or regulations.

Recommendation 37: The Zip Line should be designed and constructed with the knowledge that the area could be fire affected.

Recommendation 38: Barrier netting should not be used along the Golf Course unless it poses a negligible threat to volant fauna as determined by a suitably qualified ecologist.

Recommendation 39: The use of surface or ground-stored water should not adversely change the environmental values of the aquatic receiving environment. The parameters around which water is used should be based on specific assessment by suitably qualified persons and consider the specific values of the receiving environment.

Recommendation 40: An Environmental Management Plan (Operational Phase) should be developed for each development precinct or activity. The plan should identify and address potential threats to the environment associated with the activity/land use, measures to address threats, responsibilities and performance measures. This is particularly important for the Golf Course, which may require the use of chemicals in areas near to Threatened frog habitat.

Recommendation 41: The Environmental Area should be retained as a reserve for native wildlife with the primary function of nature conservation. The management plan should be developed by a suitably qualified and experienced ecologist. The management plan should aim to protect the value of the area as habitat for native flora and fauna, and protect its value as a wildlife corridor. The management plan should identify the values of the area, existing and emerging threats, and actions to address and monitor existing and emerging threats. The management plan should be appropriately resourced (capital, labour, time, equipment) and have clear lines of responsibility/accountability that encompass the life of project.

Recommendation 42: Conduct targeted surveys for T&NT fauna in forests and woodlands immediately west of the project area. The results should be used to inform the fire management plan for the south-western portion of the Environmental Area. The survey should include targeted searches for Northern Bettong.

5.4 Biosecurity

5.4.1 Summary of values

Not applicable.

5.4.2 Existing threats

The following biosecurity items were recorded on the project area (aquatic pests are addressed in NRA 2017).

- **Vertebrate fauna**: Feral Pigs, Cane Toads and free-ranging dogs.
- **Invasive ants**: nil detected.
- **Weeds**: 43 weed species, including WONS (two species), Biosecurity Act *Restricted Matter* (four species), 12 regionally significant species (WTMP) and 12 locally significant species (MSC PMP).

Weeds such as Lantana* and Giant Bramble* are ubiquitous in most habitats on-site. Sky Flower is also prevalent, especially in MNVF. Most other weed species pose a minor threat to forested habitats, with the exception of Cat's Claw Creeper*. A single infestation of this species is present on the project area and it has the potential to spread and dominate other areas.

Feral Pigs and Cane Toads are present though neither is noticeably abundant. A pack of approximately six free-ranging dogs (possibly Dingoes) are ranging across the project area. The same pack was recorded in the very north and south of the project area. The existing track network is likely facilitating their movements.

A variety of biosecurity threats exist in the local area and region, including Tramp Ants, which pose a significant threat to wildlife.

5.4.3 Potential impacts

As described in previous sections, urban developments have the potential to result in new biosecurity incursions and/or contribute to the spread of existing biosecurity matters. These biosecurity events can occur during construction and throughout the operational life of urban development projects.

5.4.4 Recommended management measures

Recommendations relevant to managing biosecurity threats were identified in previous sections, notably Recommendations 1, 5, 6, 7, 17, 18, 20, 29, 31, 32, 33 and 34.

5.5 Landscape integrity values

5.5.1 Summary of values

The broad landscape in which the project area occurs is an important corridor for a variety of wildlife, including T/NT&M species. Corridors supporting rainforest and sclerophyll forests, and biota relevant to each habitat, are present. The corridors are of contemporary conservation value for maintaining north-south connectivity for wildlife populations, and the rainforest corridors are of evolutionary significance.

- **Rainforest corridor**. The project area occurs in a broad section of landscape where north-south connectivity for certain rainforest fauna is relatively limited. Rainforests on the project area contribute to the Kuranda-Myola-Kowrowa rainforest corridor (**Figure 13**).

- **Sclerophyll forest corridor**. West of the project area are broad areas of Eucalypt woodland-open forest (**Figure 4**) that may be an important north-south corridor for a variety of wildlife, especially for species that prefer sclerophyll habitats. The south-western edge of the project area contributes a relatively small portion of habitat to this corridor. Formartine Forest Reserve, which adjoins the southern boundary of the project area (**Figure 13**), forms a large part of this corridor.

The project area supports forests in various states of condition, though overall habitat integrity is moderate to high. Habitats in the northern third of the site (MNVF) are in poorer condition (higher predominance of weeds, more fragmented, higher edge to area ratio) relative to habitats in the south. Habitats on the project area are generally on a trajectory of improvement in terms of their condition, though the effects of recent cyclones are evident.

5.5.2 Existing threats

The northern third of the project area and localised areas in the south have experienced cycles of woody vegetation clearing and recovery/regrowth. Currently, cleared areas predominantly occur in the north of the project area and are primarily used for rangeland cattle grazing. Areas north, east and south of the project area have experienced a similar disturbance history though many of the cleared areas were subsequently urbanised. These cleared areas and urban environments are detracting from the value of the rainforest corridors, with impacts being most pronounced in the eastern portion of the corridor (**Figure 13**). The Kennedy Highway and the local road network for the Kuranda-Myola-Kowrowa area are detracting from the value of all north-south corridors in the region; their impacts being most pronounced for ground-dwelling species.

5.5.3 Potential impacts

The potential project-related impacts to landscape level values have been discussed variously in previous sections to this report, though notably in **Section 5.3.3** (*eg* habitat fragmentation). In summary, the proposed development has the potential to further decrease the value and functionality of the eastern portion of the Kuranda-Myola-Kowrowa rainforest corridor via direct and indirect threats and processes. It may also indirectly impact to the western portion of this corridor, with impacts likely to be most pronounced along the edge of development and attenuating with distance from the development edge. If not managed appropriately, and the worst-case scenario, the proposed development has the potential to substantially reduce the value of these corridors, including their value to T/NT&M species.

5.5.4 Recommended management measures

All previous recommendations are relevant to managing threats to landscape integrity values.

6. Potential Residual Impacts and Legislative Considerations

The following presents the opinion of NRA and is based on the technical and practical experience of environmental practitioners. It is not and does not present as legal advice nor does it present as decisions from the regulatory agencies charged with the administration of the relevant acts.

6.1 Potential Residual Impacts

The project has been designed to predominantly occur in non-remnant vegetation as shown on DNRM (2017a) mapping (**Figure 5**). This approach was taken during the preliminary design and planning phases of the project, and prior to the completion of this terrestrial flora and fauna study. The design intention was to reduce the potential project-related environmental impacts. Potential residual impacts are the impacts predicted to occur following implementation of the management measures recommended in **Section 5**.

Commonwealth and Queensland Government policies are available to assist in determining whether a potential residual impact is 'significant' (hereafter, significant residual impact (SRI)). These include generic and value-specific policies, some of which overlap. The relevant generic polices are as follows.

- *Significant Residual Impact Guideline. For matters of state environmental significance and prescribed activities assessable under the Sustainable Planning Act 2009. Queensland Environmental Offsets Policy December 2014* (DSIP 2014).
- *Queensland Environmental Offsets Policy. Significant Residual Impact Guideline. Nature Conservation Act 1992, Environmental Protection Act 1994 and Marine Parks Act 2004* (EHP 2014).
- *Matters of National Environmental Significance. Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (DoE 2013).

One value-specific significant impact policy is potentially relevant as follows.

- *Significant impact guidelines for the endangered southern cassowary (Casuarius casuarius johnsonii) Wet Tropics population. EPBC Act policy statement 3.15* (DEWHA 2010).

6.1.1 Flora

The potential impacts with respect to remnant vegetation clearing are described in **Section 5.2.3**, though may vary subject to the proponent's response to Recommendation 21 (relating to habitat retention in the north-east of the project area).

Woody vegetation clearing associated with the current master plan (**Figure 1**) will result in the loss of REs and habitat for T&NT plants as described in **Table 13** and **Table 14** respectively. Surveys for T&NT plants have been conducted and identify the NC Act Near Threatened Slender Ginger as the only species likely to be directly impacted by the proposed clearing. On the available information, the potential loss is predicted to be relatively minor.

Acceptance of Recommendation 21 (**Figure 18**) will reduce estimated clearing extents in relation to the NRA revised RE mapping. The estimated clearing extents for DNRM (2017a) are unaffected by this recommendation. The revised estimated clearing extents are shown in

Table 17 and represent residual impacts. The proportion of potential loss of each RE when assessed at the local area scale (*ie* area within 5 km of the project area boundary, including project area) and Kuranda area (as defined by Queensland Government locality mapping) scale are detailed in **Table 17**.

Table 17: Estimated clearing extents (Regional Ecosystems) and proportion of loss relative to the local and regional (Kuranda area) scales

Regional Ecosystem Code	Estimated Project-related Woody Vegetation Clearing (ha)[A]		Proportion of Regional Ecosystem Loss (%)[B]			
			Local Area		Kuranda Area	
	DNRM (2017a)	NRA (this study)[C]	DNRM (2017a)	NRA (this study)	DNRM (2017a)	NRA (this study)
7.11.1a-b	1	15	<1%	<1%	<1%	<1%
7.11.7a-b	2	9	<1%	<1%	<1%	1%
7.11.13	0	<1	0%	0%	0%	<1%
7.11.33	0	0	0%	0%	0%	0%
7.11.44	1	3	1%	2%	1%	2%
7.11.51a	0	0	0%	0%	0%	0%
Total Remnant Vegetation	4	27	<1%	<1%	<1%	<1%

A: Area estimates are rounded to the nearest whole number. They are estimates because area determinations are based on work that involves the interpretation of aerial photographs that are rectified for use, the delineation of boundaries between vegetation communities may not be precise, and that delineation is defined by a line on a map, the width of which also constitutes a source of imprecision. Values calculated based on DNRM (2017a) mapping (**Figure 5**) and revised mapping derived from the current study (**Figure 11**).

B: The 'local area' is the area within 5 km of the project area boundary. The 'Kuranda area' is the locality boundary as defined by Queensland Government mapping.

C: Area estimate assumes acceptance of Recommendation 21 (**Figure 18**).

The potential for SRI on REs was assessed with reference to DSIP (2014). This was achieved via SRI criteria relating to Regulated Vegetation as defined under the VM Act. SRIs are likely when:

- clearing of more than 5 ha of VM Act Endangered or Of Concern RE vegetation
- clearing that results in an overall area (not confined to property boundaries) of Endangered or Of Concern RE vegetation of less than 5 ha
- clearing that results in the physical separation[19] of Endangered and Of Concern RE communities within and on adjoining sites.

Project-related vegetation clearing will potentially impact one or two VM Act Of Concern REs (RE 7.11.13 and RE 7.11.44) depending on which map is applied; *ie* DNRM (2017a) mapping (**Figure 5**) or NRA revised mapping (**Figure 11**).

- **RE 7.11.13**. Proposed clearing of RE 7.11.13 is minor (**Table 17**) and SRIs will not occur.

[19] Physical separation refers to any clearing that would result in the separation of an otherwise intact area of vegetation (source: DSIP (2014)).

- **RE 7.11.44**.
  - ***Clearing extents***. Proposed clearing of RE 7.11.44 is estimated as 1 ha to 3 ha (**Table 17**) depending on which mapping data is applied. In either case, the estimates are lower than 5 ha and the SRI will not occur.
  - ***Spatial separation***. The proposed access road to the Rainforest Education Centre and Adventure Park has been designed to follow an existing vehicle track (approximately 3 m to 5 m wide). The existing vehicle track has created physical separation between blocks of RE 7.11.44; however, the canopy above the track is touching along most of this area and, from an ecological function perspective, a habitat disjunction does not occur at these points. Vegetation clearing will create separation in the forest canopy.

DSIP (2014) has defined eight exceptions to the above SRI criteria – item (b) of these exceptions is relevant to the SRI determination.

> '*(b) clearing of less than 10% of the total mapped area of 'endangered' or 'of concern' REs intersecting the property boundaries of the project, if total clearing is under 5 ha; and where an equivalent area which can be mapped as endangered or of concern in the future, is rehabilitated through other locations on the subject site*.' (source: DSIP 2014).

From a regulatory perspective, it is understood that remnant vegetation on the project area is defined by the Property Map of Assessable Vegetation (PMAV) (PMAV 2016), which mirrors DNRM (2017a). On this basis, a SRI on Regulated Vegetation can be avoided because the clearing of the Of Concern RE 7.11.44:

- is approximately 1 ha (*ie* <5 ha)
- is approximately 2% (*ie* <10%) of what is available elsewhere on the project area
- >1 ha of RE 7.11.44 regrowth (non-remnant vegetation on the PMAV and DNRM 2017a) exists on the project area and can be protected from development.

On the available information, the potential for SRI on Regulated Vegetation is unlikely.

With respect to T&NT plants, DSIP (2014) and EHP (2014) have SRI criteria relating to NC Act Endangered and Vulnerable plant species. On the available information, SRIs are not anticipated because the Near Threatened Slender Ginger is the only T&NT plant species known to occur within the proposed clearing area, and the proposed clearing extents are relatively minor (**Tables 13** and **17**)[20].

Additional recommended management measures

The following recommendation is provided within the same context, and additional to that, already provided.

Recommendation 43: Protect and restore at least 1 ha of regrowth RE 7.11.44 on the project area. This figure should be reviewed if development plans affecting RE 7.11.44 change. Areas of potential RE 7.11.44 regrowth can be identified using DNRM pre-clearing RE mapping and NRA revised RE mapping (**Figure 11**).

[20] Protected plant surveys may be necessary to satisfy other regulatory requirements, specifically in relation to clearing proposed in the Rainforest Education Centre and Adventure Park, and may be required in the vicinity of the Golf Course, KUR-World Campus, Business and Leisure Hotel and Function Centre, Queenslander Lots and farm-stay accommodation in the Farm Theme Park and Equestrian Centre.

6.1.2 Fauna

Potential core habitat loss for T/NT&M fauna based on the current master plan (**Figure 1**) is shown in **Table 15**. Acceptance of Recommendation 21 will reduce the estimated extent of habitat loss when assessed using NRA revised habitat mapping. The estimated clearing extents using DSITI (2016) mapping are unaffected by this recommendation.

Revised estimates of potential habitat loss (assuming acceptance of Recommendation 21) are shown in **Tables 18** to **20**. **Table 20** also shows the proportion of potential loss when assessed at the local area (*ie* area within 5 km of the project area boundary, including project area) and Kuranda area (as defined by Queensland Government locality mapping) scales. **Table 20** uses NRA revised habitat mapping and shows that potential habitat loss at the local and regional scales is relatively minor. Assessment using DSITI (2016) would result in the same conclusion.

Table 18: Threatened and Near Threatened fauna species known or predicted to occur on the project area, their status, potential core habitat and revised estimated impact area

Core Habitat[B]	Species & Status[A] (NC Act/EPBC Act)	Predicted Occurrence[C]			Revised Estimated Impact Area (ha)[D]	
		Regular / resident	Uncertain	Intermittent	NRA Habitat Mapping[E]	DSITI (2016) Habitat Mapping
MNVF (**Figure 14**)	Kuranda Tree Frog (E/E)	✓			0	N/A
MNVF/NMVF (**Figure 16**)	Tapping Green-eyed Frog (V/-)	✓			50 (14%)	N/A
EOFW	Bare-rumped Sheathtail Bat (E/V)	✓			6 (4%)	1 (1%)
MNVF, NMVF and EOFW	Greater Large-eared Horseshoe Bat (E/V)	✓			77 (13%)	6 (1%)
	Spectacled Flying-fox (V/V)	✓				
	Macleay's Fig-parrot (V/-)	✓				
EOFW	Greater Glider (V/V)		✓		6 (4%)	1 (1%)
	Northern Bettong (E/E)		✓			
	Blue-faced Parrot-finch (NT/-)		✓			
MNVF, NMVF and EOFW	Tube-nosed Insectivorous Bat (V/-)		✓		77 (13%)	6 (1%)
	Semon's Leaf-nosed Bat (E/V)		✓			
	Diadem Leaf-nosed Bat (NT/-)		✓			
MNVF and NMVF	Southern Cassowary (E/E)			✓	70 (17%)	5 (2%)
	Lumholtz's Tree-kangaroo (NT/-)			✓		
MNVF	Australian Lacelid (E/E)			✓	0	N/A
EOFW	Northern Quoll (LC/E)			✓	6 (4%)	1 (1%)
	Red Goshawk (E/V)			✓		
	Grey Falcon (V/-)			✓		
MNVF, NMVF and EOFW	Ghost Bat (E/V)			✓	77 (13%)	6 (1%)

A: Status shown in parenthesis as per Queensland *Nature Conservation Act* 1992 (NC Act) / Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). Categories comprise: Migratory (M), Near Threatened (NT), Vulnerable (V), Endangered (E) and not listed (-).

B: Predicted core habitat for each species on project area. See **Section 4.3.2** for further detail.

C: Predicted occurrence based on published information on species distribution and ecology, and observed conditions on-site. Categories comprise: 'Regular / resident', 'Intermittent' and 'Uncertain'. See **Section 4.3.2** for further detail.

D: Based on direct loss of predicted core habitat according to master plan (**Figure 1**) and acceptance of Recommendation 21 (**Figure 18**). They are estimates because area determinations are based on work that involves the interpretation of aerial photographs that are rectified for use, the delineation of boundaries between vegetation communities may not be precise, and that delineation is defined by a line on a map, the width of which also constitutes a source of imprecision. All areas that are currently forested, including forested areas of non-remnant vegetation, are treated as potential habitat. Area estimates are rounded to the nearest whole number. Proportions shown in parenthesis are the area of habitat lost relative to what currently exists on the project area.

E: NRA habitat mapping treated all forested areas as potential habitat. Specific mapping and decisions rules were used for Kuranda Tree Frog (**Figure 14**) and Tapping Green-eyed Frog (**Figure 16**).

Table 19: Migratory-listed[A] species known or predicted to occur on the project area, their status, potential core habitat and revised estimated impact area

Core Habitat[B]	Species	Predicted Occurrence[C]			Revised Estimated Impact Area (ha)[D]	
		Regular / resident	Uncertain	Intermittent	NRA Habitat Mapping[E]	DSITI (2016) Habitat Mapping
MNVF, NMVF and EOFW	Spectacled Monarch	✓			77 (13%)	6 (1%)
	Black-faced Monarch	✓				
	Rufous Fantail	✓				
Above (airspace) all habitats	White-throated Needletail	✓			Nil	Nil
	Fork-tailed Swift	✓				
EOFW	Oriental Cuckoo			✓	6 (4%)	1 (1%)
All forested habitats	Eastern Osprey			✓	77 (13%)	6 (1%)
Open Pasture	Glossy Ibis			✓	84 (87%)	N/A
Above (airspace) all habitats	Barn Swallow			✓	Nil	Nil

A: Migratory species as listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). These species are listed as Special Least Concern under the Queensland *Nature Conservation Act* 1992 (NC Act).

B: Predicted core habitat for each species on project area. Core habitat does not necessarily encompass the full range of habitats in which a species may occur; for most species on the project area, all forested habitat types will be of some potential value. See **Section 4.3.2** for further detail.

C: Predicted occurrence based on published information on species distribution and ecology, and observed conditions on-site. Categories comprise: 'Regular / resident', 'Intermittent' and 'Uncertain'. See **Section 4.3.2** for further detail.

D: Based on direct loss of predicted core habitat according to master plan (**Figure 1**) and acceptance of Recommendation 21 (**Figure 18**). They are estimates because area determinations are based on work that involves the interpretation of aerial photographs that are rectified for use, the delineation of boundaries between vegetation communities may not be precise, and that delineation is defined by a line on a map, the width of which also constitutes a source of imprecision. All areas that are currently forested, including forested areas of non-remnant vegetation, are treated as potential habitat. Area estimates are rounded to the nearest whole number. Proportions shown in parenthesis are the area of habitat lost relative to what currently exists on the project area.

E: NRA habitat mapping treated all forested areas as potential habitat. Pre-clearing BVG mapping was used to delineate distribution of BVG types.

Table 20: Estimated clearing extents (fauna habitats) and proportion of loss relative to the local and regional (Kuranda area) scales[A]

Core Habitat	Estimated Project-related Woody Vegetation Clearing (ha)	Proportion of Habitat Loss (%)[B]	
		Local Area	Kuranda Area
MNVF (BVG 2)	45	1%	1%
NMVF (BVG 5)	25	1%	2%
EOFW (BVG 9)	6	<1%	<1%
Total	77	1%	1%

A: Area estimates are rounded to the nearest whole number. Values for 'Local Area' and 'Kuranda Area' are based on DNRM (2017a) mapping (forested areas of non-remnant vegetation are excluded from habitat calculations). For the project area, forested areas of non-remnant vegetation are treated as potential habitat (*ie* revised mapping was used). They are estimates because area determinations are based on work that involves the interpretation of aerial photographs that are rectified for use, the delineation of boundaries between vegetation communities may not be precise, and that delineation is defined by a line on a map, the width of which also constitutes a source of imprecision.

B: The 'local area' is the area within 5 km of the project area boundary (including the project area). The 'Kuranda area' is the locality boundary as defined by Queensland Government mapping.

The State (DSIP 2014; EHP 2014) and Commonwealth (DoE 2013) have criteria for assessing the potential for SRI on Threatened species. Many of the criteria are identical or very similar across all three policies. A synopsis of the criteria from the three policies is provided in **Table 21**. The following items are relevant to the interpretation of the criteria.

- All three policies define a 'population' as being an occurrence of the species in a particular area, including but not limited to:
  - a geographically distinct regional population, or collection of local populations, or
  - a population, or collection of local populations, that occurs within a particular bioregion.
- DoE (2013) defines 'habitat critical to the survival of a species'[21] as areas necessary:
  - for activities such as foraging, breeding, roosting, or dispersal
  - for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species, such as pollinators)
  - to maintain genetic diversity and long-term evolutionary development, or
  - for the reintroduction of populations or recovery of the species.
- For EPBC Act Vulnerable species, the DoE (2013) criteria are specific to 'important populations', which are defined as populations necessary for a species' long-term survival and recovery, and may include populations identified as such in recovery plans and/or that are:
  - key source populations either for breeding or dispersal
  - populations that are necessary for maintaining genetic diversity, and/or
  - populations that are near the limit of the species range.

[21] Habitat critical to the survival of a species is sometimes defined in a Recovery Plan or similar instrument maintained by the minister under the EPBC Act.

According to DSIP (2014) and EHP (2014), the criteria (a) to (d) and (h) (**Table 21**) also apply to NC Act Special Least Concern (non-migratory) species. Neither State policy has SRI criteria for Migratory species. DoE (2013) advises that a SRI on a Migratory species is likely when there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a Migratory species. An area of 'important habitat' is defined as:
  - habitat utilised by a Migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
  - habitat that is of critical importance to the species at particular life-cycle stages, and/or
  - habitat utilised by a Migratory species which is at the limit of the species range, and/or
  - habitat within an area where the species is declining
- result in an invasive species that is harmful to the Migratory species becoming established in an area of important habitat for the Migratory species, or
- seriously disrupt the life-cycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a Migratory species. An 'ecologically significant proportion' of the population varies with the species, though should include consideration of the species' population status, genetic distinctiveness and species specific behavioural patterns (*eg* site fidelity and dispersal rates).

Table 21: Significant residual impact criteria for NC Act and EPBC Act Threatened[A] species

Significant Residual Impact Criteria[B]	DSIP 2014	EHP 2014	DoE 2013	Comments
An action is likely to have a SRI on a species or its habitat if there is a real chance or possibility that it will:				
a. Lead to a long-term decrease in the size of a population.	✓	✓	✓	DSIP (2014) and EHP (2014) specify 'local population'.
b. Reduce the area of occupancy (AOO) or extent of occurrence (EOO) of the species.	✓	✓	✓	DSIP (2014) and EHP (2014) specific to 'EOO'. DoE (2013) specific to 'AOO'.
c. Fragment an existing population into two or more populations.	✓	✓	✓	State policies use slightly different terminology to Commonwealth policy.
d. Result in genetically distinct populations forming as a result of habitat isolation	✓	✓	x	State policies use slightly different terminology to each other.
e. Result in invasive species that are harmful to a threatened species becoming established in the threatened species' habitat.	✓	✓	✓	Invasive species can be non-native species or translocated native species that are harmful to the threatened species.
f. Introduce disease that may cause the species or population to decline.	✓	✓	✓	DoE (2013) specific to 'species'. DSIP (2014) and EHP (2014) specific to 'population'.

Significant Residual Impact Criteria[B]	DSIP 2014	EHP 2014	DoE 2013	Comments
g. Interfere with the recovery of the species.	✓	✓	✓	Criterion consistent across all three policies.
h. Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	✓	✓	x	This criterion for DSIP (2014) and EHP (2014) is similar in intent to DoE (2013) criteria (i) to (j) below.
i. Adversely affect habitat critical to the survival of a species.	x	x	✓	See comment against criterion (h).
j. Disrupt the breeding cycle of a population.	x	x	✓	
k. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	x	x	✓	

A: Threatened species as defined under the Queensland *Nature Conservation Act 1992* (NC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). Categories across both Acts comprise Vulnerable (V) and Endangered (E). The EPBC Act also includes the category Critically Endangered (CE).

B: The SRI criteria are an approximation of what is stated in the three policy documents (*ie* DSIP 2014, EHP 2014 and DoE 2013). The source policy documents should be consulted for precise accounts.

SRIs are not anticipated for the following fauna.

- DSIP (2014) and EHP (2014) only consider the potential for SRI on Threatened and Special Least Concern (non-migratory) species. On this basis, the potential for SRI on the following Near Threatened fauna is not considered further. These species comprise: Blue-faced Parrot-finch, Diadem Leaf-nosed Bat and Lumholtz's Tree-kangaroo.
- The fauna species least vulnerable to the potential threats of the project are those predicted to have an intermittent occurrence on the project area, and whose core habitats or areas of activity are likely to be remote to the main area of potential impacts (considering direct and indirect threats). These species comprise: White-throated Needletail, Fork-tailed Swift, Greater Glider, Northern Bettong, Northern Quoll, Red Goshawk, Grey Falcon, Ghost Bat, Oriental Cuckoo and Barn Swallow.
- SRIs on Migratory fauna are not anticipated based on consideration of DoE (2013) SRI criteria. The project area may occasionally, and temporarily, support ecologically significant proportions of White-throated Needletail, Fork-tailed Swift and Spectacled Monarch populations; however, their habitats are unlikely to be substantially modified by the proposed action. The management of biosecurity items (*ie* Tramp Ants) is of critical importance for avoiding the potential for SRI on the Spectacled Monarch.

For the remaining Threatened fauna (hereafter 'priority Threatened fauna'), the extents and relative proportion of potential core habitat loss are either minor (**Tables 18** and **19**), or are mostly affecting habitats dominated by regrowth vegetation (*ie* not optimal or climax condition states). Potential core habitat loss is minor or nil for Kuranda Tree Frog, Australian Lacelid and Bare-rumped Sheathtail Bat. Habitat loss predominantly relates to regrowth vegetation[22] for Tapping Green-eyed Tree Frog, Greater Large-eared Horseshoe Bat, Spectacled Flying Fox, Macleay's Fig-parrot, Tube-nosed Insectivorous Bat and Southern Cassowary. With the exception of Tapping Green-eyed Tree Frog, this habitat loss is unlikely to have significant impacts on populations of these species at the site, local or regional scales. This habitat loss will reduce the Tapping Green-eyed Tree Frog population

[22] This explains the large differences in estimated clearing extents derived from NRA habitat mapping compared with DSITI (2016) habitat (*ie* BVG) mapping (**Table 18**).

at the site scale, though the loss is unlikely to be significant at the local or regional population scales. Further, the magnitude of impact on all of the above species (including Tapping Green-eyed Tree Frog[23]) will be reduced by Recommendation 22 (habitat restoration as shown on **Figure 18**). SRI on the above-described species as a consequence of habitat loss is unlikely.

The likelihood of SRIs on most priority Threatened fauna as a consequence of indirect threats is low if the recommendations in **Section 5.3.3** are implemented; however, for a few species, the risk for SRI is less clear due to the following.

- While the recommended mitigation measures will reduce the potential magnitude of impact, a residual impact will remain. This is applicable to most species though certain fauna populations will be more sensitive (*eg* species with small populations).
- Given the size, complexity and duration of the project it is possible that certain aspects of management will fail at some time, or unforeseen eventualities may occur. This is applicable to most species though certain fauna populations will be more sensitive (*eg* species with small populations).

The issues described in the above points are relevant to assessing the potential for SRI and are discussed below.

- The performance outcomes recommended in **Section 5.3.3**, with respect to water quality, are for no adverse change in the aquatic receiving environment as a consequence of development (construction and operation). This performance outcome was set because significant receptors occur in the receiving environment (notably Threatened frogs). The species most at risk are the Kuranda Tree Frog and Tapping Green-eyed Frog. The Australian Lacelid is also within the downstream receiving environment, though is less vulnerable due to the population being remote from the potential pollution source. Although these frogs are sensitive to pollution, species-specific thresholds for impacts do not exist. Maintaining the status quo with respect to water quality is therefore the only option for avoiding impacts. This advice was factored into project designs for stormwater and wastewater treatment systems. The fact that Threatened stream-dwelling frogs occur along Jum Rum Creek, the receiving environment for the Kuranda township, indicates these species can exist near urban environments. In practice, it is not possible to achieve conformity with standards all the time; for example, unplanned events or extreme events occur. The Kuranda Tree Frog is the most sensitive to potential impacts because it is present in the direct receiving environment and its population is small.
- Biosecurity incursions or proliferation can require substantial investment and commitment to prevent, and greater investment and commitment to contain or eradicate incursions. Even when best practice is operating, a residual threat is likely to persist. Yellow Crazy Ants are of particular concern because they are present in Kuranda, there are numerous potential pathways for incursions into the project area (construction and operation), and their impacts can be devastating. Serious incursions of Yellow Crazy Ants have the potential to impact all Threatened fauna species, though particularly ground-dwelling species such as the Kuranda Tree Frog, Tapping Green-eyed Frog and Southern Cassowary. The magnitude of any potential impact will be commensurate with the spatial and temporal scale of the incursion, and the location of the incursion relative to core habitats for the Threatened species of interest.

[23] Residual habitat loss for Tapping Green-eyed Frog following implementation of Recommendations 21 (habitat retention) and 22 (habitat restoration) is approximately 38 ha, which is 10% of the species' habitat available on the project area.

- The proposed access roads via Myola Road and Mount Haren Road will traverse forested habitats known to support Threatened fauna and introduce the risk of vehicle strike to fauna populations in these areas. Careful planning and design can greatly reduce the risk of fauna being killed or harmed by vehicle strike; however, a residual threat is likely to remain. For most species, the potential residual impact at the population level is likely to be sustainable. The residual impact is of concern for the Southern Cassowary because the local population is apparently small, and therefore sensitive to additional threats. There is opportunity to offset this impact by implementing a wild dog control program, though the degree to which this may offset project-related threats is uncertain.

The potential for SRI on the Kuranda Tree Frog, Tapping Green-eyed Frog, Australian Lacelid and Southern Cassowary is assessed as follows. All project-related threats are considered.

- **Kuranda Tree Frog**. There is uncertainty about potential residual impacts in relation to the management of water quality and biosecurity. The scale, complexity and duration of the project contribute to uncertainty. Knowledge gaps in the ecology of the species contribute to uncertainty. The plausible worst-case scenario is that impacts that are serious at the project area, local area and regional scales may occur; under this scenario, a SRI is likely (SRI Criteria (a), (b)[24], (e), (i) and (k); **Table 21**). The plausible best-case scenario is that impacts that are serious at the project area, local area and regional scales do not occur; under this scenario, a SRI is unlikely.
- **Tapping Green-eyed Frog**[25]. There is uncertainty about potential residual impacts in relation to the management of water quality and biosecurity (as per Kuranda Tree Frog), and project-related habitat loss will occur; however, serious impacts at the local or regional population scales are unlikely. A SRI is unlikely.
- **Australian Lacelid**. There is uncertainty about potential residual impacts in relation to the management of water quality and biosecurity (as per Kuranda Tree Frog); however, the species is remote from the area most likely to be impacted upon. A SRI is unlikely.
- **Southern Cassowary**. Residual impacts in the form of habitat loss, vehicle strike and biosecurity exist. These residual impacts may interfere with the recovery of the local population. Wild dog control will offset residual impacts; however, the degree to which wild dog control will reduce overall impacts is uncertain. It is uncertain because it is not possible to predict the residual project-related impacts at the population scale or predict the degree to which the population would benefit from wild dog control. The plausible worst-case scenario is that residual impacts remain after wild dog control; under this scenario, a SRI is likely (SRI Criterion (g); **Table 21**). The plausible best-case scenario is that wild dog control effectively mitigates project-related impacts and that the project does not inhibit the recovery of the Southern Cassowary population; under this scenario, a SRI is unlikely.

Additional recommended management measures

The following recommendation is provided within the same context, and additional to that, already provided.

[24] Specific to AOO (DoE 2013). Reduction in EOO (DSIP 2014 and EHP 2014) is unlikely.

[25] Tapping Green-eyed Frog is not a Threatened species under the EPBC Act, and therefore DoE (2013) does not apply.

Recommendation 44: The project-specific biosecurity management plan (*see* Recommendation 6) should include wild dog control. The management methods should consider potential non-target impacts, especially if toxic baiting is considered (*see* Recommendation 33). The purpose and effectiveness of wild dog control should be reviewed regularly.

6.1.3 Biosecurity

The potential for SRIs in relation to biosecurity matters is addressed in **Section 6.1.2**.

6.1.4 Landscape integrity values

DSIP (2014) and EHP (2014) have criteria for determining the likelihood for SRI in relation to connectivity. The considerations are specific to physical habitat loss and fragmentation; indirect threats are not considered. Given the relatively small extent of habitat loss, a SRI with respect to loss of connectivity is not anticipated. Key to avoiding SRI is the proposed retention of approximately 500 ha of habitat in the Environmental Area (equates to approximately 74% of the project area). This habitat predominantly occurs in the western portion of the Kuranda-Myola-Kowrowa rainforest corridor (**Figure 13**) which is a potentially significant corridor for a variety of wildlife.

6.2 Legislative considerations – actions relevant to flora and fauna that may require authority

As per TOR item 11.16(g), identified below are the actions relevant to flora and fauna and that may require authorisation under the NC Act and *Water Act* 2000 and/or would be assessable development for the purposes of the VM Act or *Environmental Protection Act* 1994.

6.2.1 Queensland Nature Conservation Act 1992 (NC Act)

Authorisations or permits under the NC Act that may be required are described below.

- A clearing permit under the NC Act will be required if the Near Threatened Slender Ginger in the north-east of the project area falls within the final clearing footprint. The need for a permit should be reviewed once final clearing plans are available.
- Protected Plant Surveys in accordance with the Protected Plant Survey Guidelines (EHP 2016c) across large parts of the property were completed by Astrebla (2015) (**Figure 6**). Similar surveys are necessary in relation to clearing proposed in the Rainforest Education Centre and Adventure Park, and may be required in the vicinity of the Golf Course, KUR-World Campus, Business and Leisure Hotel and Function Centre, Queenslander Lots and farm-stay accommodation in the Farm Theme Park and Equestrian Centre. If Protected Plants are found in the 'clearing impact area' then a clearing permit under the NC Act will be required.
- Approval is required to tamper with the breeding places of native fauna. The need for a permit should be reviewed once final clearing plans are available, or if in the course of construction, a fauna breeding place is encountered in the proposed disturbance area. Approval may be subject to the preparation of a Species Management Program (SMP).

6.2.2 Queensland Water Act 2000

A Riverine Protection Permit (RPP) may be required if the proposed works require excavation of, or placement of fill in, a watercourse. Watercourses as defined by the *Water Act* 2000 occur outside the proposed development footprint and on this basis the need for a

RPP appears unlikely. This assessment should be reviewed when detailed development plans are available.

6.2.3 Queensland Vegetation Management Act 1999

The clearing of remnant vegetation will occur as part of the project, and this clearing will likely require assessment under the VM Act. It is understood that the clearing of native vegetation would be assessed pursuant to State Code 16[26] with reference to provisions for Material Change of Use/Reconfiguration of a Lot, specifically Table 16.2.2 (PO 1-4) and Table 16.2.3 (PO 7, 11, 16, 20, 22-24, and 27). Further, the 'Property Map of Assessable Vegetation' (PMAV 2016), consistent with DNRM (2017a) mapping, defines the area of remnant vegetation as assessable under the Code.

The proposed project design may not directly satisfy the Acceptable Outcomes (AOs) with regard to PO 23 (VM Act Of Concern RE 7.11.44) and PO 24 (Essential Habitat for Southern Cassowary). These impacts relate to clearing (approximately 1 ha) necessary to build and maintain a 15 m wide access road that connects the Rainforest Education Centre and Adventure Park to precincts in the north. The AOs defined in the Code for PO 23 are the same as that defined for PO 26 (*ie* clearing to 10 m wide and to 0.5 ha in area). Where potential clearing cannot be avoided, and potential clearing has been reasonably minimised, AO 23.2 and AO 24.4 consider offsets for acceptable residual impacts. According to criteria in DSIP (2014), a SRI on Essential Habitat is unlikely because the proposed clearing will not result in >10% permanent reduction in the extent of Essential Habitat mapped on site. As described in **Section 6.1.1** (this report), a SRI on RE 7.11.44 can be avoided if 1 ha of RE 7.11.44 regrowth vegetation on the property is protected from development and restored (Recommendation 43, this report). According to DSIP (2014), this avoids a SRI because the proposed clearing is under 5 ha, is <10% of the total mapped area of RE 7.11.44 intersecting the project area, and the area proposed for rehabilitation/restoration is equivalent to the impact area.

[26] Dated 1 August 2016 (source: http://www.dilgp.qld.gov.au/resources/policy/sdap/v2-1/state-code-16.pdf; accessed 20 October 2017).

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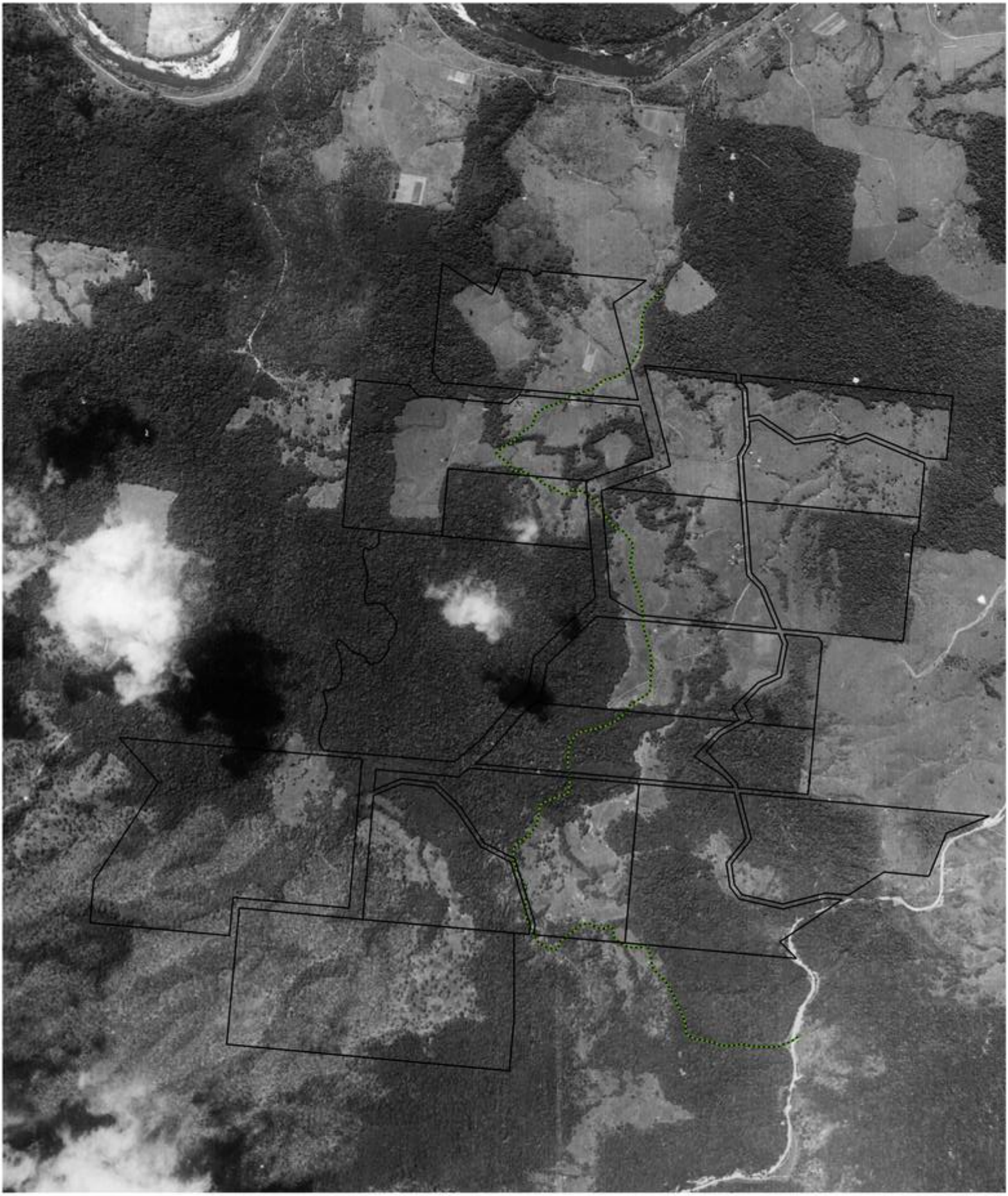
Appendix A:
Historical Aerial Photography



Reevers and Ocean - Myola landholdings - 1942 aerial image

250 0 250 500 750 1000 m

Legend

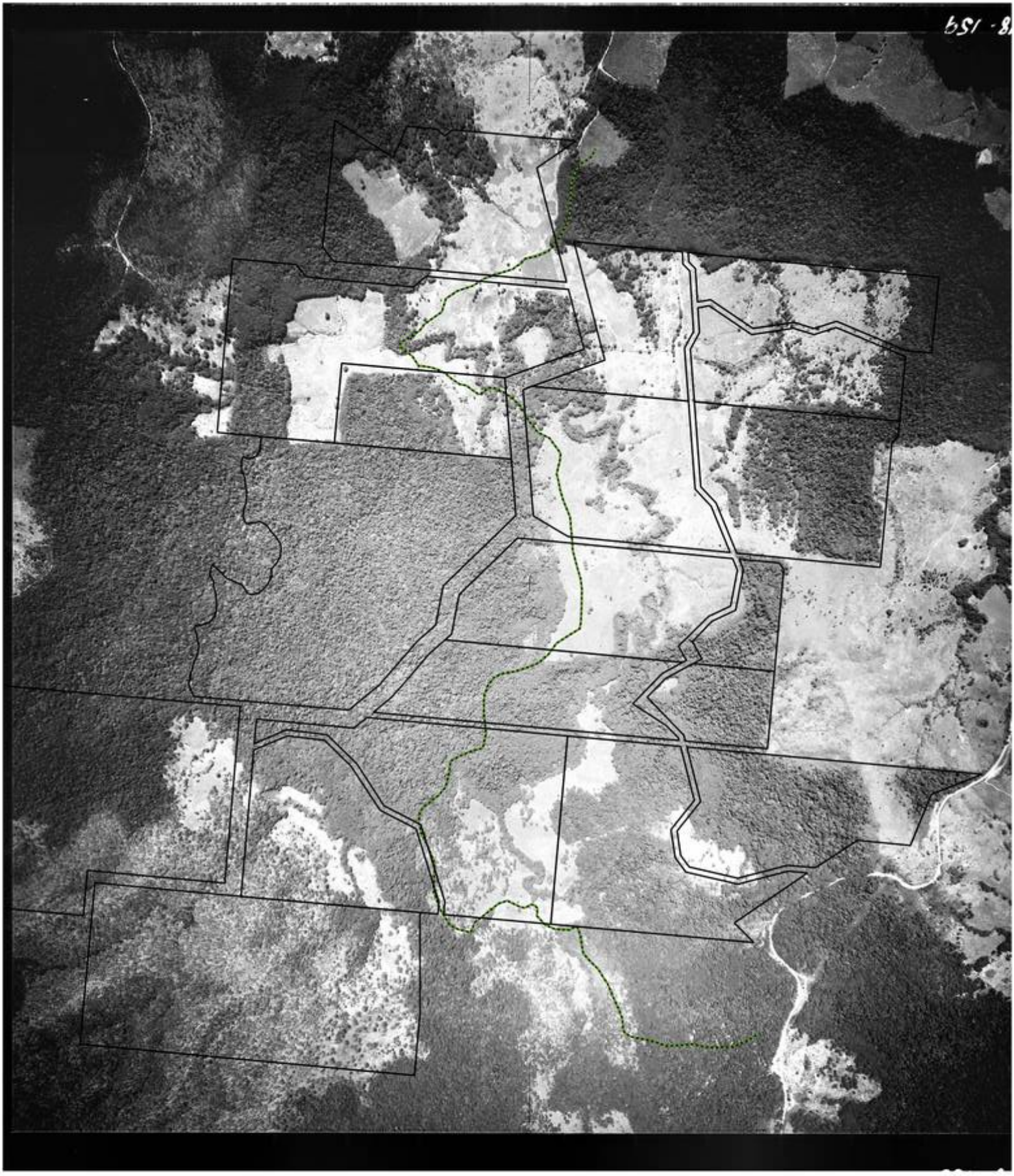
- Myola Project Lots
- Main north-south track

N

Imagery: QAP1694_16 run 2, 8064 CAIRNS 42 PROGRAM AERIAL PHOTOGRAPHY. Produced at 1:39,800. This image reproduced at 1:10,000 when printed at A3.

GIS operator Simon Danielsen, Astrebla Ecological Services. 20/10/15.

Prepared by ASTREBLA ECOLOGICAL SERVICES



Reevers and Ocean - Myola landholdings - 1951 aerial

250 0 250 500 750 1000 m

Legend

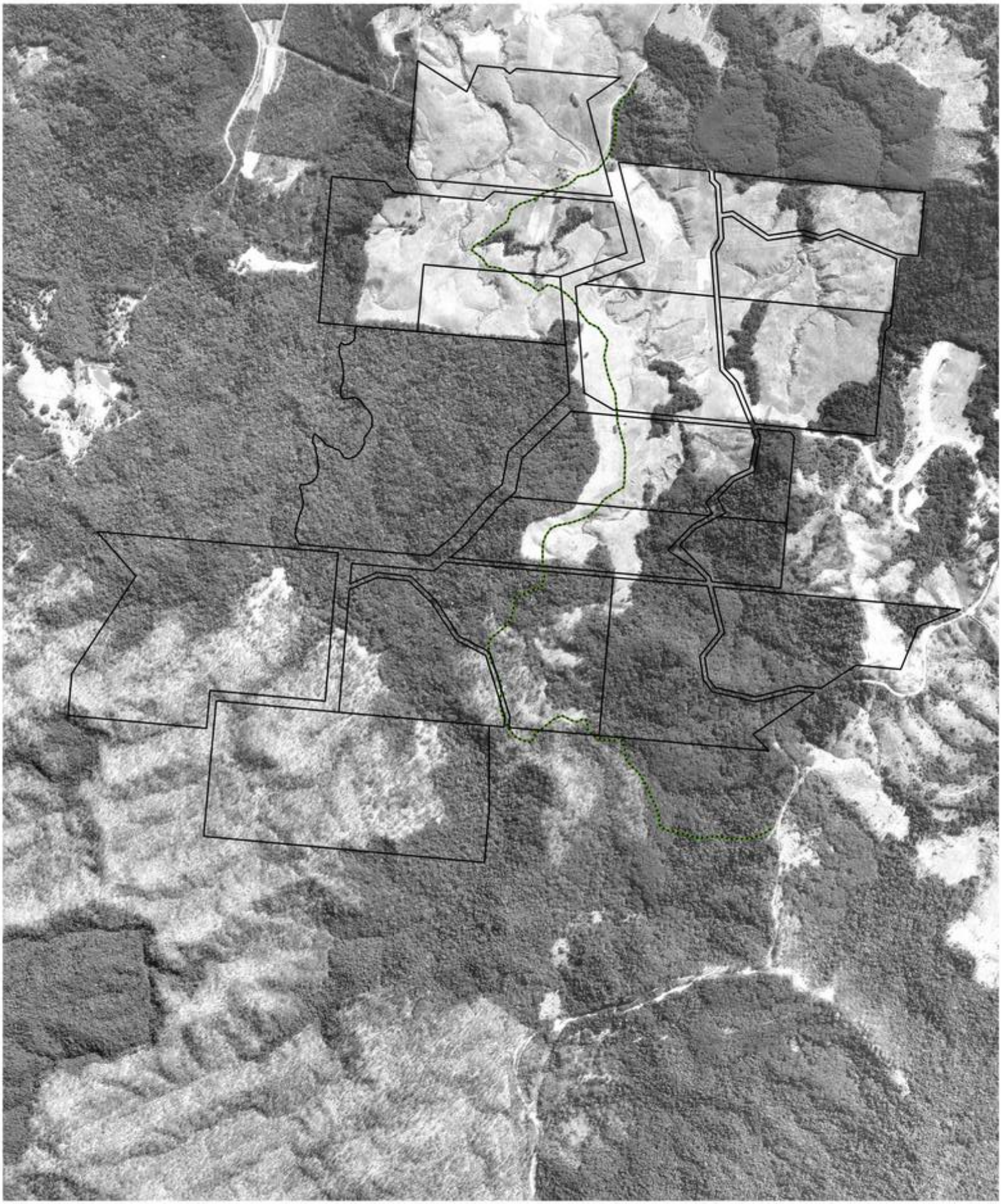
- Myola Project Lots
- Main north-south track

N

Imagery: QAP0178_159 run 4, 8064 SOUTHEDGE-CLOHESY 51 PROGRAM AERIAL PHOTOGRAPHY. Produced at 1:25,400. This image reproduced at 1:8,500 when printed at A3.

GIS operator Simon Danielsen, Astrebla Ecological Services, 20/10/15.

Prepared by ASTREBLA ECOLOGICAL SERVICES



Reevers and Ocean's Myola landholdings - 1965 aerial image

250 0 250 500 750 1000 m

Legend

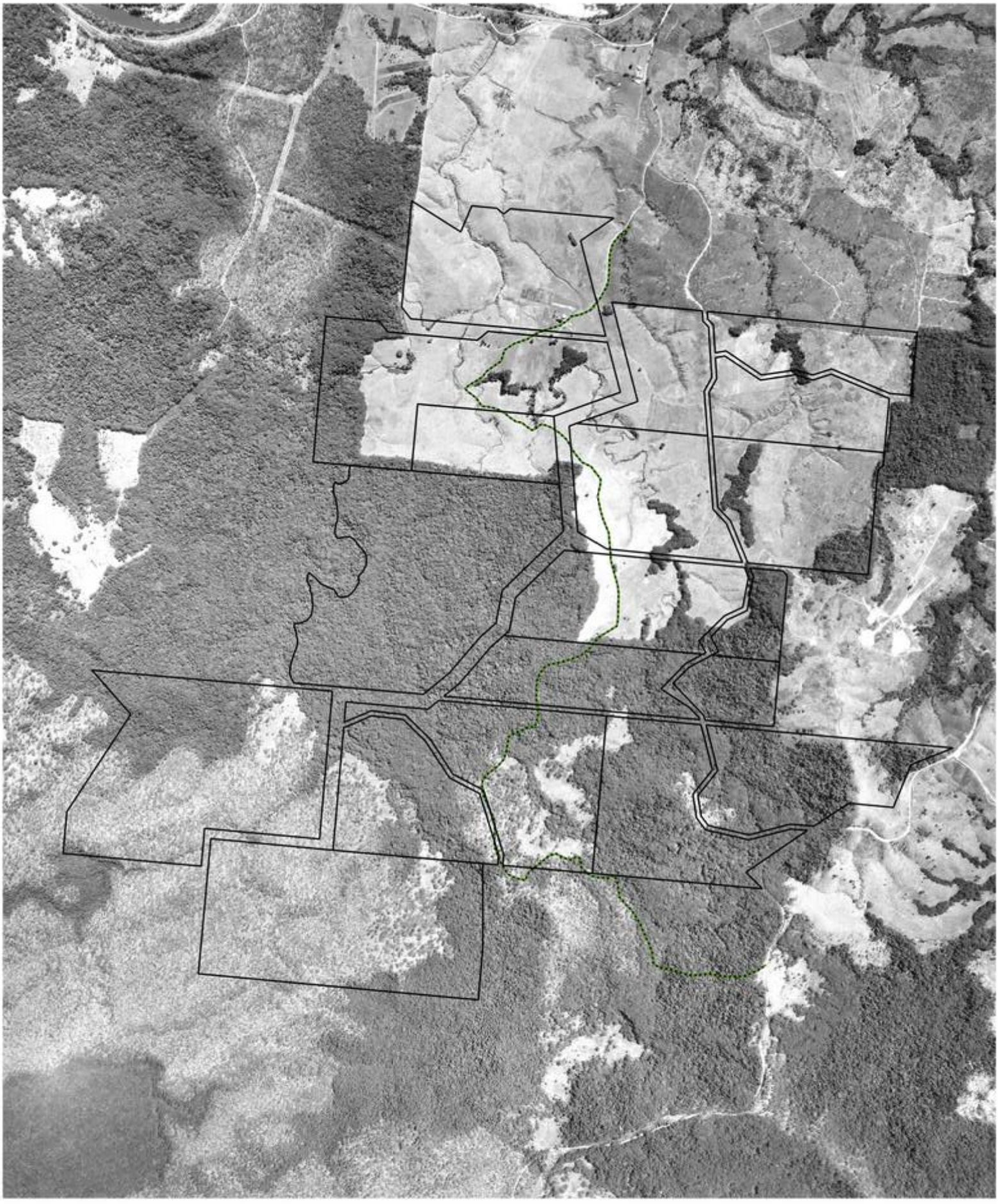
- Myola Project Lots
- Main north-south track

N

Imagery: QAP1656_12 run 3, 8064 CAIRNS 65 PROGRAM AERIAL PHOTOGRAPHY. Produced at 1:23,900. This image reproduced at 1:10,000 when printed at A3.

GIS operator Simon Danielsen, Astrebla Ecological Services, 20/10/15.

Prepared by ASTREBLA ECOLOGICAL SERVICES



Reevers and Ocean - Myola landholdings - 1971 aerial image

250 0 250 500 750 1000 m

Legend

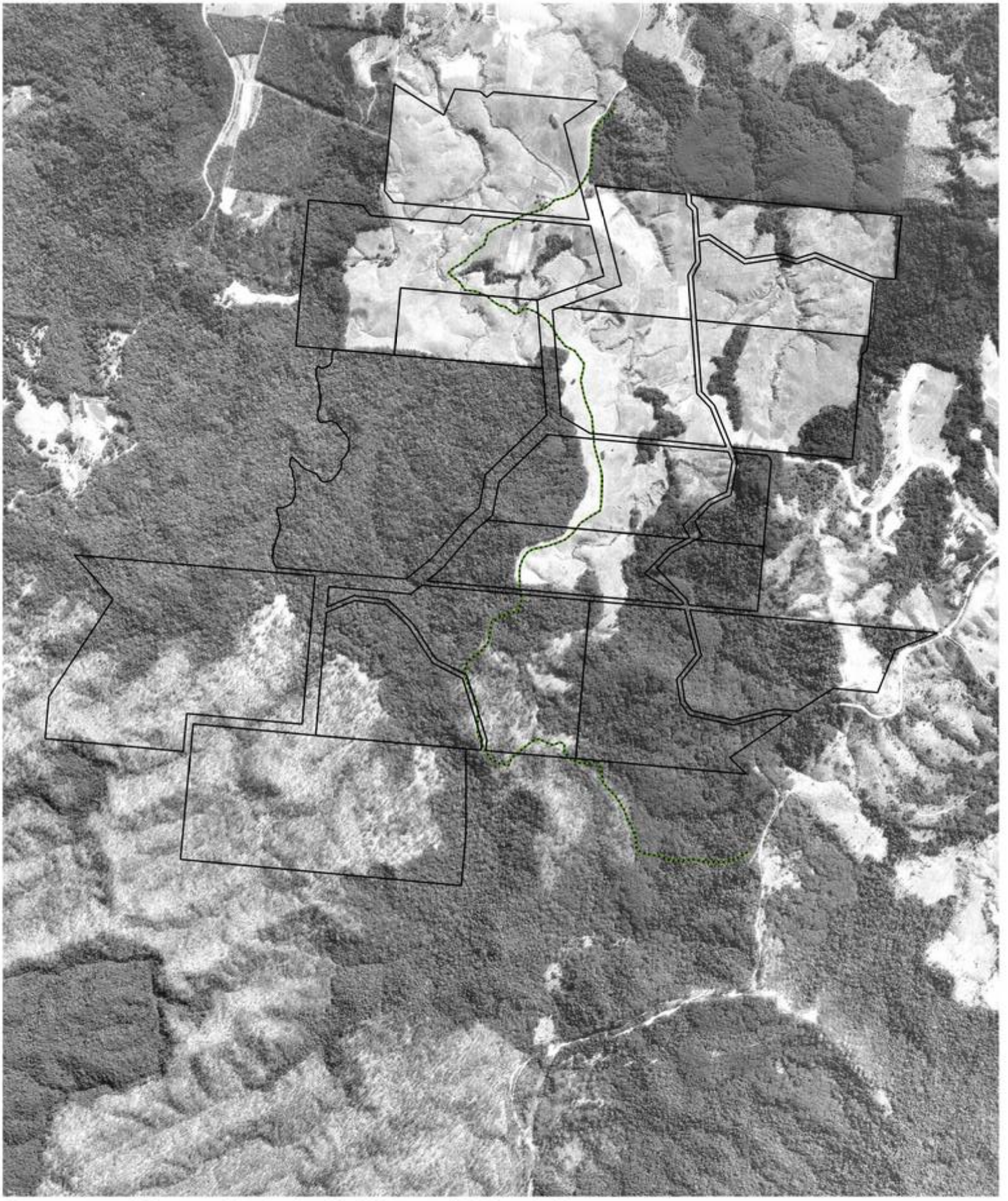
- Myola Project Lots
- Main north-south track

N

Imagery: QAP2340_105 run 3, 8064 CAIRNS 71 PROGRAM AERIAL PHOTOGRAPHY. Produced at 1:24,000. This image reproduced at 1:10,000 when printed at A3.

GIS operator Simon Danielsen, Astrebla Ecological Services, 20/10/15.

Prepared by ASTREBLA ECOLOGICAL SERVICES



Reevers and Ocean - Myola landholdings - 1982 aerial image

250 0 250 500 750 1000 m

Legend

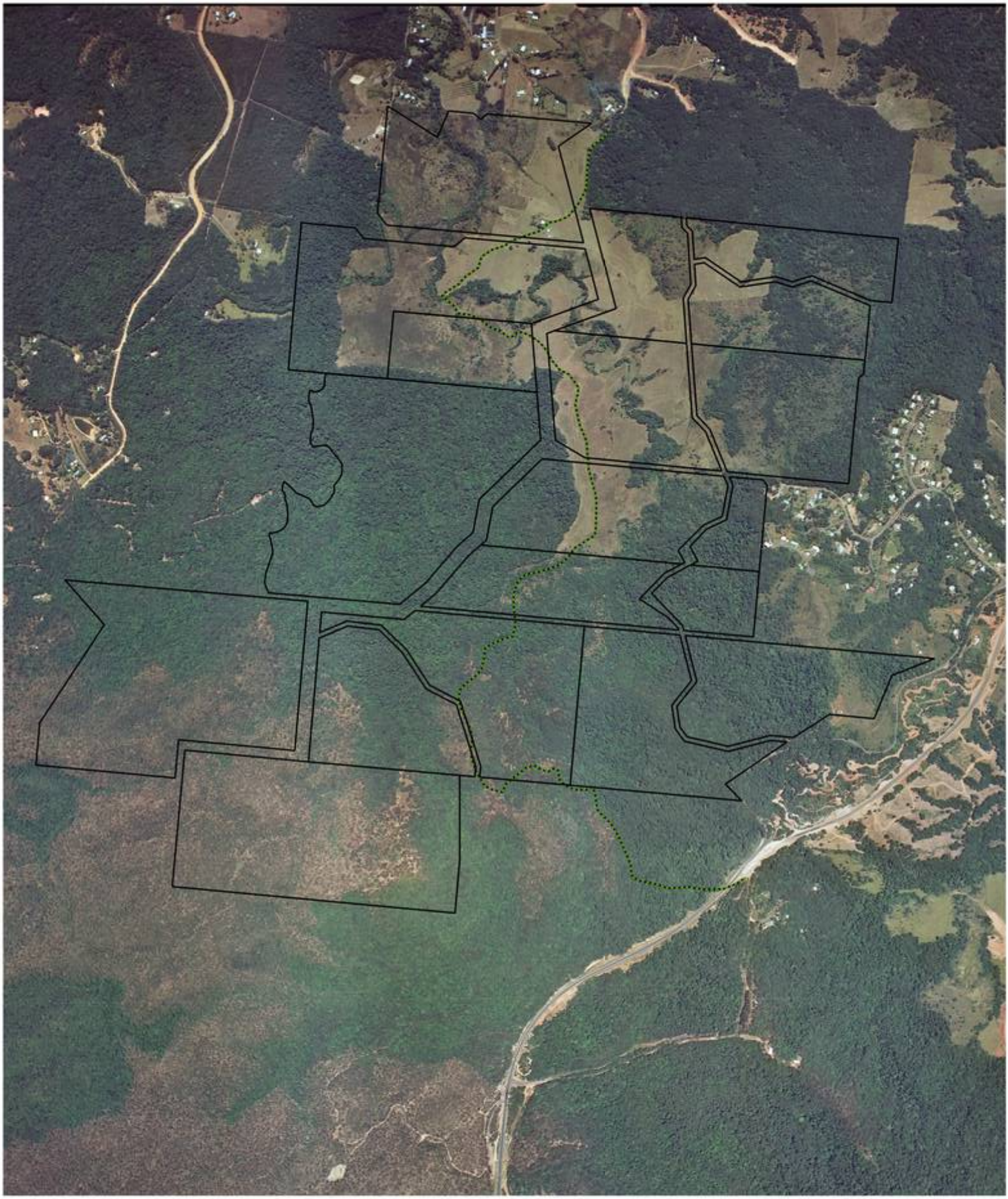
- Myola Project Lots
- Main north-south track

N

Imagery: QAP4091_6725 run 2, 8064 CAIRNS 82 PROGRAM AERIAL PHOTOGRAPHY. Produced at 1:37,500. This image reproduced at 1:10,000 when printed at A3.

GIS operator Simon Danielsen, Astrebla Ecological Services, 20/10/15.

Prepared by ASTREBLA ECOLOGICAL SERVICES



Reevers and Ocean - Myola landholdings - 1994 aerial image

250 0 250 500 750 1000 m

Legend

- Myola Project Lots
- Main north-south track

N

Imagery: QAP5331_201 run 10, 8064 CAIRNS 94 PROGRAM AERIAL PHOTOGRAPHY. Produced at 1:25,000. This image reproduced at 1:10,000 when printed at A3.

Mareeba Shire DCDB © State of Queensland (Department of Natural Resources and Mines) [2015]

GIS operator Simon Danielsen, Astrebla Ecological Services, 20/10/15.

Prepared by ASTREBLA ECOLOGICAL SERVICES

JANUARY 2013

Owen Creek
BARNWELL ROAD
Cain Creek
Tributary of Warril Creek
Haren Creek
Owen Creek
Warril Creek
PUNCH CLOSE
WARRIL DRIVE

OCTOBER 2016

Barnwell Property
Vegetation clearing 2013 - 2016
including clean-up of paddocks
2013 (51.58 ha)
2016 (45.91 ha)

Owen Creek
BARNWELL ROAD
Cain Creek
Tributary of Warril Creek
Haren Creek
Owen Creek
Warril Creek
PUNCH CLOSE
WARRIL DRIVE

NRA
Environmental Approval & Compliance Solutions
www.natres.com.au

PROJECT: KUR-World Flora and Fauna Technical Report
TITLE: Appendix A

JOB NO: 424101
DATE: October 2017

N

SOURCE:
© State of Queensland (Department of Natural Resources and Mines) 2017.
Updated data available at http://qldspatial.information.qld.gov.au/catalogue/
Google Earth
File Path: T:_AAA\424\WOR\424152\424101_ClearingComparison_161116.mxd

0 250 500
Metres

Appendix A

Recommended print size: A3

Appendix B:
EPBC Act Protected Matters Report

Australian Government
Department of the Environment and Energy

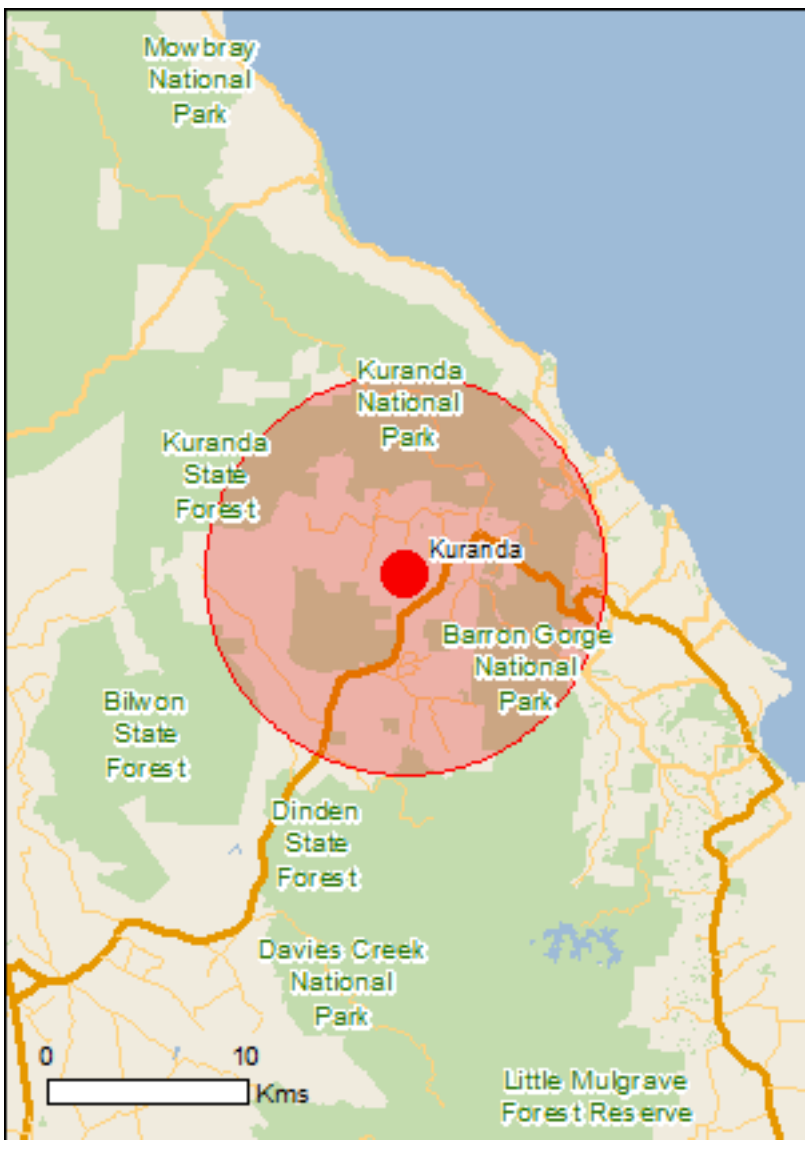
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

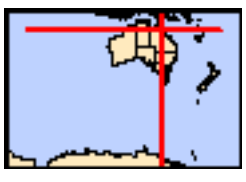
Report created: 17/01/17 10:27:49



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	2
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	50
Listed Migratory Species:	22

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	27
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	8
Regional Forest Agreements:	None
Invasive Species:	32
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Status
Wet Tropics of Queensland	QLD	Declared property

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
Wet Tropics of Queensland	QLD	Listed place
Indigenous		
Wet Tropics World Heritage Area (Indigenous Values)	QLD	Within listed place

Listed Threatened Ecological Communities		[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Broad leaf tea-tree (Melaleuca viridiflora) woodlands in high rainfall coastal north Queensland	Endangered	Community may occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Casuarius casuarius johnsonii		
Southern Cassowary, Australian Cassowary, Double-wattled Cassowary [25986]	Endangered	Species or species habitat known to occur within area
Erythrotriorchis radiatus		
Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri		
Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri		
Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli		
Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
Fish		

Name	Status	Type of Presence
Melanotaenia eachamensis		
Lake Eacham Rainbowfish [26185]	Endangered	Species or species habitat may occur within area
Frogs		
Litoria dayi		
Australian Lace-lid, Lace-eyed Tree Frog [86707]	Endangered	Species or species habitat known to occur within area
Litoria myola		
Kuranda Tree Frog [82063]	Endangered	Species or species habitat known to occur within area
Litoria nannotis		
Waterfall Frog, Torrent Tree Frog [1817]	Endangered	Species or species habitat known to occur within area
Litoria nyakalensis		
Mountain Mistfrog [1820]	Critically Endangered	Species or species habitat likely to occur within area
Litoria rheocola		
Common Mistfrog [1802]	Endangered	Species or species habitat known to occur within area
Mammals		
Bettongia tropica		
Northern Bettong [214]	Endangered	Species or species habitat likely to occur within area
Dasyurus hallucatus		
Northern Quoll, Digul [331]	Endangered	Species or species habitat known to occur within area
Dasyurus maculatus gracilis		
Spotted-tailed Quoll (North Queensland), Yarri [64475]	Endangered	Species or species habitat likely to occur within area
Hipposideros semoni		
Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat [180]	Vulnerable	Species or species habitat may occur within area
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Mesembriomys gouldii rattoides		
Black-footed Tree-rat (north Queensland), Shaggy Rabbit-rat [87620]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat may occur within area
Pteropus conspicillatus		
Spectacled Flying-fox [185]	Vulnerable	Species or species habitat known to occur within area
Rhinolophus robertsi		
Large-eared Horseshoe Bat, Greater Large-eared Horseshoe Bat [87639]	Vulnerable	Species or species habitat known to occur within area
Saccolaimus saccolaimus nudicluniatus		
Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides		
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Plants		
[Alloxylon flammeum](#) Red Silky Oak, Queensland Waratah, Tree Waratah [56400]	Vulnerable	Species or species habitat likely to occur within area
[Archontophoenix myolensis](#) Myola Palm, Myola Archontophoenix [64500]	Endangered	Species or species habitat known to occur within area
[Cajanus mareebensis](#) [8635]	Endangered	Species or species habitat known to occur within area
[Canarium acutifolium](#) [23956]	Vulnerable	Species or species habitat likely to occur within area
[Carronia pedicellata](#) [24178]	Endangered	Species or species habitat may occur within area
[Dendrobium bigibbum](#) Cooktown Orchid [10306]	Vulnerable	Species or species habitat may occur within area
[Dendrobium mirbelianum](#) Dark-stemmed Antler Orchid, Mangrove Orchid [14310]	Endangered	Species or species habitat may occur within area
[Dichanthium setosum](#) bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
[Diplazium cordifolium](#) [15585]	Vulnerable	Species or species habitat likely to occur within area
[Diplazium pallidum](#) [12764]	Endangered	Species or species habitat known to occur within area
[Myrmecodia beccarii](#) Ant Plant [11852]	Vulnerable	Species or species habitat likely to occur within area
[Phaius australis](#) Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
[Phaius pictus](#) [22564]	Vulnerable	Species or species habitat likely to occur within area
[Phalaenopsis amabilis subsp. rosenstromii](#) Native Moth Orchid [87535]	Endangered	Species or species habitat likely to occur within area
[Phlegmariurus filiformis](#) Rat's Tail Tassel-fern [86551]	Endangered	Species or species habitat likely to occur within area
[Phlegmariurus tetrastichoides](#) Square Tassel Fern [86555]	Vulnerable	Species or species habitat likely to occur within area
[Polyphlebium endlicherianum](#) Middle Filmy Fern [87494]	Endangered	Species or species habitat likely to occur within area
[Polyscias bellendenkerensis](#) [7237]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Sauropus macranthus [13189]	Vulnerable	Species or species habitat likely to occur within area
Syzygium hodgkinsoniae Smooth-bark Rose Apple, Red Lilly Pilly [3539]	Vulnerable	Species or species habitat likely to occur within area
Vappodes lithocola Dwarf Butterfly Orchid, Cooktown Orchid [78893]	Endangered	Species or species habitat may occur within area
Vappodes phalaenopsis Cooktown Orchid [78894]	Vulnerable	Species or species habitat may occur within area
Zeuxine polygonoides Velvet Jewel Orchid [46794]	Vulnerable	Species or species habitat likely to occur within area
Sharks		
Pristis pristis Largetooth Sawfish, Freshwater Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Migratory Marine Species		
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Pristis pristis Largetooth Sawfish, Freshwater Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Monarcha frater Black-winged Monarch [607]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Anous stolidus Common Noddy [825]		Species or species habitat known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha frater Black-winged Monarch [607]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna albifrons		
Little Tern [813]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Reptiles		
Crocodylus porosus		
Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Barron Gorge	QLD
Dinden	QLD
Jumrum Creek	QLD
Kamerunga	QLD
Kuranda	QLD
Myola Palm	QLD
Smithfield	QLD
Speewah	QLD

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata		
Nutmeg Mannikin [399]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Annona glabra Pond Apple, Pond-apple Tree, Alligator Apple, Bullock's Heart, Cherimoya, Monkey Apple, Bobwood, Corkwood [6311]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

Name	Status	Type of Presence
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Lepidodactylus lugubris Mourning Gecko [1712]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-16.8306 145.6032

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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Please feel free to provide feedback via the Contact Us page.

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Appendix C:
Wildlife Online and Atlas of Living Australia Flora Database Search Results

Wildlife Online and Atlas of Living Australia Flora Database Search Results

Family	Species	Common Name	Exotic	NC Act	EPBC Act	Wildlife Online	ALA	PMST
Acanthaceae	*Asystasia gangetica* subsp. *gangetica*		Y			X		
Acanthaceae	*Brillantaisia lamium*		Y			X		
Acanthaceae	*Brunoniella australis*	Blue Trumpet		C		X		
Acanthaceae	*Eranthemum pulchellum*		Y			X		
Acanthaceae	*Graptophyllum spinigerum*			C		X		
Acanthaceae	*Harnieria hygrophiloides*	White Karambal		C		X		
Acanthaceae	*Hypoestes phyllostachya*		Y			X		
Acanthaceae	*Justicia betonica*		Y			X		
Acanthaceae	*Odontonema tubaeforme*		Y			X		
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower		C		X	X	
Acanthaceae	*Ruellia blechum*		Y			X		
Acanthaceae	*Ruellia simplex*		Y			X		
Acanthaceae	*Ruellia tuberosa*		Y			X		
Acanthaceae	*Sanchezia parvibracteata*		Y			X		
Acanthaceae	*Stephanophysum longifolium*		Y			X		
Acanthaceae	*Thunbergia fragrans*		Y			X		
Acanthaceae	*Thunbergia grandiflora*	Sky Flower	Y			X		
Actinidiaceae	*Saurauia andreana*			C		X		
Adiantaceae	*Adiantum atroviride*			C		X		
Adiantaceae	*Adiantum diaphanum*			C		X	X	
Adiantaceae	*Adiantum hispidulum* var. *hispidulum*			C		X		
Adiantaceae	*Adiantum philippense*			C		X		
Adiantaceae	*Pityrogramma calomelanos* var. *calomelanos*		Y			X	X	
Adiantaceae	*Taenitis pinnata*	Morse Fern		C		X	X	
Alismataceae	*Echinodorus cordifolius*		Y			X		
Alismataceae	*Sagittaria platyphylla*	Sagittaria	Y			X		
Amaranthaceae	*Alternanthera brasiliana*		Y			X		
Amaranthaceae	*Alternanthera ficoidea*		Y			X		
Amaranthaceae	*Alternanthera sessilis*		Y			X		
Amaranthaceae	*Blepharocarya involucrigera*			C			X	
Amaranthaceae	*Celosia argentea*		Y			X		
Amaranthaceae	*Gomphrena celosioides*	Gomphrena Weed	Y			X		
Anacardiaceae	*Anacardium occidentale*		Y			X		
Anacardiaceae	*Buchanania arborescens*			C		X		
Anacardiaceae	*Euroschinus falcatus* var. *falcatus*			C		X		
Anacardiaceae	*Mangifera indica*	Mango	Y			X		
Anacardiaceae	*Pleiogynium timorense*	Burdekin Plum		C		X		
Anacardiaceae	*Semecarpus australiensis*	Native Cashew Tree		C		X		
Annonaceae	*Annona glabra*	Pond Apple	Y			X		
Annonaceae	*Cananga odorata*	Ylang-ylang		C		X		
Annonaceae	*Meiogyne cylindrocarpa* subsp. *trichocarpa*			C		X		
Annonaceae	*Meiogyne verrucosa*			C		X		
Annonaceae	*Melodorum uhrii*			C		X	X	
Annonaceae	*Miliusa brahei*			C		X		
Annonaceae	*Monoon australe*			C		X		
Annonaceae	*Polyalthia nitidissima*	Polyalthia		C		X		
Annonaceae	*Uvaria concava*			C		X		
Apiaceae	*Mackinlaya confusa*			C		X		
Apiaceae	*Mackinlaya macrosciadea*	Mackinlaya		C		X		
Apocynaceae	*Allamanda cathartica*	Yellow Allamanda	Y			X		
Apocynaceae	*Alstonia muelleriana*	Hard Milkwood		C		X	X	
Apocynaceae	*Alstonia scholaris*	White Cheesewood		C		X		
Apocynaceae	*Alstonia spectabilis* subsp. *spectabilis*			C		X		
Apocynaceae	*Alyxia oblongata*			C		X		
Apocynaceae	*Alyxia spicata*			C		X		
Apocynaceae	*Cynanchum viminale* subsp. *brunonianum*			C		X		
Apocynaceae	*Dischidia nummularia*	Button Orchid		C		X		
Apocynaceae	*Gomphocarpus physocarpus*	Balloon Cottonbush	Y			X		
Apocynaceae	*Gymnanthera oblonga*			C		X		
Apocynaceae	*Hoya australis* subsp. *australis*			C		X		
Apocynaceae	*Hoya australis* subsp. *tenuipes*			C		X		
Apocynaceae	*Hoya pottsii*			C		X		
Apocynaceae	*Ichnocarpus frutescens*			C		X		
Apocynaceae	*Marsdenia hemiptera*	Rusty Vine		C		X		
Apocynaceae	*Marsdenia longipedicellata*			C		X		
Apocynaceae	*Marsdenia velutina*			C		X		
Apocynaceae	*Melodinus acutiflorus*	Bellbird Vine		C		X	X	
Apocynaceae	*Melodinus australis*	Southern Melodinus		C		X		
Apocynaceae	*Parsonsia lenticellata*	Narrow-leaved Parsonsia		C		X		
Apocynaceae	*Parsonsia longipetiolata*			C		X		
Apocynaceae	*Parsonsia plaesiophylla*			C		X		
Apocynaceae	*Parsonsia rotata*	Veinless Silkpod		C		X		
Apocynaceae	*Parsonsia straminea*	Monkey Rope		C		X		
Apocynaceae	*Parsonsia velutina*	Hairy Silkpod		C		X		
Apocynaceae	*Secamone elliptica*			C		X		
Apocynaceae	*Tabernaemontana orientalis*			C		X		
Apocynaceae	*Tabernaemontana pandacaqui*	Banana Bush		C		X		
Apocynaceae	*Tylophora benthamii*	Coast Tylophora		C		X		
Apocynaceae	*Wrightia laevis*			C		X		
Araceae	*Aglaonema commutatum*		Y			X		
Araceae	*Dieffenbachia seguine*		Y			X		
Araceae	*Epipremnum pinnatum*			C		X		
Araceae	*Epipremnum pinnatum* cv. *Aureum*		Y			X		
Araceae	*Pothos longipes*			C		X		
Araceae	*Syngonium podophyllum*		Y			X		
Araceae	*Typhonium angustilobum*			C		X		
Araliaceae	*Polyscias australiana*	Ivory Basswood		C		X		
Araliaceae	*Polyscias bellendenkerensis*			V	V			X
Araliaceae	*Polyscias elegans*	Celery Wood		C		X		
Araliaceae	*Polyscias nodosa*			C		X		
Araliaceae	*Polyscias purpurea*			C		X		
Araliaceae	*Schefflera actinophylla*	Umbrella Tree		C		X		
Arecaceae	*Archontophoenix myolensis*	Myola Palm		E	E	X		X
Arecaceae	*Calamus australis*	Hairy Mary		C		X		
Arecaceae	*Calamus caryotoides*	Fish-tail Lawyer Cane		C		X		
Arecaceae	*Calamus moti*			C		X	X	
Arecaceae	*Calamus radicalis*	Vicious Hairy Mary		C		X		

Family	Species	Common Name	Exotic	NC Act	EPBC Act	Wildlife Online	ALA	PMST
Arecaceae	*Cocos nucifera* cv. *domesticated*		Y			X		
Arecaceae	*Licuala ramsayi*			C			X	
Arecaceae	*Linospadix minor*			C		X	X	
Argophyllaceae	*Argophyllum lejourdanii*			C		X		
Aristolochiaceae	*Aristolochia acuminata*			C		X	X	
Aristolochiaceae	*Aristolochia elegans*	Calico-flower	Y			X		
Aristolochiaceae	*Aristolochia pubera* var. *pubera*			C		X		
Aristolochiaceae	*Aristolochia ringens*		Y			X		
Aristolochiaceae	*Aristolochia thozetii*			C		X		
Aristolochiaceae	*Pararistolochia deltantha*			C		X	X	
Aspleniaceae	*Asplenium paleaceum*	Scaly Asplenium		C		X	X	
Aspleniaceae	*Asplenium simplicifrons*			C			X	
Asteraceae	*Acanthospermum hispidum*	Star Burr	Y			X		
Asteraceae	*Ageratum conyzoides*	Billygoat Weed	Y			X		
Asteraceae	*Ageratum conyzoides* subsp. *conyzoides*		Y			X	X	
Asteraceae	*Ageratum houstonianum*	Blue Billygoat Weed	Y			X		
Asteraceae	*Blumea lacera*			C		X		
Asteraceae	*Blumea mollis*			C		X		
Asteraceae	*Centratherum punctatum*		Y			X		
Asteraceae	*Coronidium lanuginosum*			C		X		
Asteraceae	*Coronidium rupicola*			C		X	X	
Asteraceae	*Cyanthillium cinereum*			C		X		
Asteraceae	*Eclipta prostrata*	White Eclipta	Y			X		
Asteraceae	*Elephantopus mollis*	Tobacco Weed	Y			X		
Asteraceae	*Eleutheranthera ruderalis*		Y			X		
Asteraceae	*Emilia sonchifolia*		Y			X		
Asteraceae	*Emilia sonchifolia* var. *sonchifolia*		Y			X		
Asteraceae	*Erigeron karvinskianus*		Y			X		
Asteraceae	*Eschenbachia leucantha*			C		X		
Asteraceae	*Glossocardia bidens*	Native Cobbler's Pegs		C		X		
Asteraceae	*Mikania micrantha*	Mikania Vine	Y			X		
Asteraceae	*Praxelis clematidea*		Y			X	X	
Asteraceae	*Sphagneticola trilobata*		Y			X		
Asteraceae	*Synedrella nodiflora*		Y			X		
Asteraceae	*Tarlmounia elliptica*		Y			X		
Asteraceae	*Tithonia diversifolia*	Japanese Sunflower	Y			X		
Asteraceae	*Youngia japonica*			C		X		
Avicenniaceae	*Avicennia marina*	Grey Mangrove		C		X		
Balanophoraceae	*Balanophora fungosa* subsp. *fungosa*			C		X		
Begoniaceae	*Begonia hirtella*		Y			X		
Bignoniaceae	*Deplanchea tetraphylla*			C		X		
Bignoniaceae	*Neosepicaea jucunda*			C		X		
Bignoniaceae	*Pandorea nervosa*			C		X		
Bignoniaceae	*Parmentiera aculeata*		Y			X		
Bignoniaceae	*Saritaea magnifica*		Y			X		
Bignoniaceae	*Spathodea campanulata* subsp. *nilotica*		Y			X		
Blechnaceae	*Blechnum cartilagineum*			C			X	
Blechnaceae	*Blechnum cartilagineum* x *Doodia media*			C		X		
Blechnaceae	*Blechnum indicum*			C			X	
Blechnaceae	*Blechnum orientale*			C			X	
Blechnaceae	*Doodia caudata*			C			X	
Blechnaceae	*Doodia media*			C			X	
Blechnaceae	*Pteridoblechnum neglectum*			C		X		
Boraginaceae	*Cordia dichotoma*			C		X	X	
Boraginaceae	*Ehretia* sp. (Whitfield Range R.Jago 17)			C		X		
Brassicaceae	*Cardamine flexuosa*	Wood Bittercress	Y			X		
Burseraceae	*Canarium acutifolium var. acutifolium*			V	V	X		X
Burseraceae	*Canarium australasicum*	Mango Bark		C		X		
Burseraceae	*Canarium muelleri*	Scrub Turpentine		C		X	X	
Byblidaceae	*Byblis liniflora*			C		X		
Byttneriaceae	*Commersonia macrostipulata*			C		X		
Caesalpiniaceae	*Caesalpinia traceyi*			C		X		
Caesalpiniaceae	*Chamaecrista mimosoides*	Dwarf Cassia		C		X		
Caesalpiniaceae	*Chamaecrista nomame* var. *grandiflora*			C		X		
Caesalpiniaceae	*Chamaecrista nomame* var. *nomame*			C		X		
Caesalpiniaceae	*Senna gaudichaudii*			C		X		
Caesalpiniaceae	*Senna obtusifolia*		Y			X	X	
Caesalpiniaceae	*Senna pendula* var. *glabrata*	Easter Cassia	Y			X		
Campanulaceae	*Lobelia leucotos*			C		X		
Campanulaceae	*Lobelia membranacea*			C			X	
Campanulaceae	*Lobelia quadrangularis*			C		X		
Capparaceae	*Capparis lanceolaris*			C		X		
Capparaceae	*Capparis lucida*			C		X		
Cardiopteridaceae	*Cardiopteris moluccana*			C		X		
Casuarinaceae	*Allocasuarina littoralis*	Coast She-oak		C			X	
Casuarinaceae	*Allocasuarina luehmannii*	Bull Oak		C		X		
Cecropiaceae	*Cecropia peltata*	Mexican Bean Tree	Y			X		
Celastraceae	*Denhamia fasciculiflora*			C		X		
Celastraceae	*Elaeodendron melanocarpum*			C		X		
Celastraceae	*Euonymus australiana*			C		X		
Celastraceae	*Hedraianthera porphyropetala*	Hedrianthera		C		X		
Celastraceae	*Hippocratea barbata*	Knotvine		C		X		
Celastraceae	*Salacia disepala*			C		X		
Celastraceae	*Siphonodon australis*	Ivorywood		C		X		
Celastraceae	*Siphonodon membranaceus*			C		X		
Chenopodiaceae	*Dysphania ambrosioides*		Y			X		
Chrysobalanaceae	*Parinari nonda*			C		X		
Cleomaceae	*Cleome aculeata*		Y			X		
Clusiaceae	*Calophyllum australianum*			C		X		
Clusiaceae	*Garcinia warrenii*			C		X		
Colchicaceae	*Gloriosa superba*	Glory Lily	Y			X		
Colchicaceae	*Schelhammera multiflora*			C		X	X	
Combretaceae	*Quisqualis indica*		Y			X		
Combretaceae	*Terminalia arenicola*	Beach Almond		C		X		
Combretaceae	*Terminalia catappa*			C		X		
Combretaceae	*Terminalia muelleri*			C		X		
Combretaceae	*Terminalia sericocarpa*	Damson		C		X		

Family	Species	Common Name	Exotic	NC Act	EPBC Act	Wildlife Online	ALA	PMST
Commelinaceae	*Aneilema acuminatum*			C		X		
Commelinaceae	*Callisia repens*		Y			X		
Commelinaceae	*Commelina ensifolia*	Scurvy Grass		C		X		
Commelinaceae	*Commelina lanceolata*			C		X		
Commelinaceae	*Murdannia nudiflora*		Y			X		
Commelinaceae	*Murdannia vaginata*		Y			X		
Commelinaceae	*Pollia macrophylla*			C			X	
Commelinaceae	*Tradescantia zebrina*		Y			X		
Connaraceae	*Connarus conchocarpus* subsp. *conchocarpus*			C		X	X	
Connaraceae	*Rourea brachyandra*			C		X		
Convolvulaceae	*Erycibe coccinea*			C		X		
Convolvulaceae	*Ipomoea coptica*			C		X		
Convolvulaceae	*Ipomoea gracilis*			C		X		
Convolvulaceae	*Ipomoea hederifolia*		Y			X		
Convolvulaceae	*Ipomoea indica*	Blue Morning-glory	Y			X		
Convolvulaceae	*Ipomoea obscura*		Y			X		
Convolvulaceae	*Ipomoea quamoclit*	Star of Bethlehem	Y			X		
Convolvulaceae	*Lepistemon urceolatus*			C		X		
Convolvulaceae	*Merremia quinquefolia*		Y			X		
Convolvulaceae	*Merremia tuberosa*	Wood-rose	Y			X		
Convolvulaceae	*Operculina riedeliana*			C		X		
Convolvulaceae	*Turbina corymbosa*		Y			X		
Costaceae	*Costus dubius*		Y			X		
Cucurbitaceae	*Diplocyclos palmatus*			C		X		
Cucurbitaceae	*Luffa aegyptiaca*			C		X		
Cucurbitaceae	*Trichosanthes pentaphylla*			C		X	X	
Cucurbitaceae	*Trichosanthes pilosa*			C		X		
Cucurbitaceae	*Zehneria erythrobacca*			C		X		
Cunoniaceae	*Pseudoweinmannia apetala*			C		X		
Cyatheaceae	*Cyathea cooperi*			C			X	
Cyatheaceae	*Cyathea rebeccae*			C			X	
Cycadaceae	*Cycas media* subsp. *banksii*			C		X		
Cyperaceae	*Bulbostylis barbata*			C		X		
Cyperaceae	*Carex horsfieldii*			C		X		
Cyperaceae	*Carex maculata*			C		X		
Cyperaceae	*Cyperus aromaticus*		Y			X	X	
Cyperaceae	*Cyperus brevifolius*	Mullumbimby Couch	Y			X		
Cyperaceae	*Cyperus cyperinus*			C		X		
Cyperaceae	*Cyperus cyperoides*			C		X	X	
Cyperaceae	*Cyperus enervis*			C		X		
Cyperaceae	*Cyperus gracilis*			C		X		
Cyperaceae	*Cyperus haspan*			C		X	X	
Cyperaceae	*Cyperus involucratus*		Y			X		
Cyperaceae	*Cyperus metzii*		Y			X		
Cyperaceae	*Cyperus multispiceus*			C		X		
Cyperaceae	*Cyperus polystachyos*			C		X		
Cyperaceae	*Cyperus polystachyos* var. *laxiflorus*			C		X		
Cyperaceae	*Cyperus prolifer*	Dwarf Papyrus	Y			X		
Cyperaceae	*Cyperus sphacelatus*		Y			X		
Cyperaceae	*Cyperus stoloniferus*			C		X		
Cyperaceae	*Fimbristylis cinnamometorum*			C		X		
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-rush		C		X		
Cyperaceae	*Fimbristylis ferruginea*			C		X		
Cyperaceae	*Fimbristylis recta*			C		X		
Cyperaceae	*Gahnia sieberiana*	Sword Grass		C		X	X	
Cyperaceae	*Rhynchospora corymbosa*			C		X		
Cyperaceae	*Rhynchospora rubra*			C		X		
Cyperaceae	*Rhynchospora subtenuifolia*			C		X		
Cyperaceae	*Schoenoplectiella mucronata*			C		X		
Cyperaceae	*Scleria brownii*			C		X		
Cyperaceae	*Scleria ciliaris*			C		X		
Cyperaceae	*Scleria levis*			C		X		
Cyperaceae	*Scleria mackaviensis*			C		X		
Cyperaceae	*Scleria polycarpa*			C		X		
Cyperaceae	*Scleria tricuspidata*			C		X		
Davalliaceae	*Davallia denticulata* var. *denticulata*			C		X	X	
Dennstaedtiaceae	*Microlepia speluncae*	Cave Fern		C		X	X	
Dennstaedtiaceae	*Pteridium esculentum*			C			X	
Dennstaedtiaceae	*Pteridium revolutum*			C			X	
Dichapetalaceae	*Dichapetalum papuanum*			C		X	X	
Dilleniaceae	*Dillenia alata*			C		X		
Dilleniaceae	*Tetracera daemeliana*			C		X		
Dilleniaceae	*Tetracera nordtiana*			C		X		
Dilleniaceae	*Tetracera nordtiana* var. *nordtiana*			C		X		
Dilleniaceae	*Tetracera nordtiana* var. *wuthiana*			C		X		
Dracaenaceae	*Pleomele angustifolia*			C		X		
Dracaenaceae	*Sansevieria trifasciata* var. *trifasciata*		Y			X		
Droseraceae	*Drosera angustifolia*			C			X	
Droseraceae	*Drosera finlaysoniana*			C		X		
Dryopteridaceae	*Coveniella poecilophlebia*			C		X		
Dryopteridaceae	*Lastreopsis rufescens*			C			X	
Dryopteridaceae	*Lastreopsis wurunuran*			C			X	
Dryopteridaceae	*Tectaria confluens*			C		X		
Ebenaceae	*Diospyros compacta*			C		X		
Ebenaceae	*Diospyros hebecarpa*			C		X		
Ebenaceae	*Diospyros laurina*			C		X		
Ebenaceae	*Diospyros pentamera*	Myrtle Ebony		C		X		
Elaeagnaceae	*Elaeagnus triflora* var. *triflora*			C		X		
Elaeocarpaceae	*Aceratium megalospermum*			C		X		
Elaeocarpaceae	*Elaeocarpus arnhemicus*			C		X		
Elaeocarpaceae	*Elaeocarpus bancroftii*			C		X	X	
Elaeocarpaceae	*Elaeocarpus eumundi*	Eumundi Quandong		C		X		
Elaeocarpaceae	*Elaeocarpus foveolatus*			C		X		
Elaeocarpaceae	*Elaeocarpus grahamii*			C		X		
Elaeocarpaceae	*Elaeocarpus grandis*	Blue Quandong		C		X		
Elaeocarpaceae	*Elaeocarpus largiflorens* subsp. *largiflorens*			C		X		
Elaeocarpaceae	*Sloanea langii*			C		X		
Ericaceae	*Acrothamnus spathaceus*			C		X		

Family	Species	Common Name	Exotic	NC Act	EPBC Act	Wildlife Online	ALA	PMST
Ericaceae	*Leucopogon leptospermoides*			C		X		
Ericaceae	*Leucopogon* sp. (Boolbunda Rock K.M.Sparshott+ KMS623)			C		X		
Ericaceae	*Melichrus adpressus*			C		X		
Eriocaulaceae	*Eriocaulon pygmaeum*			C		X		
Escalloniaceae	*Polyosma hirsuta*			C		X		
Euphorbiaceae	*Acalypha australis*		Y			X		
Euphorbiaceae	*Acalypha wilkesiana*		Y			X		
Euphorbiaceae	*Alchornea ilicifolia*	Native Holly		C		X		
Euphorbiaceae	*Alchornea rugosa*			C		X		
Euphorbiaceae	*Baloghia inophylla*	Scrub Bloodwood		C		X		
Euphorbiaceae	*Claoxylon angustifolium*			C		X		
Euphorbiaceae	*Claoxylon hillii*			C		X		
Euphorbiaceae	*Claoxylon tenerifolium* subsp. *boreale*			C		X		
Euphorbiaceae	*Cleidion javanicum*			C		X		
Euphorbiaceae	*Codiaeum variegatum* var. *moluccanum*			C		X		
Euphorbiaceae	*Croton insularis*	Queensland Cascarilla		C		X		
Euphorbiaceae	*Croton triacros*			C		X		
Euphorbiaceae	*Dimorphocalyx australiensis*			C		X		
Euphorbiaceae	*Euphorbia heterophylla*		Y			X		
Euphorbiaceae	*Euphorbia hirta*		Y			X		
Euphorbiaceae	*Macaranga dallachyana*			C		X		
Euphorbiaceae	*Macaranga inamoena*			C			X	
Euphorbiaceae	*Macaranga involucrata* var. *mallotoides*			C		X		
Euphorbiaceae	*Macaranga subdentata*			C		X		
Euphorbiaceae	*Macaranga tanarius*	Macaranga		C		X		
Euphorbiaceae	*Mallotus philippensis*	Red Kamala		C		X		
Euphorbiaceae	*Mallotus polyadenos*			C		X		
Euphorbiaceae	*Mallotus repandus*			C		X		
Euphorbiaceae	*Manihot esculenta*		Y			X		
Euphorbiaceae	*Tragia finalis*			C		X		
Euphorbiaceae	*Wetria australiensis*			V		X		
Eupomatiaceae	*Eupomatia barbata*			C		X		
Eupomatiaceae	*Eupomatia laurina*	Bolwarra		C		X		
Fabaceae	*Aeschynomene americana*		Y			X		
Fabaceae	*Austrosteenisia blackii*	Bloodvine		C		X		
Fabaceae	*Austrosteenisia stipularis*			C		X		
Fabaceae	*Cajanus mareebensis*			E	E			X
Fabaceae	*Calopogonium mucunoides*		Y			X		
Fabaceae	*Canavalia rosea*	Coastal Jack Bean		C		X		
Fabaceae	*Castanospermum australe*	Black Bean		C		X		
Fabaceae	*Centrosema molle*		Y			X		
Fabaceae	*Clitoria ternatea*	Butterfly Pea	Y			X		
Fabaceae	*Crotalaria calycina*			C		X		
Fabaceae	*Crotalaria goreensis*	Gambia Pea	Y			X		
Fabaceae	*Crotalaria medicaginea*	Trefoil Rattlepod		C		X		
Fabaceae	*Crotalaria montana* var. *angustifolia*			C		X		
Fabaceae	*Crotalaria pallida* var. *obovata*		Y			X	X	
Fabaceae	*Crotalaria trichotoma*		Y			X		
Fabaceae	*Dalbergia candenatensis*			C		X		
Fabaceae	*Dalbergia sissoo*	North Indian Rosewood	Y			X		
Fabaceae	*Daviesia flava*			C		X		
Fabaceae	*Derris koolgibberah*			C		X		
Fabaceae	*Derris* sp. (Daintree D.E.Boyland+ 469)			C		X		
Fabaceae	*Desmodium heterocarpon* var. *heterocarpon*			C		X		
Fabaceae	*Desmodium heterocarpon* var. *strigosum*			C		X		
Fabaceae	*Dioclea hexandra*			C			X	
Fabaceae	*Eriosema chinense*			C		X		
Fabaceae	*Flemingia macrophylla*		Y			X	X	
Fabaceae	*Hovea longipes*	Brush Hovea		C		X		
Fabaceae	*Indigofera pratensis*			C		X		
Fabaceae	*Indigofera suffruticosa*		Y			X	X	
Fabaceae	*Jacksonia thesioides*			C		X		
Fabaceae	*Macroptilium atropurpureum*	Siratro	Y			X		
Fabaceae	*Medicago sativa* subsp. *sativa*		Y			X		
Fabaceae	*Millettia pinnata*			C		X		
Fabaceae	*Mucuna gigantea*	Burny Bean		C		X		
Fabaceae	*Pycnospora lutescens*	Pycnospora		C		X		
Fabaceae	*Rhynchosia minima*			C		X		
Fabaceae	*Sesbania cannabina* var. *cannabina*			C		X		
Fabaceae	*Sesbania grandiflora*		Y			X		
Fabaceae	*Stylosanthes scabra*		Y			X	X	
Fabaceae	*Tephrosia noctiflora*		Y			X		
Fabaceae	*Tephrosia* sp. (Iron Range L.J.Brass 19242)			C		X		
Fabaceae	*Uraria lagopodioides*			C		X		
Fabaceae	*Vandasina retusa*			C		X		
Fabaceae	*Vigna vexillata* var. *angustifolia*			C		X	X	
Fabaceae	*Zornia muriculata* subsp. *muriculata*			C		X		
Flacourtiaceae	*Casearia grewiifolia* var. *gelonioides*			C		X		
Flacourtiaceae	*Casearia* sp. (Mission Beach B.P.Hyland 773)			C		X		
Flacourtiaceae	*Homalium circumpinnatum*			C		X	X	
Flacourtiaceae	*Scolopia braunii*	Flintwood		C		X		
Flagellariaceae	*Flagellaria indica*	Whip Vine		C		X		
Gesneriaceae	*Boea hygroscopica*			C		X	X	
Gleicheniaceae	*Dicranopteris linearis*			C			X	
Gleicheniaceae	*Dicranopteris linearis* var. *linearis*			C			X	
Gleicheniaceae	*Sticherus flabellatus* var. *flabellatus*			C			X	
Goodeniaceae	*Goodenia pilosa*			C		X		
Grammitidaceae	*Grammitis queenslandica* (Syn *Oreogrammitis queenslandica*)			C		X	X	
Haemodoraceae	*Haemodorum coccineum*			C		X		
Hemerocallidaceae	*Dianella atraxis*			C		X		
Hemerocallidaceae	*Geitonoplesium cymosum*	Scrambling Lily		C		X		
Hernandiaceae	*Hernandia albiflora*			C		X		
Himantandraceae	*Galbulimima baccata*			C		X		
Hydrocharitaceae	*Hydrilla verticillata*	Hydrilla		C		X		
Hymenophyllaceae	*Cephalomanes atrovirens*			C			X	
Hymenophyllaceae	*Cephalomanes obscurum*			C			X	
Hymenophyllaceae	*Crepidomanes majoriae*			V		X		
Hymenophyllaceae	*Crepidomanes proliferum*			C		X		

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Hymenophyllaceae	*Crepidomanes saxifragoides*			C			X	
Hymenophyllaceae	*Polyphlebium endlicherianum*	Middle Filmy Fern		V	E			X
Hypericaceae	*Hypericum gramineum*	Native St. Johns Wort		C			X	
Hypoxidaceae	*Curculigo ensifolia* var. *ensifolia*			C		X		
Johnsoniaceae	*Tricoryne anceps* subsp. *anceps*			C		X		
Juncaceae	*Juncus usitatus*			C		X		
Juncaginaceae	*Cycnogeton procerus*			C		X		
Lamiaceae	*Anisomeles moschata*			C		X		
Lamiaceae	*Callicarpa longifolia*			C		X		
Lamiaceae	*Clerodendrum floribundum*			C		X		
Lamiaceae	*Clerodendrum longiflorum* var. *glabrum*			C		X		
Lamiaceae	*Clerodendrum tracyanum*			C		X		
Lamiaceae	*Faradaya splendida*			C		X		
Lamiaceae	*Glossocarya hemiderma*			C		X		
Lamiaceae	*Gmelina fasciculiflora*			C		X		
Lamiaceae	*Hyptis capitata*		Y			X		
Lamiaceae	*Leucas lavandulifolia*		Y			X		
Lamiaceae	*Mesosphaerum pectinatum*		Y			X		
Lamiaceae	*Platostoma longicorne*			C		X		
Lamiaceae	*Plectranthus amboinicus*	Allspice	Y			X		
Lamiaceae	*Plectranthus apreptus*			C		X		
Lamiaceae	*Plectranthus foetidus*			C		X	X	
Lamiaceae	*Premna limbata*			C		X		
Lamiaceae	*Premna serratifolia*			C		X		
Lamiaceae	*Vitex acuminata*			C		X		
Lauraceae	*Beilschmiedia bancroftii*			C		X		
Lauraceae	*Beilschmiedia elliptica*	Grey Walnut		C		X		
Lauraceae	*Beilschmiedia obtusifolia*	Hard Bolly Gum		C		X		
Lauraceae	*Cassytha filiformis*	Dodder Laurel		C		X		
Lauraceae	*Cryptocarya angulata*	Ivory Laurel		C		X		
Lauraceae	*Cryptocarya clarksoniana*			C		X		
Lauraceae	*Cryptocarya hypospodia*	North Queensland Purple Laurel		C		X		
Lauraceae	*Cryptocarya laevigata*			C		X		
Lauraceae	*Cryptocarya lividula*			C		X		
Lauraceae	*Cryptocarya mackinnoniana*			C		X		
Lauraceae	*Cryptocarya murrayi*	Murray's Laurel		C		X		
Lauraceae	*Cryptocarya rhodosperma*			C		X		
Lauraceae	*Cryptocarya triplinervis* var. *riparia*			C		X		
Lauraceae	*Cryptocarya vulgaris*			C		X		
Lauraceae	*Endiandra acuminata*			C		X		
Lauraceae	*Endiandra cowleyana*	Northern Rose Walnut		C		X		
Lauraceae	*Endiandra hypotephra*	Blue Walnut		C		X		
Lauraceae	*Endiandra impressicosta*			C		X		
Lauraceae	*Endiandra longipedicellata*			C		X		
Lauraceae	*Endiandra monothyra* subsp. *monothyra*			C		X		
Lauraceae	*Endiandra wolfei*			C		X	X	
Lauraceae	*Lindera queenslandica*			C		X		
Lauraceae	*Litsea bindoniana*			C		X		
Lauraceae	*Litsea fawcettiana*			C		X		
Lauraceae	*Litsea glutinosa*			C		X		
Lauraceae	*Litsea leefeana*			C		X		
Lauraceae	*Neolitsea brassii*			C		X		
Laxmanniaceae	*Cordyline cannifolia*			C		X		
Laxmanniaceae	*Eustrephus latifolius*	Wombat Berry		C		X	X	
Laxmanniaceae	*Lomandra hystrix*			C		X		
Lentibulariaceae	*Utricularia australis*	Yellow Bladderwort		C		X		
Limnocharitaceae	*Hydrocleys nymphoides*		Y			X		
Linderniaceae	*Artanema fimbriatum*			C		X		
Linderniaceae	*Lindernia antipoda*			C		X		
Linderniaceae	*Lindernia ciliata*			C		X		
Linderniaceae	*Lindernia crustacea*			C		X		
Lindsaeaceae	*Lindsaea brachypoda*			C			X	
Lindsaeaceae	*Lindsaea ensifolia* subsp. *agatii*			C			X	
Lindsaeaceae	*Lindsaea ensifolia* subsp. *ensifolia*			C		X		
Lindsaeaceae	*Lindsaea media*			C		X		
Lindsaeaceae	*Lindsaea obtusa*			C		X	X	
Loganiaceae	*Mitrasacme oasena*			C		X		
Loganiaceae	*Strychnos minor*			C		X		
Loganiaceae	*Strychnos psilosperma*	Strychnine Tree		C		X		
Loranthaceae	*Amyema conspicua* subsp. *conspicua*			C		X		
Loranthaceae	*Amyema sanguinea* var. *sanguinea*			C		X		
Loranthaceae	*Amylotheca dictyophleba*			C		X		
Loranthaceae	*Decaisnina congesta*			C		X		
Loranthaceae	*Decaisnina signata*			C			X	
Loranthaceae	*Dendrophthoe curvata*			C		X	X	
Lycopodiaceae	*Lycopodiella cernua*			C			X	
Lycopodiaceae	*Phlegmariurus filiformis*	Rat's Tail Tassel-fern		E	E			X
Lycopodiaceae	*Phlegmariurus tetrastichoides*	Square Tassel Fern		V	V			X
Lygodiaceae	*Lygodium flexuosum*			C			X	
Lygodiaceae	*Lygodium microphyllum*			C			X	
Lythraceae	*Ammannia auriculata*		Y			X		
Lythraceae	*Ammannia multiflora*	Jerry-jerry		C		X		
Lythraceae	*Cuphea carthagenensis*		Y			X		
Lythraceae	*Rotala mexicana*			C		X		
Maesaceae	*Maesa dependens* var. *dependens*			C		X		
Maesaceae	*Maesa dependens* var. *pubescens*			C		X		
Maesaceae	*Maesa haplobotrys*			C		X		
Malpighiaceae	*Stigmaphyllon timoriense*			C		X		
Malvaceae	*Hibiscus heterophyllus*			C		X		
Malvaceae	*Hibiscus rosasinensis*		Y			X		
Malvaceae	*Hibiscus tiliaceus*	Cotton Tree		C		X		
Malvaceae	*Sida acuta*	Spinyhead Sida	Y			X		
Malvaceae	*Sida cordifolia*		Y			X		
Malvaceae	*Sida rhombifolia*		Y			X		
Malvaceae	*Urena lobata*	Urena Weed	Y			X		
Marattiaceae	*Ptisana oreades*			C			X	
Marsileaceae	*Marsilea mutica*			C			X	
Melastomataceae	*Dissotis rotundifolia*		Y			X		

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Melastomataceae	*Medinilla balls-headleyi*			C		X		
Melastomataceae	*Melastoma cyanoides*			C			X	
Melastomataceae	*Melastoma malabathricum* subsp. *malabathricum*			C		X	X	
Melastomataceae	*Miconia calvescens*	Miconia	Y			X		
Melastomataceae	*Miconia racemosa*		Y			X		
Melastomataceae	*Tristemma mauritianum* var. *mauritianum*		Y			X		
Meliaceae	*Dysoxylum arborescens*			C		X		
Meliaceae	*Dysoxylum klanderi*			C		X		
Meliaceae	*Dysoxylum latifolium*			C		X		
Meliaceae	*Dysoxylum oppositifolium*			C		X		
Meliaceae	*Dysoxylum papuanum*			C		X		
Meliaceae	*Dysoxylum pettigrewianum*			C		X		
Memecylaceae	*Memecylon hylandii*			C		X		
Memecylaceae	*Memecylon pauciflorum*			C		X		
Menispermaceae	*Carronia pedicellata*			E	E			X
Menispermaceae	*Hypserpa laurina*			C		X		
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine		C		X		
Menispermaceae	*Stephania japonica*			C		X		
Menispermaceae	*Tinospora smilacina*	Snakevine		C		X		
Mimosaceae	*Acacia calyculata*			C			X	
Mimosaceae	*Acacia celsa*			C		X		
Mimosaceae	*Acacia cincinnata*			C		X	X	
Mimosaceae	*Acacia crassicarpa*			C		X	X	
Mimosaceae	*Acacia disparrima* subsp. *calidestris*			C		X		
Mimosaceae	*Acacia fimbriata*			C			X	
Mimosaceae	*Acacia flavescens*	Toothed Wattle		C		X		
Mimosaceae	*Acacia leptocarpa*	North Coast Wattle		C		X		
Mimosaceae	*Acacia leptostachya*	Townsville Wattle		C		X		
Mimosaceae	*Acacia mangium*			C		X		
Mimosaceae	*Acacia oraria*			C		X	X	
Mimosaceae	*Acacia polystachya*			C		X		
Mimosaceae	*Acacia simsii*			C		X	X	
Mimosaceae	*Albizia procera*			C		X		
Mimosaceae	*Archidendron grandiflorum*	Lace Flower Tree		C		X		
Mimosaceae	*Archidendron hendersonii*	White Lace Flower		C		X		
Mimosaceae	*Archidendron lucyi*			C		X		
Mimosaceae	*Falcataria toona*			C		X		
Mimosaceae	*Leucaena leucocephala*		Y			X		
Mimosaceae	*Mimosa diplotricha*	Giant Sensitive Plant	Y			X	X	
Mimosaceae	*Mimosa diplotricha* var. *diplotricha*	Giant Sensitive Plant	Y			X	X	
Mimosaceae	*Mimosa pudica*		Y			X		
Mimosaceae	*Mimosa pudica* var. *unijuga*		Y			X		
Mimosaceae	*Neptunia plena*	Water Mimosa	Y			X		
Mimosaceae	*Pararchidendron pruinosum*			C		X		
Mimosaceae	*Samanea saman*		Y			X		
Mimosaceae	*Senegalia albizioides*			NT		X		
Molluginaceae	*Mollugo verticillata*		Y			X		
Monimiaceae	*Austromatthaea elegans*			C			X	
Monimiaceae	*Palmeria hypotephra*			C		X		
Monimiaceae	*Steganthera laxiflora* subsp. *laxiflora*			C		X		
Monimiaceae	*Wilkiea macrophylla*	Large-leaved Wilkiea		C		X		
Monimiaceae	*Wilkiea pubescens*			C		X	X	
Monimiaceae	*Wilkiea smithii*			C		X		
Moraceae	*Artocarpus heterophyllus*		Y			X		
Moraceae	*Castilla elastica*		Y			X		
Moraceae	*Fatoua villosa*		Y			X		
Moraceae	*Ficus benjamina* var. *benjamina*	Weeping Fig		C		X		
Moraceae	*Ficus destruens*			C		X	X	
Moraceae	*Ficus fraseri*	White Sandpaper Fig		C		X		
Moraceae	*Ficus hispida* var. *hispida*			C		X		
Moraceae	*Ficus microcarpa*			C		X		
Moraceae	*Ficus obliqua*			C		X		
Moraceae	*Ficus opposita*			C		X		
Moraceae	*Ficus septica* var. *septica*			C		X		
Moraceae	*Ficus variegata* var. *variegata*			C		X		
Moraceae	*Ficus virens* var. *virens*			C		X		
Moraceae	*Ficus virgata* var. *virgata*			C		X		
Moraceae	*Maclura cochinchinensis*	Cockspur Thorn		C		X		
Moraceae	*Streblus brunonianus*	Whalebone Tree		C		X		
Moraceae	*Trophis scandens* subsp. *scandens*			C		X		
Muntingiaceae	*Muntingia calabura*		Y			X		
Myristicaceae	*Myristica globosa* subsp. *Muelleri*	Native Nutmeg		C		X		
Myrsinaceae	*Aegiceras corniculatum*	River Mangrove		C		X		
Myrsinaceae	*Ardisia crenata*		Y			X		
Myrsinaceae	*Ardisia elliptica*		Y			X		
Myrsinaceae	*Myrsine porosa*			C		X	X	
Myrsinaceae	*Myrsine subsessilis subsp. cryptostemon*			C		X		
Myrsinaceae	*Myrsine variabilis*			C		X		
Myrtaceae	*Acmenosperma claviflorum*	Grey Satinash		C		X		
Myrtaceae	*Archirhodomyrtus beckleri*	Rose Myrtle		C		X	X	
Myrtaceae	*Backhousia hughesii*			C		X		
Myrtaceae	*Baeckea frutescens*			C		X		
Myrtaceae	*Corymbia clarksoniana*			C		X		
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood		C		X		
Myrtaceae	*Corymbia tessellaris*	Moreton Bay Ash		C		X		
Myrtaceae	*Corymbia torelliana*	Cadaghi		C		X	X	
Myrtaceae	*Decaspermum humile*	Silky Myrtle		C		X		
Myrtaceae	*Eucalyptus acmenoides*			C			X	
Myrtaceae	*Eucalyptus granitica*	Granite Ironbark		C		X		
Myrtaceae	*Eucalyptus leptophleba*	Molloy Red Box		C		X	X	
Myrtaceae	*Eucalyptus lockyeri* subsp. *exuta*			C		X		
Myrtaceae	*Eucalyptus mediocris*			C		X		
Myrtaceae	*Eucalyptus pellita*	Large-fruited Red Mahogany		C		X		
Myrtaceae	*Eucalyptus platyphylla*	Poplar Gum		C		X		
Myrtaceae	*Eucalyptus portuensis*			C		X		
Myrtaceae	*Eucalyptus reducta*			C		X		
Myrtaceae	*Eucalyptus tereticornis* subsp. *tereticornis*			C		X		
Myrtaceae	*Eucalyptus tindaliae*			C			X	

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Myrtaceae	*Gossia bidwillii*			C		X		
Myrtaceae	*Gossia myrsinocarpa*			C		X	X	
Myrtaceae	*Lophostemon confertus*	Brush Box		C		X		
Myrtaceae	*Lophostemon suaveolens*	Swamp Box		C		X		
Myrtaceae	*Melaleuca leucadendra*	Broad-leaved Tea-tree		C		X		
Myrtaceae	*Melaleuca monantha*			C		X		
Myrtaceae	*Melaleuca quinquenervia*	Swamp Paperbark		C		X		
Myrtaceae	*Melaleuca recurva*			C		X		
Myrtaceae	*Melaleuca trichostachya*			C		X	X	
Myrtaceae	*Melaleuca viridiflora* var. *viridiflora*			C		X		
Myrtaceae	*Pilidiostigma tetramerum*			C		X		
Myrtaceae	*Pilidiostigma tropicum*			C			X	
Myrtaceae	*Rhodamnia sessiliflora*			C		X		
Myrtaceae	*Rhodamnia spongiosa*			C		X	X	
Myrtaceae	*Rhodomyrtus macrocarpa*	Finger Cherry		C		X		
Myrtaceae	*Rhodomyrtus pervagata*			C		X		
Myrtaceae	*Syncarpia glomulifera* subsp. *glomulifera*			C		X		
Myrtaceae	*Syzygium cormiflorum*	Bumpy Satinash		C		X		
Myrtaceae	*Syzygium cryptophlebium*			C		X		
Myrtaceae	*Syzygium endophloium*			C		X		
Myrtaceae	*Syzygium hodgkinsoniae*			V	V			X
Myrtaceae	*Syzygium johnsonii*	Johnson's Satinash		C		X		
Myrtaceae	*Syzygium kuranda*	Kuranda Satinash		C		X		
Myrtaceae	*Syzygium suborbiculare*			C			X	
Myrtaceae	*Syzygium tierneyanum*	River Cherry		C		X		
Myrtaceae	*Syzygium wesa*			C		X		
Myrtaceae	*Tristaniopsis exiliflora*	Kanuka Box		C		X		
Myrtaceae	*Waterhousea unipunctata*			C		X		
Najadaceae	*Najas tenuifolia*	Water Nymph		C		X		
Nephrolepidaceae	*Nephrolepis hirsutula*			C		X		
Nyctaginaceae	*Bougainvillea glabra*		Y			X		
Nyctaginaceae	*Pisonia grandis*			C		X		
Nyctaginaceae	*Pisonia umbellifera*	Birdlime Tree		C		X		
Oleaceae	*Chionanthus axillaris*			C		X		
Oleaceae	*Chionanthus ramiflorus*	Northern Olive		C		X	X	
Oleaceae	*Jasminum didymum* subsp. *didymum*			C		X		
Oleaceae	*Jasminum elongatum*			C		X		
Oleaceae	*Ligustrum australianum*			C		X		
Oleaceae	*Olea paniculata*			C		X		
Onagraceae	*Ludwigia octovalvis*	Willow Primrose		C		X		
Opiliaceae	*Cansjera leptostachya*			C		X		
Orchidaceae	*Apostasia wallichii*			C		X		
Orchidaceae	*Bulbophyllum baileyi*			C		X		
Orchidaceae	*Dendrobium canaliculatum*			C		X		
Orchidaceae	*Dienia montana*			C		X		
Orchidaceae	*Durabaculum mirbelianum* (Syn. *Dendrobium mirbelianum*)	Dark-stemmed Antler Orchid		E	E			X
Orchidaceae	*Phaius australis*	Lesser Swamp-orchid		E	E			X
Orchidaceae	*Phaius pictus*			V	V			X
Orchidaceae	*Phalaenopsis rosenstromii* (Syn *Phalaenopsis amabilis subsp. rosenstromii*)	Native Moth Orchid		E	E			X
Orchidaceae	*Vappodes biggiba* (Syn. *Dendrobium biggibum*)	Cooktown Orchid		V	V			X
Orchidaceae	*Vappodes lithocola*	Dwarf Butterfly Orchid		C	E			X
Orchidaceae	*Vappodes phalaenopsis*			V	V			X
Orchidaceae	*Zeuxine polygonoides*	Velvet Jewel Orchid		C	V			X
Pandanaceae	*Pandanus solms-laubachii*			C		X		
Papaveraceae	*Argemone ochroleuca* subsp. *ochroleuca*	Mexican Poppy	Y			X		
Passifloraceae	*Adenia heterophylla* subsp. *heterophylla*			C		X		
Passifloraceae	*Passiflora aurantia* var. *aurantia*			C		X		
Passifloraceae	*Passiflora edulis*		Y			X		
Passifloraceae	*Passiflora foetida*		Y			X		
Passifloraceae	*Passiflora kuranda*			C		X		
Passifloraceae	*Passiflora pallida*		Y			X		
Passifloraceae	*Passiflora suberosa*	Corky Passion Flower	Y			X		
Petiveriaceae	*Rivina humilis*		Y			X		
Philydraceae	*Helmholtzia glaberrima*			C			X	
Phyllanthaceae	*Actephila latifolia*			C		X		
Phyllanthaceae	*Actephila petiolaris* subsp. *jagonis*			C		X		
Phyllanthaceae	*Antidesma erostre*			C		X		
Phyllanthaceae	*Breynia androgyna*		Y			X		
Phyllanthaceae	*Breynia cernua*			C		X		
Phyllanthaceae	*Bridelia tomentosa*			C		X		
Phyllanthaceae	*Cleistanthus apodus*			C		X		
Phyllanthaceae	*Cleistanthus discolor*			C		X		
Phyllanthaceae	*Cleistanthus semiopacus*			C		X		
Phyllanthaceae	*Flueggea virosa* subsp. *melanthesoides*			C		X		
Phyllanthaceae	*Glochidion ferdinandi* var. *ferdinandi*			C		X		
Phyllanthaceae	*Glochidion harveyanum*			C		X		
Phyllanthaceae	*Glochidion harveyanum* var. *harveyanum*			C		X		
Phyllanthaceae	*Glochidion philippicum*			C		X		
Phyllanthaceae	*Glochidion sessiliflorum* var. *pedicellatum*			C		X	X	
Phyllanthaceae	*Glochidion sumatranum*	Umbrella Cheese Tree		C		X		
Phyllanthaceae	*Phyllanthus amarus*		Y			X		
Phyllanthaceae	*Phyllanthus cuscutiflorus*			C		X		
Phyllanthaceae	*Phyllanthus tenellus*		Y			X		
Phyllanthaceae	*Sauropus decrescentifolius*			C		X		
Phyllanthaceae	*Sauropus macranthus*			C	V			X
Phytolaccaceae	*Phytolacca octandra*	Inkweed	Y			X		
Pinaceae	*Pinus caribaea*	Caribbean Pine	Y			X		
Piperaceae	*Peperomia blanda* var. *floribunda*			C		X		
Piperaceae	*Piper caninum*	Peppervine		C		X		
Piperaceae	*Piper hederaceum*			C			X	
Piperaceae	*Piper hederaceum var. hederaceum*			C		X		
Piperaceae	*Piper interruptum*			C		X		
Piperaceae	*Piper umbellatum*			C			X	
Pittosporaceae	*Bursaria incana*			C			X	
Pittosporaceae	*Bursaria tenuifolia*			C		X	X	
Pittosporaceae	*Pittosporum ferrugineum*			C		X		
Pittosporaceae	*Pittosporum rubiginosum*			C		X		
Pittosporaceae	*Pittosporum wingii*			C		X		

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Plantaginaceae	*Mecardonia procumbens*		Y			X		
Poaceae	*Aristida polyclados*			C			X	
Poaceae	*Arundinella nepalensis*	Reedgrass		C		X		
Poaceae	*Arundinella setosa*			C		X		
Poaceae	*Axonopus compressus*		Y			X		
Poaceae	*Bothriochloa bladhii* subsp. *bladhii*			C		X		
Poaceae	*Brachyachne convergens*			C			X	
Poaceae	*Capillipedium parviflorum*	Scented Top		C		X		
Poaceae	*Cenchrus purpureus*		Y			X		
Poaceae	*Chloris gayana*	Rhodes Grass	Y			X		
Poaceae	*Chloris inflata*	Purpletop Chloris	Y			X		
Poaceae	*Chloris lobata*			C		X		
Poaceae	*Chrysopogon aciculatus*	Mackie's Pest	Y			X		
Poaceae	*Chrysopogon fallax*			C		X		
Poaceae	*Cyrtococcum oxyphyllum*			C		X		
Poaceae	*Dactyloctenium aegyptium*	Coast Button Grass	Y			X		
Poaceae	*Dichanthium setosum*	Bluegrass		C	V			X
Poaceae	*Digitaria orbata*			C		X		
Poaceae	*Dinebra decipiens* var. *decipiens*			C		X		
Poaceae	*Echinochloa crus-galli*	Barnyard Grass	Y			X		
Poaceae	*Echinochloa dietrichiana*			C		X		
Poaceae	*Echinochloa picta*			C		X		
Poaceae	*Ectrosia leporina*			C		X		
Poaceae	*Eleusine indica*	Crowsfoot Grass	Y			X		
Poaceae	*Eragrostis brownii*	Brown's Lovegrass		C		X		
Poaceae	*Eragrostis interrupta*			C		X		
Poaceae	*Eragrostis pilosa*			C			X	
Poaceae	*Eragrostis spartinoides*			C		X		
Poaceae	*Eragrostis tenellula*	Delicate Lovegrass		C		X		
Poaceae	*Eragrostis tenuifolia*	Elastic Grass	Y			X		
Poaceae	*Eriachne squarrosa*			C		X		
Poaceae	*Eulalia trispicata*			C			X	
Poaceae	*Heteropogon triticeus*	Giant Speargrass		C		X		
Poaceae	*Hymenachne amplexicaulis*	Hymenachne	Y			X		
Poaceae	*Hymenachne amplexicaulis* cv. *Olive*		Y			X		
Poaceae	*Imperata cylindrica*	Blady Grass		C		X		
Poaceae	*Leptaspis banksii*			C		X	X	
Poaceae	*Lepturus repens*	Stalky Grass		C		X		
Poaceae	*Megathyrsus maximus*		Y			X		
Poaceae	*Megathyrsus maximus* var. *coloratus*		Y			X		
Poaceae	*Megathyrsus maximus* var. *maximus*		Y			X		
Poaceae	*Melinis minutiflora*	Molasses Grass	Y			X		
Poaceae	*Melinis repens*	Red Natal Grass	Y			X		
Poaceae	*Mnesithea rottboellioides*			C		X		
Poaceae	*Oplismenus compositus*			C		X		
Poaceae	*Oplismenus imbecillis*			C		X		
Poaceae	*Ottochloa nodosa*			C		X		
Poaceae	*Panicum effusum*			C		X		
Poaceae	*Panicum mitchellii*			C		X	X	
Poaceae	*Paspalidium disjunctum*			C		X		
Poaceae	*Paspalum conjugatum*	Sourgrass	Y			X		
Poaceae	*Paspalum paniculatum*	Russell River Grass	Y			X		
Poaceae	*Paspalum urvillei*	Vasey Grass	Y			X		
Poaceae	*Paspalum vaginatum*	Saltwater Couch		C		X		
Poaceae	*Phalaris canariensis*	Canary Grass	Y			X	X	
Poaceae	*Phalaris paradoxa*	Paradoxa Grass	Y			X	X	
Poaceae	*Pogonatherum crinitum*			C		X		
Poaceae	*Sarga plumosum*			C		X		
Poaceae	*Setaria italica*	Foxtail Millet	Y			X		
Poaceae	*Setaria palmifolia*	Palm Grass	Y			X		
Poaceae	*Setaria surgens*			C		X		
Poaceae	*Sorghum arundinaceum*	Rhodesian Sudan Grass	Y			X		
Poaceae	*Sorghum nitidum*			C			X	
Poaceae	*Sorghum x almum*		Y			X		
Poaceae	*Sporobolus coromandelianus*		Y			X		
Poaceae	*Sporobolus fertilis*	Giant Parramatta Grass	Y			X		
Poaceae	*Sporobolus jacquemontii*		Y			X		
Poaceae	*Sporobolus laxus*			C		X		
Poaceae	*Sporobolus natalensis*		Y			X		
Poaceae	*Sporobolus pyramidalis*		Y			X		
Poaceae	*Sporobolus virginicus*	Sand Couch		C		X		
Poaceae	*Themeda quadrivalvis*	Grader Grass	Y			X		
Poaceae	*Themeda triandra*	Kangaroo Grass		C		X		
Poaceae	*Urochloa decumbens*		Y			X		
Poaceae	*Urochloa distachya*		Y			X		
Podocarpaceae	*Prumnopitys amara*			C		X		
Polygalaceae	*Polygala longifolia*			C		X		
Polygalaceae	*Polygala paniculata*		Y			X	X	
Polygalaceae	*Xanthophyllum octandrum*			C		X		
Polygonaceae	*Muehlenbeckia zippelii*			C		X		
Polygonaceae	*Persicaria attenuata*			C		X		
Polygonaceae	*Persicaria strigosa*			C		X		
Polypodiaceae	*Colysis ampla*			C			X	
Polypodiaceae	*Drynaria rigidula*			C			X	
Polypodiaceae	*Drynaria sparsisora*			C		X		
Polypodiaceae	*Goniophlebium subauriculatum*			C			X	
Polypodiaceae	*Microsorum punctatum*			C		X	X	
Polypodiaceae	*Pyrrosia longifolia*			C		X	X	
Pontederiaceae	*Monochoria vaginalis*			C		X		
Potamogetonaceae	*Potamogeton octandrus*			C		X		
Proteaceae	*Alloxylon flammeum*	Red Silky Oak		V	V			X
Proteaceae	*Cardwellia sublimis*			C			X	
Proteaceae	*Carnarvonia araliifolia* var. *araliifolia*			C		X	X	
Proteaceae	*Darlingia darlingiana*			C		X	X	
Proteaceae	*Grevillea baileyana*			C		X		
Proteaceae	*Grevillea hilliana*			C		X		
Proteaceae	*Helicia nortoniana*			C		X	X	
Proteaceae	*Musgravea heterophylla*			C		X	X	

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Proteaceae	*Neorites kevedianus*			C		X		
Proteaceae	*Placospermum coriaceum*			C		X	X	
Pteridaceae	*Acrostichum speciosum*	Mangrove Fern		C		X		
Pteridaceae	*Cheilanthes brownii*			C			X	
Pteridaceae	*Pteris ensiformis*		Y				X	
Pteridaceae	*Pteris ensiformis* cv. *Victoriae*		Y			X		
Pteridaceae	*Pteris tremula*			C			X	
Pteridaceae	*Pteris vittata*			C			X	
Rhamnaceae	*Alphitonia excelsa*	Soap Tree		C		X		
Rhamnaceae	*Alphitonia oblata*			C		X		
Rhamnaceae	*Alphitonia petriei*	Pink Ash		C		X	X	
Rhamnaceae	*Alphitonia whitei*	Red Ash		C		X	X	
Rhamnaceae	*Emmenosperma cunninghamii*			C		X		
Rhamnaceae	*Gouania australiana*			C		X		
Rhamnaceae	*Rhamnella vitiensis*			C		X		
Rhamnaceae	*Ventilago ecorollata*			C		X		
Rhizophoraceae	*Carallia brachiata*	Carallia		C		X		
Rosaceae	*Prunus turneriana*	Almondbark		C		X		
Rosaceae	*Rubus alceifolius*	Giant Bramble	Y			X		
Rosaceae	*Rubus moluccanus* var. *moluccanus*			C		X	X	
Rosaceae	*Rubus probus*			C		X		
Rubiaceae	*Aidia racemosa*			C		X		
Rubiaceae	*Atractocarpus fitzalanii* subsp. *fitzalanii*			C		X		
Rubiaceae	*Coelospermum dasylobum*			C		X		
Rubiaceae	*Coelospermum reticulatum*			C		X		
Rubiaceae	*Coffea arabica*	Arabian Coffee	Y			X		
Rubiaceae	*Cyclophyllum multiflorum*			C		X	X	
Rubiaceae	*Cyclophyllum protractum*			C		X		
Rubiaceae	*Gardenia ovularis*			C		X		
Rubiaceae	*Gynochthodes sessilis*			C			X	
Rubiaceae	*Hedyotis auricularia* var. *melanesica*			C		X		
Rubiaceae	*Ixora timorensis*			C		X		
Rubiaceae	*Knoxia sumatrensis*			C		X		
Rubiaceae	*Mitracarpus hirtus*		Y			X		
Rubiaceae	*Morinda citrifolia*			C		X		
Rubiaceae	*Myrmecodia beccarii*	Ant Plant		V	V	X		X
Rubiaceae	*Nauclea orientalis*	Leichhardt Tree		C		X		
Rubiaceae	*Neolamarckia cadamba*			C		X		
Rubiaceae	*Neonauclea glabra*			C		X		
Rubiaceae	*Oldenlandia corymbosa* var. *corymbosa*		Y			X		
Rubiaceae	*Oldenlandia galioides*			C		X		
Rubiaceae	*Ophiorrhiza australiana* subsp. *australiana*			C		X		
Rubiaceae	*Pavetta australiensis*			C		X		
Rubiaceae	*Pavetta australiensis* var. *australiensis*			C		X		
Rubiaceae	*Psychotria dallachiana*			C		X		
Rubiaceae	*Psychotria loniceroides*	Hairy Psychotria		C		X		
Rubiaceae	*Psydrax odorata*			C		X		
Rubiaceae	*Psydrax odorata forma foveolata*			C		X		
Rubiaceae	*Psydrax tropica*			C		X		
Rubiaceae	*Randia audasii*			NT		X		
Rubiaceae	*Randia tuberculosa*			C		X		
Rubiaceae	*Spermacoce exilis*		Y			X		
Rubiaceae	*Spermacoce* sp. (Lorim Point A.Morton AM1237)			C		X		
Rubiaceae	*Tarenna dallachiana* subsp. *dallachiana*			C		X		
Rubiaceae	*Tarenna monticola*			C		X	X	
Rutaceae	*Acronychia acronychioides*			C		X		
Rutaceae	*Acronychia laevis*	Glossy Acronychia		C		X		
Rutaceae	*Acronychia vestita*			C		X		
Rutaceae	*Bosistoa medicinalis*			C		X		
Rutaceae	*Brombya platynema*			C		X	X	
Rutaceae	*Dinosperma erythrococcum*			C		X		
Rutaceae	*Dinosperma melanophloia*			C		X		
Rutaceae	*Flindersia acuminata*	Silver Silkwood		C		X		
Rutaceae	*Flindersia ifflaiana*	Hickory Ash		C		X		
Rutaceae	*Flindersia laevicarpa* var. *laevicarpa*			C		X		
Rutaceae	*Flindersia pimenteliana*			C			X	
Rutaceae	*Glycosmis trifoliata*			C		X		
Rutaceae	*Halfordia kendack*	Saffron Heart		C		X		
Rutaceae	*Melicope elleryana*			C		X		
Rutaceae	*Melicope rubra*			C		X		
Rutaceae	*Melicope vitiflora*	Northern Evodia		C		X		
Rutaceae	*Melicope xanthoxyloides*			C		X	X	
Rutaceae	*Murraya paniculata*			C		X		
Rutaceae	*Pitaviaster haplophyllus*			C		X		
Rutaceae	*Zanthoxylum ovalifolium*			C		X		
Santalaceae	*Notothixos subaureus*			C			X	
Sapindaceae	*Alectryon tomentosus*			C		X		
Sapindaceae	*Arytera divaricata*	Coogera		C		X		
Sapindaceae	*Arytera pauciflora*			C		X		
Sapindaceae	*Atalaya rigida*			C		X		
Sapindaceae	*Cardiospermum halicacabum* var. *halicacabum*		Y			X	X	
Sapindaceae	*Castanospora alphandii*	Brown Tamarind		C		X		
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo		C		X		
Sapindaceae	*Cupaniopsis flagelliformis* var. *flagelliformis*			C		X		
Sapindaceae	*Cupaniopsis foveolata*	Narrow-leaved Tuckeroo		C		X	X	
Sapindaceae	*Dodonaea polyandra*			C			X	
Sapindaceae	*Elattostachys microcarpa*			C		X	X	
Sapindaceae	*Ganophyllum falcatum*			C		X		
Sapindaceae	*Guioa acutifolia*	Northern Guioa		C		X		
Sapindaceae	*Harpullia pendula*			C		X		
Sapindaceae	*Harpullia rhyticarpa*			C		X		
Sapindaceae	*Jagera pseudorhus*			C		X		
Sapindaceae	*Jagera pseudorhus* var. *pseudorhus*			C		X		
Sapindaceae	*Lepiderema sericolignis*			C		X		
Sapindaceae	*Mischocarpus anodontus*	Veiny Pearfruit		C		X		
Sapindaceae	*Mischocarpus exangulatus*			C		X		
Sapindaceae	*Mischocarpus grandissimus*			C		X		
Sapindaceae	*Mischocarpus lachnocarpus*			C		X	X	

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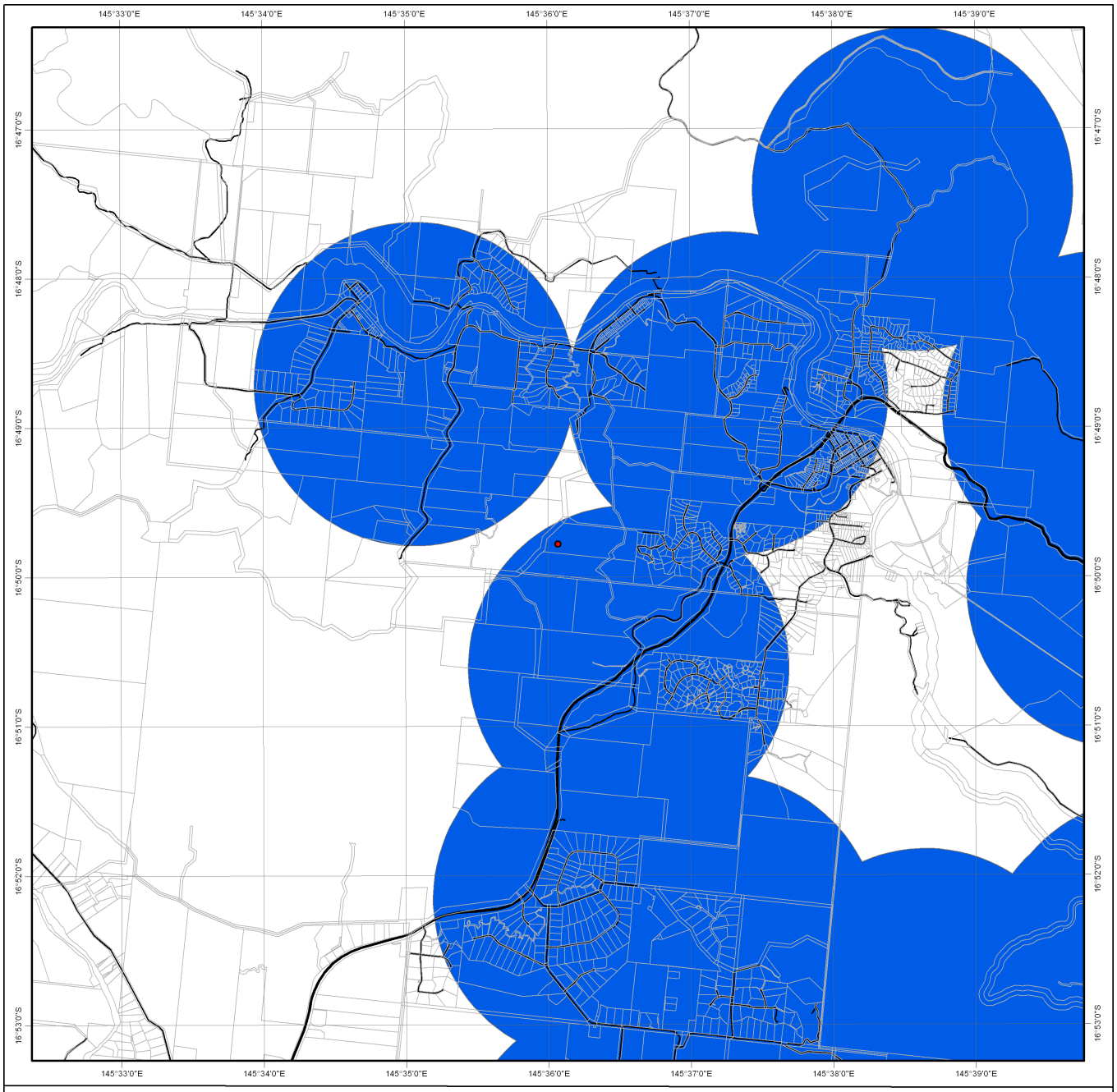
Sapindaceae	*Mischocarpus stipitatus*			C		X		
Sapindaceae	*Rhysotoechia flavescens*			C		X		
Sapindaceae	*Rhysotoechia mortoniana*			C		X		
Sapindaceae	*Rhysotoechia robertsonii*			C		X		
Sapindaceae	*Sarcopteryx reticulata*			C		X		
Sapindaceae	*Sarcotoechia villosa*			C		X		
Sapindaceae	*Synima cordierorum*			C		X		
Sapindaceae	*Synima macrophylla*			C		X		
Sapindaceae	*Toechima daemelianum*			C		X		
Sapindaceae	*Toechima erythrocarpum*			C		X		
Sapotaceae	*Chrysophyllum cainito*		Y			X		
Sapotaceae	*Palaquium galactoxylon*			C		X		
Sapotaceae	*Planchonella chartacea*			C		X		
Sapotaceae	*Planchonella myrsinodendron*			C		X	X	
Sapotaceae	*Planchonella obovata*			C		X		
Sapotaceae	*Planchonella pohlmaniana* var. *pohlmaniana*			C			X	
Sapotaceae	*Vanroyena castanosperma*			C		X		
Schizaeaceae	*Lygodium reticulatum*			C		X	X	
Schizaeaceae	*Schizaea dichotoma*	Branched Comb Fern		C		X		
Smilacaceae	*Smilax australis*	Barbed-wire Vine		C		X		
Smilacaceae	*Smilax glyciphylla*	Sweet Sarsaparilla		C		X		
Solanaceae	*Capsicum annuum* var. *glabriusculum*		Y			X		
Solanaceae	*Capsicum frutescens*		Y			X		
Solanaceae	*Duboisia myoporoides*			C			X	
Solanaceae	*Physalis angulata*		Y			X		
Solanaceae	*Solanum capsicoides*	Devil's Apple	Y			X		
Solanaceae	*Solanum corifolium*	Straggling Nightshade		C		X		
Solanaceae	*Solanum dryanderense*			C		X		
Solanaceae	*Solanum intonsum*			C		X		
Solanaceae	*Solanum macoorai*			C		X		
Solanaceae	*Solanum mauritianum*	Wild Tobacco	Y			X		
Solanaceae	*Solanum seaforthianum*	Brazilian Nightshade	Y			X		
Solanaceae	*Solanum torvum*	Devil's Fig	Y			X	X	
Solanaceae	*Solanum viridifolium*			C		X		
Sparrmanniaceae	*Grewia papuana*			C		X		
Sparrmanniaceae	*Trichospermum pleiostigma*			C		X		
Sparrmanniaceae	*Triumfetta rhomboidea*	Chinese Burr	Y			X		
Stemonuraceae	*Gomphandra australiana*			C		X		
Sterculiaceae	*Argyrodendron peralatum*	Red Tulip Oak		C		X		
Sterculiaceae	*Argyrodendron polyandrum*	Brown Tulip Oak		C		X		
Sterculiaceae	*Franciscodendron laurifolium*			C		X		
Sterculiaceae	*Heritiera littoralis*			C		X		
Sterculiaceae	*Sterculia quadrifida*	Peanut Tree		C		X		
Stylidiaceae	*Stylidium alsinoides*			C		X		
Stylidiaceae	*Stylidium capillare*			C		X		
Symplocaceae	*Symplocos paucistaminea*			C		X		
Symplocaceae	*Symplocos puberula*			C		X		
Taccaceae	*Tacca leontopetaloides*			C		X		
Thelypteridaceae	*Ampelopteris prolifera*			C		X		
Thelypteridaceae	*Amphineuron opulentum*			C		X		
Thelypteridaceae	*Christella dentata*	Creek Fern		C		X	X	
Thelypteridaceae	*Christella subpubescens*			C		X	X	
Thelypteridaceae	*Macrothelypteris polypodioides*			C		X		
Thelypteridaceae	*Pronephrium asperum*			C			X	
Thelypteridaceae	*Pronephrium triphyllum*			C		X		
Thymelaeaceae	*Lethedon setosa*			C			X	
Thymelaeaceae	*Thecanthes cornucopiae*			C		X		
Ulmaceae	*Aphananthe philippinensis*			C		X		
Ulmaceae	*Celtis paniculata*	Native Celtis		C		X		
Ulmaceae	*Trema orientalis*	Tree Peach		C		X		
Ulmaceae	*Trema tomentosa*			C		X		
Ulmaceae	*Trema tomentosa* var. *tomentosa*			C		X		
Urticaceae	*Dendrocnide moroides*	Gympie Stinger		C		X		
Urticaceae	*Pipturus argenteus*	White Nettle		C		X		
Verbenaceae	*Duranta erecta*	Duranta	Y			X	X	
Verbenaceae	*Lantana camara*	Lantana	Y			X		
Verbenaceae	*Stachytarpheta cayennensis*		Y			X	X	
Verbenaceae	*Stachytarpheta jamaicensis*	Jamaica Snakeweed	Y			X		
Verbenaceae	*Stachytarpheta mutabilis*	Pink Snakeweed	Y			X	X	
Violaceae	*Hybanthus enneaspermus*			C			X	
Violaceae	*Rinorea bengalensis forma bengalensis*			C		X		
Viscaceae	*Notothixos leiophyllus*			C		X	X	
Vitaceae	*Cayratia cardiophylla*			C		X		
Vitaceae	*Cayratia saponaria*			C		X		
Vitaceae	*Cissus adnata*			C		X		
Vitaceae	*Cissus hastata*			C		X		
Vitaceae	*Cissus hypoglauca*			C		X		
Vitaceae	*Cissus oblonga*			C		X		
Vitaceae	*Cissus penninervis*			C		X	X	
Vitaceae	*Cissus reniformis*			C		X		
Vitaceae	*Cissus repens*			C		X		
Vitaceae	*Cissus sterculiifolia*			C		X		
Vitaceae	*Leea indica*	Bandicoot Berry		C		X		
Vitaceae	*Leea novoguineensis*			C		X		
Vitaceae	*Tetrastigma thorsborneorum*			C		X		
Vittariaceae	*Antrophyum callifolium*			C		X		
Woodsiaceae	*Diplazium cordifolium*			V	V			X
Woodsiaceae	*Diplazium dietrichianum*			C			X	
Woodsiaceae	*Diplazium pallidum*			E	E			X
Xanthorrhoeaceae	*Xanthorrhoea johnsonii*			C		X	X	
Xyridaceae	*Xyris complanata*	Yellow-eye		C		X		
Zamiaceae	*Bowenia spectabilis*			C		X		
Zingiberaceae	*Alpinia arctiflora*			C		X		
Zingiberaceae	*Alpinia caerulea*	Wild Ginger		C		X		
Zingiberaceae	*Alpinia hylandii*			NT		X	X	
Zingiberaceae	*Amomum dallachyi*			C		X		

Appendix D:
Protected Plants Flora Survey Trigger Map



Protected Plants Flora Survey Trigger Map

Legend

- Coordinates
- High risk area
- Cadastral line
  Property boundaries shown are provided as a locational aid only
- Freeways / motorways / highways
- Secondary roads / streets

N

0 490 980 1,470 1,960 2,450 m

This product is projected into:
GDA 1994 Queensland Albers

This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Heritage Protection at palm@ehp.qld.gov.au

Disclaimer:
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

Appendix E:
Matters of State Environmental Significance Environmental Report

Queensland Government

Department of Environment and Heritage Protection

Environmental Reports

Matters of State Environmental Significance

Area of Interest: Longitude: 145.599916 Latitude: -16.831078

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: Planning.Support@ehp.qld.gov.au

Disclaimer

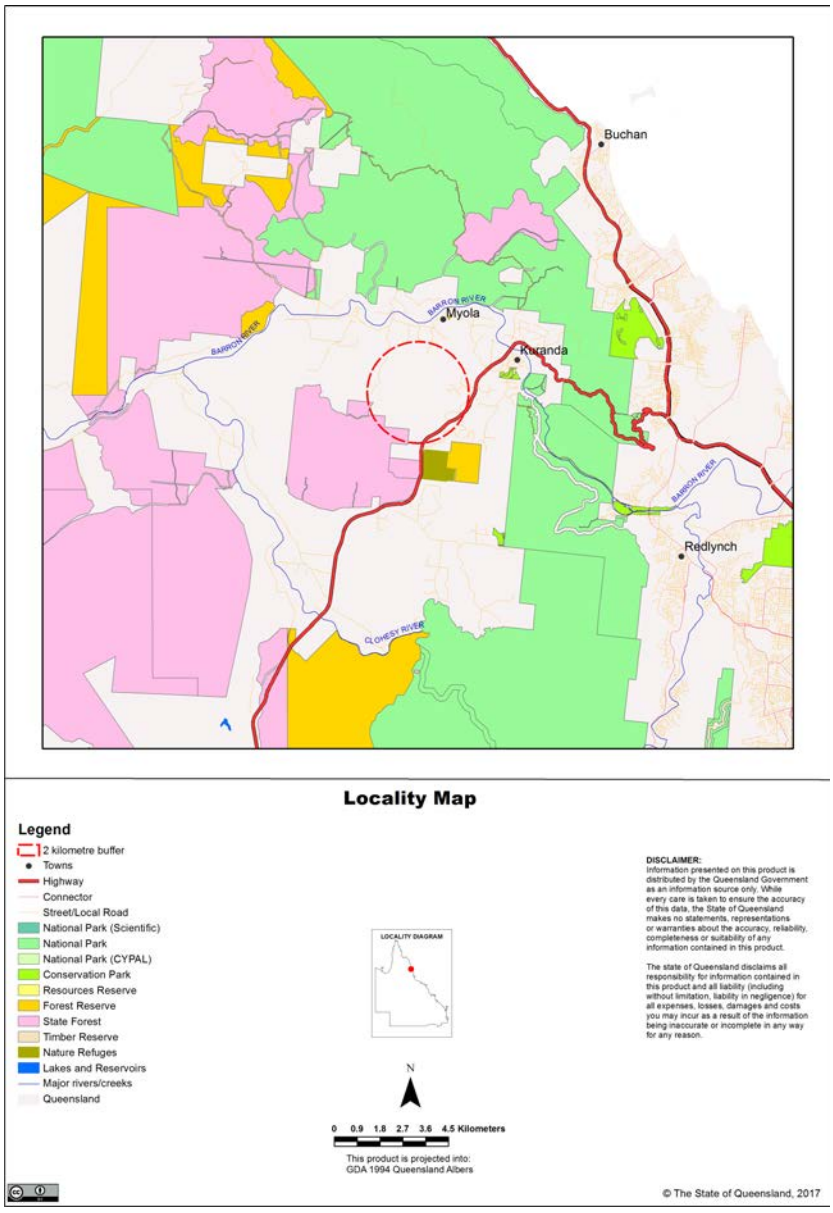
Table of Contents

Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI Longitude: 145.599916 Latitude: -16.831078

Size (ha)	1256.55
Local Government(s)	Mareeba Shire
Bioregion(s)	Wet Tropics
Subregion(s)	Macalister
Catchment(s)	Barron



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992*;

- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004*;

- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;

- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;

- Regulated vegetation under the *Vegetation Management Act 1999* that is:

    • Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;

    • Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;

    • Category R areas on the regulated vegetation management map;

    • Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;

    • Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;

- Strategic Environmental Areas under the *Regional Planning Interests Act 2014*;

- Wetlands in a wetland protection area of wetlands of high ecological significance shown on the Map of Referable Wetlands under the Environmental Protection Regulation 2008;

- Wetlands and watercourses in high ecological value waters defined in the Environmental Protection (Water) Policy 2009, schedule 2;

- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	0.0 ha	0.0 %
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways **	3.2 km	Not applicable
7 Threatened species and Iconic species	590.95 ha	47.0%
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	122.29 ha	9.7%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0 %
8c Regulated Vegetation - Category R (GBR riverine regrowth)	97.56 ha	7.8%
8d Regulated Vegetation - Essential habitat	590.95 ha	47.0%
8e Regulated Vegetation - intersecting a watercourse **	21.6 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	0.0 ha	0.0 %
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

Protected area (estates)

(no results)

Protected area (nature refuges)

(no results)

Marine park (highly protected)

(no results)

Declared fish habitat area (A and B areas)

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

Strategic environmental area (designated precinct)

(no results)

High ecological significance wetlands

(no results)

HEV wetlands

(no results)

HEV watercourse

Natural waterways that occur in HEV (maintain) freshwater and estuarine areas under the Environmental Protection (water) Policy are present.

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

Wildlife habitat (threatened and special least concern animal)

Threatened species and iconic species	Act	Species least concern animal	Koala Bushland Habitat	Dugong Protection	VMA Essential 2014 Habitat
Threat wildlife & Spec LeastC animals	NCA, VMA	None	None	None	Essential

Threatened species habitat

(no results)

Note: The Threatened and Special Least Concern Animal (7) layer originates from the previous MSES version (4.1, dated at 2014). The layer does not represent all currently listed species and is subject to review.

**Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL). Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)*

To request a species list for an area, or search for a species profile, access Wildlife Online at:
https://www.qld.gov.au/environment/plants-animals/species-list/

Refer to **Map 3 - MSES - Species** for an overview of the relevant MSES.

MSES - Regulated Vegetation

category B

Regional ecosystem	Vegetation management polygon	Vegetation management status
7.11.33a	O-dom	rem_oc
7.11.13	O-dom	rem_oc
7.11.44	O-dom	rem_oc

category C

Not applicable

For further information relating to regional ecosystems in general, go to:
https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/
For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:
https://environment.ehp.qld.gov.au/regional-ecosystems/

category R

Regulated vegetation map category	Map number	RVM rule
R	0	None
R	8064	None

essential habitat

Values are present

Regulated vegetation intersecting a watercourse

A vegetation management watercourse is mapped as present

Regulated vegetation 100m from wetland

Not applicable

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

Legally secured offset area (offset register)

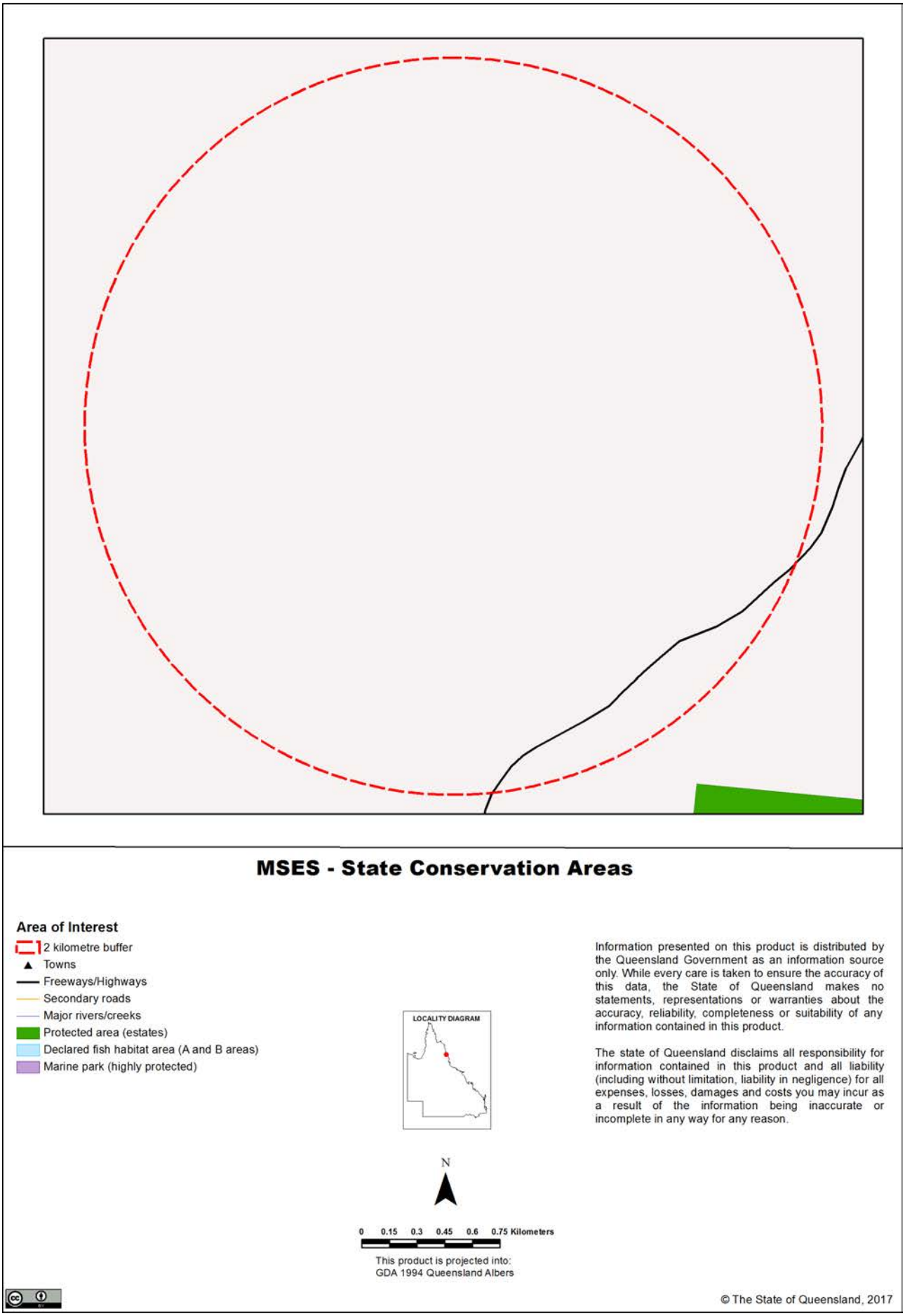
(no results)

Legally secured offset area (vegetation offsets)

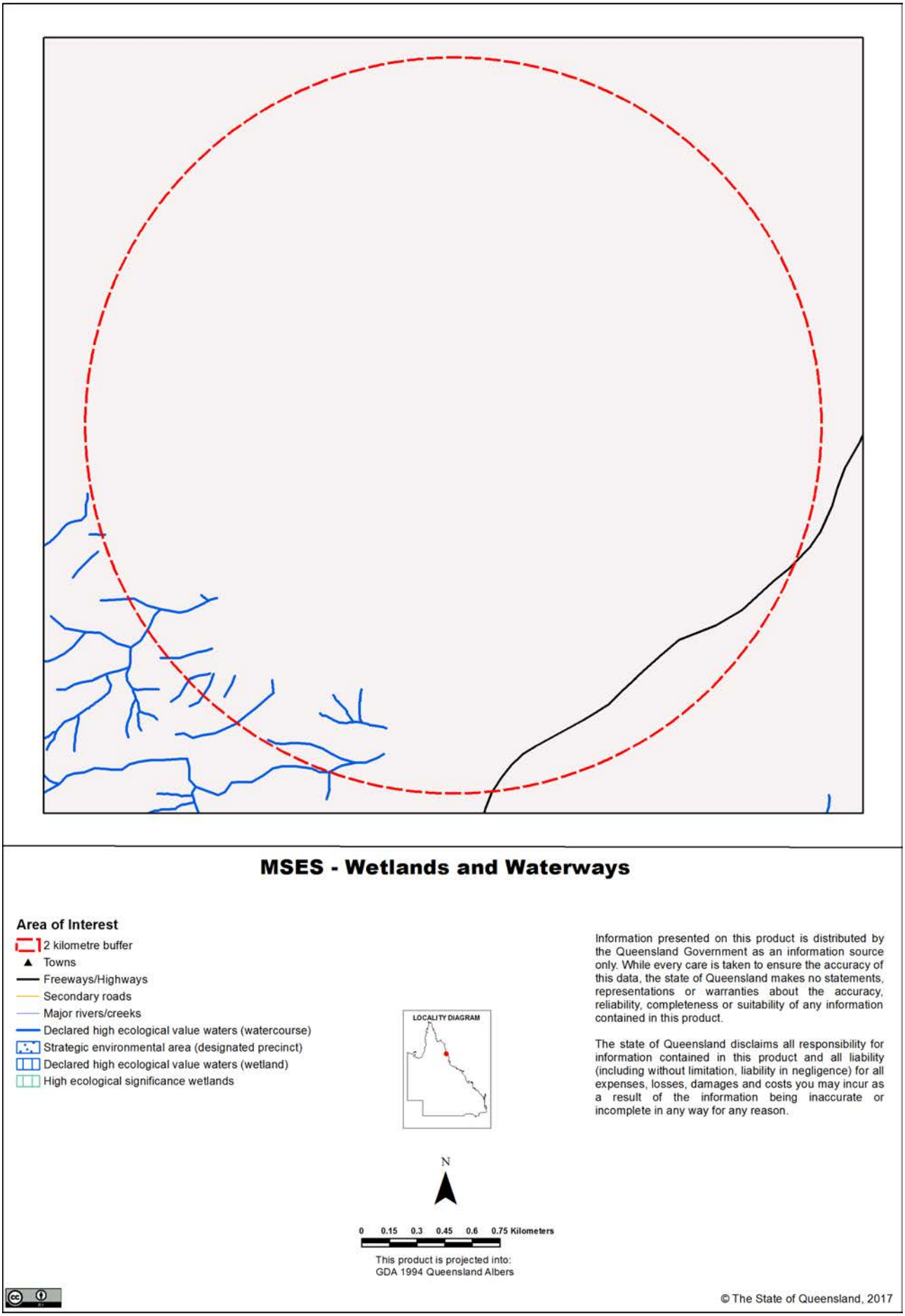
(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

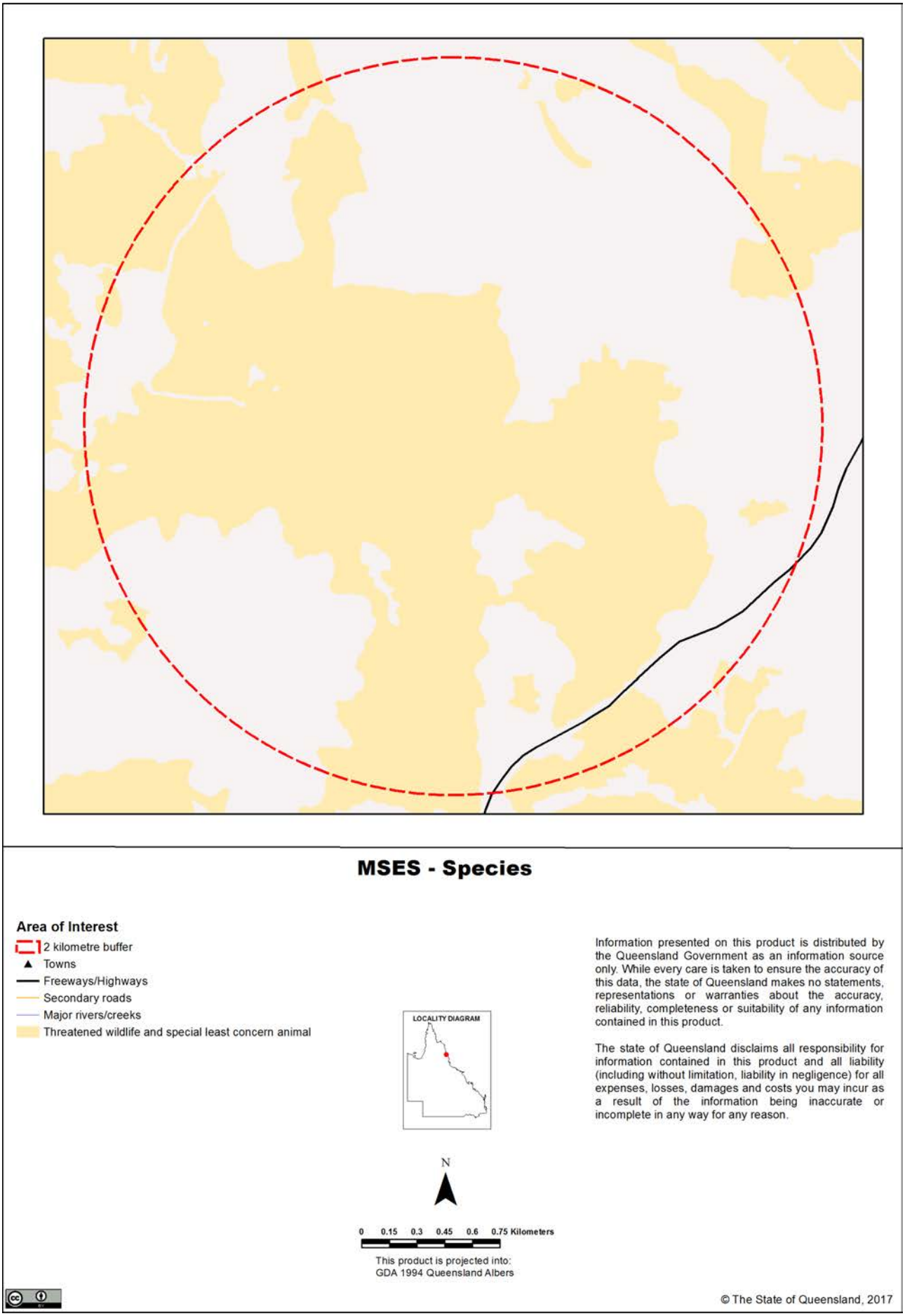
Map 1 - MSES - State Conservation Areas



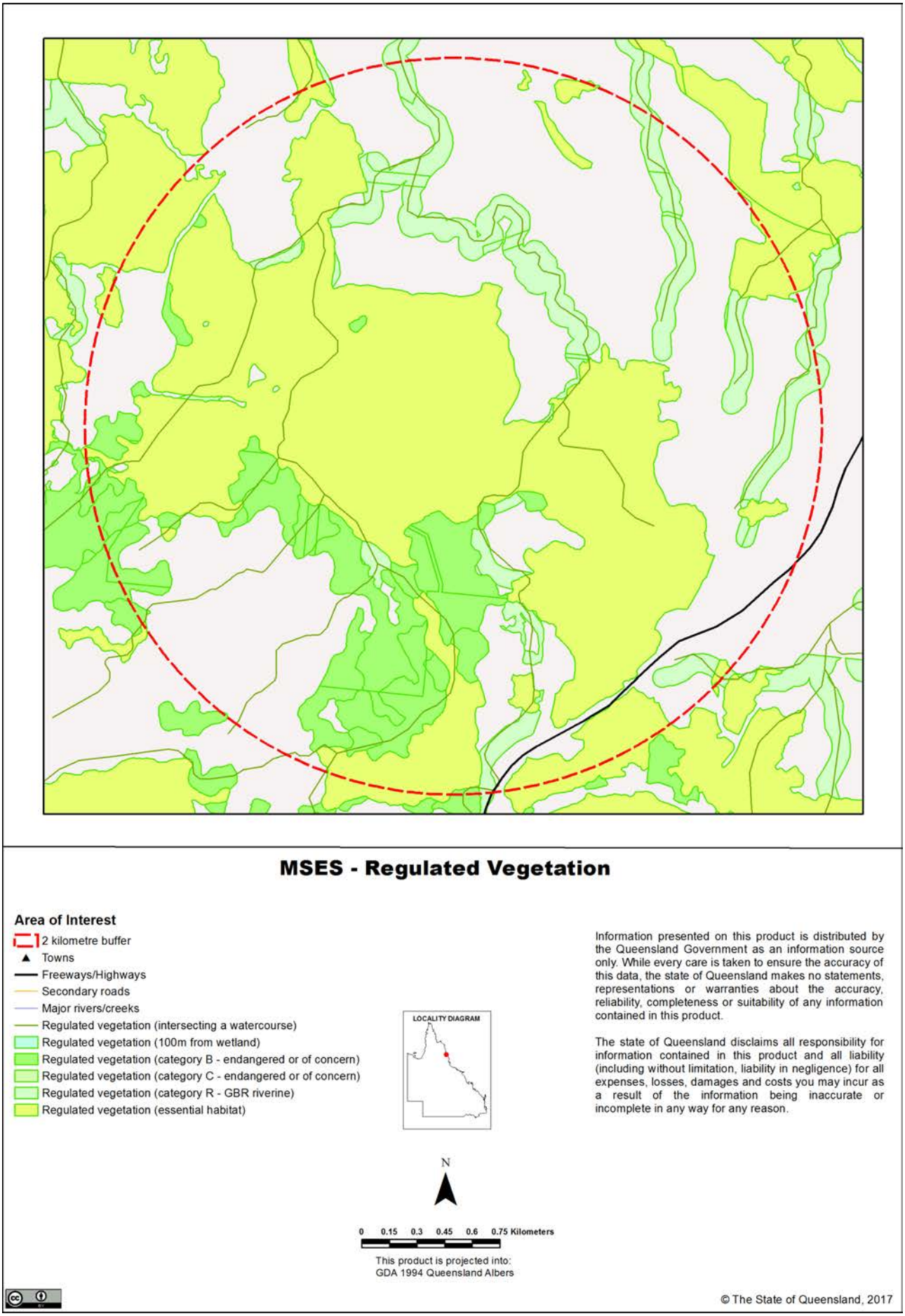
Map 2 - MSES - Wetlands and Waterways



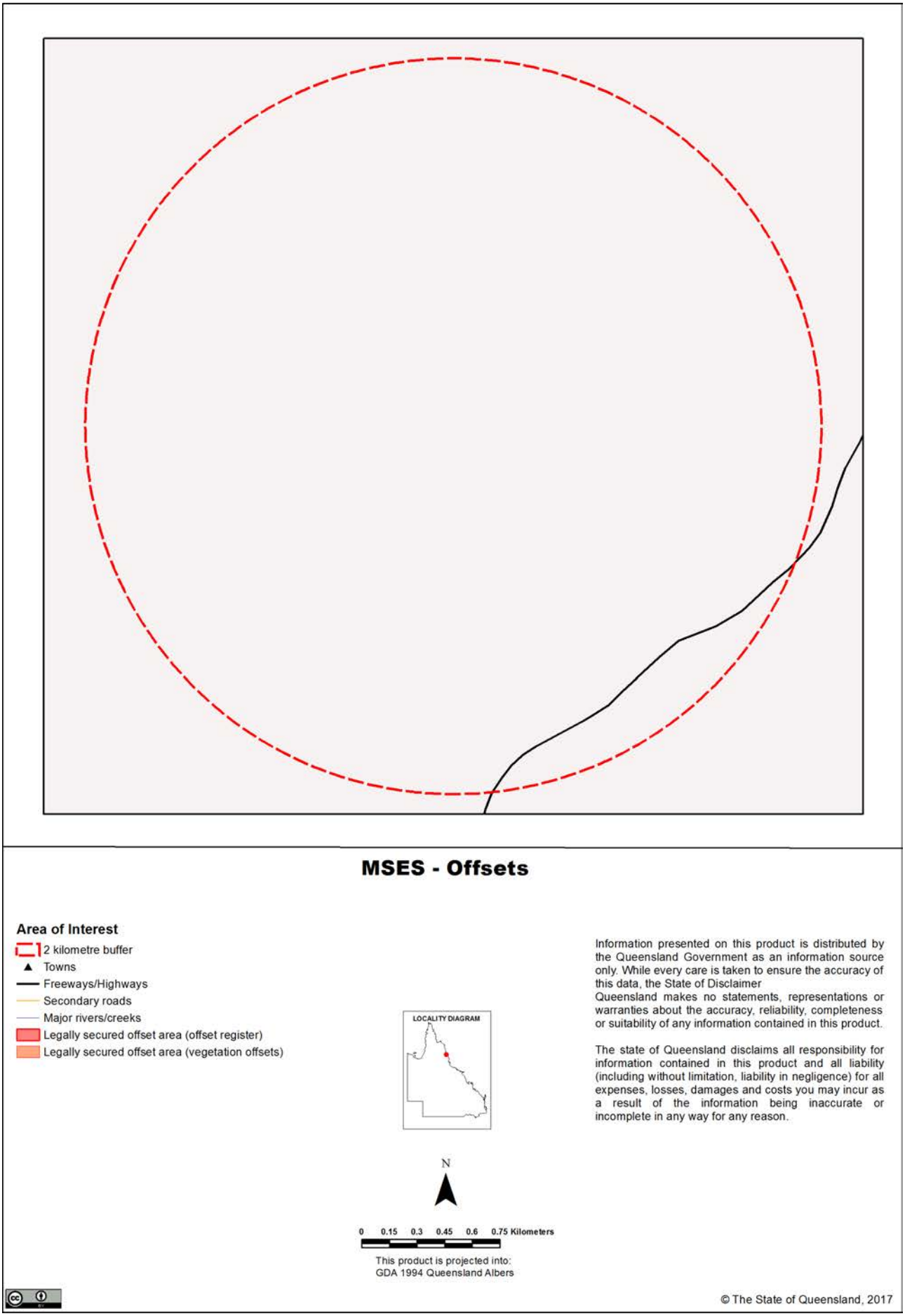
Map 3 - MSES - Species



Map 4 - MSES - Regulated Vegetation



Map 5 - MSES - Offset Areas



Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" can be downloaded from:

http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html.

Appendix 2 - Source Data

The datasets listed below are available on request from:

http://qldspatial.information.qld.gov.au/catalogue/custom/index.page

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

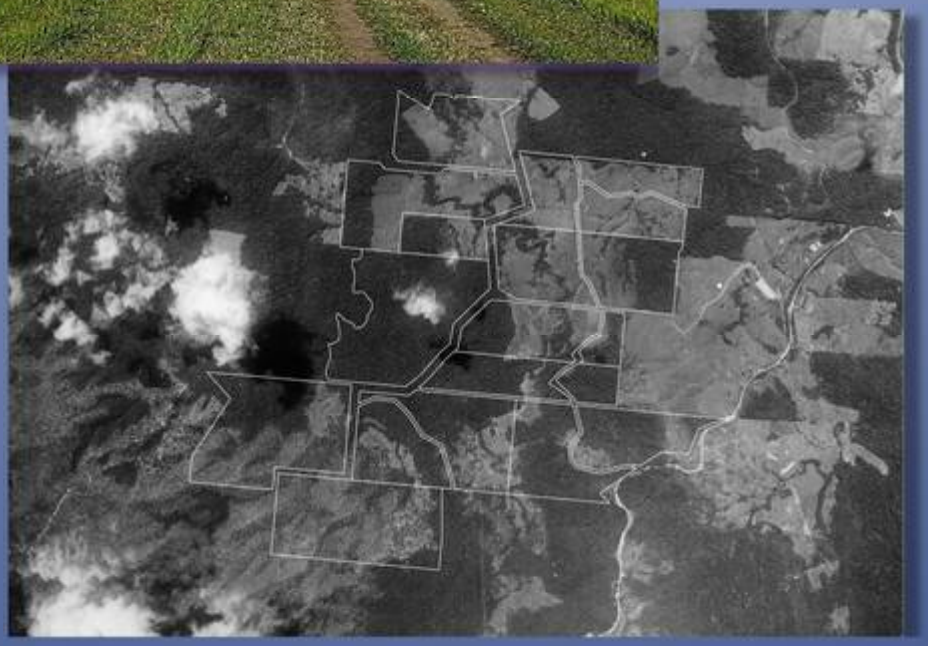
Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	**current QSpatial data (http://qspatial.ingormation.qld.gov.au)**
Protected Areas-Estates and Nature Refuges	- Protected areas of Queensland - Nature Refuges - Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Referable Wetland - wetland layers: - Wetland management area wetlands - Wetland protection area wetlands
wetlands in HEV waters	HEV waters: - EPP Water (multiple locations) intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 4, 2015) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000) - latest version 1.4
Wildlife habitat (threatened and special least concern)	-WildNet database species records - habitat suitability models (various)
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map - latest version 8.0
VMA Essential Habitat	Vegetation management - essential habitat map - latest version 4.41
VMA Wetlands	Vegetation management wetlands map - latest version 2.41
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact EHP
Regulated Vegetation Map	Vegetation management - regulated vegetation management map - latest version 1.41

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
EHP	- Department of Environment and Heritage Protection
EP Act	- *Environmental Protection Act 1994*
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- *Nature Conservation Act 1992*
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- *Vegetation Management Act 1999*

Appendix F:
Astrebla (2015a,b) Reports



Opportunities and Constraints Review

Barnwell Road, Myola

Prepared by Astrebla Ecological Services
November 2015

A discussion of potential ecological opportunities and constraints in the development of land at Barnwell Rd, Myola

This Opportunities and Constraints Review ('the Report') has been prepared by Astrebla Ecological Services ('AES') on behalf of and for Reevers and Ocean Pty Ltd ('the client'). The Report may only be used and relied on by the client for the reviewing potential opportunities and ecological constraints associated with the planned development of the subject land ('the Purpose') and may not be used by, or relied on by any person other than the client.

The services undertaken by AES in connection with preparing the Report were limited to those specifically detailed in the Report. The Report is based on conditions encountered and information reviewed, including assumptions made by AES, at the time of preparing the Report. Assumptions made by AES are those stated throughout the Report.

To the maximum extent permitted by law AES expressly disclaims responsibility for or liability arising from:

- *any error in, or omission in connection with assumptions, or*
- *reliance on the Report by a third party, or use of this Report other than for the Purpose.*

Executive Summary

Reevers and Ocean Pty Ltd plan to develop a 626 ha site on Barnwell Road at Myola, in Mareeba Shire, North Queensland. Approximately one third of this site contains non-remnant vegetation (Stage One) and the remainder is under a blanket of remnant eucalypt open forest and rainforest (Stage Two). The eucalypt open forest is mapped as an 'of concern' vegetation type. A number of ecological constraints operate on the development of this property as follows:

- Stage One:
    - Habitat for the Myola tree frog must be retained – as 60 m buffers from the centreline of all creeks. This requirement comes mostly from the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act).
    - Much of the clearing area is in a high risk area for threatened plants, so any further clearing can be done only after a plant survey is conducted. A threatened native ginger was found on the property on lot 20. This requirement comes from the Queensland *Nature Conservation Act 1992*.
    - There are also some areas of remnant vegetation in Stage One which should be avoided. Provided these areas are avoided, and buffers are left around watercourse vegetation, there are no constraints applying to Stage One from the *Vegetation Management Act 1999.*
- Stage Two:
    - Habitat for the Myola tree frog must be retained as outlined above.
    - Clearing in a high risk area for threatened plants must be done according to the procedure outlined above.
    - This stage contains extensive areas of remnant vegetation – approval to clear these areas will generally (but not in all cases) require a clearing permit for development or for operational works under the *Sustainable Planning Act 2009.* Some of this vegetation will require offsetting in order to get approval to clear it.
    - Much of the remnant vegetation in this area is mapped as essential habitat for the cassowary. Clearing this vegetation will in most cases require offsetting for an approval. Approvals would be required from both the Queensland and Commonwealth governments.

It should be noted that clearing to re-establish cattle grazing on the property is likely to be permissible under the EPBC Act with no need for a referral, as long as more land is not cleared than was formerly farmed before 2000.

Development of the land in Stage One is relatively straightforward from an ecological point of view, and intensive residential or tourism related development is viable (subject to engineering and zoning constraints, among other things). Development of Stage Two will generally be possible but highly constrained, and plans for this area should be limited to infrastructure that has a small footprint (ie small clearing area) and is environmentally sensitive, such as a modest number of 'tree houses', eco-lodges and other low impact structures and activities. Intensive, broad-scale features such as a golf course would not be suitable for this stage.

In most cases, development of Stage Two will require offsetting, which will be time-consuming and relatively expensive (hence the need for structures that can provide a high investment yield but have a low clearing impact).

Contents

Figures

Plates

Appendices

1. Introduction

1.1 Overview

Reevers and Ocean Pty Ltd own a 626 ha parcel of 12 adjoining freehold lots in the Myola area, two kilometres west of Kuranda town centre (see Figure 1). This land holding, at the southern terminus of Barnwell Road, was previously a cattle farm.

These lots, all located in Mareeba Shire in a rural zone, are (listed in order from north to south):

- Lot 22 N157227 (37.259 ha)
- Lot 1 RP703984 (16.187 ha)
- Lot 2 RP703984 (48.312 ha)
- Lot 17 N157227 (57.713 ha)
- Lot 18 N157227 (63.012 ha)
- Lot 19 N157452 (39.598 ha)
- Lot 95 N157452 (34.049 ha)
- Lot 20 N157423 (70.618 ha)
- Lot 131 N157491 (64.75 ha)
- Lot 129 NR456 (65.89 ha)
- Lot 43 N157359 (64.514 ha)
- Lot 290 N157480 (64.75 ha)

This land is located in an area that has a number of ecological constraints under both state and Commonwealth government legislation. This document will review those constraints and how they affect plans to develop the land. In addition, opportunities to address those constraints will be discussed, and recommendations made.

1.2 Project land description

The project area is divided into two for the purpose of this report. The northern third of the project area is less constrained and so is more easily developable – this section is referred to as Stage One and comprises lots 1, 2, 17, 18, 19 and 22 (the lots with the black boundaries in Figure 2). Stage Two comprises the remainder of the lots (mapped with a red boundary in Figure 2).

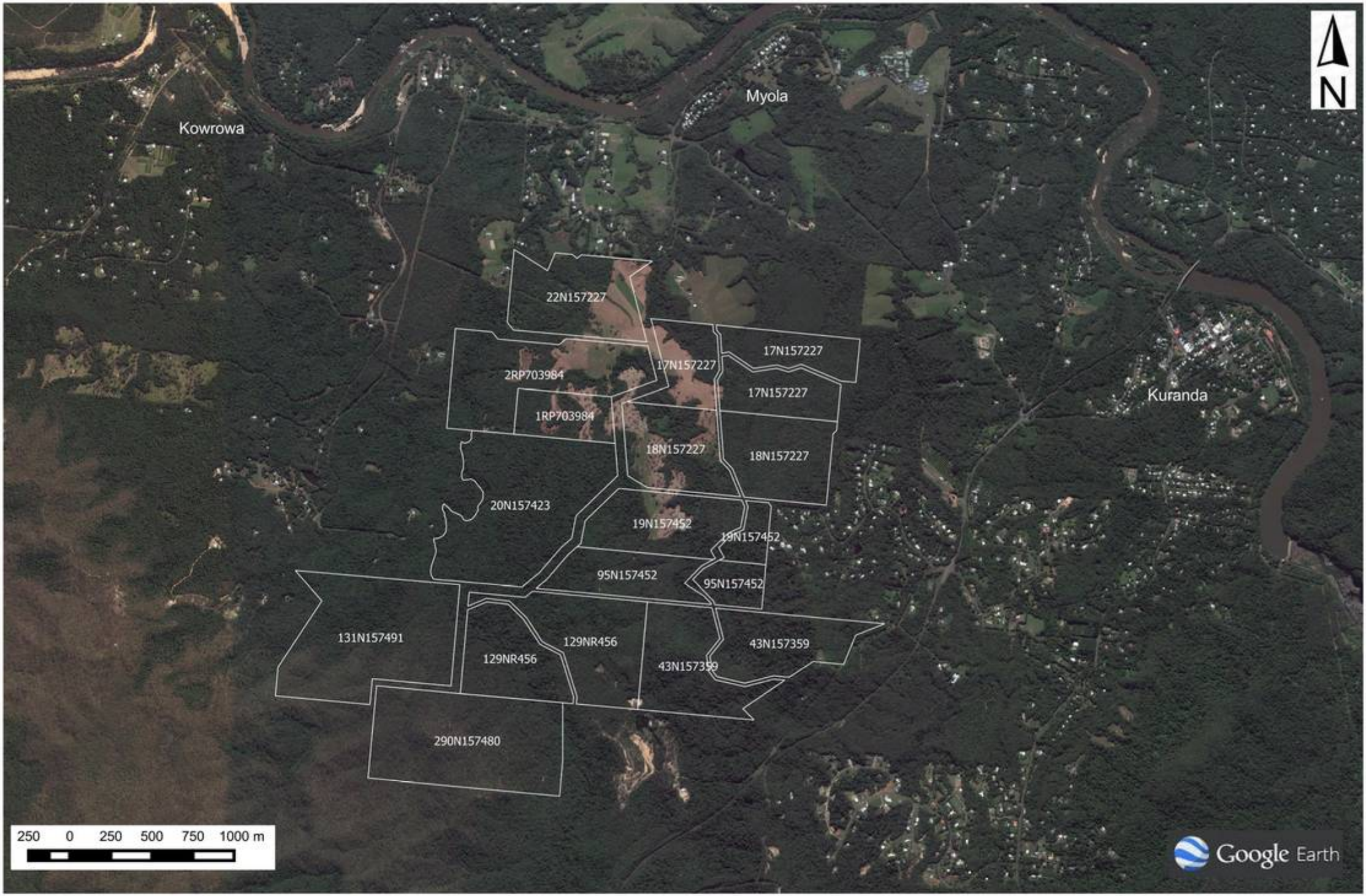
1.2.1 Stage One

Stage One is located on gently undulating to undulating rises dissected by steep gullies. It has been predominately clear of vegetation at least since the 1940s. However, the aerial photo history suggests it has been neglected since about the late 1980s/early 1990s (see Appendix A), and today this area is characterised by advanced rainforest regrowth.

In the west (the inland side) a major stream (Owen Creek) is located just inside the boundary (see Figure 3). This is a rocky creek interspersed with sandy sections and is heavily vegetated.

1.2.2 Stage Two

The majority of the Stage Two lots are comprised of dense rainforest. Aerial photos suggest these lots have mostly never been cleared (at least since the 1930s), although some clearing has occurred in lots 43, 95, 129 and 131 historically, and these areas were kept clear at least until 1971 (see Appendix A). Stage Two also has a number of waterways, however these are higher in the catchment and are consequently smaller.

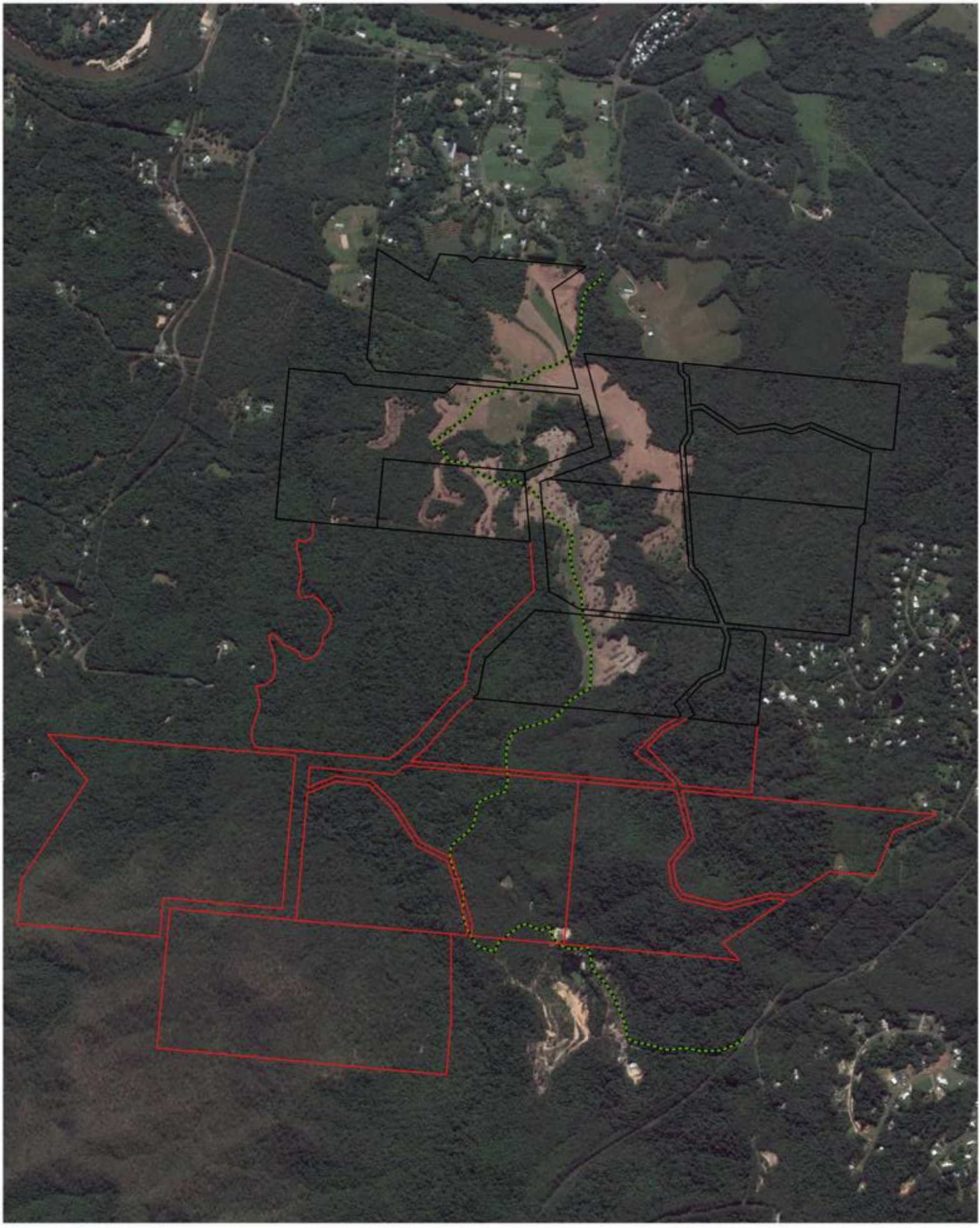


Project area

Figure 1

Imagery:© Google. Taken 6/5/2015. This image reproduced at 1:20,000 when printed at A3.
Mareeba Shire DCDB © State of Queensland (Department of Natural Resources and Mines) [2015]
GIS operator Simon Danielsen, Astrebla Ecological Services, 23/10/15.

Prepared by ASTREBLA ECOLOGICAL SERVICES



Stage one and two

250 0 250 500 750 1000 m

N

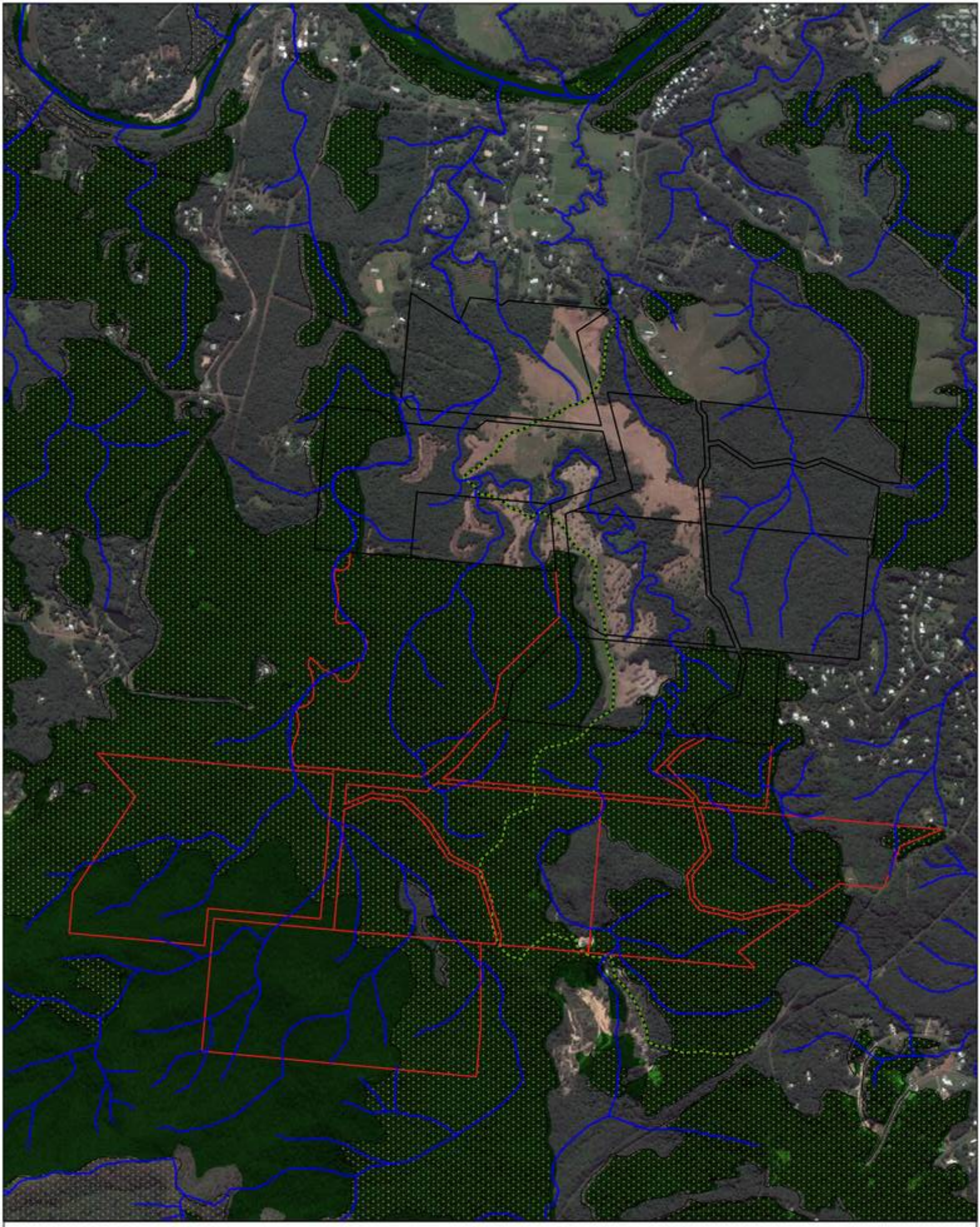
Legend

- Stage One
- Stage Two
- Main north-south track

Figure 2

Imagery © Google. This image reproduced at 1:10,000 when printed at A3.
Mareeba Shire DCDB © State of Queensland (Department of Natural Resources and Mines) [2015]
GIS operator Simon Danielsen, Astrebla Ecological Services, 20/10/15.

Prepared by ASTREBLA ECOLOGICAL SERVICES



Waterways, remnant vegetation and essential habitat mapping

Figure 3

250 0 250 500 750 1000 m

Legend

- Waterways_Barnwell Rd
- Main north-south track
- Stage One
- Essential_habitat_map
- Stage Two
- Remnant areas

N

Imagery © Google. Taken 6/5/2015. This image reproduced at 1:10,000 when printed at A3.
Remnant vegetation layer © State of Queensland (Department of Natural Resources and Mines) 2015.
Mareeba Shire DCDB © State of Queensland (Department of Natural Resources and Mines) [2015]
GIS operator Simon Danielsen, Astrebla Ecological Services, 20/10/15.

Prepared by ASTREBLA ECOLOGICAL SERVICES

2. Constraints

The ecological constraints associated with developing this property are:

- Stage One:
    - Habitat for the Myola tree frog must be retained – as 60 m buffers from the centreline of all creeks. However, where more than 60 m has already been cleared, these cleared areas will be retained. This requirement comes from the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) and the Queensland *Nature Conservation Act 1992*.
    - Much of the clearing area is in a high risk area for threatened plants, so any further clearing can be done only after a plant survey is conducted. If threatened plants are not found, clearing can commence after a report has been submitted – if threatened plants are present, clearing can only be done under a Nature Conservation Act threatened plants clearing permit. A threatened native ginger was found on the property on lot 20.
    - There are also some areas of remnant vegetation in Stage One which should be avoided. Provided these areas are avoided, and clearing of reef watercourse regrowth vegetation is done according to the self-assessable code, there are no constraints applying to Stage One from the *Vegetation Management Act 1999.*
- Stage Two:
    - Habitat for the Myola tree frog must be retained as outlined above.
    - Clearing in a high risk area for threatened plants must be done according to the procedure outlined above.
    - This stage contains extensive areas of remnant vegetation – approval to clear these areas will generally (but not in all cases) require a clearing permit for development or for operational works under the *Sustainable Planning Act 2009.* Some of this vegetation will require offsetting in order to get approval to clear it.
    - Much of the remnant vegetation in this area is mapped as essential habitat for the cassowary. Clearing this vegetation will in most cases require offsetting for an approval. Approvals would be required from both the Queensland and Commonwealth governments.

Listed by the level of government, the constraints are:

- Queensland government:
    - *Nature Conservation Act 1992* – clearing in a high risk area for protected plants requires a flora survey and associated report. One protected plant species, a native ginger (*Alpinia hylandii* R.M.Sm.), was found on the boundary of lot 1 and lot 20, and a protected palm species (the Myola palm *Archontophoenix myolensis* Dowe) is believed to be growing in a creek on lot 22. This Act also protects certain fauna species such as the cassowary and the Myola tree frog.

- *Vegetation Management Act 1999* – clearing of remnant vegetation is not permitted for development purposes unless you are doing the clearing for a reconfiguration of lot (RaL) or material change of use (MCU) that has been approved by Council. When you go through the application process for a ROL or MCU the submitted development plans will be assessed against a clearing code. The Queensland Department of Natural Resources and Mines (NRM) will have the ability to veto the development if remnant vegetation clearing does not meet its requirements. **This is by far the heaviest Queensland government constraint on vegetation mapped as remnant within the project area**.

- Commonwealth government – the *Environment Protection and Biodiversity Conservation Act 1999* (known as the EPBC Act) is the only ecological constraints at a national level. The items of concern under the EPBC Act that affect development of the Barnwell Rd property are:
  - Myola tree frog (*Litoria myola*) and two other tree frog species – the issues are:
    - protection of the habitat that these frogs live in, as they can be found up to 60-100 m away from the stream – this is done by leaving buffers along the streams.
    - protection of the water quality in the stream, by installing best-practice standard sediment and erosion management measures.
  - Southern cassowary (*Casuarius casuarius*) – the issues are likely to be:
    - clearing of habitat – much of the remnant vegetation on the property (mostly located in Stage Two) is mapped as essential habitat for the southern cassowary (see Figure 3). Obtaining approval to clear cassowary essential habitat will require a habitat offset.
    - impacts on the cassowary from the proposed activities – mostly from new fences, increased traffic and the importation of dogs.

These constraints are discussed in more detail in the following sections.

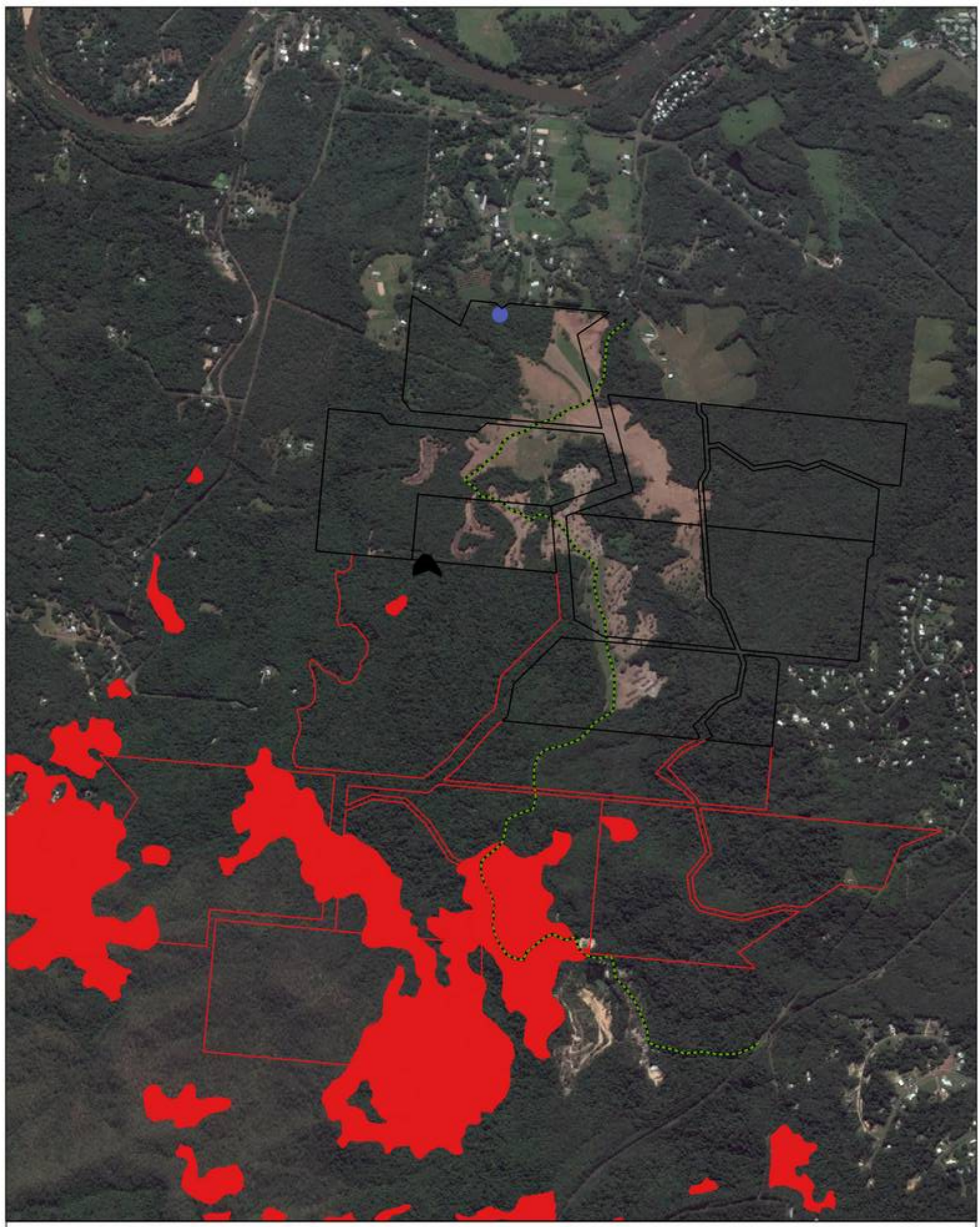
2.1 Queensland government constraints

2.1.1 Nature Conservation Act requirements

Under section 256 of the *Nature Conservation (Wildlife Management) Regulation 2006* (the NCWMR), a flora survey and flora survey report is required prior to clearing if an area is identified as an area of high risk on a flora trigger map. The majority of the Barnwell Rd project area is mapped as a high risk area on a flora trigger map – see Figure 5. If threatened plants are found, as occurred during the flora survey conducted in September (see below), the flora survey report must outline details of the threatened plants, including where they were located, and discuss how they will be protected from the impacts of clearing.

What impact will this have on development plans?

It means those plants must be protected from clearing, and this is likely to mean a buffer of perhaps 100 m between the edge of any clearing and the known location of the threatened plants. The native ginger found in the project area is currently directly on the boundary of an area that was recently cleared for this project. It remains to be seen how the Department of Environment and Heritage Protection (DEHP) will wish to proceed but it is likely they will only require a cessation of clearing in the area adjacent to the ginger (its location is mapped in Figure 4).



Protected plants and Of Concern remnant vegetation

Figure 4

250 0 250 500 750 1000 m

Legend

- Stage One
- Stage Two
- Main north-south track
- Possible Myola palm location
- Native ginger
- Of Concern remnant vegetation

N

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Remnant vegetation layer © State of Queensland (Department of Natural Resources and Mines) 2015.
Mareeba Shire DCDB © State of Queensland (Department of Natural Resources and Mines) [2015]
GIS operator Simon Danielsen, Astrebla Ecological Services, 20/10/15.

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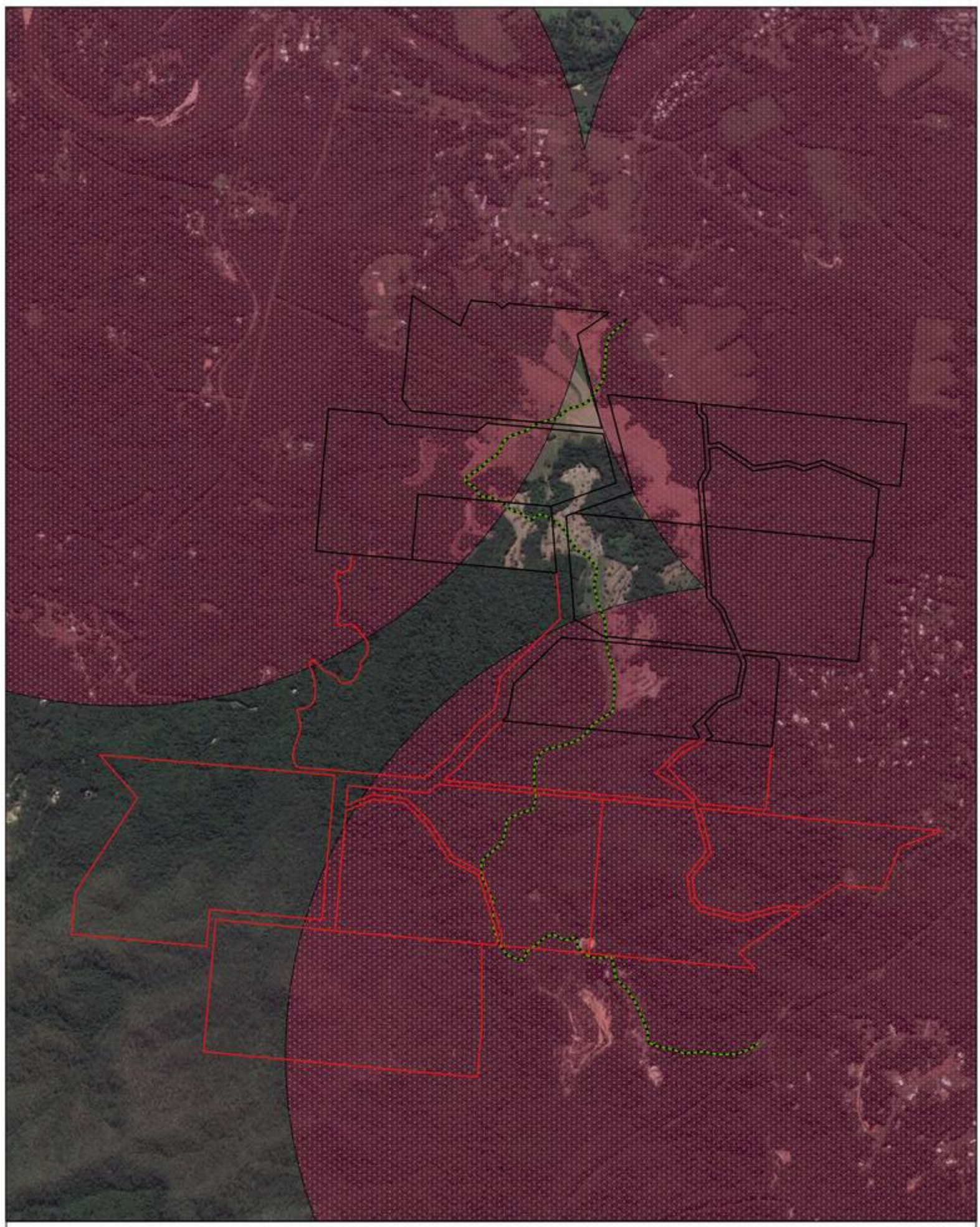

Flora survey trigger mapping

Figure 5

250 0 250 500 750 1000 m

Legend

- Stage One
- Stage Two
- Main north-south track
- High risk area on a flora trigger map

N

Imagery © Google. Taken 6/5/2015. This image reproduced at 1:10,000 when printed at A3.
Nature Conservation Act Protected Plants EVNT Flora Survey Trigger Map Spatial Layer Version 4 © State of Queensland (Department of Environment and Heritage Protection) 2015.
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GIS operator Simon Danielsen, Astrebla Ecological Services, 24/10/15.

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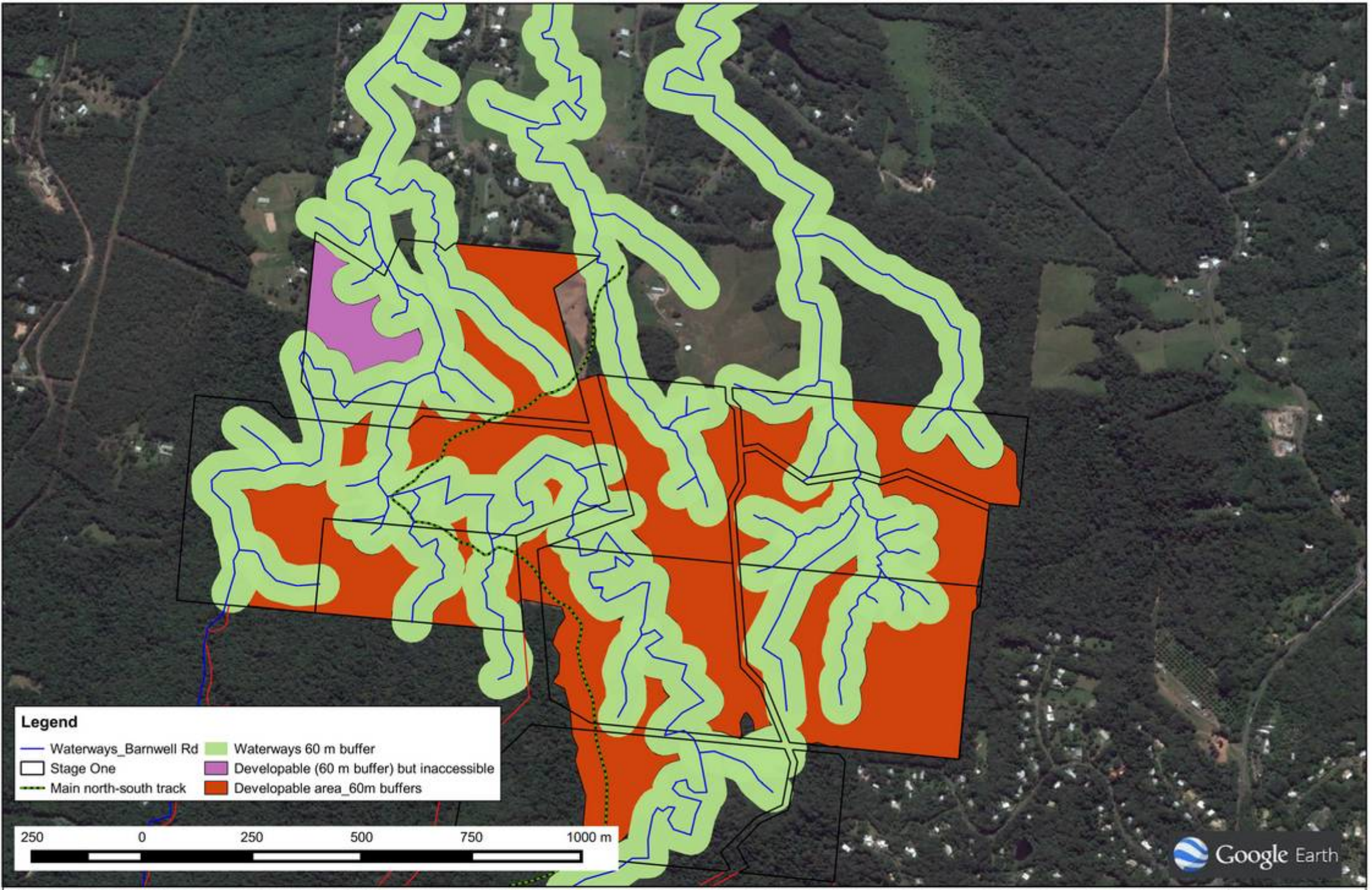

Stage One waterway buffers (60 m) and the resulting developable area

Figure 6

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Waterways traced from historic aerial photography by Simon Danielsen.
Mareeba Shire DCDB © State of Queensland (Department of Natural Resources and Mines) [2015]
GIS operator Simon Danielsen, Astrebla Ecological Services, 23/10/15.

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This species may be found throughout lot 20 and the other Stage Two lots where rainforest occurs. Therefore, any future plans to clear vegetation on these lots should only be made after the entire areas proposed to be cleared have been surveyed for the presence of this plant, and a report submitted to DEHP.

The Myola palm only occurs in creek beds. As these will be protected from clearing so as to protect the Myola tree frog, this species is not likely to be impacted and should not act as a constraint.

Both species are discussed in more detail below.

2.1.1.1 Native ginger

The near threatened native ginger *A. hylandii* R.M.Sm. was observed in one location (see Figure 4 and Plate 1), on lot 20 and on the southern boundary with lot 1. Approximately 60 'clumps' were recorded within an area of 0.7 ha. These clumps are primarily located in rainforest, within 100 m of the edge of an area that has now been cleared. Five clumps were found outside of the rainforest but on its immediate edge.

Other populations of *A. hylandii* are likely to be present in rainforest within the Stage Two lots.

Plate 1 Protected (or suspected) plant species recorded on site

Left: *Alpinia hylandii* showing characteristic petiolate leaves; Right: possible *Archontophoenix myolensis* (right side of image) growing below the low bank of a minor stream in the Owen Creek catchment. This plant was too immature to identify to species, and may be *A. alexandrae* (a species that is not threatened).

2.1.1.2 Possible Myola palm

Two possible Myola palm individuals were recorded in a minor creek within the Owen Creek catchment (see Figure 4 and Plate 1). Both were less than two metres tall and as such not of sufficient maturity to be identifiable. Photographs sent to Dr John Dowe confirmed that these palms are not identifiable to species level at this time. However, Dr Dowe thought there is a strong possibility that the Myola palm may be in this area (Dr J. Dowe, *pers. comm.,* 21/9/15).

In order to detect further possible Myola palm individuals, all creek beds within the possible clearing impact area were searched in the Owen Creek catchment within the Barnwell Rd farm (but no further individuals were found). Gullies in the Warrill Creek catchment were practically impossible to access – extremely dense climbing palms and steep banks made access very difficult (and painful) to obtain. However, frequent point searches, from a vantage point on a bank using binoculars, failed to locate it in the Warrill Creek catchment within the clearing impact area. A number of Myola palm individuals are growing in tributaries of Warrill Creek where crossed by Barnwell Rd, but these are outside of the property.

2.2 Vegetation Management Act requirements

The *Vegetation Management Act 1999* (referred to as the VMA) regulates the clearing of native vegetation in Queensland. It is administered by the Department of Natural Resources and Mines (DNRM).

Under the VMA, on freehold land you can clear non-remnant vegetation without a permit. If you wish to clear remnant vegetation without a development permit (see Figure 3 for a map of remnant vegetation on the project site), you must ensure you clear according to a permit exemption category.

Otherwise, you can't clear until after you get approval for your development. And in order to get your development approved, you will have to demonstrate how you can do any required clearing according to the relevant clearing code.

2.2.1 Clearing for an exemption

Schedule 24 of the *Sustainable Planning Regulation 2009* (referred to as the SPR) outlines the clearing that can be done without a clearing permit i.e. under an 'exemption'. Exemptions will play a very important part in the planning for Stage Two of the Barnwell Road development – they represent opportunities and are discussed in Section 0.

2.2.2 Clearing code for development applications

There are three types of development application that may be applicable to development for this project:

- Reconfiguration of a lot (RaL) – where an application is made to divide one lot into two or more.
- Material change of use (MCU) – where an application is made to change the zoning and therefore the associated allowable uses for the land eg from rural to rural residential.
- Operational works – to conduct clearing works (or bulk earthworks or other types of operational work) that cannot be done under an exemption – in this case, if Council requires any roads to be constructed within the road reserves to have an associated corridor wider than 10 m, an operational works permit for vegetation clearing will be required.

When these applications are lodged, they will be assessed by the DNRM against Module 8 of the State Development Assessment Provisions (SDAP). A complete version of Module 8 is provided in Appendix B.

In general, it is easiest to obtain approval for a MCU or RaL if you can demonstrate that either *no clearing will result* (probably not possible for Stage Two but possible for Stage One), OR that all clearing that would result from the development *could already be done under existing clearing exemptions* (if the MCU or RaL were already approved).

If not, a full assessment against Table 8.1.4 in Module 8 will be required (Performance Outcomes or PO2 to PO11). In particular, constraints contained in Table 8 that would be critical for this project include:

- Streams must be buffered by at least 10 m (in Stage Two) from the high bank or defining bank.
- Clearing of remnant vegetation mapped as 'of concern' (see Figure 4) or essential habitat (see Figure 3) must be demonstrated to have been avoided wherever possible, and where absolutely impossible to avoid, an offset would be required. Offsetting is discussed in the Opportunities section.

Similar constraints are in force for the Operational Works application process, although due to the nature of the lots and the limited access options available, these constraints are not thought likely to be as difficult (that is, you have little choice where you can locate the roads, and council dictate the width of the roads required).

2.3 Commonwealth government constraints

The EPBC Act is a significant constraint on development plans for this project. Under this Act, any action that has, will have, or is likely to have a significant impact on a matter of national environmental significance requires referral to the Commonwealth government.

The matters of national environmental significance that may possibly be significantly impacted by this project are the:

- Myola tree frog – an endangered tree frog restricted to only a few creek systems in the Myola-Kuranda area. The second largest known population occurs in Warrill Creek, whose catchment includes parts of the north eastern corner of the project area (mostly in Stage One). It is also known from Owen Creek, which runs along the western boundary of Stage One, and forms the western lot boundary of lot 20. Although the males are restricted to the stream bed and banks, the females are known to occur up to 60-100 m from the streams.
- Australian lacelid tree frog (*Litoria dayi*) – an endangered tree frog that has been located in the Myola area previously, but only rarely. Populations of this frog suffered rapid and dramatic declines in upland areas of the Atherton Tablelands in the early 1990s. It has similar habitat requirements to the Myola tree frog.
- Southern cassowary – this emu-like bird is restricted to rainforests of the Wet Tropics, where its population has been steadily declining since European arrival. Cassowaries are impacted most by habitat removal and interactions with cars and dogs. It is unlikely that any cassowaries use the Barnwell Road property. However, cassowary habitat is protected so that the species has somewhere to go if populations increase in the future. It is possible that juvenile birds may occur in this area from time to time. Mature cassowaries are common just to the north of the Barron River, and south of the Kennedy Highway.

These matters of national environmental significance are likely to have a constraining influence on the project because:

- Rainforest vegetation beside waterways must be buffered (ie, retained) to protect habitat for the two tree frog species. Buffers should be at least 60 m, and possibly up to 100 m. This will result in approximately 136 ha of developable land in Stage One (see Figure 6), based on a 60 m buffer width (that is, 60 m either side of each waterway). In Stage Two, buffering of watercourses by 60 m in the non-remnant and lower value remnant vegetation will leave an easily developable area of 38.7 ha (see Figure 7). Where clearing has reduced the buffer to less than 60 m, restoration is not proposed and the figure of 136 ha is based on these cleared areas being kept clear. Of course, this is subject to the approval of the Commonwealth government.
- Clearing areas mapped as essential habitat for the cassowary (see Figure 3) will almost always require an offset. It is expected that areas mapped as essential habitat are only proposed for development where no suitable alternative site exists, so careful planning is required to avoid essential habitat if possible. Offsets provided under the Queensland legislation can be used to satisfy the Commonwealth government and are discussed in the Opportunities section below.
- Design elements of any development must be cassowary friendly – this means fences must be avoided where possible, or constructed in such a way that they will not adversely affect cassowary movement and safety, and dogs would not be allowable on the site.

Under the Commonwealth government EPBC Act referral procedure, the referral document we submit must be made public and there are two phases where the public are invited to submit comment. Therefore, good public relations are important. In my previous EPBC referrals in the Kuranda/Atherton area, public comments were extensive.

2.3.1 Lawful continuation of land use

Section 43b of the EPBC Act states that *an EPBC referral is not required* if the use of the land is a lawful continuation of a land use that was in place before 2000, without intensification or expansion.

This means that an EPBC referral would not be required provided:

- the Barnwell Rd property is used for cattle grazing only, and
- clearing does not exceed the limits of pre-2000 clearing (if it does, it would be an expansion of use).

This is based on the following assumptions:

- Cattle grazing at Barnwell Rd commenced before 2000,
- Cattle grazing is a lawful use of the land,
- Cattle grazing at Barnwell Rd does not require special authorisation under either Commonwealth or Queensland legislation,
- Cattle grazing has continued at Barnwell Rd (since 2000) without enlargement, expansion or intensification.

Note – it is not relevant that the use has contracted since 2000. It is only necessary that the land use hasn't expanded since then – an expansion, intensification or enlargement (on this particular property) would very likely require an EPBC referral.

Any change in land use, such as to residential or tourism activities, particularly if clearing was proposed, may require an EPBC referral. Any clearing for those purposes would almost certainly require an EPBC referral, particularly if it is to occur in mapped essential habitat for cassowaries, or in the creek buffer for the Myola tree frog.

3. Opportunities

Despite the constraints, there are a number of opportunities which can be used to advantage, primarily for Stage Two.

3.1 Vegetation Management Act exemptions

Clearing under an exemption means you don't need a permit. Clearing that can be done for an exemption depends on the type of vegetation and the land tenure on which the clearing will occur. The exemptions relevant to possible future development in Stage Two are:

- For any vegetation type:
    - On the road reserves –
        - clearing necessary for reasonable access to adjoining land from the existing formed road, to a maximum width of 10m. A width of 10 m will be suitable for access purposes. However, if a road is required to be built to Mareeba Shire Council requirements, it will probably need to be wider than 10 m and an operational works permit would be required for clearing remnant vegetation.
    - On freehold land –
        - clearing for a single residence and any associated necessary clearing, if a building development application or compliance permit has been issued.
        - to establish 'fire management lines' – essentially access tracks for the primary purpose of managing fires – either planned (hazard reduction burns) or unplanned (bushfires).
        - for fire breaks to protect built infrastructure (not fences).
        - necessary to maintain existing infrastructure including fences.
- For least concern remnant vegetation (that is, the lowest category) on freehold land:
    - to establish a necessary fence or road if the clearing is not more than 10 m wide.
    - to construct built infrastructure that is necessary to the purpose for which the lot is being used or will be used (if the planned use is allowed under the zoning and Council bylaws), to a maximum area of 2 ha.

If the development of a lot (either an MCU or a RaL) can be designed such that any resulting clearing would be within these exemptions, then an approval is highly likely. Development applications that cannot meet these exemptions (for example, which involve a golf course or a hotel etc) would need to be assessed on their merits against the full clearing code (Module 8 Table 8.1.4 of the SDAP).

These exemptions are opportunities to get simple developments approved easily. For example, to get a simple RaL approved that divides one lot into three.

3.2 Offsetting

What is an offset?

Offsetting allows a developer to provide replacement habitat in order to get approval to clear essential habitat or areas of higher ecological value (in this case, of concern remnant vegetation – see Figure 4). In this case, offsetting would be negotiated with the Queensland government according to the *Environmental Offsets Act 2014* – any offset negotiated under this Act would be likely to be acceptable to the Commonwealth government as well (but concurrent negotiations can occur). Offsets would be required for clearing of essential habitat for cassowaries (see Figure 3), and for clearing of any of concern remnant vegetation (see Figure 4).

Offsets not to be used in the first instance

However, offsets are not to be used in the first instance – they can only be used as a *last resort*. An applicant would have to demonstrate that they had first tried to avoid the impact – by locating their infrastructure in an area that will not require clearing of essential habitat or of concern remnant vegetation. If avoidance is not possible, the applicant would be expected to mitigate any impact, which means implementing measures such as sediment and erosion management measures, or installing cassowary friendly fences.

Types of offset

There are two broad types of offset:

- Financial settlement offsets – where the proponent pays the Queensland government and 'walks away' – this may in the order of $1 million per 10 ha.
- Proponent driven offsets – where the development proponent offers an offset package – that may be a combination of alternative land on which habitat can be managed/established, or pre-approved packaged habitat investments that deliver strategic benefits to the species or habitat being impacted.

Or, a developer may propose a combination of the two offset types.

It should be noted that it is unlikely that recreational uses such as golf courses would be permitted to be offset. However, this can be confirmed with the Queensland and Commonwealth governments at a later date if necessary.

Recommendation re: offsetting

Offsetting is a complex and specialist process and an offset broker is highly recommended, particularly where the development involves large areas. The offset broker Earthtrade is the premier offsetting brokerage in Queensland, with experience in brokering offsets with both the Queensland and Commonwealth government. With the assistance of Earthtrade, more areas within Stage Two may be developable than is indicated in Figure 7.

4. Possibilities for development

There are a number of possibilities for development of the landholdings at Barnwell Road, Myola.

4.1 Stage one

It is the intention of Reevers and Ocean to initially graze cattle at the Barnwell Rd site, and so to restore the land to its pre-2000 open state. Therefore, subject to the assumptions in Section 2.3.1, no EPBC referral would be required as this is a lawful continuation of land use. Subject to meeting the requirements for an exemption from the need for a clearing permit under the NCWMR (given much of Stage one is in a high risk area on a flora trigger map), and as long as remnant vegetation is not cleared and sediment and erosion management measures are in place, no impediments under Queensland environmental legislation would be met either.

Development of stage one has the highest residential potential given it is located closest to existing services such as power and water (presumably), and would be most easily subdivided. The following points are made in relation to the development potential of stage one:

- After waterways are buffered by 60 m (to be measured *on the ground* from the centreline of the actual waterway), a minimum of 124 ha of developable land is possible (see Figure 6). This means, 124 ha of land is 'developable', ie it can be cleared and used for residential or other intensive purposes (subject to zoning, engineering and other potential limitations).
- Allotment boundaries can still be placed through buffers and remnant vegetation. However:
    - future owners would likely have to sign a covenant stating they will not clear or fence their boundaries, and
    - the lots will need a suitably sized building envelope (4000 m^2 or similar) located at least 20 m away from the edge of the buffer.
- Some buffered waterway areas could be included as park contribution to Council (this was done for the waterway buffer required to be implemented for the Myola Heights development on Myola Rd).
- In addition, buffered waterways can be retained as common property and used as a feature of the development, with low impact walking tracks etc to facilitate community usage.

4.2 Stage Two

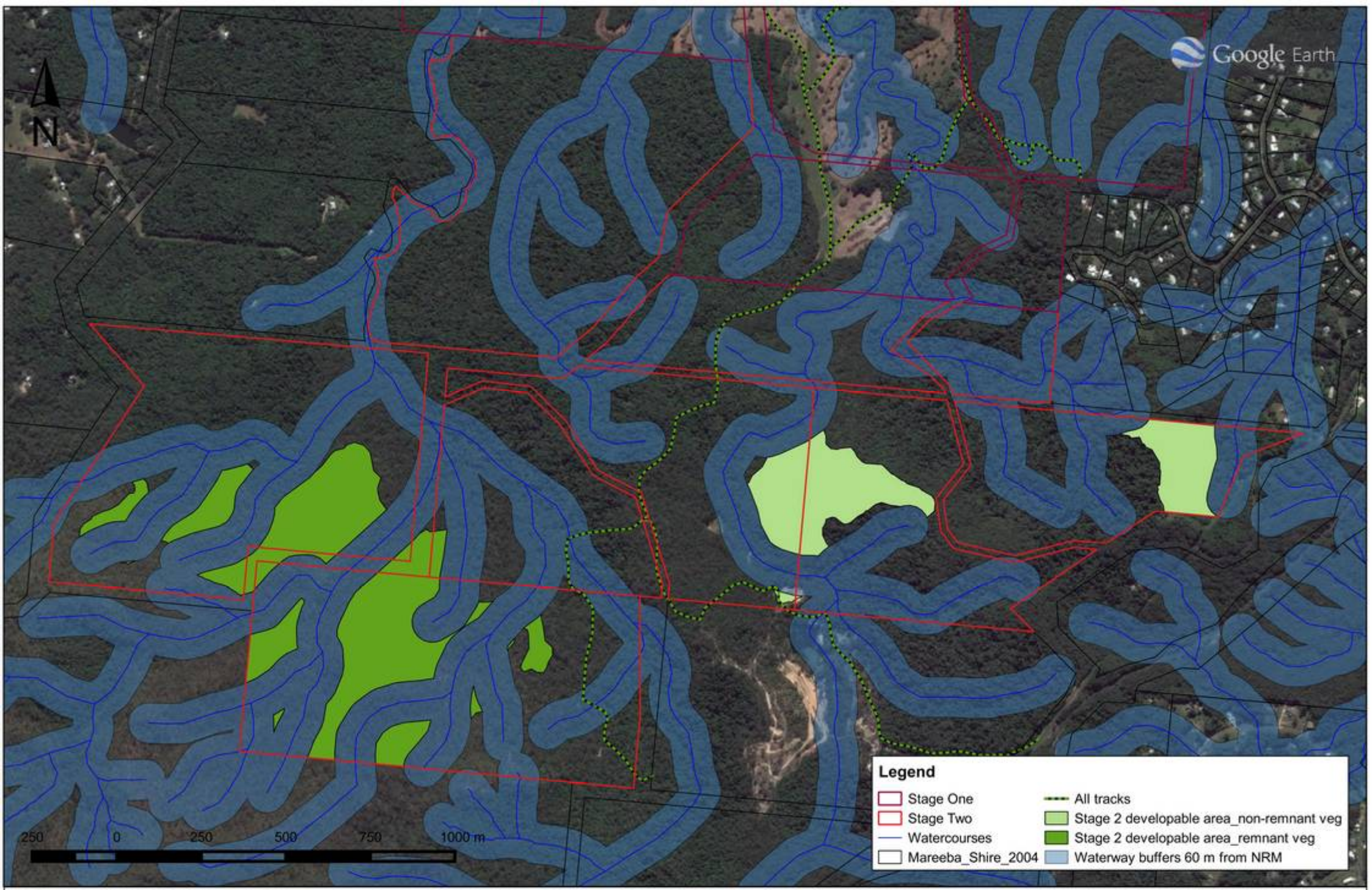
Land in stage Two is more heavily constrained because of the extensive remnant vegetation mapping with essential habitat for cassowaries. However, Figure 7 shows land that is relatively easily developable. The two green areas (15.1 ha) are non-remnant vegetation – this means they have the same status as most of the land in Stage One – subject to a clearing exemption under the NCWMR , and provided buffers of 60 m from the waterways are maintained, it can be cleared with no permit required. However, note that much of the area in the far east is steep, inaccessible land.

The orange areas in the west are least concern remnant vegetation that are not mapped as essential habitat for the cassowary. There is 28.3 ha of this land. Although cut by waterway buffers, these buffers can be crossed with roads so access is possible (if appropriate care is taken when clearing not to impact on the Myola tree frog). This land could be cleared under an exemption.

The remainder of the land in Stage Two can be developed subject to the following constraints:

- Clearing of any land mapped as essential habitat for the cassowary (see Figure 3) will probably require an EPBC referral, and possibly require offsetting. This is Commonwealth government requirement and sits over and above any Queensland requirements (outlined below). The only land in Stage Two *not mapped* as essential habitat for the cassowary is shown as developable in Figure 7.
- Clearing of any land mapped as 'of concern' remnant vegetation (see Figure 4) will probably require offsetting, unless it is done under an exemption (eg for building one house per lot). Note, some land is mapped as of concern AND essential habitat for cassowaries!
- 60 m waterway buffers must be retained for the Myola tree frog.
- New tracks can be cleared through any least concern remnant vegetation without a permit as long as they are:
    - less than 10 m wide,
    - demonstrably necessary for any existing use under the current zoning.
- Up to two ha of land can be cleared in least concern remnant vegetation per lot for 'necessary built infrastructure', subject to EPBC Act requirements.

Stage Two is a complex area and it is difficult to compile general rules covering what can and cannot be done here. In general, development outside of the developable areas mapped in Figure 7 will probably be possible in this area, but it will need to be carefully located to avoid waterway buffers, have a minimal clearing area (as small as possible), and be environmentally sensitive, particularly in relation to the cassowary (ie no fences, no dogs etc). Intensive development, including a golf course, will simply not be feasible in this area. 'Tree houses' and similar environmentally-sensitive structures would be more feasible.



Stage two developable areas

Figure 7

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Watercourse identification map - watercourse - Queensland © State of Queensland (Department of Natural Resources and Mines) 2015.
Watercourse identification map - yet to be mapped - Queensland © State of Queensland (Department of Natural Resources and Mines) 2015.
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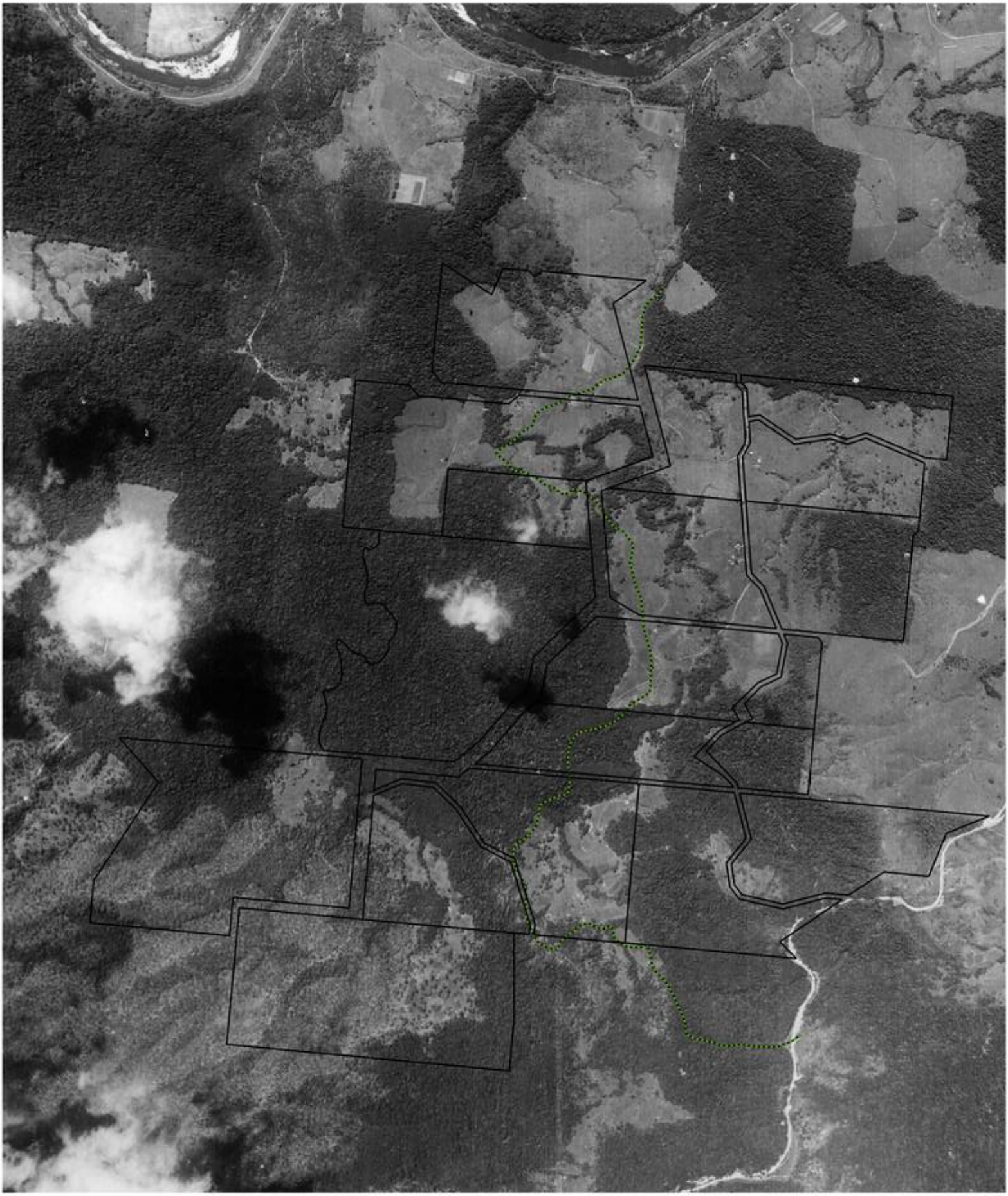
Appendices

Appendix A Clearing history maps



Reevers and Ocean - Myola landholdings - 1942 aerial image

250 0 250 500 750 1000 m

Legend

- Myola Project Lots
- Main north-south track

N

Imagery: QAP1694_16 run 2, 8064 CAIRNS 42 PROGRAM AERIAL PHOTOGRAPHY. Produced at 1:39,800. This image reproduced at 1:10,000 when printed at A3.

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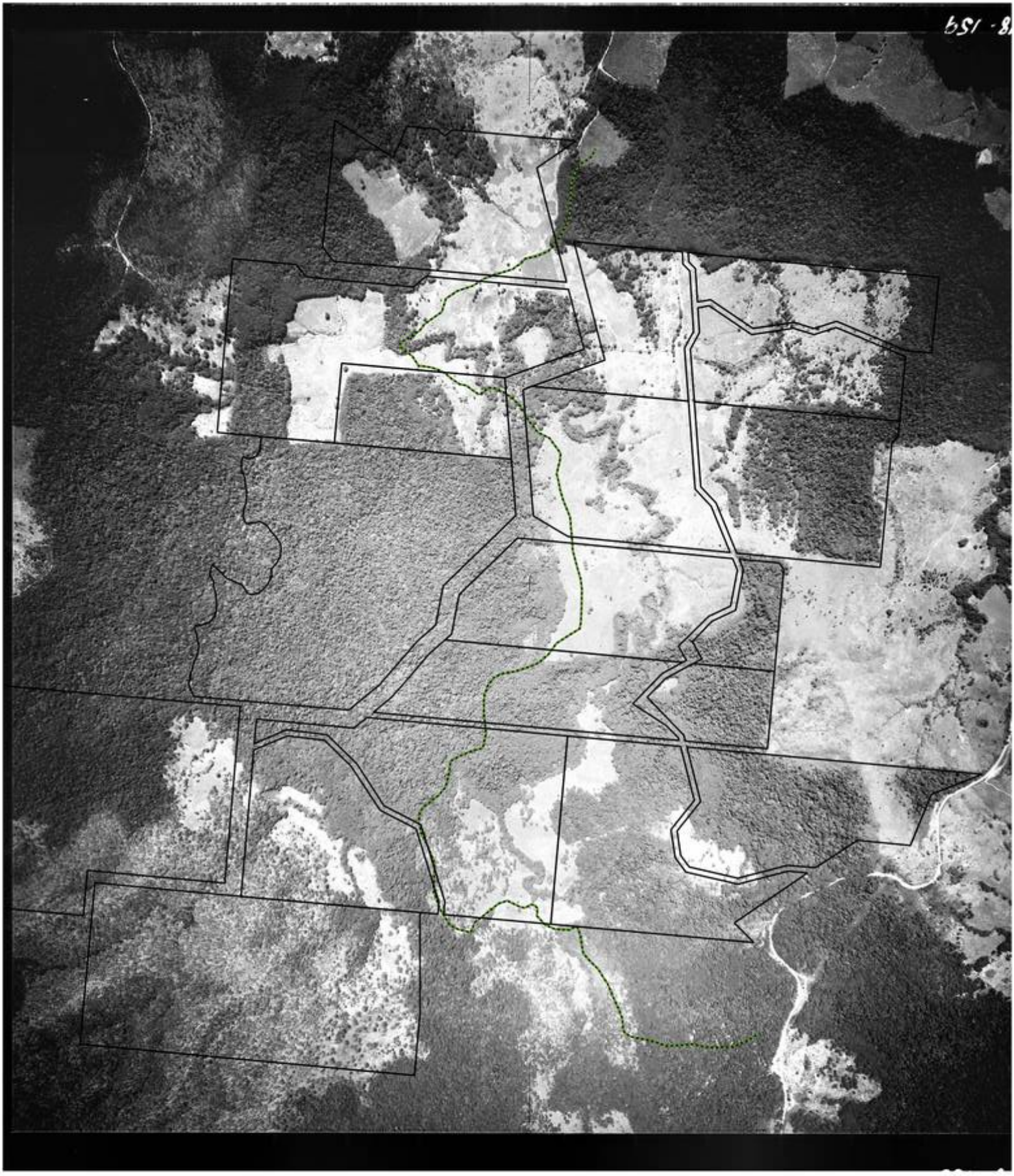

Reevers and Ocean - Myola landholdings - 1951 aerial

250 0 250 500 750 1000 m

Legend

- Myola Project Lots
- Main north-south track

N

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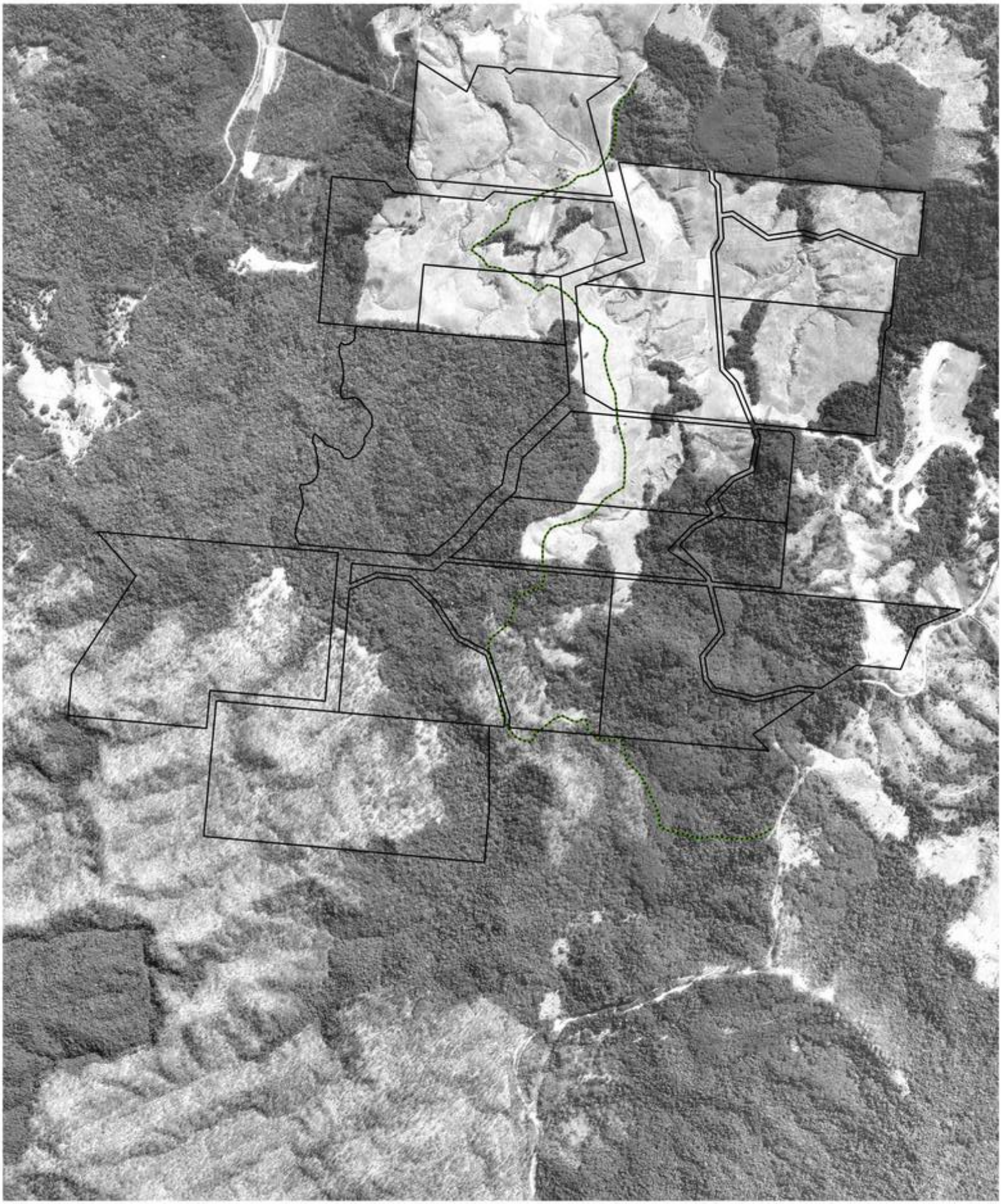

Reevers and Ocean's Myola landholdings - 1965 aerial image

250 0 250 500 750 1000 m

Legend

- Myola Project Lots
- Main north-south track

N

Imagery: QAP1656_12 run 3, 8064 CAIRNS 65 PROGRAM AERIAL PHOTOGRAPHY. Produced at 1:23,900. This image reproduced at 1:10,000 when printed at A3.

GIS operator Simon Danielsen, Astrebla Ecological Services, 20/10/15.

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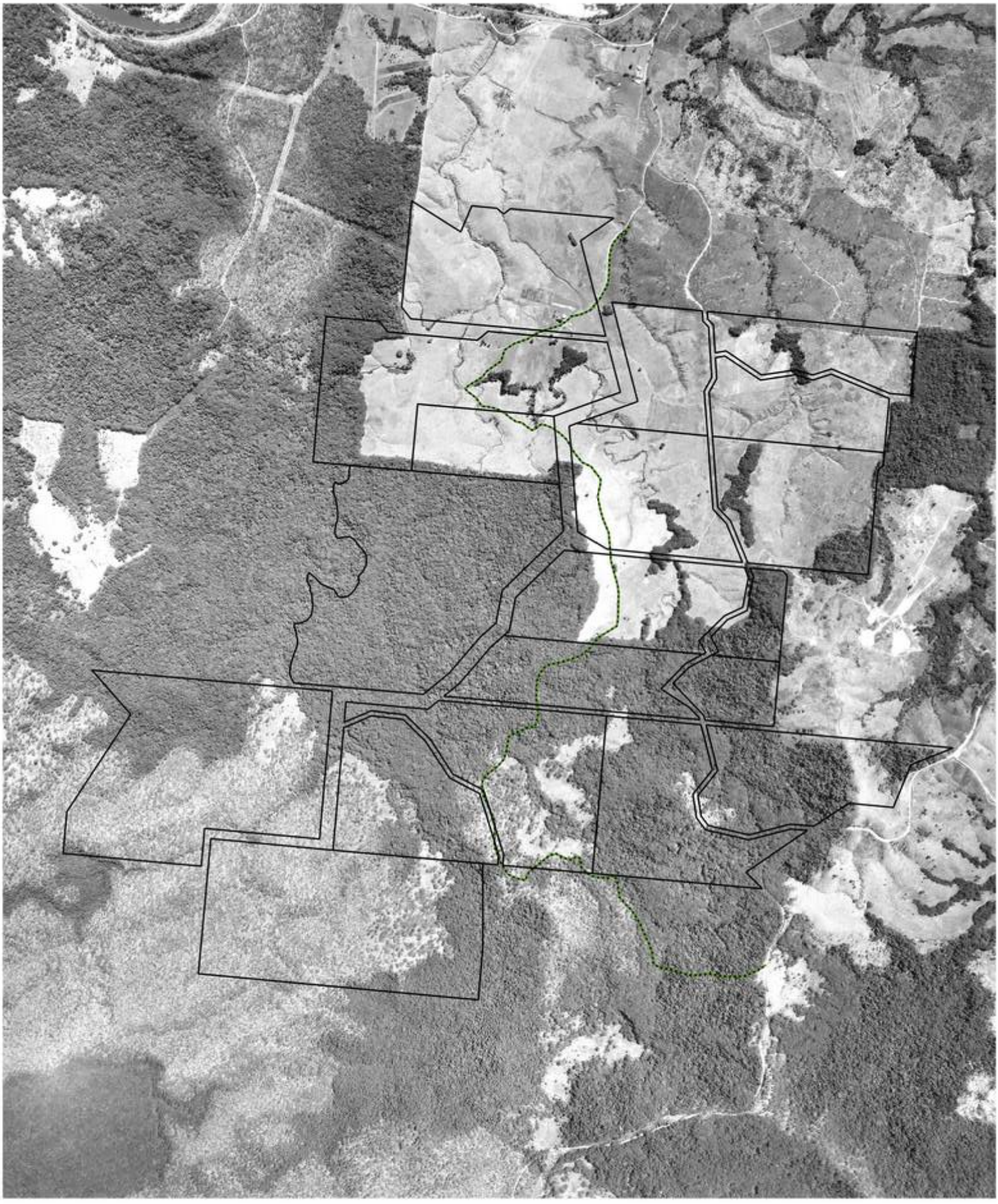

Reevers and Ocean - Myola landholdings - 1971 aerial image

250 0 250 500 750 1000 m

Legend

- Myola Project Lots
- Main north-south track

N

Imagery: QAP2340_105 run 3, 8064 CAIRNS 71 PROGRAM AERIAL PHOTOGRAPHY. Produced at 1:24,000. This image reproduced at 1:10,000 when printed at A3.

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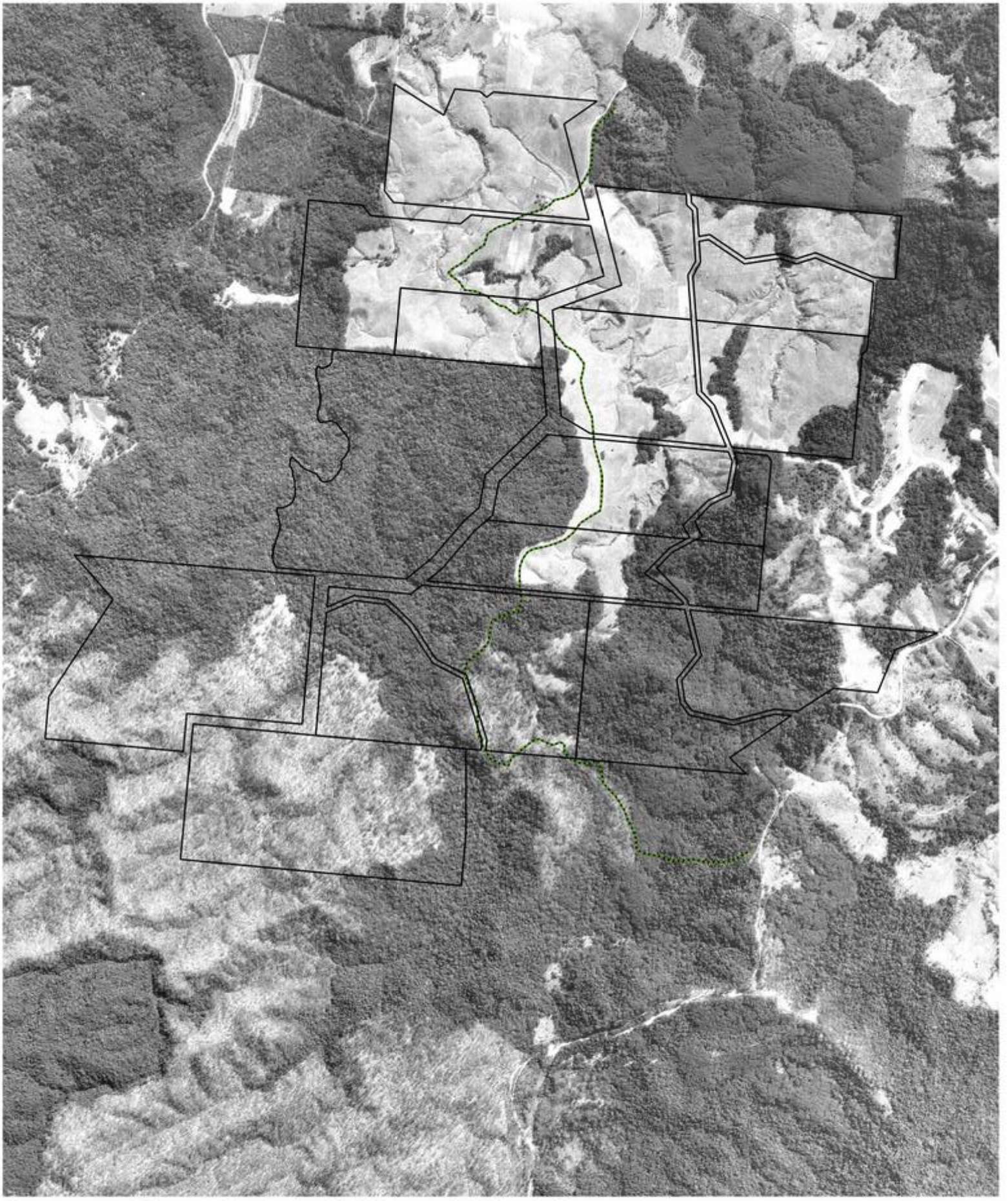

Reevers and Ocean - Myola landholdings - 1982 aerial image

250 0 250 500 750 1000 m

Legend

- Myola Project Lots
- Main north-south track

N

Imagery: QAP4091_6725 run 2, 8064 CAIRNS 82 PROGRAM AERIAL PHOTOGRAPHY. Produced at 1:37,500. This image reproduced at 1:10,000 when printed at A3.

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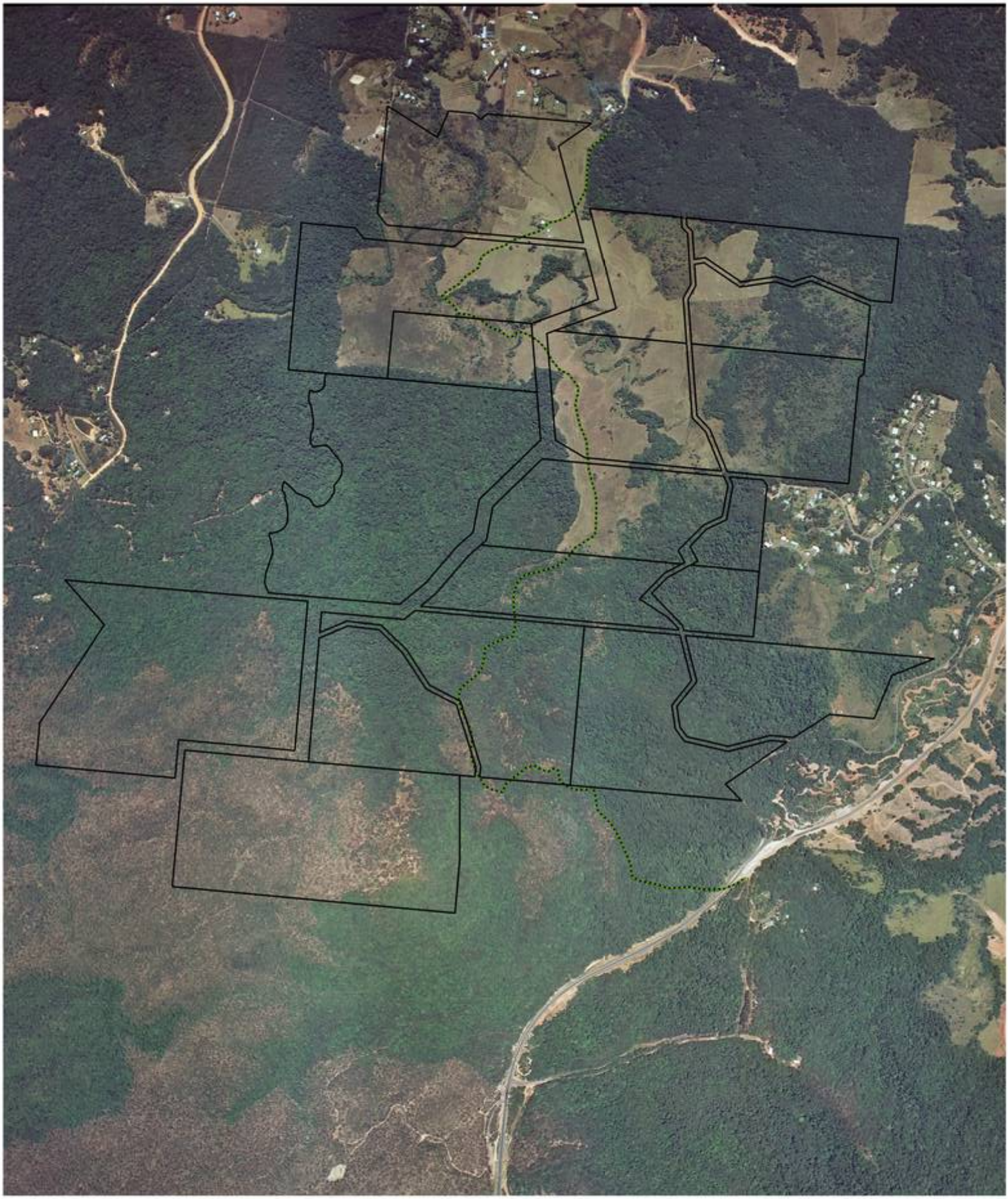

Reevers and Ocean - Myola landholdings - 1994 aerial image

250 0 250 500 750 1000 m

Legend

- Myola Project Lots
- Main north-south track

N

Imagery: QAP5331_201 run 10, 8064 CAIRNS 94 PROGRAM AERIAL PHOTOGRAPHY. Produced at 1:25,000. This image reproduced at 1:10,000 when printed at A3.

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Appendix B SDAP version 1.6 - module 8

Module 8. Native vegetation clearing

8.1 Queensland vegetation management state code

8.1.1 Purpose

The purpose of the code is to regulate the clearing of native vegetation within Queensland to:

(1) conserve remnant vegetation that is—
  (a) an endangered regional ecosystem
  (b) an of concern regional ecosystem
  (c) a least concern regional ecosystem
(2) conserve vegetation in declared areas
(3) ensure clearing does not cause land degradation
(4) prevent loss of biodiversity
(5) maintain ecological processes
(6) manage environmental effects of the clearing to achieve (1) through (5)
(7) reduce greenhouse gas emissions
(8) allow for sustainable land use.

8.1.2 Criteria for assessment

(1) Subject to subsection (2), development mentioned in column 1 below must be assessed against the assessment criteria in the table mentioned in column 2.

Column 1	Column 2
Material change of use	Table 8.1.1
Operational work	Table 8.1.2
Reconfiguring a lot	Table 8.1.1

(2) Development that is a material change of use or reconfiguring a lot mentioned in column 1 of Table 8.1.1 must comply with the relevant provisions of Tables 8.1.3 to 8.1.11 mentioned in column 2 of Table 8.1.1.
(3) Development that is operational work mentioned in column 1 of Table 8.1.2 must comply with the relevant provisions of Tables 8.1.4 to 8.1.11 mentioned in column 2 of Table 8.1.2.

Table 8.1.1: Development and relevant provisions of the code—material change of use and reconfiguring a lot

Development	Relevant provisions of code
An application for a project declared to be a coordinated project	**Table 8.1.3** — General: PO1 – PO3 **Table 8.1.4** — Public safety, relevant infrastructure and coordinated projects: PO2 — PO10
An application for an extractive industry	**Table 8.1.3** — General: PO1 – PO3 **Table 8.1.5** — Extractive industry: PO2 – PO9
An application for high value agriculture or irrigated high value agriculture	**Table 8.1.3** — General: PO1 – PO3 **Table 8.1.6** — High value agriculture clearing and irrigated high value agriculture clearing: PO1 – PO9
An application for a material change of use or reconfiguring a lot for which there will be no clearing as a result of the material change of use or reconfiguring a lot	**Table 8.1.3** — General: PO1 – PO5

Development	Relevant provisions of code
An application for a material change of use or reconfiguring a lot for which all clearing is limited to clearing that could be done under an exemption for the purpose of the development (as prescribed under Schedule 24, Parts 1 and 2 of the Sustainable Planning Regulation 2009) prior to the material change of use or reconfiguring a lot application being approved	**Table 8.1.3** — General: PO1 – PO5
An application for all other purposes, where not listed above	**Table 8.1.3** — General: PO1 – PO3 **Table 8.1.4** — Public safety, relevant infrastructure and coordinated projects: PO2 — PO10

Table 8.1.2: Development and relevant provisions of the code—operational work

Development	Relevant provisions of code
Clearing of encroachment	**Table 8.1.3** — General: PO2- PO3 **Table 8.1.10** — Encroachment: PO1 – PO6
For fodder harvesting	**Table 8.1.3** — General: PO2– PO3 **Table 8.1.11** — Fodder: PO1 – PO11
Establishing a necessary fence, firebreak, road or vehicular track, or for constructing necessary built infrastructure (each relevant infrastructure), and the clearing for the relevant infrastructure cannot reasonably be avoided or minimised	**Table 8.1.3** — General: PO2– PO3 **Table 8.1.4—** Public safety, relevant infrastructure and coordinated projects: PO1 – PO10
Clearing that is a natural and ordinary consequence of other assessable development for which a development approval was given under the repealed *Integrated Planning Act 1997*, or a development application was made under that Act, before 16 May 2003	**Table 8.1.3** — General: PO2– PO3 **Table 8.1.4** — Public safety, relevant infrastructure and coordinated projects: PO1 – PO10
To ensure public safety	**Table 8.1.3** — General: PO2– PO3 **Table 8.1.4** — Public safety, relevant infrastructure and coordinated projects: PO1 – PO10
A project declared to be a coordinated project under the *State Development and Public Works Organisation Act 1971*, section 26	**Table 8.1.3** — General: PO2– PO3 **Table 8.1.4** — Public safety, relevant Infrastructure and coordinated projects: PO1 – PO10 OR Where the coordinated project involves extractive industry: **Table 8.1.3** — General: PO1 – PO3 **Table 8.1.4** — Public safety, relevant infrastructure and coordinated projects: PO2 – PO10 **Table 8.1.5** — Extractive industry: PO1 – PO2 OR Where the coordinated project involves high value agriculture clearing or irrigated high value agriculture clearing: **Table 8.1.3** — General: PO1 – PO3 **Table 8.1.6** — High value agriculture clearing and irrigated high value agriculture clearing: PO1(1)-(3) and (5) – PO9

Development	Relevant provisions of code
For thinning	**Table 8.1.3** — General: PO2– PO3 **Table 8.1.9** — Thinning: PO1 – PO7
Necessary to control non-native plants or declared pests	**Table 8.1.3** — General: PO2– PO3 **Table 8.1.8** — Weed or pest management: PO1 – PO7
For an extractive industry	**Table 8.1.3** — General: PO2– PO3 **Table 8.1.5** — Extractive industry: PO1 – PO9
For necessary environmental clearing	**Table 8.1.3** — General: PO2– PO3 **Table 8.1.7** — Necessary environmental clearing: PO1 – PO14
For high value agriculture clearing and irrigated high value agriculture clearing	**Table 8.1.3** — General: PO2– PO3 **Table 8.1.6** — High value agriculture clearing and irrigated high value agriculture clearing: PO1 – PO9

Table 8.1.3: General

Performance outcomes	Acceptable outcomes
Clearing to avoid and minimise impacts	
PO1 Clearing only occurs where the applicant has demonstrated that the development has first avoided, and then minimised the impacts of development.	No acceptable outcome is prescribed.
Clearing on land in particular circumstances	
PO2 Clearing in an area must not be inconsistent with or impact on any of the following unless a better environmental outcome can be achieved: (1) a declared area, or (2) an exchange area, or (3) unlawfully cleared area, or (4) a restoration notice, or (5) an enforcement notice under the *Sustainable Planning Act 2009* issued for a vegetation clearing offence, or (6) a compliance notice containing conditions about the restoration of vegetation, or (7) a Land Act notice, or (8) a trespass notice if the trespass related act under the *Land Act 1994* for the notice is the clearing of vegetation on the relevant land, or (9) an area on a PMAV shown to be category A where the chief executive of the VMA reasonably believes that a vegetation clearing offence is being, or has been, committed in relation to the area.	No acceptable outcome is prescribed.
Clearing on land that is an environmental offset area	
PO3 Clearing on land that contains an existing environmental offset is consistent with the delivery plan or agreement for the environmental offset area.	**AO3.1** Clearing is consistent with the offset delivery plan or agreement for the environmental offset area. OR **AO3.2** An additional environmental offset is provided that is consistent with

Performance outcomes	Acceptable outcomes
Editor's note: Environmental offset agreements may also be described as an 'agreed delivery arrangement' or 'delivery agreement'. Clearing should be consistent with any agreement however described.	the relevant *Queensland Environmental Offsets Policy.*
No clearing of vegetation as a result of the material change of use or reconfiguration of a lot	
PO4 Clearing as a result of the material change of use or reconfiguration of a lot will not occur.	No acceptable outcome is prescribed.
Clearing that could already be done under an exemption	
PO5 All clearing is limited to clearing that could be done under an exemption for the purpose of the development (as prescribed under Schedule 24, Parts 1 and 2 of the Sustainable Planning Regulation 2009) prior to the material change of use application being approved.	No acceptable outcome is prescribed.

Table 8.1.4: Public safety, relevant infrastructure and coordinated projects

Performance outcomes	Acceptable outcomes
Limits to clearing	
PO1 Clearing is limited to the extent that is necessary: (1) for establishing a necessary fence, firebreak, road or vehicular track, or for constructing necessary built infrastructure, if there is no suitable alternative site for the fence, firebreak, road, track or infrastructure (relevant infrastructure), or (2) as a natural and ordinary consequence of other assessable development for which a development approval as defined under the repealed *Integrated Planning Act 1997* was given, or a development application as defined under that Act was made, before 16 May 2003, or (3) to ensure public safety, or (4) for a coordinated project and any associated ancillary works —other than a coordinated project that involves high value agriculture clearing, or irrigated high value agriculture clearing.	No acceptable outcome is prescribed.
Wetlands	
PO2 Maintain the current extent of vegetation associated with any natural wetland to protect: (1) water quality by filtering sediments, nutrients and other pollutants (2) aquatic habitat (3) terrestrial habitat.	**AO2.1** Clearing does not occur in or within 100 metres of any natural wetland. OR **AO2.2** Clearing only occurs within 100 metres of any natural wetland where: (1) the clearing does not occur within 50 metres of the defining bank of any natural wetland, or (2) the widths stipulated by Table 1 are not exceeded. OR **AO2.3** Where it can be demonstrated that clearing cannot be avoided, and the extent of clearing has been minimised, an environmental offset is provided for any significant residual impact from clearing of vegetation

Performance outcomes	Acceptable outcomes
	associated with a natural wetland. Editor's note: Applications for development should identify whether there is likely to be a significant residual impact and a need for an environmental offset having regard to Section 3.3 (Wetlands and watercourses) of the *Significant Residual Impact Guideline* and the relevant *Queensland Environmental Offsets Policy*.
Watercourses	
PO3 Maintain the current extent of vegetation associated with any watercourse to protect: (1) bank stability by protecting against bank erosion (2) water quality by filtering sediments, nutrients and other pollutants (3) aquatic habitat (4) terrestrial habitat.	**AO3.1** Clearing does not occur: (1) in any watercourse, or (2) within the relevant distance stipulated by Table 2 of the defining bank of any watercourse. OR **AO3.2** Clearing only occurs within any watercourse or within the relevant distance stipulated by Table 2 of the defining bank of any watercourse where: (1) the clearing does not occur within 5 metres of the defining bank, or (2) the widths stipulated by Table 1 is not exceeded. OR **AO3.3** Where it can be demonstrated that clearing cannot be avoided, and the extent of clearing has been minimised, an environmental offset is provided for any significant residual impact from clearing of vegetation associated with any watercourse. Editor's note: Applications for development should identify whether there is likely to be a significant residual impact and a need for an environmental offset having regard to Section 3.3 (Wetlands and watercourses) of the *Significant Residual Impact Guideline* and the relevant *Queensland Environmental Offsets Policy*.
Connectivity (public safety and relevant infrastructure)	
PO4 In consideration of vegetation on the subject lot(s) and in the landscape adjacent to the subject lot(s), vegetation is retained that: (1) is of sufficient size and configured in a way that maintains ecosystem functioning (2) remains in the landscape despite threatening processes.	**AO4.1** Clearing occurs in accordance with Table 3.
Connectivity (coordinated projects)	
PO5 In consideration of vegetation on the subject lot(s) and in the landscape adjacent to the subject lot(s), vegetation is retained that: (1) is of sufficient size and configured in a way that maintains ecosystem functioning (2) remains in the landscape despite threatening processes or where this is not reasonably possible, maintain the current extent of vegetation.	**AO5.1** Clearing occurs in accordance with Table 3. OR **AO5.2** Where it can be demonstrated that clearing cannot be avoided, and the extent of clearing has been minimised, an environmental offset is provided for any significant residual impact from clearing of vegetation that forms a connectivity area. Editor's note: Applications for development should identify whether there is likely to be a significant residual impact and a need for an environmental offset having regard to Section 3.2 (Connectivity areas) of the *Significant Residual Impact Guideline* and the relevant *Queensland Environmental Offsets Policy*.
Soil erosion	
PO6 Clearing does not result in: (1) mass movement, gully erosion, rill erosion, sheet erosion, tunnel erosion, stream bank erosion, wind erosion, or scalding (2) any associated loss of chemical, physical or biological fertility — including, but not	**AO6.1** Clearing is undertaken in accordance with a sediment and erosion control plan which avoids and minimises land degradation. OR **AO6.2** The application is a development application where a local government is the assessment manager.

Performance outcomes	Acceptable outcomes
limited to water holding capacity, soil structure, organic matter, soil biology, and nutrients within or outside the lot(s) that are the subject of the application.	
Salinity	
PO7 Clearing does not contribute to land degradation through: (1) waterlogging, or (2) the salinisation of groundwater, surface water or soil.	**AO7.1** Clearing does not occur in or within 200 metres of a discharge area or recharge area. OR **AO7.2** Clearing is less than: (1) 2 hectares, or (2) 10 metres wide.
Conserving endangered and of concern regional ecosystems	
PO8 Maintain the current extent of endangered regional ecosystems and of concern regional ecosystems.	**AO8.1** Clearing does not occur in: (1) an endangered regional ecosystem, or (2) an of concern regional ecosystem. OR **AO8.2** Clearing in an endangered regional ecosystem or an of concern regional ecosystem does not exceed the width or area prescribed in Table 1. OR **AO8.3** Where it can be demonstrated that clearing cannot be avoided, and the extent of clearing has been minimised, an environmental offset is provided for any significant residual impact from clearing of endangered regional ecosystems and of concern regional ecosystems. Editor's note: Applications for development should identify whether there is likely to be a significant residual impact and a need for an environmental offset having regard to Section 3.1 (Regulated vegetation) of the *Significant Residual Impact Guideline* and the relevant *Queensland Environmental Offsets Policy*.
Essential habitat	
PO9 Maintain the current extent of essential habitat.	**AO9.1** Clearing does not occur in an area of essential habitat. OR **AO9.2** Clearing in essential habitat does not exceed the widths or areas prescribed in Table 1. OR **AO9.3** Clearing only occurs where an area of essential habitat is isolated and small in size and at risk from threatening processes, for the prescribed species. OR **AO9.4** Where it can be demonstrated that clearing cannot be avoided, and the extent of clearing has been minimised, an environmental offset is provided for any significant residual impact from clearing of essential habitat. Editor's note: Applications for development should identify whether there is likely to be a significant residual impact and a need for an environmental offset having regard to Section 3.1 (Regulated vegetation) of the *Significant Residual Impact Guideline* and the relevant *Queensland Environmental Offsets Policy*.
Acid sulfate soils	
PO10 Clearing activities do not result in disturbance of acid sulfate soils or changes to the hydrology of the location that will	**AO10.1** Clearing does not occur in land zone 1, land zone 2 or land zone 3. OR

Performance outcomes	Acceptable outcomes
either: (1) aerate horizons containing iron sulfides, or (2) mobilise acid or metals.	**AO10.2** Clearing in land zone 1, land zone 2 or land zone 3 in areas below the 5 metre Australian Height Datum only occurs where: (1) it does not involve mechanical clearing (2) the acid sulfate soils are managed consistent with the *State Planning Policy*, Department of State Development, Infrastructure and Planning, 2014, and with the Soil Management Guidelines in the *Queensland Acid Sulfate Soil Technical Manual*, Department of Science, Information Technology, Innovation and the Arts, 2014. OR **AO10.3** The application is a development application where a local government is the assessment manager.

Table 8.1.5: Extractive industry

Performance outcomes	Acceptable outcomes
Limits to clearing for an extractive industry	
PO1 Clearing is limited to the extent that is necessary for: (1) dredging material from the bed of any waters (2) extracting, from a pit or quarry, rock, sand, clay, gravel, loam or other material (3) screening, washing, grinding, milling, sizing or separating material extracted from a pit or quarry (4) carrying out work that is the natural and ordinary consequence of carrying out work mentioned in subparagraphs (1), (2) and (3) above.	No acceptable outcome is prescribed.
Clearing is staged	
PO2 Clearing: (1) is staged in line with operational needs that restrict clearing to the current operational area (2) is limited to the area from which material will be extracted, and any reasonably associated infrastructure, within the term of the development approval (3) cannot occur until all required permits are obtained.	No acceptable outcome is prescribed.
Wetlands	
PO3 Maintain the current extent of vegetation associated with any natural wetland to protect: (1) water quality by filtering sediments, nutrients and other pollutants (2) aquatic habitat (3) terrestrial habitat.	**AO3.1** Clearing does not occur in, or within 100 metres of, any natural wetland. OR **AO3.2** Clearing only occurs within 100 metres of any natural wetland where: (1) the clearing does not occur within 50 metres of the of the natural wetland, or (2) the widths stipulated by Table 1 are not exceeded. OR **AO3.3** Where it can be demonstrated that clearing cannot be avoided, and the extent of clearing has been minimised, an environmental offset is provided

Performance outcomes	Acceptable outcomes
PO10 Maintain the current extent of essential habitat.	**AO10.1** Fodder harvesting does not occur in essential habitat. OR **AO10.2** Clearing in essential habitat does not exceed the width or area prescribed in Table 1. OR **AO10.3** Where it can be demonstrated that the clearing cannot be avoided, and the extent of clearing has been minimised, an environmental offset is provided for any significant residual impact from clearing of essential habitat. Editor's note: Applications for development should identify whether there is likely to be a significant residual impact and a need for an environmental offset having regard to Section 3.1 (Regulated vegetation) of the *Significant Residual Impact Guideline* and the relevant *Queensland Environmental Offsets Policy*.
Fodder species	
PO11 Fodder harvesting consists predominantly of fodder species.	**AO11.1** Fodder harvesting consists predominantly of fodder species and only occurs in the regional ecosystems listed in Tables 8 or 9.

8.1.3 Reference tables

Table 1

Clearing limits per regional ecosystem structure category		
Structure category	**Width (metres)**	**Area (hectares)**
Dense and mid-dense*	10	0.5
Sparse and very sparse*	20	2
Grassland*	25	5

*Editor's note: Refer to the structure category within the *Regional Ecosystem Description Database* available on the Department of Environment and Heritage Protection website.

Table 2

Distance from defining banks of watercourses	
Watercourse stream order	**Distance from the defining bank (metres)**
Coastal bioregions and sub-regions	
1 or 2	10
3 or 4	25
5 or greater	50
Non-coastal bioregions and sub-regions	
1 or 2	25
3 or 4	50
5 or greater	100

Table 3

Maintaining connectivity

Coastal bioregions and sub-regions	Non-coastal bioregions and sub-regions
Clearing does not: (1) occur in areas of vegetation that are less than 10 hectares (2) reduce the extent of vegetation to less than 10hectares (3) occur in areas of vegetation less than 100 metres wide (4) reduce the width of vegetation to less than 100 metres (5) occur where the extent of vegetation on the subject lot(s) is reduced to or less than 30 per cent of the total area of the lot(s)	Clearing does not: (1) occur in areas of vegetation that are less than 50 hectares (2) reduce the extent of vegetation to less than 50 hectares (3) occur in areas of vegetation less than 200 metres wide (4) reduce the width of vegetation to less than 200 metres (5) occur where the extent of vegetation on the subject lot(s) is reduced to or less than 30 per cent of the total area of the lot(s).

Table 4

Clearing limitations for mechanical weed control	
Estimated per cent weed cover	**Clearing limitations**
Up to 50 per cent	Retain all habitat trees and retained trees and at least 50 per cent of the trees with a diameter of 15-19 cm, measured at breast height.
More than 50 per cent	Retain all retained trees or habitat trees.

Table 5

Dense regional ecosystems					
3.2.1	3.10.17	7.8.2	7.12.16	8.12.17	12.2.3
3.2.2	3.10.18	7.8.3	7.12.17	8.12.18	12.2.12
3.2.11	3.10.19	7.8.4	7.12.19	8.12.19	12.2.21
3.2.12	3.11.1	7.8.11	7.12.20	8.12.28	12.3.1
3.2.13	3.11.2	7.8.12	7.12.37	8.12.29	12.3.13
3.2.17	3.11.3	7.8.13	7.12.39	8.12.30	12.5.13
3.2.21	3.12.1	7.8.14	7.12.40	9.5.2	12.8.3
3.2.28	3.12.2	7.11.1	7.12.41	9.8.3	12.8.4
3.2.29	3.12.20	7.11.2	7.12.42	9.8.7	12.8.5
3.2.30	3.12.21	7.11.3	7.12.43	9.11.8	12.8.6
3.2.31	3.12.22	7.11.6	7.12.44	9.11.9	12.8.7
3.3.1	3.12.35	7.11.7	7.12.45	9.12.8	12.8.13
3.3.2	3.12.36	7.11.8	7.12.46	9.12.34	12.8.18
3.3.3	3.12.3	7.11.10	7.12.47	11.2.3	12.8.21
3.3.4	3.12.4	7.11.12	7.12.48	11.3.11	12.8.22
3.3.5	3.12.5	7.11.14	7.12.49	11.4.1	12.9-10.15
3.3.6	3.12.6	7.11.23	7.12.50	11.4.6	12.9-10.16
3.3.7	7.2.1	7.11.24	7.12.64	11.5.11	12.11.1
3.3.38	7.2.2	7.11.25	7.12.68	11.5.15	12.11.4
3.3.39	7.2.5	7.11.27	8.2.2	11.5.18	12.11.10
3.3.40	7.2.6	7.11.28	8.2.4	11.7.5	12.11.11
3.3.55	7.2.9	7.11.29	8.2.5	11.8.3	12.11.12
3.3.68	7.2.10	7.11.30	8.3.1	11.8.6	12.11.13
3.5.3	7.3.3	7.11.36	8.3.9	11.8.7	12.12.1
3.5.4	7.3.4	7.12.1	8.3.10	11.8.13	12.12.10
3.5.20	7.3.5	7.12.2	8.8.1	11.9.4	12.12.13
3.5.32	7.3.10	7.12.4	8.10.1	11.9.8	12.12.16
3.7.1	7.3.17	7.12.5	8.11.2	11.10.8	12.12.17
3.8.1	7.3.23	7.12.6	8.11.10	11.11.5	12.12.18
3.8.2	7.3.35	7.12.7	8.12.1	11.11.18	13.11.7
3.8.5	7.3.36	7.12.9	8.12.2	11.11.21	13.12.6
3.10.1	7.3.37	7.12.10	8.12.3	11.12.4	
3.10.2	7.3.38	7.12.11	8.12.10	11.12.18	
3.10.3	7.3.49	7.12.12	8.12.11	12.2.1	
3.10.5	7.8.1	7.12.13	8.12.16	12.2.2	

Table 6

Regional ecosystems where thinning cannot occur					
1.10.5	3.12.4	7.11.7	8.3.9	10.4.5	11.11.18
2.1.1	3.12.5	7.11.8	8.3.10	10.4.6	11.11.19
2.1.2	3.12.6	7.11.10	8.5.7	10.4.7	11.11.21
2.1.3	3.12.20	7.11.12	8.8.1	10.7.3	11.12.4
2.1.4	3.12.21	7.11.14	8.10.1	10.7.7	11.12.12
2.7.1	3.12.22	7.11.23	8.11.2	10.7.8	11.12.18
2.7.2	3.12.28	7.11.24	8.11.7	10.9.1	11.12.21
2.10.5	3.12.35	7.11.25	8.11.9	10.9.2	12.1.1
3.1.1	3.12.36	7.11.26	8.11.10	10.9.3	12.1.2
3.1.2	3.12.37	7.11.27	8.12.1	10.9.6	12.1.3
3.1.3	3.12.38	7.11.28	8.12.2	10.10.1	12.2.1
3.1.4	4.3.23	7.11.29	8.12.3	11.1.1	12.2.2
3.1.5	4.7.1	7.11.30	8.12.10	11.1.2	12.2.3
3.1.6	4.7.6	7.11.36	8.12.11	11.1.3	12.2.12
3.2.1	4.7.7	7.12.1	8.12.16	11.1.4	12.2.21
3.2.2	4.7.8	7.12.2	8.12.17	11.2.3	12.3.1
3.2.11	4.9.15	7.12.4	8.12.18	11.3.1	12.3.13
3.2.12	4.9.17	7.12.5	8.12.19	11.3.5	12.5.9
3.2.13	4.9.19	7.12.6	8.12.28	11.3.8	12.5.13
3.2.17	5.7.1	7.12.7	8.12.30	11.3.11	12.8.3
3.2.21	5.7.2	7.12.9	9.3.9	11.3.17	12.8.4
3.2.28	5.7.5	7.12.10	9.3.23	11.3.34	12.8.5
3.2.29	5.7.12	7.12.11	9.4.1	11.4.1	12.8.6
3.2.30	5.7.13	7.12.12	9.4.2	11.4.3	12.8.7
3.2.31	5.7.14	7.12.13	9.4.3	11.4.5	12.8.13
3.3.1	7.1.1	7.12.16	9.5.2	11.4.6	12.8.18
3.3.2	7.1.2	7.12.17	9.5.15	11.4.7	12.8.19
3.3.3	7.1.3	7.12.19	9.5.16	11.4.8	12.8.21
3.3.4	7.1.4	7.12.20	9.7.2	11.4.9	12.8.22
3.3.5	7.2.1	7.12.39	9.8.3	11.4.10	12.8.23
3.3.6	7.2.2	7.12.40	9.8.6	11.5.10	12.9-10.6
3.3.7	7.2.5	7.12.41	9.8.7	11.5.11	12.9-10.9
3.3.38	7.2.6	7.12.42	9.10.3	11.5.15	12.9-10.15
3.3.39	7.2.10	7.12.43	9.11.8	11.5.16	12.9-10.16
3.3.40	7.3.3	7.12.44	9.11.9	11.5.18	12.11.1
3.3.68	7.3.4	7.12.45	9.11.28	11.7.1	12.11.4
3.3.69	7.3.10	7.12.46	9.11.29	11.7.2	12.11.10
3.3.70	7.3.17	7.12.47	9.11.30	11.7.5	12.11.11

Regional ecosystems where thinning cannot occur					
3.5.3	7.3.23	7.12.48	9.12.8	11.8.3	12.11.12
3.5.4	7.3.35	7.12.49	9.12.9	11.8.6	12.11.13
3.5.20	7.3.36	7.12.50	9.12.34	11.8.7	12.12.1
3.5.32	7.3.37	7.12.54	9.12.36	11.8.13	12.12.10
3.7.1	7.3.38	7.12.57	9.12.37	11.9.1	12.12.13
3.7.2	7.3.49	7.12.64	9.12.38	11.9.4	12.12.16
3.8.1	7.8.1	7.12.65	10.3.1	11.9.5	12.12.17
3.8.2	7.8.2	7.12.66	10.3.2	11.9.6	12.12.18
3.8.5	7.8.3	7.12.68	10.3.3	11.9.8	12.12.19
3.10.1	7.8.4	8.1.1	10.3.4	11.9.11	12.12.26
3.10.3	7.8.11	8.1.2	10.3.16	11.9.12	13.11.7
3.10.5	7.8.12	8.1.3	10.3.19	11.10.3	13.12.6
3.11.1	7.8.13	8.1.5	10.3.29	11.10.8	
3.11.2	7.8.14	8.2.2	10.3.30	11.11.2	
3.11.3	7.11.1	8.2.4	10.4.1	11.11.5	
3.12.1	7.11.2	8.2.5	10.4.2	11.11.13	
3.12.2	7.11.3	8.2.14	10.4.3	11.11.14	
3.12.3	7.11.6	8.3.1	10.4.4	11.11.16	

Table 7

Grassland regional ecosystems in which encroachment can be cleared					
3.3 56	4.3.13	4.9.9	6.7.17	10.3.7	11.4.11
3.3.60	4.3.20	5.7.9	8.3.12	10.3.8	11.8.11
3.3.61	4.9.7	5.7.10	9.8.5	11.3.20	11.9.12
3.12.32	4.9.8	6.3.13	9.12.42	11.3.31	

Table 8

Regional ecosystems in which fodder species are dominant and suitable for fodder harvesting by all harvesting practices						
4.5.1	5.5.2	5.7.14	6.5.8	6.5.14	6.7.9	6.7.17
4.5.2	5.5.4	6.3.21	6.5.9	6.5.15	6.7.10	
4.5.3	5.5.6	6.5.1	6.5.10	6.5.16	6.7.11	
4.5.4	5.6.4	6.5.6	6.5.11	6.5.18	6.7.12	
5.5.1	5.7.5	6.5.7	6.5.13	6.6.1	6.7.13	

Table 9

Regional ecosystems in which fodder species are not dominant and harvesting is limited to selective harvesting only.					
4.7.3	6.3.24	6.5.17	6.7.15	11.3.28	11.7.2
5.5.3	6.5.2	6.7.1	6.7.16	11.3.17	11.11.2
6.3.16	6.5.3	6.7.6	11.3.2	11.5.13	
6.3.18	6.5.5	6.7.14	11.3.20	11.7.1	

Table 10

Block harvesting	
Block harvesting area	**Minimum width of retained vegetation**
1 – 4 hectares (100 metre by 100 metre – 200 metre by 200 metre)	100 metres
0.5 hectare (75 metre by 75 metre)	50 metres
0.25 hectare (50 metre by 50 metre)	25 metres

Table 11

Measurements of mature trees at 1.3 metres (diameter breast height)		
Clearing purpose	**Bioregion/subregion**	**Measurement at 1.3 metres**
Encroachment	N/A	Trees with a single trunk – ›20 centimetres Trees with several trunks – ›30 centimetres
Thinning and weed control	Coastal bioregions and subregions	Eucalyptus, Corymbia, Angophora, Lophostemon - ›40 centimetres Genera other than Eucalyptus, Corymbia, Angophora and Lophostemon – ›20 centimetres
Thinning and weed control	Non-coastal bioregions and subregions	Eucalyptus, Corymbia, Angophora, Lophostemon - ›30 centimetres Genera other than Eucalyptus, Corymbia, Angophora and Lophostemon - ›20 centimetres

Table 12

Range of size classes – trees	
Class	**Diameter at breast height (1.3 metres)**
1	‹5 centimetres
2	5-10 centimetres
3	›10-20 centimetres
4	›20-40 centimetres

8.2 Figures

Figure 1: Location of coastal and non-coastal bioregions and sub-regions

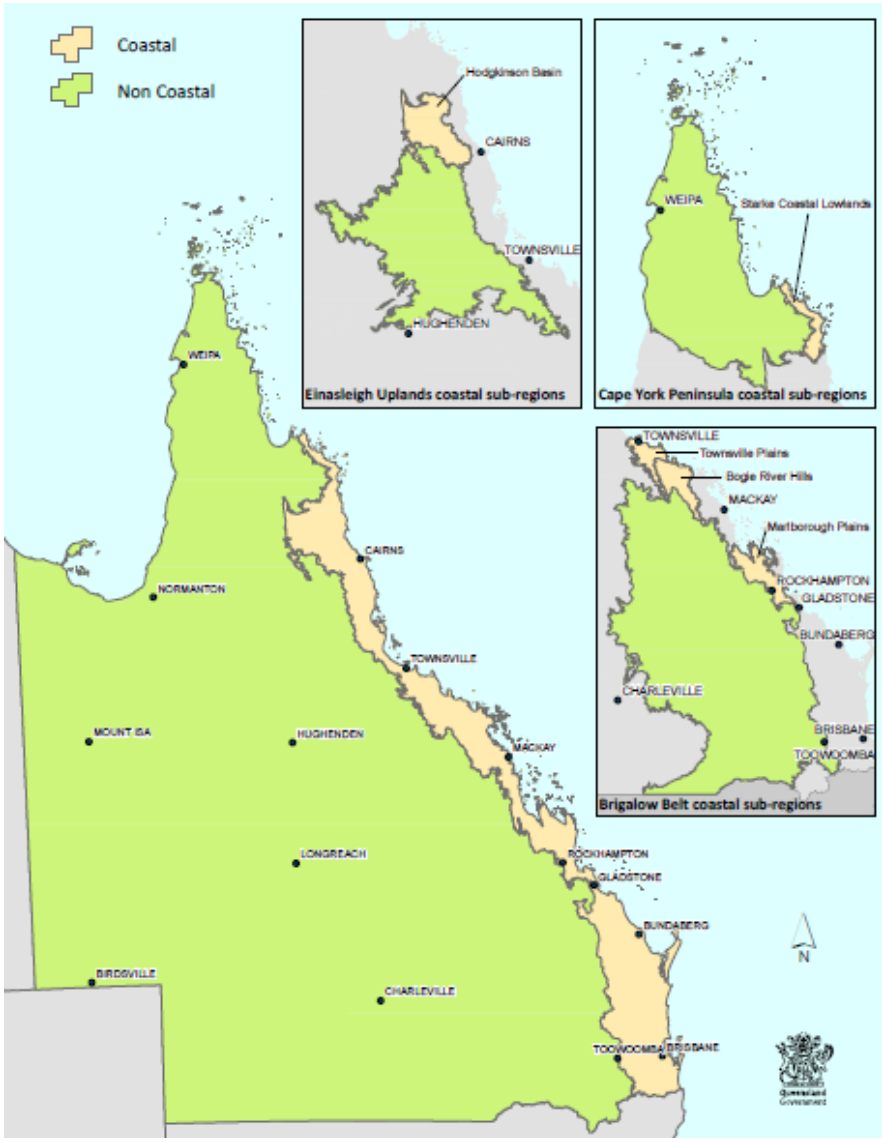
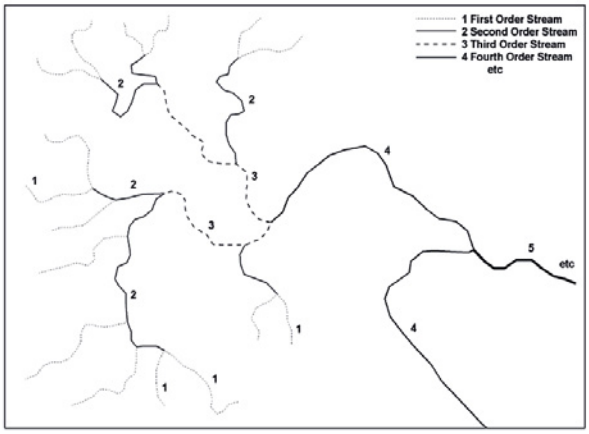


Figure 2: Diagrammatic view of stream ordering

When two streams of the same order join, the resulting watercourse becomes one stream order larger. If two streams of different orders join, the resultant stream order is that of the larger stream.



8.3 Reference documents

Department of State Development, Infrastructure and Planning 2014 *State Planning Policy*

Department of Science, Information Technology Innovation and the Arts *Queensland Acid Sulfate Soil Technical Manual*

Department of Natural Resources and Mines 2014 *Guidelines for determining high value and irrigated high value agriculture*

Department of Environment and Heritage Protection *Regional ecosystems database*

Department of Environment and Heritage Protection *Benchmarks*

Department of Environment and Heritage Protection 2014 *Queensland Environmental Offsets Policy*

Department of Environment and Resource Management 2011 *Salinity Management Handbook*

Department of Natural Resources and Mines 2013 *Guidelines for necessary environmental clearing*

8.4 Glossary of terms

Aerial application is application by aircraft.

Application area is the area identified as proposed for clearing in the property vegetation management plan.

Benchmarks are quantitative values derived from reference sites for each condition attribute assessed in BioCondition, and are used as a reference value for comparison purposes. Benchmarks have been developed from information published by the State of Queensland (acting through the Department of Science, Information Technology, Innovation and the Arts).

Block harvesting refers to fodder harvesting in a patch or clump and retaining undisturbed fodder vegetation around the block.

Breaker harvesting refers to fodder harvesting using a single tractor with a breaker bar to push down or break off the top or branches of fodder trees.

Broadacre cropping refers to the commercial cultivation of plants for oil; winter and summer cereals including wheat, barley, oats, triticale, sorghum, maize and millets; pulses including lupins, chickpeas, faba beans, field peas, mung beans, soybeans, lentils, guar, dolichos; sugar cane; rice; or cotton; or tea; or another commercial crop as approved by the Chief Executive of the VMA.

Category A area see the *Vegetation Management Act 1999* section 20AL.

Editor's note: A category A area is an area, other than a category B area, category C area, category R area or category X area, shown on the regulated vegetation management map as a category A area that—

(1) is any of the following—

(a) a declared area;

(b) an offset area;

(c) an exchange area; or

(2) has been unlawfully cleared; or

(3) is, or has been, subject to—

(a) a restoration notice; or

(b) an enforcement notice under the Planning Act containing conditions about restoration of vegetation; or

(4) has been cleared of native vegetation and in relation to the clearing a person has been found guilty by a court, whether or not a conviction has been recorded, of a clearing offence; or

(5) the chief executive decides under section 20BA [of the VMA] is a category A area.

Category B area see the *Vegetation Management Act 1999*, section 20AM.

Editor's note: A category B area is an area, other than a category A area, category C area, category R area or category X area, shown on the regulated vegetation management map as a category B area that—

(1) contains remnant vegetation; or

(2) the chief executive [administering the VMA] decides to show on the regulated vegetation management map as a category B area; or

(3) if section 20AN [of the VMA] does not apply to the area—

(a) is a Land Act tenure to be converted under the *Land Act 1994* to another form of tenure; and

(b) contains—

(i) an endangered regional ecosystem; or

(ii) an of concern regional ecosystem; or

(iii) a least concern regional ecosystem.

Category X area see the *Vegetation Management Act 1999*, section 20AO.

Editor's note: A category X area is an area, other than a category A area, category B area, category C area or category R area, shown on the regulated vegetation management map as a category X area. However, an area is not a category X area if the chief executive decides under section 20CA of the *Vegetation Management Act 1999* the area is not a category X area.

Clearing to clear, for vegetation:

(1) means remove, cut down, ringbark, push over, poison or destroy in any way including by burning, flooding or draining, but

(2) does not include destroying standing vegetation by stock, or lopping a tree.

Editor's note: For the purpose of assessment of a material change of use or reconfiguring a lot application, any reference to clearing is taken to be "clearing as a result of the material change of use" or "clearing as a result of the reconfiguring a lot".

"Clearing as a result of the material change of use" includes:

(1) Clearing of vegetation that will result from the change in use, consisting of any of the following:

(a) Clearing to construct built infrastructure—including buildings, stormwater management systems, water supply and sewerage systems—that are proposed as part of the material change of use application.

(b) Clearing for roads, vehicle parking, vehicle and pedestrian access, utilities corridors, services, fences, firebreaks and fire management lines that are proposed as part of the material change of use application.

(c) Clearing that may not be necessary for developing infrastructure but is associated with the use applied for.

(2) Clearing of vegetation that will become exempt if the development application is approved. This includes any of the following examples:

(a) Clearing for routine management and essential management purposes associated with the approved development including clearing to maintain proposed infrastructure, facilities, roads, access routes, utilities, services and fences, and clearing to maintain the safety of persons and property that will be associated with the development.

(b) Clearing for necessary fire breaks and fire management lines and safety buffers associated with the development. This will be assessed as follows:

(i) All built infrastructure other than underground services, roads and fences will be assessed as requiring clearing for firebreaks and safety buffers with a width of 20 metres or 1.5 times the height of the tallest adjacent tree to the infrastructure, whichever is the greater

(ii) All proposed allotment boundaries will be assessed as requiring clearing for fire management lines with a width of 10 metres constructed on either side of the allotment boundary unless written evidence from the relevant Area Director of the Queensland Fire and Rescue Service which confirms an alternative fire management line width is required or acceptable.

(iii) In the case of evidence being presented which demonstrates constraints on clearing for fire management lines as being reasonably imposed in accordance with written evidence from the relevant Area Director or equivalent officer of the Queensland Fire and Rescue Service, the development may be conditioned so that the full extent of exempt clearing prescribed for essential management under Schedule 24 of the Sustainable Planning Regulation 2009 cannot be carried out by current or future **landholders.**

"Clearing as a result of reconfiguring a lot" includes:

(1) Clearing of vegetation that will result from reconfiguring a lot, consisting of any of the following:

(a) Clearing for boundary fence lines for each proposed allotment (whether or not the clearing is proposed as part of the application)

(b) Clearing to construct built infrastructure, including stormwater management systems, water supply and sewerage systems, roads, access routes or utilities corridors that are proposed as part of the reconfiguring a lot application or that will be required as a condition of approval by the assessment manager

(c) Clearing for excavation and filling, for example, where the lots are to be levelled.

(2) Clearing of vegetation that will become exempt if the development application is approved. This includes any of the following examples:

(a) Clearing for a single residence and reasonably associated buildings and structures for each allotment to be created as a result of the reconfiguring a lot, where no such dwelling house already exists on the proposed allotment

(b) All lots will be assessed as including clearing of 2 hectares for the purpose stated in (2)(a), or for lots smaller than 2 hectares the whole area of the lot, unless the application demonstrates that a greater or smaller area will be required and achieved—for example, building envelopes binding on title

(c) Clearing for routine management and essential management purposes associated with the approved development including clearing to maintain proposed infrastructure, facilities, roads, access routes, utilities, services and fences, and clearing to maintain the safety of persons and property that will be associated with the development

(d) Clearing for necessary fire breaks, fire management lines and safety buffers associated with the development. This will be assessed as follows:

(i) All built infrastructure other than underground services, roads and fences will be assessed as requiring clearing for firebreaks and safety buffers with a width of 20 metres or 1.5 times the height of the tallest adjacent tree to the infrastructure, whichever is the greater.

(ii) All proposed allotment boundaries will be assessed as requiring clearing for fire management lines with a width of 10 metres constructed on either side of the allotment boundary unless written evidence from the relevant Area Director of the Queensland Fire and Rescue Service which confirms an alternative fire management line width is required or acceptable.

(iii) In the case of evidence being presented which demonstrates constraints on clearing for fire management lines as being reasonably imposed in accordance with written evidence from the relevant Area Director of the Queensland Fire and Rescue Service, the development may be conditioned so that the full extent of exempt clearing prescribed for essential management under Schedule 24 of the Sustainable Planning Regulation 2009 cannot be carried out by current or future landholders. .

Coastal bioregions and subregions include the following bioregions and subregions, as shown in Figure 1:

(1) Brigalow Belt Bioregion sub-regions Townsville Plains (sub-region 11.1), Bogie River Hills (sub-region 11.2), and Marlborough Plains (sub-region 11.14)

(2) Central Queensland Coast Bioregion

(3) Cape York Peninsula Bioregion sub-region Starke Coastal Lowlands (sub-region 3.2)

(4) Einasleigh Uplands Bioregion sub-region Hodgkinson Basin

(5) Wet Tropics Bioregion

(6) South East Queensland Bioregion.

Contaminants removal means part (d) of necessary environmental clearing, defined as clearing of vegetation that is necessary to remove contaminants from land.

Coordinated project see the *State Development and Public Works Organisation Act 1971*, section 26.

Editor's note: A coordinated project is a project declared to be a coordinated project under the *State Development and Public Works Organisation Act 1971*.

Crops see the *Vegetation Management Act 1999*

Editor's note: Crops means all or any of the following—

(a) annual horticulture,
(b) broadacre cropping, or
(c) perennial horticulture.

Defining bank is the bank which confines the seasonal flows but may be inundated by flooding from time to time. This can be either:

(1) the bank or terrace that confines the water before the point of flooding, or

(2) where there is no bank the seasonal high water line which represents the point of flooding.

Dense regional ecosystems are those listed in Table 5.

Discharge area is an area in the landscape where the net movement of groundwater is out of the catchment. Waterlogging and salting are most likely to occur in this area, as expressions of groundwater discharging at the soil surface by seepage or evaporation. A discharge area is identified by an assessment process that is consistent with the *Salinity Management Handbook*, second edition, Department of Environment and Resource Management, 2011.

Eligible owner see the *Vegetation Management Act 1999*, section 22DAC.

Editor's note: Eligible owner means an owner of land who—

(1) is authorised under the *Water Act 2000*, section 20 to take overland flow water or subartesian water for any purpose; or

(2) holds a water entitlement for the taking of water under the *Water Act 2000*; or

(3) holds an existing authority for the taking of water under the *Water Act 2000*, section 1089; or

(4) was, when the application was made, eligible to participate in a process for a water entitlement; or

(5) is a customer of a water service provider under the *Water Supply (Safety and Reliability) Act 2008*; or

(6) holds an approval under the *Waste Reduction and Recycling Act 2011*, chapter 8 and the resource to which the approval relates is water; or

(7) has applied for a water licence under the *Water Act 2000*, section 206; or

(8) holds, or has a right to be supplied water under, an environmental authority under the *Environmental Protection Act 1994*; or

(9) is authorised to take water under a law of another State or Territory in compliance with an authorisation declared under the *Water Act 2000*, section 808(1)(b).

Encroachment means a woody species that has invaded an area of a grassland regional ecosystem to an extent the area is no longer consistent with the description of the regional ecosystem.

Endangered regional ecosystem see the *Vegetation Management Act 1999*

Editor's note: Endangered regional ecosystem means a regional ecosystem declared to be an endangered regional ecosystem under the *Vegetation Management Act 1999.*

Environmental clearing management plan outlines management actions that will be undertaken in an area cleared for necessary environmental clearing to rehabilitate the area over time to ensure endangered regional ecosystems, of concern regional ecosystems, least concern regional ecosystems, essential habitat and connectivity are maintained, wetlands and watercourses are protected, and the effects of clearing do not result in land degradation.

Editor's note: Refer to the *Guidelines for necessary environmental clearing,* Department of Natural Resources and Mines, 2013 to assist with developing the management plan.

Environmental offset see the *Environmental Offsets Act 2014*.

Editor's note: Environmental offset means an activity undertaken to counterbalance a significant residual impact of a prescribed activity on a prescribed environmental matter.

Environmental offset area see the *Environmental Offsets Act 2014*

Editor's note: Environmental offset area means a legally secured offset area under *the Environmental Offset Act 2014*.

Essential habitat see the *Vegetation Management Act 1999*, section 20AC.

Editor's note: Essential habitat is shown on the essential habitat map.

Editor's note: Essential habitat for protected wildlife is a category A area, category B area or category C area shown on the regulated vegetation management map:

(1) that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or

(2) in which the protected wildlife, at any stage of its life cycle, is located.

Essential habitat database see the *Vegetation Management Act 1999*.

Editor's note: An essential habitat database means a database, listing essential habitat factors for protected wildlife, certified by the chief executive administering the *Vegetation Management Act 1999* as an essential habitat database.

Essential habitat factor see the *Vegetation Management Act 1999*.

Editor's note: Essential habitat factor, for protected wildlife, is a component of the wildlife's habitat, including for example, a landform, pollinator, regional ecosystem, soil and water, that is necessary or desirable for the wildlife at any stage of its lifecycle.

Essential habitat map see the *Vegetation Management Act 1999*, section 20AC.

Editor's note: The essential habitat map is a map certified by the chief executive [vegetation] as the essential habitat map for the State and showing, for the State, areas the chief executive reasonably believes are areas of essential habitat for protected wildlife.

Essential management see the *Sustainable Planning Regulation 2009*.

Editor's note: Essential management means clearing native vegetation:

(1) for establishing or maintaining a necessary firebreak to protect infrastructure other than a fence, road or vehicular track, if the maximum width of the firebreak is equivalent to 1.5 times the height of the tallest vegetation adjacent to the infrastructure, or 20 metres, whichever is the greater, or

(2) for establishing a necessary fire management line if the maximum width of the clearing for the fire management line is 10 metres, or

(3) necessary to remove or reduce the imminent risk that the vegetation poses of serious personal injury or damage to the infrastructure, or
(4) by fire under the *Fire and Rescue Service Act 1990* to reduce hazardous fuel load, or
(5) necessary to maintain infrastructure including any core airport infrastructure, buildings, fences, helipads, roads, stockyards, vehicular tracks, watering facilities and constructed drains other than contour banks, other than to source construction material, or
(6) for maintaining a garden or orchard, other than clearing predominant canopy trees to maintain underplantings established within remnant vegetation, or
(7) on land subject to a lease issued under the *Land Act 1994* for agriculture or grazing purposes to source construction timber to repair existing infrastructure on the land, if —
    (a) the infrastructure is in need of immediate repair
    (b) the clearing does not cause land degradation as defined under the VMA
    (c) restoration of a similar type, and to the extent of the removed trees, is ensured, or
(8) by the owner on freehold land to source construction timber to maintain infrastructure on any land of the owners, if —
    (a) the clearing does not cause land degradation as defined under the VMA
    (b) restoration of a similar type, and to the extent of the removed trees, is ensured.

Exchange area see the *Vegetation Management Act 1999*.

Editor's note: Exchange area means an area of vegetation that must be protected in the way provided under a self-assessable vegetation clearing code in exchange for clearing high value regrowth vegetation.

Extractive industry see the *Vegetation Management Act 1999*.

Editor's note: Extractive industry means an extractive industry as defined under the standard planning scheme provisions.

Extractive industry means premises used for the extraction and processing of extractive resources and associated activities, including their transportation to market.

Fodder harvesting see the *Vegetation Management Act 1999.*

Editor's note: Fodder harvesting is the clearing of vegetation predominantly consisting of fodder species:

(1) necessary to provide fodder for stock

(2) carried out in a way that—
    (a) conserves the vegetation in perpetuity
    (b) conserves the regional ecosystem in which the vegetation is situated
    (c) results in the woody biomass of the cleared vegetation remaining where it is cleared.

Fodder species are any of the following:

(1) *Acacia aneura*

(2) *Acacia cibaria (Acacia brachystachya)*

(3) *Acacia excelsa*

(4) *Acacia pendula*

(5) *Acacia stowardii*

(6) *Alphitonia excelsa*

(7) *Flindersia maculosa*

(8) *Geijera parviflora*.

Groundwater is water occurring below the surface of the ground.

Gully erosion is the removal of soil by water creating large incised channels more than 30 centimetres in depth.

Habitat trees includes trees used for habitat, nesting and feeding. Habitat trees are trees used or potentially used by hollow-dwelling fauna. Habitat trees are identified as a living tree with one or more visible hollows of 10 cm or more in diameter that are positioned at least 2 metres above the base of the tree. Nest trees are trees which contain an active bird's nest or the nest of a raptor or other bird which utilises the same nest year after year. Feed trees are trees which display five or more incisions typically made by a yellow bellied glider.

Horticulture means the commercial cultivation of fruit, vegetables and flowers including berries, grapes, vines and nuts.

High value agriculture clearing see the *Vegetation Management Act 1999*.

Editor's note: High value agriculture clearing means clearing carried out to establish, cultivate and harvest crops, other than clearing for grazing activities or plantation forestry. For further information refer to *Guidelines for determining high value and irrigated high value agriculture*, Department of Natural Resources and Mines, 2013.

Immature trees are all woody plants that are greater than 2 metres high, other than mature trees.

Irrigated high value agriculture clearing see the *Vegetation Management Act 1999*.

Editor's note: Irrigated high value agriculture clearing means clearing carried out to establish, cultivate and harvest crops, or pasture, other than clearing for plantation forestry, that will be supplied with water by artificial means. For further information refer to *Guidelines for determining high value and irrigated high value agriculture*, Department of Natural Resources and Mines, 2013.

Land Act Notice see the *Vegetation Management Act 1999,* section 20BA(b).

Editor's note: A Land Act Notice is issued by the chief executive (administering the VMA) for clearing in contravention of a tree clearing provision under the *Land Act 1994* as in force before the commencement of the *Vegetation Management and Other Legislation Amendment Act 2004*, section 3.

Land degradation see the *Vegetation Management Act 1999*.

Editor's note: Land degradation includes the following:

(1) soil erosion

(2) rising water tables

(3) the expression of salinity

(4) mass movement by gravity of soil or rock

(5) stream bank instability

(6) a process that results in declining water quality.

Land restoration means part (a) of the necessary environmental clearing, defined as clearing of vegetation that is necessary to restore the ecological and environmental condition of land.

Land Zone 1 quaternary estuarine and marine deposits subject to periodic inundation by saline or brackish marine waters. Includes mangroves, saltpans, off-shore tidal flats and tidal beaches.

Land Zone 2 quaternary coastal dunes and beach ridges. Includes degraded dunes, sand plains and swales, lakes and swamps enclosed by dunes, as well as coral and sand cays.

Land Zone 3 quaternary alluvial systems, including floodplains, alluvial plains, alluvial fans, terraces, levees, swamps, channels, closed depressions and fine textured palaeo- estuarine deposits. Also includes estuarine plains currently under fresh water influence, inland lakes and associated dune systems (lunettes).

Least concern regional ecosystem see the *Vegetation Management Act 1999*

Editor's note: Least concern regional ecosystem means a regional ecosystem declared to be a least concern regional ecosystem under the *Vegetation Management Act 1999*.

Maintain the current extent means to:

(1) avoid clearing the regional ecosystems, or

(2) if subparagraph (1) is not reasonably practicable, ensure the structure and function of the regional ecosystem is maintained (minimise the clearing), or

(3) if subparagraphs (1) or (2) are not reasonably practicable, provide an environmental offset.

Mass movement is a landslip, earthflow, landslide, rock avalanche or soil creep.

Mature trees are trees with a diameter at 1.3 metres (diameter breast height) as specified in Table 11.

Mechanical clearing is the clearing of vegetation using machinery which disturbs the soil surface or uproots woody vegetation.

Natural channel diversion means part (b) of necessary environmental clearing, defined as clearing that is necessary to divert existing natural channels in a way that replicates the existing form of the natural channels.

Natural disaster preparation means part (c) of necessary environmental clearing, defined as clearing that is necessary to prepare for the likelihood of a natural disaster.

Necessary environmental clearing see the *Vegetation Management Act 1999*.

Editor's note: Necessary environmental clearing means clearing of vegetation that is necessary to—

(a) restore the ecological and environmental condition of land, or

Example—stabilising banks of watercourses, works to rehabilitate eroded areas, works to prevent erosion of land or for ecological fire management

(b) divert existing natural channels in a way that replicates the existing form of the natural channels, or

(c) prepare for the likelihood of a natural disaster, or

Example—removal of silt to mitigate flooding

(d) remove contaminants from land.

Non-coastal bioregions and subregions include the following bioregions and subregions, as shown in Figure 1:

(1) Brigalow Belt Bioregion sub-regions not listed under coastal bioregions and subregions

(2) New England Tableland Bioregion

(3) Northwest Highlands Bioregion

(4) Gulf Plains Bioregion

(5) Cape York Peninsula Bioregion sub-regions not listed under coastal bioregions and sub-regions

(6) Mitchell Grass Downs Bioregion

(7) Channel Country Bioregion

(8) Mulga Lands Bioregion

(9) Einasleigh Uplands Bioregion sub-regions not listed under coastal bioregions and sub-regions

(10) Desert Uplands Bioregion.

Of concern regional ecosystem see the *Vegetation Management Act 1999.*

Editor's note: Of concern regional ecosystem means a regional ecosystem declared to be an of concern regional ecosystem under the *Vegetation Management Act 1999*.

Property map of assessable vegetation (PMAV) see *Vegetation Management Act 1999*.

Editor's note:

(1) A property map of assessable vegetation (or PMAV) is a map certified by the chief executive as a PMAV for an area and showing the vegetation category area for the area.

(2) The map may also show for the area the location of the boundaries of, and the regional ecosystem number for, each regional ecosystem in the area.

Property vegetation management plan see the *Vegetation Management Act 1999*

Editor's note: Property vegetation management plan mean a plan of the are to which a vegetation clearing application or concurrence agency application relates showing the matters prescribed under a regulation.

Protected wildlife see the *Vegetation Management Act 1999.*

Editor's note: Protected wildlife means native wildlife prescribed under the *Nature Conservation Act 1992* as —

(1) extinct in the wild wildlife, or

(2) endangered wildlife, or

(3) vulnerable wildlife, or

(4) rare wildlife, or

(5) near threatened wildlife, or

(6) least concern wildlife.

Public safety means clearing to ensure public safety.

Range of sizes means retaining a range of all size classes as outlined in Table 12.

Recharge area an area in the landscape where the net movement of water is downwards into and 'recharging' the groundwater. (Also sometimes referred to as an intake area.) A recharge area is identified by an assessment process that is consistent with the *Salinity Management Handbook*, second edition, Department of Environment and Resource Management, 2011.

Regional ecosystem description database is a database prepared by the Queensland Herbarium, which can be accessed at www.ehp.qld.gov.au.

Regulated vegetation management map see the *Vegetation Management Act 1999* section 20A.

Editor's note: The regulated vegetation management map is the map certified by the chief executive [administering the VMA] as the regulated vegetation management map for a part of the State and showing the vegetation category areas for the part.

Regional ecosystem see the *Vegetation Management Act 1999.*

Editor's note: Regional ecosystem means a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil.

Rehabilitated means undertaking management actions in accordance with an environmental clearing management plan to ensure:

(1) clearing vegetation associated with a wetland protects:

  (a) water quality by filtering sediments, nutrients and pollutants

  (b) aquatic habitat

  (c) terrestrial habitat

(2) clearing vegetation associated with a watercourse protects:

  (a) bank stability by protecting against bank erosion

  (b) water quality by filtering sediments, nutrients and pollutants

  (c) aquatic habitat

  (d) terrestrial habitat

(3) connectivity areas are maintained

(4) essential habitat is maintained

(5) endangered regional ecosystems, of concern regional ecosystem and least concern regional ecosystems are maintained.

Editor's note: Refer to the *Guidelines for necessary environmental clearing*, Department of Natural Resources and Mines, 2013 to assist with developing relevant management actions to ensure the application area is appropriately rehabilitated.

Relevant infrastructure see the *Vegetation Management Act 1999*.

Editor's note: A vegetation clearing application is for a relevant purpose if the applicant satisfies the chief executive administering the VMA that the development applied for is for a necessary fence, firebreak, road or vehicular track, or for constructing necessary built infrastructure (each relevant infrastructure) and the clearing for the relevant infrastructure cannot be reasonably avoided or minimised.

Remnant vegetation see the *Vegetation Management Act 1999.*

Editor's note: Remnant vegetation means vegetation:

(1) that is—

  (a) an endangered regional ecosystem, or

  (b) an of concern regional ecosystem, or

  (c) a least concern regional ecosystem

(2) forming the predominant canopy of the vegetation:

  (a) covering more than 50 per cent of the undisturbed predominant canopy

  (b) averaging more than 70 per cent of the vegetation's undisturbed height

  (c) composed of species characteristic of the vegetation's undisturbed predominant canopy.

Retained tree is any native tree that has a diameter at 1.3 metres above ground level which is 20 centimetres or more. For multi-stemmed trees, add the diameters of the two largest stems.

Retained vegetation is an area of a fodder regional ecosystem that has an average canopy height of fodder species that is more than 4 metres.

Rill erosion is the removal of soil creating small channels up to 30 centimetres deep.

Routine management see the Sustainable Planning Regulation 2009.

Editor's note: Routine management, for clearing native vegetation on land, means the clearing of native vegetation:

(1) to establish a necessary fence, road or vehicular track if the maximum width of clearing for the fence, road or track is 10 metres, or

(2) to construct necessary build infrastructure, including core airport infrastructure, other than contour banks, fences, roads or vehicular tracks, if:

  (a) the clearing is not to source construction timber

  (b) the total extent of clearing is less than 2 hectares

  (c) the total extent of the infrastructure is less than 2 hectares, or

(3) by the owner on freehold land to source construction timber for establishing necessary infrastructure on any land of the owner, if —

  (a) the clearing does not cause land degradation as defined under the VMA

  (b) restoration of a similar type, and to the extent of the removed trees, is ensured, or

(4) by the lessee of land subject to a lease issued under the *Land Act 1994* for agriculture or grazing purposes to source construction timber, other than commercial timber, for establishing necessary infrastructure on the land if:

  (a) the clearing does not cause land degradation as defined under the VMA

  (b) restoration of a similar type, and to the extent of the removed trees, is ensured.

Salinisation is the process of salts accumulating in soils or waters.

Salinity means waterlogging or the salinisation of groundwater, surface water or soil.

Salinity warning area means:

(1) vegetation indicative of saline conditions

(2) current or periodic seepage of the soil level or where the water table depth is less than 5 meters

(3) low-lying or break of slope areas

(4) landforms where seepage is likely (e.g. sandy soils overlaying heavier soils)

(5) vegetation indicative of wet conditions or bare areas, scalds or areas that are prone to erosion.

Scalding is:

(1) a bare area formed when the surface soil is removed by wind or water erosion, exposing a more clayey subsoil which is relatively impermeable to water, or

(2) where surface soil has been transformed into a hard-setting condition by exposure to raindrop impact or wind erosion.

Seasonal high water line is a zone which represents the usual peak seasonal flow level and can be identified by deposition, debris or characteristic vegetation zonation. If this is not obvious, project a horizontal line from the seasonal high water line on the opposite bank.

Selective harvesting means the harvesting of individual fodder trees in regional ecosystems identified in Tables 8 or 9 while retaining at least 50 per cent of the fodder trees in the harvesting area.

Sheet erosion is the removal of a uniform layer of soil from the surface with generally no obvious channel created.

Significant beneficial outcome is environmental work that will achieve a significant beneficial outcome to the biodiversity values of the land. This can include:

(1) repairing soil erosion or scalds, or

(2) stabilising unstable gullies, or

(3) fencing stock out of the area between the defining banks of a watercourse, or

(4) improving the condition of regulated vegetation or wildlife habitat by activities such as:

  (a) weed or pest control

  (b) using environmental burning to restore the regional ecosystem

  (c) undertake revegetation.

Editor's note: The environmental work can occur on the same lot as the clearing, another lot on the same property, or another lot on a different property in the locality. Applicant will be required to identify the location, nature of the works and a management plan for the works.

Significant residual impact see the *Environmental Offsets Act 2014*

Editor's note: Generally, a significant residual impact is an adverse impact, whether direct or indirect, of a prescribed activity on all or part of a prescribed environmental matter that –

(1) remains, or will or is likely to remain, (whether temporarily or permanently) despite on-site mitigation measures for the prescribed activity; and

(2) is, or will or is likely to be, significant.

Slope is a measure of the upward or downward incline of the land surface over any 30 metre length in the application area.

Soil absorbed broad spectrum herbicides are herbicides that are taken up through the root systems of plants, such as those with hexazinone and tebuthiuron as active ingredients.

Soil erosion means mass movement, gully erosion, rill erosion, sheet erosion, tunnel erosion, stream bank erosion, wind erosion, or scalding; and any associated loss of chemical, physical or biological fertility— including, but not limited to water holding capacity, soil structure, organic matter, soil biology, and nutrients,

Stream order is a numerical ordering classification of each watercourse segment according to its position within a catchment, as shown in Figure 2. Stream orders are determined using the vegetation management watercourse map.

Strip harvesting refers to harvesting fodder in a strip and retaining undisturbed fodder vegetation along both sides of the strip.

Thinning is the selective clearing of vegetation to restore a regional ecosystem to the floristic composition and range of densities typical of that regional ecosystem in that area.

Vegetation see the *Vegetation Management Act 1999*, section 8.

Editor's note: Vegetation is a native tree or plant other than the following—

(1) a grass or non-woody herbage

(2) a plant within a grassland ecosystem prescribed under a regulation

(3) a mangrove.

Editor's note: For the purpose of this code, vegetation is limited to vegetation located within a category A area or category B area, shown on the regulated vegetation management map or a property map of assessable vegetation. Vegetation is also limited to vegetation located within a category X area where it is identified as assessable under the *Sustainable Planning Regulation 2009*.

Vegetation management watercourse map see the *Vegetation Management Act 1999*.

Editor's note: The vegetation management watercourse map is the map certified by the chief executive administering the VMA as the vegetation management watercourse map showing particular watercourses for the State.

The map consists of the following documents:

(1) the document called Vegetation management watercourse map (1:25 000)

(2) the document called Vegetation management watercourse map (1:100 000 and 1:250 000).

Vegetation management wetlands map see the *Vegetation Management Act 1999*.

Editor's note: The vegetation management wetlands map is the map certified by the chief executive administering the VMA as the vegetation management wetlands map showing particular wetlands for the State.

Watercourse means the area of land:

(1) that is between the defining banks of a natural channel, whether artificially improved or not, in which water flows permanently or intermittently

(2) that is shown:

  (a) as a watercourse at a scale of 1:25 000 on the vegetation management watercourse map for the local government areas of Brisbane, Moreton Bay, Gold Coast, Sunshine Coast, Logan and Redlands, excluding applications to clear vegetation for extractive industry, or

  (b) as a watercourse shown on the vegetation management watercourse map for all other local governments and applications to clear vegetation for extractive industries.

Waterlogging is to soak or saturate with water.

Weed cover is the estimated percentage of the area that is covered by weeds, measured over a 30 by 30 metre (0.09 hectare) area.

Wetland means an area of land that supports plants or is associated with plants that are adapted to and dependent on living in wet conditions for at least part of their life cycle, and are shown on the vegetation management wetlands map.

Wind erosion is the movement of soil by wind.

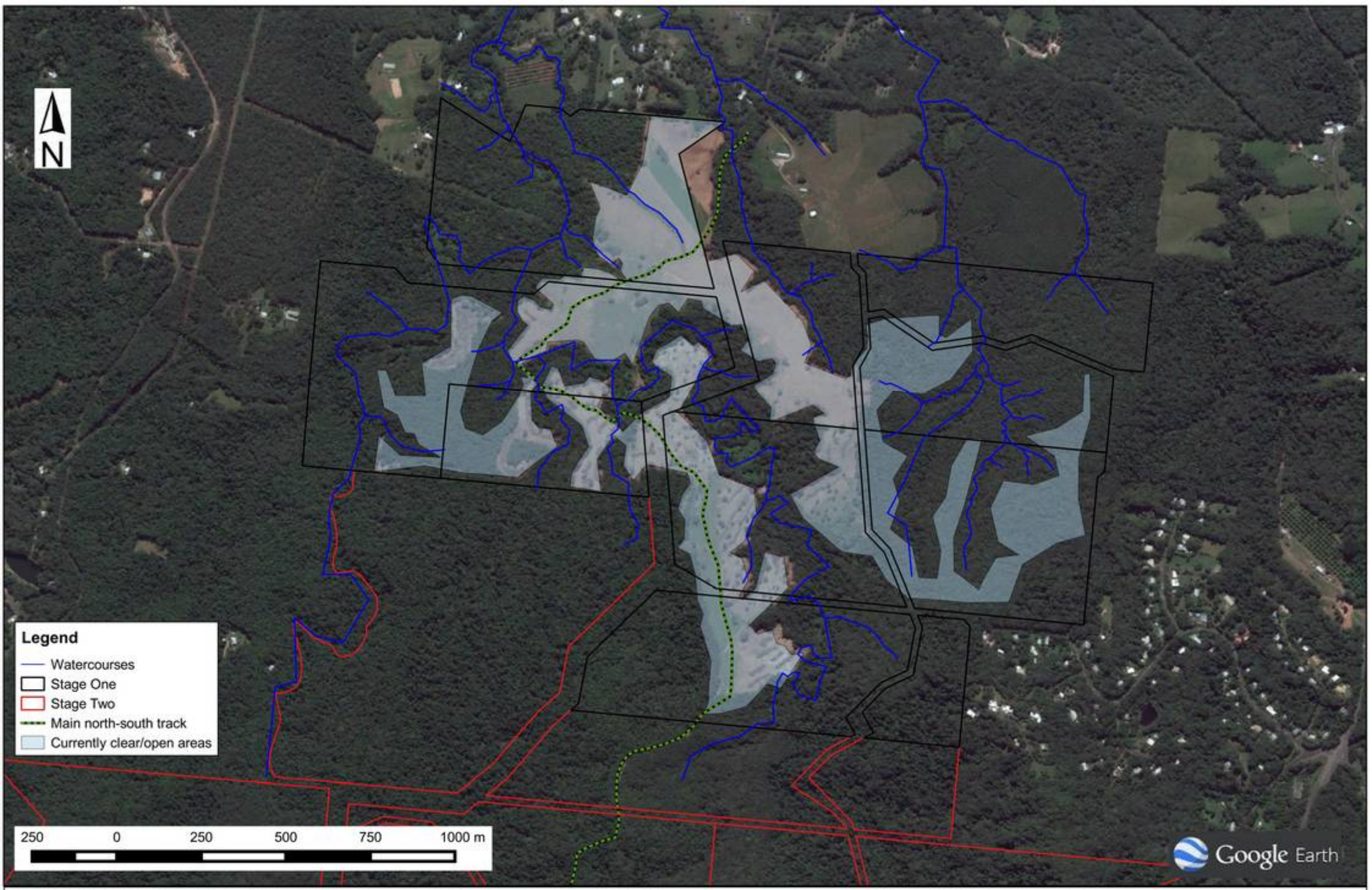
8.5 Abbreviations

DNRM – Department of Natural Resources and Mines

PMAV – Property Map of Assessable Vegetation

VMA – *Vegetation Management Act 1999*

Appendix C Currently cleared areas, Stage One



Currently cleared areas, Stage One

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Watercourse identification map - watercourse - Queensland © State of Queensland (Department of Natural Resources and Mines) 2015.
Watercourse identification map - yet to be mapped - Queensland © State of Queensland (Department of Natural Resources and Mines) 2015.
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GIS operator Simon Danielsen, Astrebla Ecological Services. 23/10/15.

Prepared by ASTREBLA ECOLOGICAL SERVICES

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Version: 1

Version date: 6 November 2015

Author: Simon Danielsen

Figures produced by Simon Danielsen

Flora Survey Report

Barnwell Road, Myola

Prepared by Astrebla Ecological Services
November 2015

A flora survey report for clearing in an area mapped as a high risk area on a flora trigger map, as required under section 256 of the *Nature Conservation (Wildlife Management) Regulation 2006* . This report demonstrates that section 261ZA 1(a) of that regulation is met, and therefore clearing is authorised under the regulation.

This Flora Survey Report ('the Report') has been prepared by Astrebla Ecological Services ('AES') on behalf of and for Reever and Ocean Pty Ltd ('the client'). The Report may only be used and relied on by the client for the purpose of meeting the requirements of Chapter 4 of the Nature Conservation (Wildlife Management) Regulation 2006 *('the Purpose') and may not be used by, or relied on by any person other than the client and the State of Queensland for the purpose of assessment under Chapter 4 of the above mentioned regulation.*

The services undertaken by AES in connection with preparing the Report were limited to those specifically detailed in the Report. The Report is based on conditions encountered and information reviewed, including assumptions made by AES, at the time of preparing the Report. Assumptions made by AES are those stated throughout the Report.

To the maximum extent permitted by law AES expressly disclaims responsibility for or liability arising from:

- *any error in, or omission in connection with assumptions, or*
- *reliance on the Report by a third party, or use of this Report other than for the Purpose.*

Contents

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Appendices

1 Introduction

1.1 Overview

Reever and Ocean Pty Ltd (the landowner) own a parcel of adjoining freehold lots in the Myola area, two kilometres west of Kuranda town centre. This land holding, at the southern of Barnwell Road terminus (street number 112), was previously a cattle farm. The majority of these lots are now vegetated by remnant vegetation that is predominately mapped as least concern regional ecosystems (see Appendix A).

However, a number of lots in the north of the project area are primarily mapped as non-remnant vegetation, and the landowners wish to clear some of this non-remnant vegetation so as to reinstate the property to its original condition as an operating farm.

The lots (referred to hereafter as 'the subject lots') which were surveyed for this Flora Report, all located in Mareeba Shire in a rural zone, are mapped in Figure 1 (the lots with white boundaries) and are:

- Lot 17 N157227
- Lot 18 N157227
- Lot 19 N157452

Most of the non-remnant vegetation in these lots is mapped as a high risk area on a flora trigger map. Therefore, under section 256 of the *Nature Conservation (Wildlife Management) Regulation 2006* (the NCWMR) a flora survey and flora survey report is required prior to clearing.

Note – parts of these lots have already been cleared in breach of s.256 and this breach has been self-reported to the Department of Environment and Heritage Protection (EHP) by the landowners (letter to Wildlife Officer Kerry Walsh dated 7 September 2015, see Appendix C).

This report is concerned only with areas not impacted under that previous clearing.

A flora survey undertaken in accordance with the requirements of the *Flora Survey Guidelines – Protected Plants* (as required under s.257 of the NCWMR) was undertaken in the areas of non-remnant vegetation proposed to be cleared. No protected plants were detected.

Therefore, this intended clearing will meet the activity exemption outlined in s.261ZA of the NCWMR, as no protected plant occurs in the clearing area or within 100 m.

1.2 Project location and description

The subject lots listed in Section 1.1 and mapped in Figure 1 are located at the southern end of Barnwell Road in Myola, within Mareeba Shire, in the rural zone. They form part of the old Barnwell family farm, which was formerly used for cattle grazing. The street address is 112 Barnwell Rd, Kuranda.

The entire northern third of the project area is located on gently undulating to undulating rises dissected by gullies. It had been cleared by the previous owners – historical aerial photo research indicates most of the northern third of the project area was already cleared in 1942, and had been kept in that state until the mid-1990s.

These cleared areas were either open signal grass (*Urochloa mutica*) pasture, under lantana (*Lantana camara*) and raspberry (*Rubus alceifolius*), or wattle-dominated regrowth (dominated by a mixture of *Acacia celsa* and/or *A. cincinnata*).

The eastern sections of lots 17 and 18 are located in the Warril Creek catchment. The remainder of those lots, and lot 19, are located in the Haren Creek catchment (which forms part of Owen Creek catchment).

1.2.1 Geology

The entire project area is located on Barron River metamorphics (slate, phyllite, quartzite, chert, greywacke) (Bureau of Mineral Resources, Geology and Geophysics, 1962). Some local areas of sandstone have been noted.

1.3 Proposed land use and clearing area

The landowner proposes to restore this land, zoned rural, to its previous status as a farm, by clearing the non-remnant vegetation located outside of areas mapped as reef-regrowth watercourse vegetation (category R under the *Vegetation Management Act 1999*). In addition, a 60 m buffer from all creek lines (as detected on the ground, not as mapped in any publicly available mapping) has been imposed to protect habitat potentially utilised by the Kuranda treefrog (*Litoria myola*).

Therefore, only vegetation mapped as non-remnant will be directly impacted. The land proposed to be used for this purpose is mapped in Figure 1 and comprises all coloured areas – that is, areas mapped in Figure 1 as 'currently clear/open areas' and 'proposed new clearing areas'. Areas mapped in black are the areas proposed to be cleared which are the subject of this report (numbered one to five).

1.4 Survey methodology

This survey was conducted in two phases – an initial desktop survey was conducted to identify possible protected plants (listed by either the Commonwealth or Queensland governments) that are known or predicted to occur in the area within a ten kilometre radius, followed by random meander surveys on site in accordance with the *Flora Survey Guidelines – Protected Plants* (Department of Environment and Heritage Protection, 2014).

Surveys were conducted in two periods, between 29 August to 4 September 2015, and 9 November to 18 November 2015.

1.4.1 Desktop survey

The desktop survey involved two searches of the Wildlife Online database using differing radii, and a search of the Commonwealth government's online Protected Matters Search Tool (PMST). The results are provided in Appendix D. It should be noted that the PMST is predictive and as such a number of records nominated were discounted after further research into habitat requirements and records of known locations (and particularly the altitudes at which they occur). Protected species nominated in these searches that it was considered *may possibly be present* in the Myola area in mesophyll/notophyll vine forest, and that were targeted during the field survey, are:

- *Alpinia hylandii*: a petiolate ginger (Zingiberaceae) (Cooke, 1987) previously recorded at two locations within five kilometres of the Barnwell Rd site in mesophyll vine forest (Australia's Virtual Herbarium, 2015). This species was previously located by the author of this report on nearby land, lot 20 N157423 (in a patch of 0.7 ha at 55 350456 E 8139318 S).
- *Archontophoenix myolensis* (Myola palm): an *Archontophoenix* (Arecaceae) that is very similar to the common *A. alexandrae* – the main morphological point of difference is in the mature fruit, with generally difficult to assess vegetative differences. It is restricted to riverine rainforest in the Warril Ck catchment, and adjacent riparian areas of the Barron River downstream of Warril Ck (Dowe and Hodel, 1994). The Barnwell Road property encompasses part of the Warril Ck catchment. Suspected Myola palms have been located adjacent to lot 17 by this report author, and one suspected individual has been recorded on lot 22. However, identification to species is very difficult with this species before reproductive age is reached (as was the case with all individuals found here).
- *Canarium acutifolium* var. *acutifolium*: a tree to 40 m tall in the Burseraceae, mainly distinguished from other *Canarium* spp. by the number of stamens. It has been collected from mesophyll vine forest beside watercourses at up to 200 m elevation (Threatened Species Scientific Committee, 2008ka). The record closest to Myola (and the only record in the Cairns/Kuranda area) came from a 1961 collection at Redlynch (Australia's Virtual Herbarium, 2015).
- *Polyphlebium (Crepidomanes) endlicherianum* (middle filmy ferm) and *P. majoriae*: these filmy ferns (Hymenophyllaceae) are restricted to damp locations, where they grow on rocks, logs or tree trunks (Bostock and Spokes, 1998; Department of the Environment, 2015). Both species have been infrequently collected in the Cairns/Kuranda area, with one record for each species between five and ten kilometres from Barnwell Rd (Australia's Virtual Herbarium, 2015).
- *Randia audasii*: an understorey tree (Rubiaceae) endemic to North Queensland growing in well-developed rainforest (Hyland *et al*, 2010). Four collections of this species have been made in the Kuranda and Speewah area within five kilometres of the Barnwell Road site (Australia's Virtual Herbarium, 2015).
- *Senegalia albizioides* (climbing wattle): a scrambling plant with bipinnate leaves endemic to North Queensland (Hyland *et al*, 2010), and previously recorded from Smithfield growing in disturbed notophyll vine forest and regrowth with lantana on metamorphic soils (Australia's Virtual Herbarium, 2015).

1.4.2 Site survey

As recommended in the *Flora Survey Guidelines – Protected Plants* (Department of Environment and Heritage Protection, 2014), a random meander method was used to search for protected plants on this site. The survey was conducted over two survey events between 29 August and 4 September, and 9 to 18 November, 2015. The surveys were conducted in areas that are proposed to be cleared that are 'in the wild', and the impact area (encompassing a 100 m buffer of 'in the wild' vegetation as defined in the guidelines). The objective of the surveys was to determine the presence of protected plants in the areas proposed to be cleared and in the impact areas.

The total area proposed to be cleared is 20.13 ha. According to the *Flora Survey Guidelines – Protected Plants* (Department of Environment and Heritage Protection, 2014), areas of less than 10 ha should be surveyed at a density of at least one transect. Those between 10 and 100 ha should be surveyed at a minimum density of two to five transects. All except one area proposed for clearing are less than 10 ha, and that area exceeds the 10 ha threshold by only 0.35 ha.

Therefore, a total of six transects were surveyed, as described below (and mapped in Figure 5). Each discrete area has at least one transect surveyed, and area 1, the largest, has two:

- Area 1 (10.35 ha):
    - Transect 1: 152 species recorded.
    - Transect 2: 102 species recorded.
- Area 2 (3.9 ha):
    - Transect 3: 126 species recorded.
- Area 3 (1.99 ha):
    - Transect 4: 135 species recorded.
- Area 4 (0.16 ha):
    - Transect 5: 99 species recorded.
- Area 5 (3.73 ha):
    - Transect 6: 154 species recorded.

Each transect was conducted recording plant species until no new plant species had been recorded for 30 minutes, or until all areas in the wattle-dominated regrowth and its 100 m buffer in that location had been searched.

Note – some transects are not continuous – due to the large areas and time involved in these surveys, it was sometimes necessary to interrupt the field survey, and the GPS tracks will reflect these interruptions.

The survey results for each transect are provided in Table 1. Transects are mapped in Figure 2, Figure 3 and Figure 4. All of the targeted threatened species listed in Section 1.4.1 above are apparent and identifiable at the time of year this survey was conducted (September and November). None were recorded as being present anywhere on the subject lots (lots 17 and 18 N157227 and lot 19 N157452).

1.5 Clearing dates

Clearing dates will be weather dependant and will be between 28 December 2015 and 28 December 2016. It is expected that clearing will occur sooner rather than later. However, in case of unforeseen delays, the dates on the application form have been entered as 28 December 2015 to 28 December, 2017.

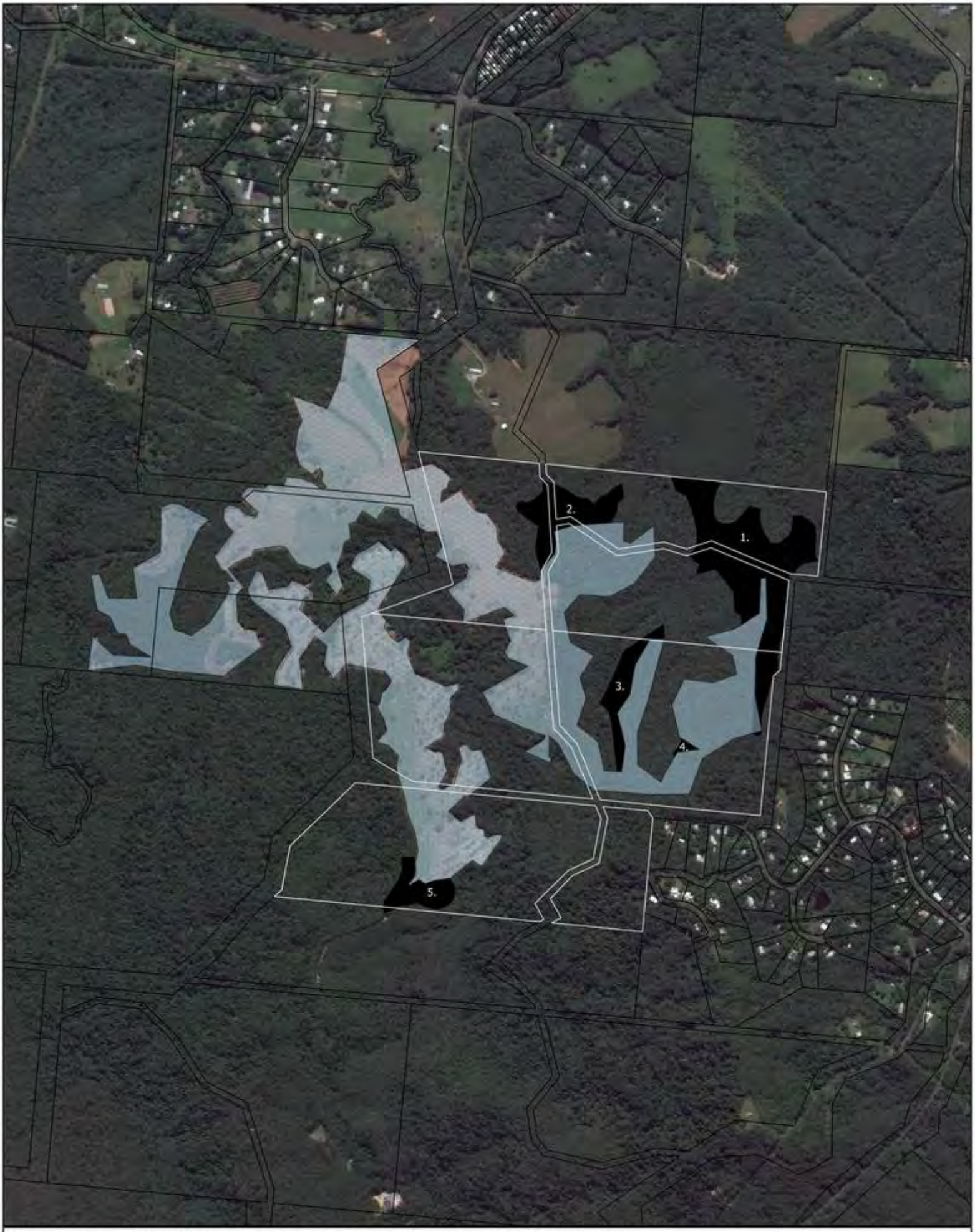

Figure 1 Subject lots, proposed clearing and existing clearing

250 0 250 500 750 1000 m

Legend

Currently clear/open areas

Proposed new clearing areas

N

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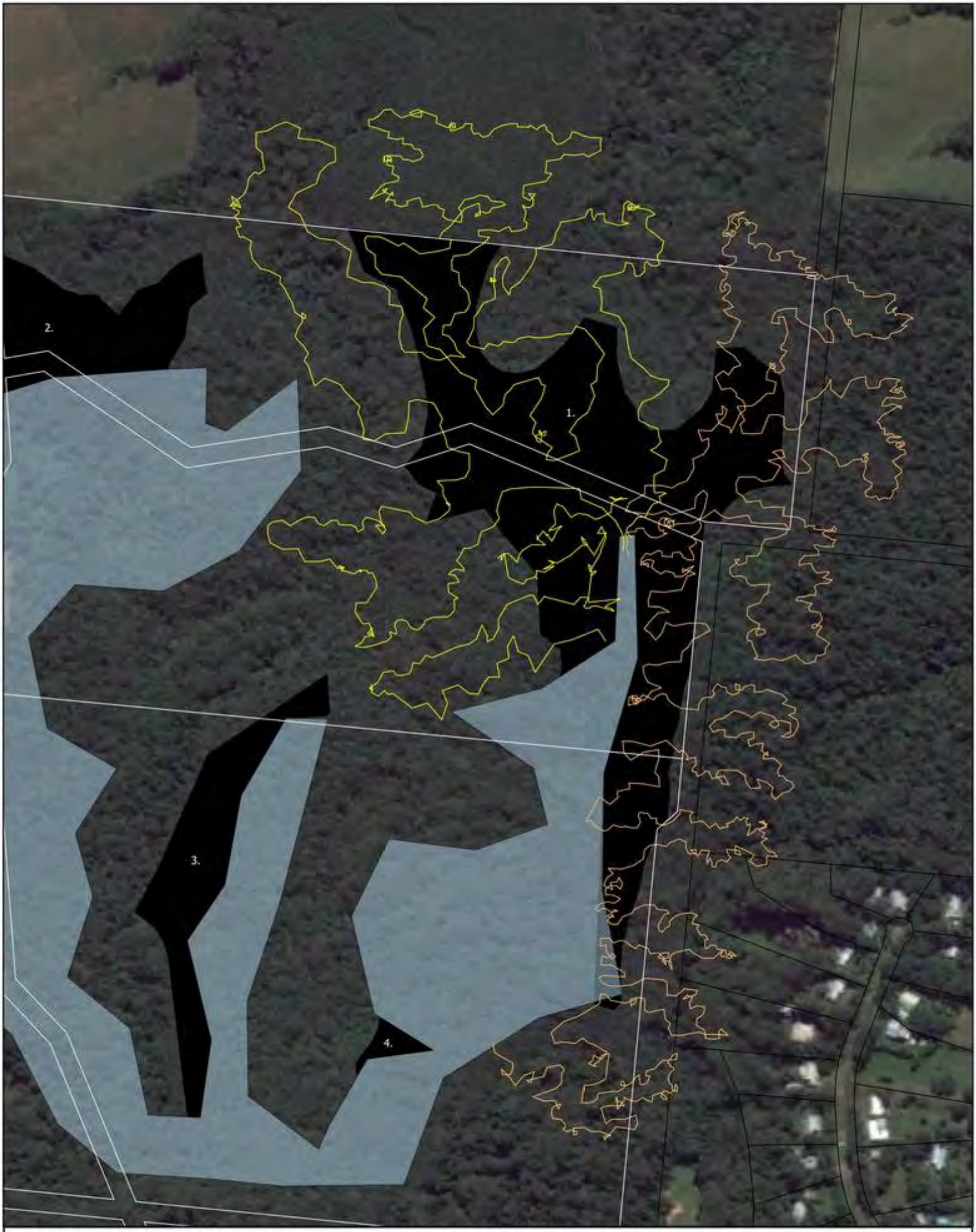

Figure 2 Area one transects

100 0 100 200 300 400 m

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Legend

- Transect 1
- Transect 2
- Currently clear/open areas
- Proposed new clearing areas

N

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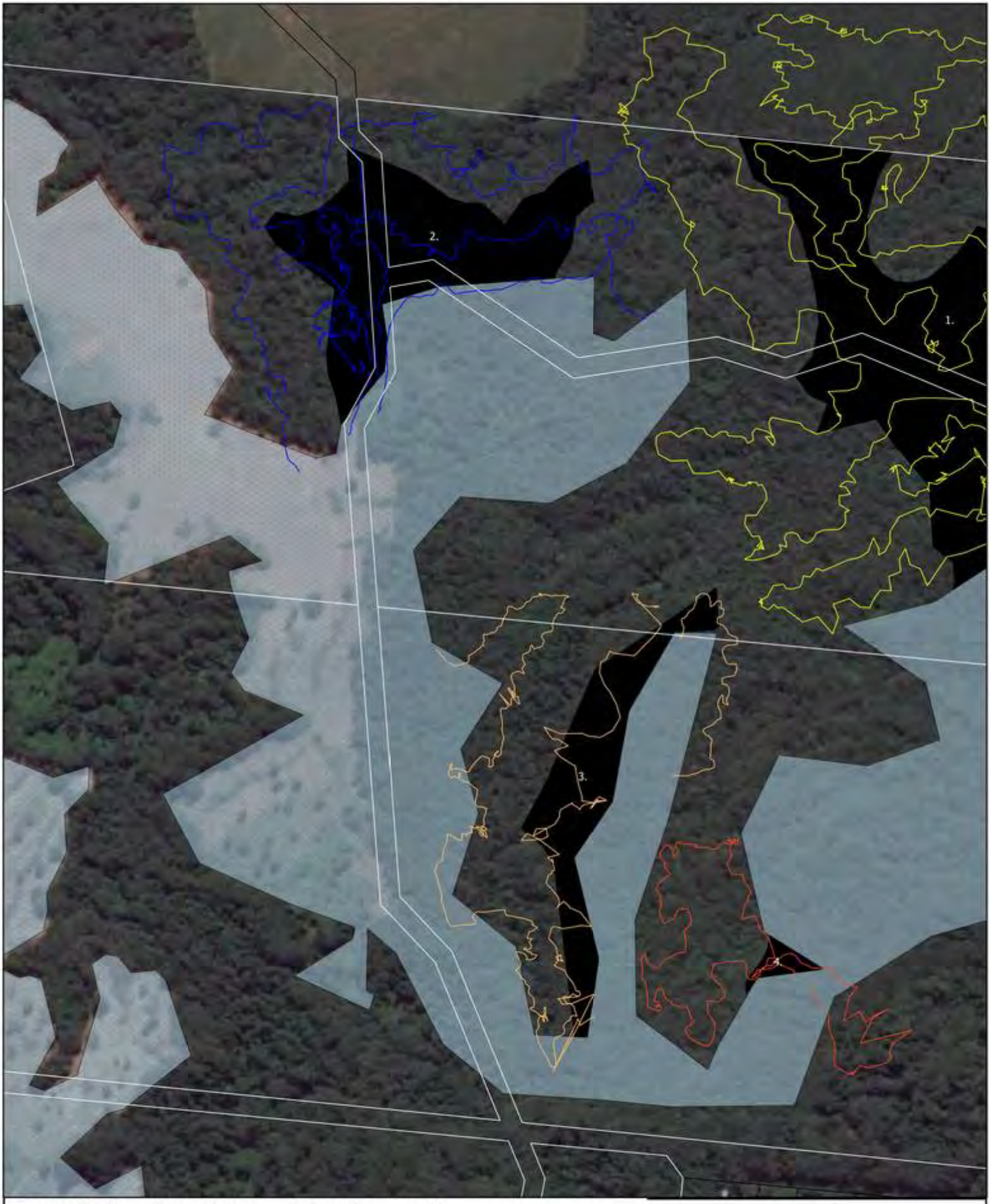

Figure 3 Area two, three and four transects

100 0 100 200 300 400 m

Legend

- Transect 2
- Transect 3
- Transect 4
- Transect 5
- Currently clear/open areas
- Proposed new clearing areas

N

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Figure 4 Area five transect (transect six)

25 0 25 50 75 100 m

Legend

- DCDB_Myola area
- Transect 6
- Currently clear/open areas
- Proposed new clearing areas

N

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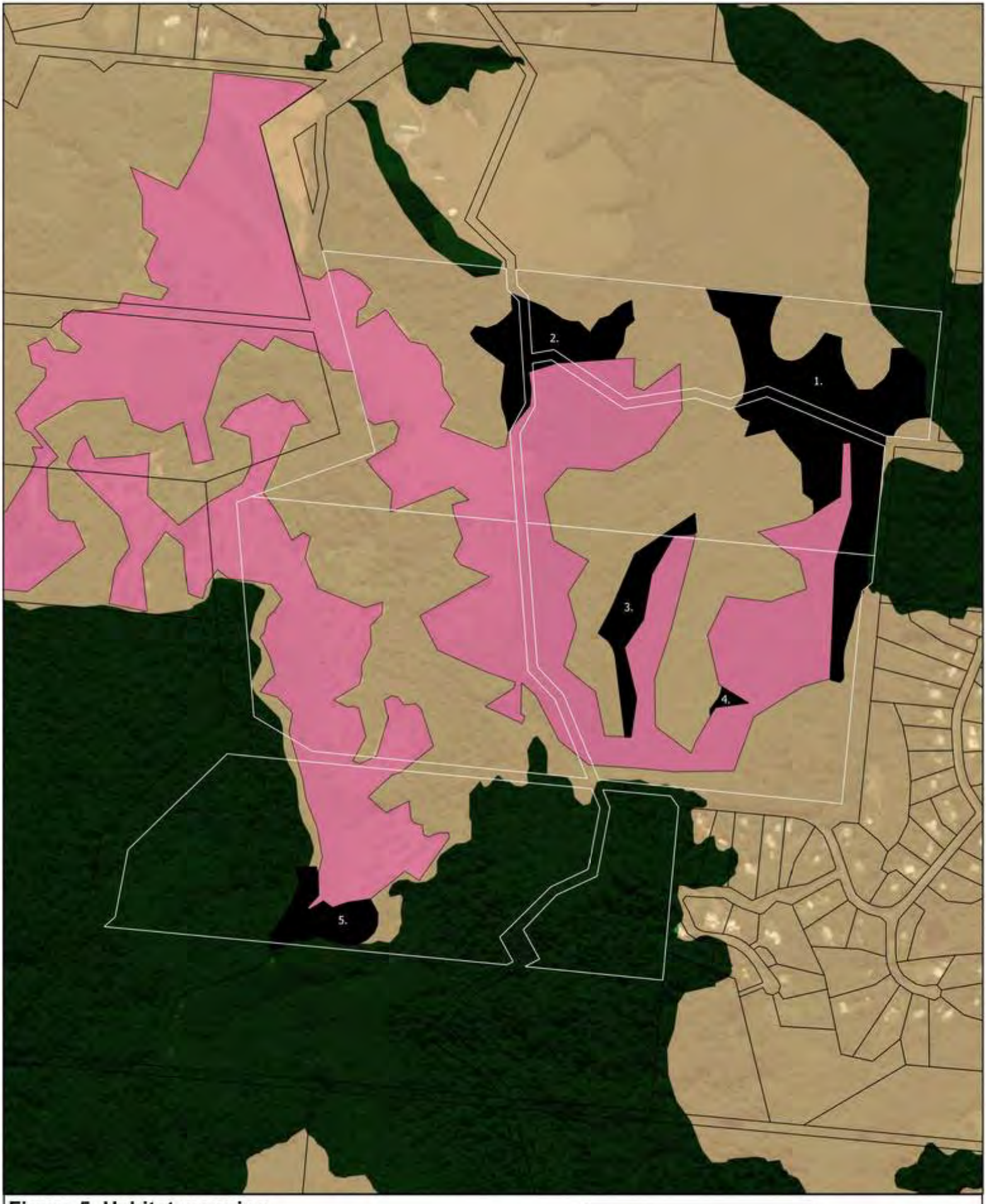

Figure 5 Habitat mapping

100 0 100 200 300 400 m

NOTE: All areas mapped as 'proposed new clearing areas' are included in 'wattle regrowth habitat'.

Legend

- Proposed new clearing areas
- Open habitat
- Wattle regrowth habitat
- Remnant vegetation habitat

N

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GIS operator Simon Danielsen, Astrebla Ecological Services, 13/12/15.

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2 Survey results

2.1 Random meander results

The results of the six random meander surveys of the clearing impact areas are presented in Table 1. Random meanders are mapped in Figure 2. No species of conservation significance were detected in the clearing impact areas. A total of 232 species from 174 genera, in 83 families, were recorded. The most diverse families were:

- Elaeocarpaceae: 3 genera, 8 species
- Lauraceae: 6 genera, 14 species
- Myrtaceae: 10 genera, 15 species
- Rubiaceae: 8 genera, 8 species
- Rutaceae: 7 genera, 12 species
- Sapindaceae: 12 genera, 16 species.

The most diverse genera were:

- *Elaeocarpus* (Elaeocarpaceae): 5 species
- *Cryptocarya* (Lauraceae): 6 species
- *Ficus* (Moraceae): 5 species
- *Syzygium* (Myrtaceae): 5 species.

Table 1 Survey results

Family	Species	1	2	3	4	5	6
Adiantaceae	*Adiantum hispidulum* Sw.	Y		Y	Y	Y	Y
	Taenitis pinnata (J.Sm.) Holttum	Y	Y	Y	Y	Y	Y
Anacardiaceae	*Blepharocarya involucrigera* F.Muell.	Y					Y
Annonaceae	*Melodorum uhrii* F.Muell.	Y	Y	Y	Y	Y	Y
	Xylopia maccreae (F. Muell.) L.S.Sm.	Y					Y
Apiaceae	*Mackinlaya macrosciadea* (F.Muell.) F.Muell.	Y	Y	Y	Y		Y
Apocynaceae	*Alstonia muelleriana* Domin	Y	Y		Y	Y	Y
	Alstonia scholaris (L.) R.Br.				Y	Y	
	Alyxia ruscifolia R.Br.	Y					Y
	Hoya macgillivrayi F.M.Bailey	Y		Y			
	Melodinus acutiflorus F.Muell.	Y		Y			Y
	Melodinus australis (F.Muell.) Pierre	Y	Y	Y	Y	Y	Y
	Parsonsia latifolia (Benth.) S.T.Blake		Y	Y			Y
Araceae	*Epipremnum pinnatum* (L.) Engl.	Y			Y		Y
	Pothos longipes Schott	Y					Y
	Rhaphidophora australasica F.M. Bailey	Y					Y
Araliaceae	*Delarbrea michieana* (F. Muell.) F. Muell.	Y					
	Polyscias australiana (F.Muell.) Philipson	Y	Y	Y	Y	Y	Y
	Polyscias elegans (C.Moore & F.Muell.) Harms	Y	Y	Y	Y	Y	Y
	Polyscias purpurea C.T.White	Y			Y		
	Schefflera actinophylla (Endl.) Harms	Y			Y	Y	
Araucariaceae	*Agathis robusta* (C.Moore ex F.Muell.) F.M.Bailey			Y			Y

Family	Species	1	2	3	4	5	6
Arecaceae	*Archontophoenix alexandrae* (F.Muell.) H.Wendl. & Drude	Y		Y			Y
	Calamus australis Mart.	Y	Y	Y	Y	Y	Y
	Calamus caryotoides A.Cunn. ex Mart.	Y					Y
	Calamus moti F.M.Bailey	Y	Y		Y	Y	Y
	Linospadix minor (W.Hill) F.Muell.	Y	Y		Y	Y	Y
	Syagrus romanzoffiana (Cham.) Glassman*			Y			
Aristolochiaceae	*Pararistolochia deltantha* (F.Muell.) Michael J.Parsons			Y	Y		
Aspleniaceae	*Asplenium australasicum* (J.Sm.) Hook.	Y	Y		Y	Y	Y
Asteraceae	*Ageratum houstonianum* Mill.*			Y			
	Coronidium rupicola (DC.) Paul G.Wilson			Y			
Balanophoraceae	*Balanophora fungosa* J.R.Forst. & G.Forst.	Y					Y
Bignoniaceae	*Deplanchea tetraphylla* (R.Br.) F.Muell.			Y			Y
	Neosepicaea jucunda (F.Muell.) Steenis	Y					Y
	Pandorea pandorana (Andrews) Steenis					Y	
Blechnaceae	*Blechnum cartilagineum* Sw.	Y		Y	Y	Y	Y
Carpodetaceae	*Abrophyllum ornans* (F.Muell.) Hook.f. ex Benth.	Y		Y	Y		Y
Clusiaceae	*Calophyllum sil* Lauterb.	Y	Y	Y	Y	Y	Y
	Garcinia warrenii F.Muell.	Y	Y			Y	Y
Connaraceae	*Connarus conchocarpus* F.Muell. subsp. *conchocarpus*	Y	Y				Y
Cunoniaceae	*Davidsonia pruriens* F.Muell.	Y	Y		Y	Y	Y
Cyatheaceae	*Cyathea rebeccae* (F.Muell.) Domin	Y		Y	Y	Y	Y
	Cyathea cooperi (Hook. ex F.Muell.) Domin	Y		Y	Y		Y
Cyperaceae	*Gahnia aspera* (R.Br.) Spreng.	Y	Y	Y	Y	Y	
	Scleria polycarpa Boeckeler			Y		Y	
Dennstaedtiaceae	*Pteridium esculentum* (G.Forst.) Cockayne		Y	Y		Y	
Dichapetalaceae	*Dichapetalum papuanum* (Becc.) Boerl.	Y			Y		Y
Dilleniaceae	*Dillenia alata* (R.Br. ex DC.) Martelli	Y					
	Hibbertia scandens (Willd.) Gilg	Y	Y	Y	Y	Y	Y
	Tetracera daemeliana F.Muell.	Y		Y	Y	Y	Y
	Tetracera nordtiana F.Muell.	Y	Y	Y	Y	Y	Y
Dioscoreaceae	*Dioscorea transversa* R. Br.						Y
Ebenaceae	*Diospyros cupulosa* (F.Muell.) F.Muell.	Y					Y
	Diospyros hebecarpa A.Cunn. ex Benth.						Y
Elaeocarpaceae	*Aceratium megalospermum* (F.Muell.) Balgooy	Y					Y
	Elaeocarpus bancroftii F.Muell. & F.M.Bailey	Y	Y		Y	Y	
	Elaeocarpus eumundi F.M.Bailey				Y		
	Elaeocarpus foveolatus F.Muell.	Y		Y	Y		
	Elaeocarpus grahamii F.Muell.	Y					Y
	Elaeocarpus grandis F.Muell.	Y	Y	Y	Y	Y	Y
	Sloanea australis (Benth.) F.Muell. subsp. *australis*				Y		Y
	Sloanea langii F.Muell.	Y	Y	Y	Y	Y	Y
Euphorbiaceae	*Homalanthus novoguineensis* (Warb.) K.Schum.	Y					Y
	Macaranga involucrata var. *mallotoides* (F.Muell.) L.M.Perry	Y	Y	Y	Y	Y	Y
	Macaranga subdentata Benth.	Y	Y				Y
	Mallotus polyadenos F.Muell.	Y					
	Omphalea queenslandiae F.M.Bailey	Y		Y			Y
	Rockinghamia angustifolia (Benth.) Airy Shaw	Y					Y

Family	Species	1	2	3	4	5	6
Fabaceae	*Austrosteenisia blackii* (F.Muell.) R.Geesink var. *blackii*	Y			Y		Y
	Austrosteenisia stipularis (C.T. White) Jessup		Y				Y
Flacourtiaceae	*Scolopia braunii* (Klotzsch) Sleumer	Y		Y	Y		Y
Flagellariaceae	*Flagellaria indica* L.	Y	Y	Y	Y		Y
Gleicheniaceae	*Dicranopteris linearis* (Burm.f.) Underw.	Y		Y	Y		Y
Hemerocallidaceae	*Dianella caerulea* Sims	Y	Y	Y	Y	Y	Y
Hypoxidaceae	*Molineria capitulata* (Lour.) Herb.	Y		Y			
Icacinaceae	*Apodytes brachystylis* F.Muell.		Y				Y
Lamiaceae	*Clerodendrum floribundum* R.Br.	Y			Y	Y	
Lauraceae	*Beilschmiedia bancroftii* (F.M.Bailey) C.T.White	Y	Y	Y	Y		
	Cinnamomum laubatii F. Muell.		Y	Y	Y	Y	Y
	Cryptocarya clarksoniana B.Hyland					Y	
	Cryptocarya grandis B.Hyland		Y	Y	Y		
	Cryptocarya laevigata Blume	Y					
	Cryptocarya mackinnoniana F.Muell.	Y	Y	Y	Y	Y	Y
	Cryptocarya murrayi F. Muell.	Y	Y				
	Cryptocarya vulgaris B.Hyland	Y	Y	Y			
	Endiandra acuminata C.T.White & W.D.Francis	Y	Y	Y		Y	Y
	Endiandra hypotephra F.Muell.	Y			Y		Y
	Litsea bindoniana (F.Muell.) F.Muell.	Y	Y	Y	Y	Y	
	Litsea leefeana (F.Muell.) Merr.	Y	Y	Y	Y	Y	Y
	Neolitsea brassii C.K.Allen		Y				Y
	Neolitsea dealbata (R.Br.) Merr.	Y	Y	Y	Y	Y	Y
Laxmanniaceae	*Cordyline cannifolia* R.Br.	Y	Y	Y	Y	Y	Y
	Eustrephus latifolius R.Br. ex Ker Gawl.			Y	Y		
	Lomandra longifolia Labill.		Y				Y
Leptaulaceae	*Citronella moorei* (F.Muell. ex Benth.) R.A.Howard	Y		Y			
Loranthaceae	*Amyema queenslandica* (Blakely) Danser	Y		Y	Y		Y
Lygodiaceae	*Lygodium reticulatum* Schkuhr	Y	Y	Y	Y	Y	Y
Maesaceae	*Maesa dependens* F.Muell.	Y	Y	Y			
Melastomataceae	*Melastoma cyanoides* Sm.				Y		
	Melastoma malabathricum L. subsp. *malabathricum*	Y		Y	Y	Y	Y
Meliaceae	*Dysoxylum oppositifolium* F.Muell.						Y
Menispermaceae	*Hypserpa decumbens* (Benth.) Diels	Y	Y	Y	Y	Y	
	Hypserpa laurina (F.Muell.) Diels	Y	Y	Y	Y	Y	Y
	Stephania japonica (Thunb.) Miers	Y				Y	Y
	Tinospora smilacina Benth.			Y	Y		
Mimosaceae	*Acacia celsa* Tindale	Y	Y	Y	Y	Y	Y
	Acacia cincinnata F.Muell.	Y	Y		Y	Y	Y
	Acacia mangium Willd.			Y	Y		Y
	Acacia melanoxylon R.Br.	Y			Y		
Monimiaceae	*Austromatthaea elegans* L.S. Sm.	Y	Y				
	Levieria acuminata (F.Muell.) Perkins				Y		Y
	Palmeria scandens F.Muell.	Y	Y	Y	Y	Y	
	Steganthera laxiflora (Benth.) Whiffin & Foreman subsp. *laxiflora*	Y	Y		Y	Y	Y
	Tetrasynandra longipes Perkins						Y
Moraceae	*Ficus congesta* Roxb. var. *congesta*			Y	Y	Y	
	Ficus destruens F. Muell. ex C.T. White	Y	Y		Y		Y

Family	Species	1	2	3	4	5	6
	Ficus fraseri Miq.				Y	Y	
	Ficus hispida L.f. *var. hispida*			Y			
	Ficus opposita Miq.			Y			
	Trophis scandens (Lour.) Hook. & Arn. subsp. *scandens*					Y	Y
Myristicaceae	*Myristica insipida* R.Br.		Y		Y		Y
Myrsinaceae	*Ardisia brevipedata* F.Muell.	Y	Y	Y	Y	Y	
	Ardisia crenata Sims		Y	Y			
	Embelia caulialata S.T.Reynolds	Y		Y	Y		
	Myrsine subsessilis F.Muell.	Y	Y	Y		Y	Y
Myrtaceae	*Archirhodomyrtus beckleri* (F.Muell.) A.J.Scott	Y	Y		Y	Y	Y
	Corymbia torelliana (F.Muell.) K.D.Hill & L.A.S.Johnson				Y		Y
	Decaspermum humile (G.Don) A.J.Scott	Y	Y		Y	Y	
	Eucalyptus tereticornis Sm.						Y
	Melaleuca leucadendra (L.) L.						Y
	Psidium guajava L.*			Y			
	Rhodamnia sessiliflora Benth.	Y	Y	Y	Y	Y	Y
	Rhodamnia spongiosa (F.M.Bailey) Domin			Y			
	Rhodomyrtus macrocarpa Benth.	Y			Y		
	Syzygium fibrosum (F.M. Bailey) T.G. Hartley & L.M. Perry				Y		
	Syzygium kuranda (F.M.Bailey) B.Hyland	Y	Y	Y	Y	Y	Y
	Syzygium luehmannii (F.Muell.) L.A.S.Johnson	Y	Y		Y	Y	Y
	Syzygium suborbiculare (Benth.) T.G.Hartley & L.M.Perry						Y
	Syzygium wilsonii (F.Muell.) B. Hyland	Y					Y
	Tristania exiliflora F. Muell.						Y
Oleaceae	*Jasminum didymum* G.Forst. *subsp. didymum*			Y			Y
Orchidaceae	*Cymbidium madidum* Lindl.	Y	Y	Y		Y	Y
Pandanaceae	*Benstonea monticola* (F.Muell.) Callm. & Buerki	Y	Y	Y	Y	Y	Y
	Freycinetia excelsa F.Muell.	Y					Y
	Freycinetia scandens Gaudich.	Y					Y
Passifloraceae	*Passiflora edulis* Sims*				Y		
	Passiflora kuranda Krosnick & A.J. Ford	Y	Y		Y	Y	Y
Phyllanthaceae	*Breynia cernua* (Poir.) Muell.Arg.	Y		Y	Y		
	Glochidion harveyanum Domin			Y			Y
	Glochidion sumatranum Miq.				Y		
Pinaceae	*Pinus caribaea* L.		Y				
Piperaceae	*Piper caninum* Blume	Y	Y	Y	Y	Y	Y
	Piper hederaceum (Miq.) A. Cunn. ex C.DC.		Y	Y			Y
Pittosporaceae	*Bursaria incana* Lindl.					Y	
	Bursaria spinosa Cav. subsp. *spinosa*				Y	Y	Y
	Pittosporum rubiginosum A. Cunn.	Y		Y	Y	Y	
Poaceae	*Imperata cylindrica* (L.) Raeusch.		Y	Y	Y	Y	
	Megathyrsus maximus (Jacq.) B.K. Simon & S.W.L.Jacobs			Y	Y		Y
	Melinis repens (Willd.) Zizka*				Y		
	Oplismenus undulatus (Ard.) Roem. & Schult.	Y					
	Urochloa decumbens (Stapf) R.D. Webster*			Y	Y	Y	
Podocarpaceae	*Podocarpus grayae* de Laub.	Y	Y	Y	Y	Y	Y

Family	Species	1	2	3	4	5	6
Polygalaceae	*Xanthophyllum fragrans* C.T. White	Y	Y		Y		
	Xanthophyllum octandrum (F.Muell.) Domin	Y			Y	Y	
Polypodiaceae	*Drynaria rigidula* (Sw.) Bedd.	Y	Y	Y	Y	Y	
	Platycerium bifurcatum (Cav.) C. Chr.	Y		Y	Y	Y	Y
Proteaceae	*Cardwellia sublimis* F. Muell.	Y	Y	Y	Y	Y	
	Carnarvonia araliifolia F.Muell. var. *araliifolia*	Y	Y	Y	Y	Y	Y
	Darlingia darlingiana (F.Muell.) L.A.S. Johnson	Y	Y	Y	Y	Y	Y
	Grevillea hilliana F. Muell.						Y
	Musgravea heterophylla L.S. Sm.	Y	Y	Y	Y		Y
	Opisthiolepis heterophylla L.S. Sm.		Y	Y			
	Placospermum coriaceum C.T.White & W.D. Francis	Y	Y	Y	Y	Y	Y
Psilotaceae	*Psilotum nudum* (L.) P. Beauv.	Y	Y	Y		Y	
Rhamnaceae	*Alphitonia petriei* Braid & C.T. White	Y	Y	Y	Y	Y	Y
	Alphitonia whitei Braid	Y	Y	Y	Y	Y	Y
Rhizophoraceae	*Carallia brachiata* (Lour.) Merr.	Y					Y
Ripogonaceae	*Ripogonum album* R.Br.	Y	Y	Y	Y	Y	Y
Rosaceae	*Rubus alceifolius* Poir.*	Y	Y	Y	Y	Y	Y
Rubiaceae	*Aidia racemosa* (Cav.) Tirveng.					Y	Y
	Atractocarpus fitzalanii (F.Muell.) Puttock				Y		Y
	Coelospermum paniculatum F.Muell.		Y				Y
	Coffea liberica W.Bull. ex Hiern*			Y	Y		
	Cyclophyllum coprosmoides (F.Muell.) S.T.Reynolds & R.J.F.Hend.	Y		Y			Y
	Gardenia ovularis F.M.Bailey	Y	Y	Y	Y	Y	Y
	Psydrax attenuata (Benth.) S.T. Reynolds & R.J.F. Hend.				Y		Y
	Spermacoce latifolia Aubl.*			Y			
Rutaceae	*Acronychia acronychioides* (F.Muell.) T.G.Hartley	Y	Y		Y	Y	
	Acronychia laevis J.R.Forst. & G.Forst.	Y					Y
	Brombya platynema F.Muell.	Y	Y		Y		Y
	Flindersia bourjotiana F.Muell.	Y	Y			Y	
	Flindersia ifflaiana F.Muell.	Y	Y		Y	Y	Y
	Flindersia pimenteliana F.Muell.		Y		Y		
	Medicosma fareana (F.Muell.) T.G. Hartley		Y				Y
	Melicope bonwickii (F. Muell.) T.G. Hartley		Y		Y		Y
	Melicope elleryana (F.Muell.) T.G. Hartley		Y	Y	Y	Y	Y
	Melicope xanthoxyloides (F.Muell.) T.G. Hartley	Y	Y	Y	Y	Y	
	Pitaviaster haplophyllus (F.Muell.) T.G. Hartley			Y			
	Tarenna dallachiana (F. Muell. ex Benth.) S. Moore	Y		Y			
Sapindaceae	*Castanospora alphandii* (F.Muell.) F.Muell.			Y			
	Elattostachys microcarpa S.T.Reynolds	Y					Y
	Ganophyllum falcatum Blume			Y			
	Guioa acutifolia Radlk.	Y	Y	Y	Y	Y	Y
	Guioa lasioneura Radlk.		Y				Y
	Harpullia rhyticarpa C.T.White & W.D.Francis	Y		Y			Y
	Jagera pseudorhus (A.Rich.) Radlk. var. *pseudorhus*			Y			
	Mischocarpus exangulatus (F. Muell.) Radlk.	Y		Y	Y		
	Mischocarpus grandissimus (F. Muell.) Radlk.		Y				Y
	Mischocarpus lachnocarpus (F.Muell.) Radlk.	Y	Y	Y	Y	Y	Y

Family	Species	1	2	3	4	5	6
	Rhysotoechia robertsonii (F. Muell.) Radlk.	Y	Y	Y	Y	Y	
	Sarcopteryx reticulata S.T.Reynolds	Y	Y	Y	Y	Y	Y
	Sarcotoechia serrata S.T.Reynolds	Y	Y	Y	Y	Y	Y
	Synima cordierorum (F.Muell.) Radlk.	Y	Y		Y	Y	Y
	Toechima daemelianum (F.Muell.) Radlk.	Y					Y
	Toechima erythrocarpum (F.Muell.) Radlk.	Y	Y	Y	Y		Y
Sapotaceae	*Planchonella chartacea* (F.Muell. ex Benth.) H.J.Lam	Y	Y	Y	Y	Y	Y
	Planchonella pohlmaniana (F.Muell.) Pierre ex Dubard		Y		Y		Y
Schizaeaceae	*Lygodium reticulatum* Schkuhr			Y	Y	Y	
Smilaceae	*Smilax australis* R.Br.			Y		Y	
Sparrmanniaceae	*Trichospermum pleiostigma* (F.Muell.) Kosterm.		Y		Y		
Sterculiaceae	*Brachychiton acerifolius* Macarthur	Y	Y				Y
	Franciscodendron laurifolium (F.Muell.) B.Hyland & Steenis	Y	Y				Y
Symplocaceae	*Symplocos puberula* Jessup	Y	Y	Y	Y		Y
Thymelaeaceae	*Lethedon setosa* (C.T.White) Kosterm.	Y	Y	Y		Y	Y
Urticaceae	*Dendrocnide moroides* (Wedd.) Chew.						Y
Verbenaceae	*Stachytarpheta jamaicensis* (L.) Vahl*			Y	Y		Y
	Duranta erecta L.*	Y	Y	Y	Y	Y	Y
	Lantana camara L.*	Y	Y	Y	Y	Y	Y
Vitaceae	*Cissus hypoglauca* A.Gray	Y		Y	Y		Y
	Cissus penninervis (F.Muell.) Planch.	Y	Y	Y	Y	Y	Y
Vittariaceae	*Vittaria elongata* Sw.				Y		Y
Winteraceae	*Bubbia semecarpoides* (F. Muell.) B.L. Burtt.	Y					Y
Zingiberaceae	*Alpinia caerulea* (R.Br.) Benth.	Y					Y

2.2 Habitats

Three general habitat types were noted in the clearing impact areas. These have been mapped in Figure 5.

2.2.1 Cleared areas

These areas are not 'in the wild' and were not surveyed. They include areas that have been clear for many years, and are largely dominated by lantana or signal grass, and areas that have recently been cleared by the proponent.

2.2.2 Wattle-dominated non-remnant regrowth

These are the areas proposed to be cleared by the proponent – **all areas proposed to be cleared are located in this habitat type**. They are generally characterised by advanced regrowth approximately 20 years old – from historical aerial photography these areas appear to have commenced re-establishing in the mid-1990s. They are dominated by *Acacia celsa* and *A. cincinnata,* with the following species also well-represented in all areas of this habitat type:

- *Polyscias australiana* (Araliaceae)
- *Sloanea langii* (Elaeocarpaceae)
- *Macaranga involucrata* var. *mallotoides* (Euphorbiaceae)
- *Cryptocarya mackinnoniana* and *Litsea leefeana* (Lauraceae)
- *Hypserpa laurina* (Menispermiaceae)

- *Rhodamnia sessiliflora* and *Syzygium kuranda* (Myrtaceae)
- *Benstonea monticola* (formerly *Pandanus monticola*) (Pandanaceae)
- *Carnarvonia araliifolia* var. *araliifolia, Darlingia darlingiana* and *Placospermum coriaceum* (Proteaceae)
- *Alphitonia petriei* and *whitei* (Rhamnaceae)
- *Gardenia ovularis* (Rubiaceae)
- *Guioa acutifolia, Mischocarpus lachnocarpus, Sarcopteryx reticulata* and *Sarcotoechia serrata* (Sapindaceae)
- *Planchonella chartacea* (Sapotaceae).

Vines commonly encountered were:

- C*alamus australis* (Arecaceae)
- *Tetracera nordtiana* (Dilleniaceae)
- *Piper caninum* (Piperaceae)
- *Cissus penninervis* (Vitaceae).

In general, these areas were characterised by a lower species diversity and tree density – they are relatively easily traversed and species abundance is lower than in remnant mesophyll/notophyll vine forest (which is the 'climax' representation toward which this habitat type is heading).

In places along creeks, primarily beside transects two and five (but also present beside all other transects), dense 'thickets' of lantana and raspberry have taken over, to the exclusion of most other species. These thickets were generally present on alluvial flats and in the creek beds of those creeks that may have more ephemeral flows. In places the lantana and raspberry was three metres high. This vegetation can be difficult to map out and is incorporated into the areas mapped as wattle regrowth or (in some cases) as remnant mesophyll-notophyll vine forest.

2.2.3 Remnant mesophyll/notophyll vine forest

These areas are mapped as remnant on regional ecosystem mapping, and *generally* have not been cleared (at least, no clearing is evident in aerial photos going back to 1942).

They include the following regional ecosystems:

- 7.11.1a: Mesophyll vine forest. Lowlands and foothills on metamorphics. Very wet and wet rainfall zones. This community is located adjacent to area 1.
- 7.11.7a: Complex notophyll vine forest (with emergent *Agathis robusta*). Foothills and uplands. Moist rainfall zone. This community is located adjacent to area 5.

3 Qualifications of survey team

The survey was led by Simon Danielsen (CV is included as Appendix E). Simon is considered to be a 'suitably qualified person' for this survey because:

- He has a Bachelor of Science (Australian Environment Studies) (awarded 2000).
- He has five years experience working in Wet Tropics rainforests, including three years as a ranger with Skyrail in Barron Gorge National Park, and two years leading regular walking trips in Wooroonooran National Park.
- He has ten years experience in conducting flora surveys in Queensland, including in the Wet Tropics, Cape York Peninsula, Brigalow Belt, Central Queensland, Einasleigh Uplands and South East Queensland bioregions (for details see Appendix E).
- He has recently logged over 300 botanical determinations as a volunteer botanist at the Bangkok Forestry Herbarium in Thailand, including many of the families present at this survey site.

Simon was assisted by Mr Tore Linde, a Skyrail Ranger with 18 years experience in the identification of rainforest species in the Kuranda area. Mr Linde has conducted weekly phenology surveys from the Skyrail cableway and worked in the rainforest on a daily basis for most of his 18 year tenure at Skyrail. He has extensive knowledge of the rainforest species in Barron Gorge National Park, and the Kuranda/Smithfield area in general. Tore's CV is also included in Appendix E.

4 Potential impacts and mitigative measures

4.1 Potential impacts and mitigation measures

The potential impacts expected from this clearing are outlined below.

4.1.1 Impacts to threatened species

No threatened flora species were detected in the clearing impact areas (that is, within the clearing areas or a 100 m buffer). Fauna species that may utilise these areas include the Kuranda tree frog and the Australian lacelid (*Litoria dayi*) (Hoskin, 2007). Vegetation buffers of 60 m from all creeks on the property have been adopted to ensure habitat for both species is retained. This will also assist to protect water quality in these creeks, which are ephemeral and have either no or very low flow in most dry seasons.

4.1.2 Impacts from soil erosion and sedimentation

Exposure of soil in this area can result in soil erosion and associated sedimentation of waterways. This is particularly an issue on slopes and where sub-surface sections of the soil profile are exposed, especially during the wet season.

As outlined above, native vegetation buffers of 60 m will be retained adjacent to all waterways. This will assist to filter any overland flows from clearing areas. In addition, a sediment and erosion management plan prepared by a suitably qualified engineer will be implemented immediately after areas are cleared, to ensure that best practice sediment and erosion management standards are adopted.

4.1.3 Impacts to remnant vegetation and buffer areas

If clearing areas are not well-defined, clearing of regrowth may impact on adjacent areas of remnant vegetation and waterway corridors. The outer edge of all remnant vegetation areas have been identified on the ground using a mapping program on a GPS equipped 'tablet'. The boundary between areas proposed for clearing and those to be retained will be clearly marked with flagging tape and the bulldozer driver will be walked over the boundary so he will be familiar with it.

4.2 Summary

In summary, mitigation measures adopted for this clearing will be:

- Impacts to threatened species:
    - No threatened flora species are located within the clearing impact areas.
    - Vegetation buffers of 60 m will be retained adjacent to all waterways, meaning all waterways will have 120 m corridors after clearing is finished.
- Impacts from soil erosion and sedimentation:
    - All waterways will be buffered by a 120 m corridor of retained vegetation (60 m each side of the waterway).
    - A sediment and erosion management plan to be prepared by a suitably qualified engineer will be prepared and will be implemented as soon as possible on the completion of clearing in an area.
- Impacts to remnant vegetation and buffer areas:

- The outer edge of remnant vegetation areas adjacent to the proposed clearing areas have been identified using a GPS-equipped mapping program, and no clearing will occur in remnant areas.
- The boundary between areas to be cleared and those to be retained will be clearly marked with flagging tape, and the bulldozer driver will be walked over the boundary to ensure he is familiar with it.

5 References

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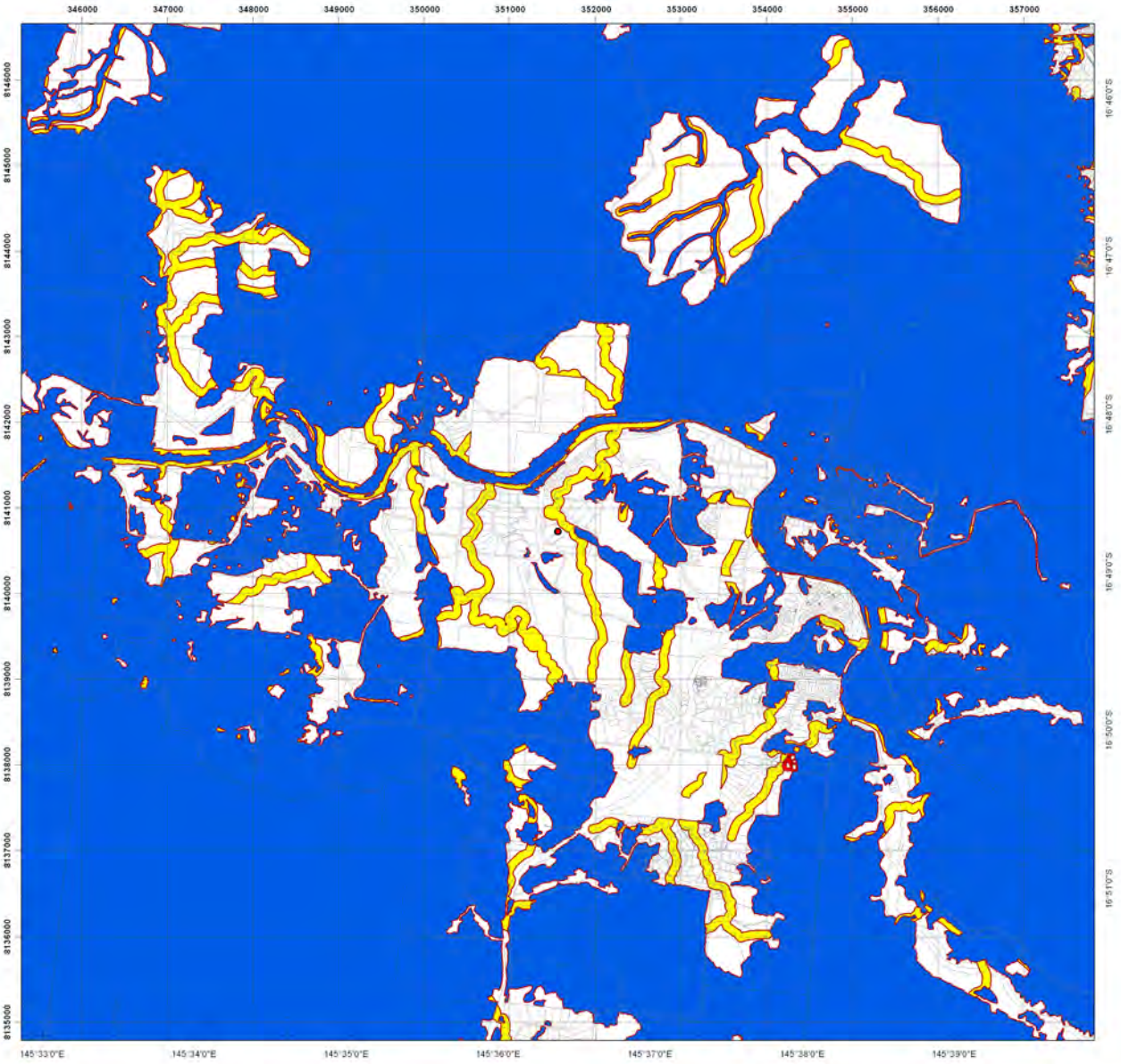
Appendices

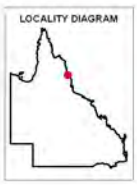
Appendix A NRM vegetation mapping



Regulated Vegetation Management Map

Legend

- Coordinates
- Category A area (Vegetation offsets/compliance notices/VDecs)
- Category B area (Remnant vegetation)
- Category C area (High-value regrowth vegetation)
- Category R area (Reef regrowth watercourse vegetation)
- Category X area (Vegetation not regulated under the VMA)
- Water
- Area not categorised
- Cadastral line
  Property boundaries shown are provided as a locational aid only



Additional information required for the assessment of vegetation values is provided in the accompanying "Vegetation Management Supporting map". For further information go to the web site: www.dnrm.qld.gov.au or contact the Department of Natural Resources and Mines.

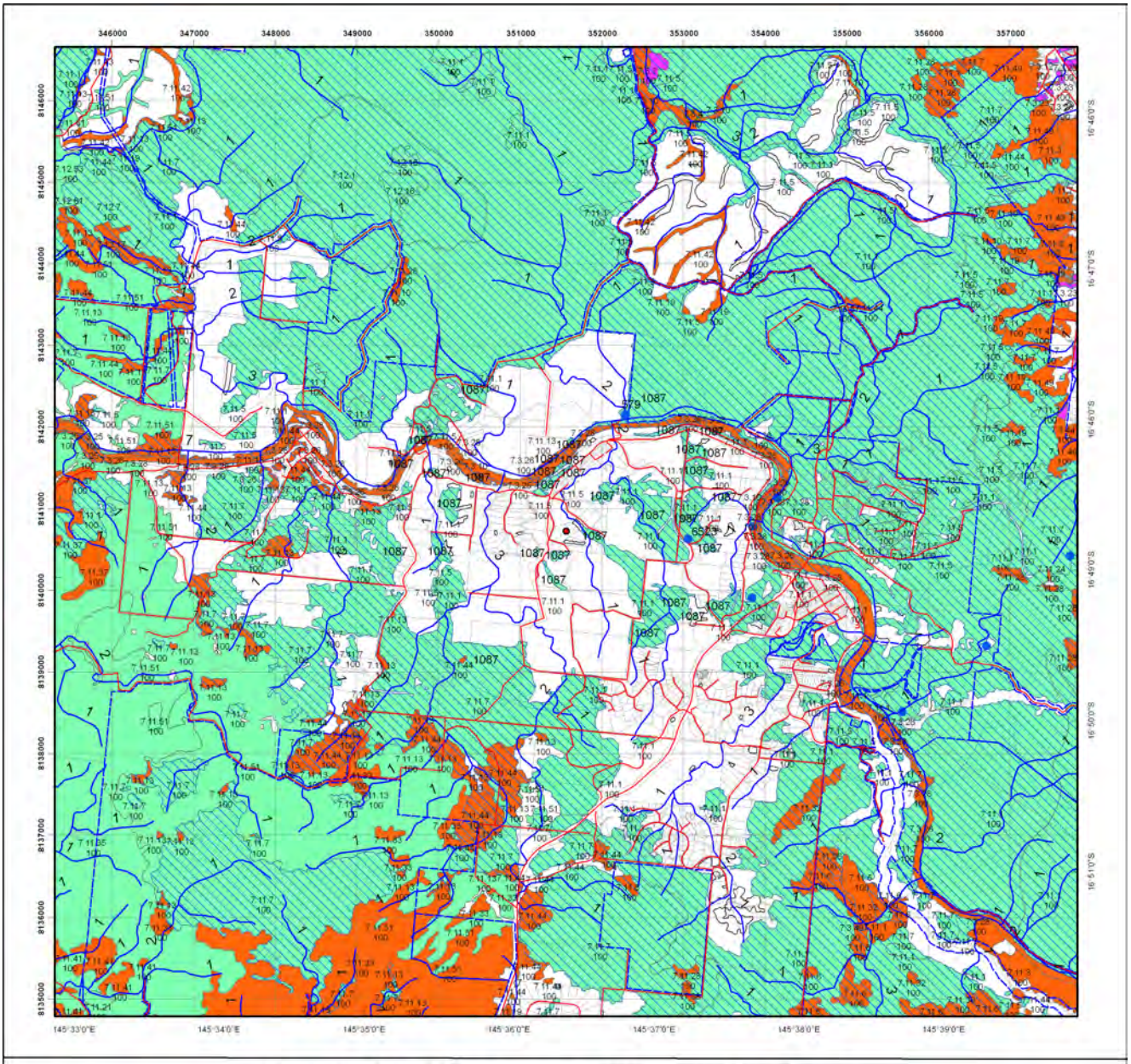
Digital data for the regulated vegetation management map is available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

This map is updated on a monthly basis to ensure new PMAVs are included as they are approved.

N

0 680 1,360 2,040 2,720 3,400 m

This product is projected into:
GDA 1994 MGA Zone 55



Vegetation Management Supporting Map

Legend

- Coordinates
- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystem
- Category A or B area containing remnant vegetation
- Category A or B area under Section 20AH
  These areas are edged in yellow and filled with the remnant RE Status
- Category C area containing endangered regional ecosystems
- Category C area containing of concern regional ecosystems
- Category C area that is a least concern regional ecosystem
- Category C area containing high value regrowth vegetation
- Category C area under Section 20AI
  These areas are edged in purple and filled with the remnant RE Status
- Non Remnant
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourse on the vegetation management watercourse map
  (Stream order shown as black number against stream where available)
- Roads
- National Parks, State Forest and other reserves
- Cadastral line
  Property boundaries shown are
  provided as a locational aid only

Queensland Government

LOCALITY DIAGRAM

N

0 490 980 1,470 1,960 2,450 m

This product is projected into:
GDA 1994 MGA Zone 55

Labels for Essential Habitat are centred on the area of enquiry.

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/- 100 metres.

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Natural Resources and Mines makes no representations or warranties about its accuracy, reliability, completeness or suitability or any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incurr as a result of the product being inaccurate or incomplete in anyway and for any reason.

Additional information may be required for the purposes of land clearing or assessment of a regional ecosystem map or PMAV applications. For further information go to the web site: www.dnrm.qld.gov.au or contact the Department of Natural Resources and Mines.

Digital data for the vegetation management watercourse map, vegetation management wetlands map, essential habitat map and the vegetation management remnant and regional ecosystem map are available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

29/06/2015 10:45:35
Longitude: 145.607 Latitude: -16.812

Vegetation Management Act 1999 - Extract from the essential habitat database - version 4.0

Essential habitat is required for assessment under the:

- State Development Assessment Provisions - Module 8: Native vegetation clearing which sets out the matters of interest to the state for development assessment under the *Sustainable Planning Act 2009*; and
- Self-assessable vegetation clearing codes made under the *Vegetation Management Act 1999*

Essential habitat for one or more of the following species is found on and within 1.1 km of the identified subject lot/s or on and within 2.2 km of an identified coordinate on the accompanying essential habitat map.

This report identifies essential habitat in Category A, B and Category C areas.

The numeric labels on the essential habitat map can be cross referenced with the database below to determine which essential habitat factors might exist for a particular species.

Essential habitat is compiled from a combination of species habitat models and buffered species records.

The Department of Natural Resources and Mines website (http://www.dnrm.qld.gov.au) has more information on how the layer is applied under the State Development Assessment Provisions - Module 8: Native vegetation clearing and the *Vegetation Management Act 1999*.

Regional ecosystem is a mandatory essential habitat factor, unless otherwise stated.

Essential habitat, for protected wildlife, means a category A area, a category B area or category C area shown on the regulated vegetation management map-

1) (a) that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or

2) (b) in which the protected wildlife, at any stage of its life cycle, is located.

Essential habitat identifies endangered or vulnerable native wildlife prescribed under the *Nature Conservation Act 1994*.

Essential habitat in Category A and B (Remnant vegetation species record) areas:2200m Species Information

Label	Scientific Name	Common Name	NCA Status	Vegetation Community	Altitude	Soils	Position in Landscape
6523	Archontophoenix myolensis	None	E	rainforest (simple to complex mesophyll to notophyll vine forest)	300 to 400 m	(Rudosols, Tenosols, Sodosols, Chromosols)	gullies, creek banks and lower slopes
579	Litoria dayi	Australian Lace-lid	E	Associated with fast flowing rocky streams and soaks in rocky areas in rainforest/monsoon vine forest, including margins.	Sea level to 1400m.	no soil information	Near/in streams.

Essential habitat in Category A and B (Remnant vegetation species record) areas:2200m Regional Ecosystems Information

Label	Regional Ecosystem (this is a mandatory essential habitat factor, unless otherwise stated)
6523	7.11.1
579	7.1.1, 7.1.4, 7.2.1, 7.2.2, 7.2.3, 7.2.5, 7.2.6, 7.3.3, 7.3.4, 7.3.5, 7.3.10, 7.3.17, 7.3.20, 7.3.23, 7.3.25, 7.3.35, 7.3.36, 7.3.37, 7.3.38, 7.3.49, 7.3.50, 7.5.2, 7.8.1, 7.8.2, 7.8.3, 7.8.4, 7.8.11, 7.8.12, 7.8.13, 7.8.14, 7.8.16, 7.11.1, 7.11.2, 7.11.3, 7.11.7, 7.11.8, 7.11.12, 7.11.23, 7.11.24, 7.11.25, 7.11.27, 7.11.28, 7.11.29, 7.11.30, 7.11.32, 7.11.38, 7.11.40, 7.12.1, 7.12.2, 7.12.6, 7.12.7, 7.12.10, 7.12.11, 7.12.12, 7.12.13, 7.12.16, 7.12.19, 7.12.20, 7.12.26, 7.12.38, 7.12.39, 7.12.40, 7.12.42, 7.12.43, 7.12.44, 7.12.45, 7.12.46, 7.12.47, 7.12.48, 7.12.49, 7.12.50, 7.12.66, 7.12.68

Essential habitat in Category A and B (Remnant vegetation) areas:2200m Species Information

Label	Scientific Name	Common Name	NCA Status	Vegetation Community	Altitude	Soils	Position in Landscape
1087	Casuarius casuarius johnsonii (southern population)	Southern Cassowary (southern population)	E	Dense lowland and highland tropical rainforest, closed gallery forest, eucalypt forest with vine forest elements, swamp forest and adjacent melaleuca swamps, littoral scrub, eucalypt woodland and mangroves; often using a habitat mosaic; will cross open eucalypt, canefields and dry ridges between rainforest patches.	Sea level to 1500m.	no soil information	None

Essential habitat in Category A and B (Remnant vegetation) areas:2200m Regional Ecosystems Information

Label	Regional Ecosystem (this is a mandatory essential habitat factor, unless otherwise stated)
1087	7.1.3, 7.2.1, 7.2.3, 7.2.4, 7.2.5, 7.2.6, 7.2.11, 7.3.1, 7.3.3, 7.3.4, 7.3.5, 7.3.6, 7.3.7, 7.3.8, 7.3.10, 7.3.12, 7.3.17, 7.3.23, 7.3.25, 7.3.36, 7.3.37, 7.3.38, 7.8.1, 7.8.2, 7.8.3, 7.8.4, 7.8.7, 7.8.8, 7.8.14, 7.11.1, 7.11.2, 7.11.5, 7.11.6, 7.11.7, 7.11.10, 7.11.12, 7.11.13, 7.11.14, 7.11.18, 7.11.23, 7.11.24, 7.11.25, 7.11.28, 7.11.29, 7.11.30, 7.11.34, 7.12.1, 7.12.2, 7.12.4, 7.12.5, 7.12.7, 7.12.9, 7.12.13, 7.12.16, 7.12.17, 7.12.19, 7.12.20, 7.12.39, 7.12.40, 7.12.44, 7.12.47, 7.12.50, 7.12.68. Also includes secondary habitat within identified priority corridors, and secondary habitat surrounded by primary habitat. Secondary regional ecosystems are 7.1.1, 7.1.2, 7.1.4, 7.1.5, 7.2.2, 7.2.7, 7.2.8, 7.2.9, 7.2.10, 7.3.2, 7.3.9, 7.3.13, 7.3.14, 7.3.16, 7.3.19, 7.3.20, 7.3.21, 7.3.26, 7.3.28, 7.3.29, 7.3.30, 7.3.31, 7.3.34, 7.3.35, 7.3.39, 7.3.40, 7.3.43, 7.3.45, 7.3.46, 7.3.47, 7.3.49, 7.8.11, 7.8.12, 7.8.13, 7.8.15, 7.8.16, 7.11.16, 7.11.19, 7.11.21, 7.11.26, 7.11.27, 7.11.31, 7.11.32, 7.11.36, 7.11.39, 7.11.40, 7.11.42, 7.11.43, 7.11.44, 7.11.46, 7.11.49, 7.12.10, 7.12.11, 7.12.12, 7.12.21, 7.12.22, 7.12.32, 7.12.24, 7.12.25, 7.12.26, 7.12.27, 7.12.28, 7.12.29, 7.12.30, 7.12.34, 7.12.35, 7.12.37, 7.12.41, 7.12.45, 7.12.48, 7.12.49, 7.12.53, 7.12.59, 7.12.60, 7.12.61, 7.12.62, 7.12.67

Essential habitat in Category C (High value regrowth vegetation) areas:2200m Species Information

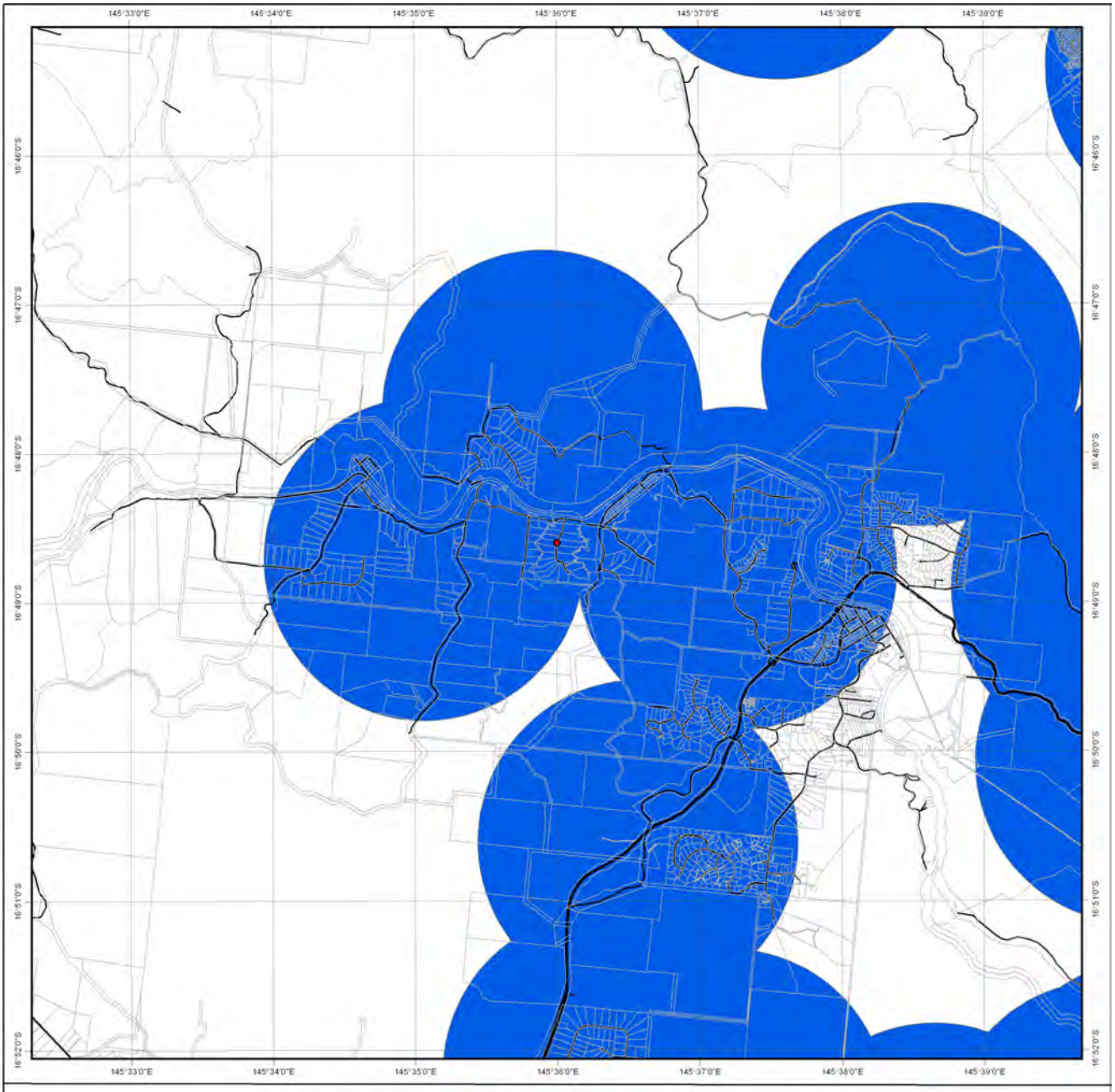
(no results)

Essential habitat in Category C (High value regrowth vegetation) areas:2200m Regional Ecosystems Information

(no results)

Appendix B Flora trigger map

13/07/2015 17:52:49
Longitude: 145.6 Latitude: -16.81



Protected Plants Flora Survey Trigger Map

Legend

- Coordinates
- High risk area
- Cadastral line
  Property boundaries shown are provided as a locational aid only
- Freeways / motorways / highways
- Secondary roads / streets

N

0 490 980 1,470 1,960 2,450 m

This product is projected into:
GDA 1994 Queensland Albers

This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Heritage Protection at palm@ehp.qld.gov.au

Disclaimer:
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

Appendix C Letter to EHP advising prior clearing

7 September, 2015

Kerry Walsh
Wildlife Officer
Dept. Environment and Heritage Protection
Queensland government

Dear Mr Walsh

I am writing on behalf of my client (the landowner) to advise you of clearing of native vegetation that he has conducted on the following lots in the Myola area (Mareeba Shire):
Lots 1 and 2 RP703984
Lots 17 and 18 N157227
Lot 19 N157452

The clearing has occurred in mapped non-remnant vegetation under the *Vegetation Management Act 1999* and was commissioned after liaison with the Townsville unit of the Vegetation Management section in the Department of Natural Resources and Mines.

However, it is located in an area mapped as 'high risk' on a Flora Trigger map, and a flora survey was not conducted prior to clearing commencing.

I have been instructed to formally inform you of this clearing and request instruction from you in relation to your department's requirements. All clearing on the properties has been halted until we obtain your advice.

I can be contacted on 0423 706 440 or you can email me at simond1313@gmail.com.

Regards

Simon Danielsen
Principal Ecologist
Astrebla Ecological Services

Astrebla Ecological Services
80 Dumaresq St
Hamilton, 2303
NSW

Appendix D Desktop search results

Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Status: Rare and threatened species
Records: All
Date: All
Latitude: -16.8238
Longitude: 145.6032
Distance: 5
Email: simond1313@gmail.com
Date submitted: Wednesday 26 Aug 2015 21:47:43
Date extracted: Wednesday 26 Aug 2015 21:50:10

The number of records retrieved = 17

Queensland Government

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Status: Rare and threatened species
Records: All
Date: All
Latitude: -16.8238
Longitude: 145.6032
Distance: 10
Email: simond1313@gmail.com
Date submitted: Wednesday 26 Aug 2015 22:00:05
Date extracted: Wednesday 26 Aug 2015 22:10:04

The number of records retrieved = 29

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Hylidae	*Litoria nyakalensis*	mountain mistfrog		E	CE	1/1
animals	amphibians	Hylidae	*Litoria rheocola*	common mistfrog		E	E	22/17
animals	amphibians	Hylidae	*Litoria nannotis*	waterfall frog		E	E	6
animals	amphibians	Hylidae	*Litoria serrata*	tapping green eyed frog		NT		100/19
animals	amphibians	Hylidae	*Litoria myola*	Kuranda treefrog		NT	E	32
animals	amphibians	Hylidae	*Litoria dayi*	Australian lacelid		E	E	14/6
animals	amphibians	Myobatrachidae	*Taudactylus acutirostris*	sharp snouted dayfrog		E	EX	1
animals	birds	Accipitridae	*Erythrotriorchis radiatus*	red goshawk		E	V	5/1
animals	birds	Burhinidae	*Esacus magnirostris*	beach stone-curlew		V		9
animals	birds	Casuariidae	*Casuarius casuarius johnsonii (southern population)*	southern cassowary (southern population)		E	E	51
animals	birds	Estrildidae	*Erythrura trichroa*	blue-faced parrot-finch		NT		1
animals	birds	Falconidae	*Falco hypoleucos*	grey falcon		NT		1
animals	birds	Psittacidae	*Cyclopsitta diophthalma macleayana*	Macleay's fig-parrot		V		309
animals	birds	Scolopacidae	*Numenius madagascariensis*	eastern curlew		NT	CE	2
animals	birds	Turnicidae	*Turnix olivii*	buff-breasted button-quail		V	E	1
animals	insects	Lycaenidae	*Hypochrysops apollo apollo*	Apollo jewel (Wet Tropics subspecies)		V		4
animals	mammals	Hipposideridae	*Hipposideros diadema reginae*	diadem leaf-nosed bat		NT		2/1
animals	mammals	Megadermatidae	*Macroderma gigas*	ghost bat		V		1
animals	mammals	Vespertilionidae	*Murina florium*	tube-nosed insectivorous bat		V		1
animals	reptiles	Crocodylidae	*Crocodylus porosus*	estuarine crocodile		V		12
plants	ferns	Athyriaceae	*Diplazium pallidum*			E	E	2/2
plants	ferns	Hymenophyllaceae	*Crepidomanes majoriae*			V		2/2
plants	higher dicots	Burseraceae	*Canarium acutifolium var. acutifolium*			V	V	1/1
plants	higher dicots	Euphorbiaceae	*Wetria australiensis*			V		3/3
plants	higher dicots	Mimosaceae	*Senegalia albizioides*			NT		1/1
plants	higher dicots	Rubiaceae	*Randia audasii*			NT		4/4
plants	monocots	Arecaceae	*Archontophoenix myolensis*			E	E	2/2
plants	monocots	Orchidaceae	*Rhomboda polygonoides*			V	V	1/1
plants	monocots	Zingiberaceae	*Alpinia hylandii*			NT		4/4

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.* The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ( ).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.* The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).
This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Hylidae	*Litoria rheocola*	common mistfrog		E	E	15/15
animals	amphibians	Hylidae	*Litoria nannotis*	waterfall frog		E	E	2
animals	amphibians	Hylidae	*Litoria serrata*	tapping green eyed frog		NT		66/13
animals	amphibians	Hylidae	*Litoria myola*	Kuranda treefrog		NT	E	32
animals	amphibians	Hylidae	*Litoria dayi*	Australian lacelid		E	E	9/3
animals	amphibians	Myobatrachidae	*Taudactylus acutirostris*	sharp snouted dayfrog		E	EX	1
animals	birds	Accipitridae	*Erythrotriorchis radiatus*	red goshawk		E	V	4
animals	birds	Casuariidae	*Casuarius casuarius johnsonii (southern population)*	southern cassowary (southern population)		E	E	32
animals	birds	Falconidae	*Falco hypoleucos*	grey falcon		NT		1
animals	birds	Psittacidae	*Cyclopsitta diophthalma macleayana*	Macleay's fig-parrot		V		62
animals	birds	Turnicidae	*Turnix olivii*	buff-breasted button-quail		V	E	1
animals	insects	Lycaenidae	*Hypochrysops apollo apollo*	Apollo jewel (Wet Tropics subspecies)		V		4
animals	mammals	Hipposideridae	*Hipposideros diadema reginae*	diadem leaf-nosed bat		NT		1/1
animals	mammals	Megadermatidae	*Macroderma gigas*	ghost bat		V		1
plants	higher dicots	Rubiaceae	*Randia audasii*			NT		2/2
plants	monocots	Arecaceae	*Archontophoenix myolensis*			E	E	2/2
plants	monocots	Zingiberaceae	*Alpinia hylandii*			NT		2/2

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.* The codes are Extinct in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ( ).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.* The values of EPBC are Conservation Dependent (CD), Critically Endangered (CE), Endangered (E), Extinct (EX), Extinct in the Wild (XW) and Vulnerable (V).

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).
This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Australian Government

Department of the Environment

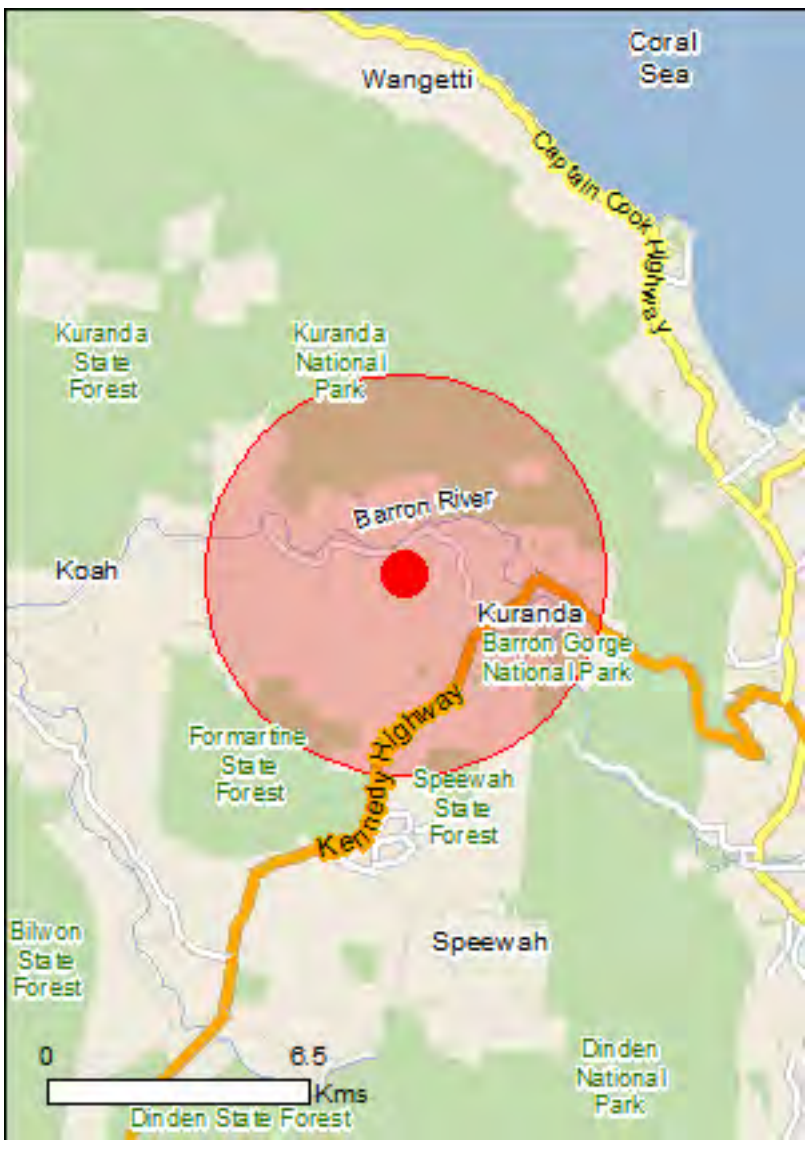
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

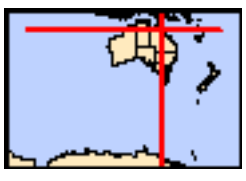
Report created: 29/06/15 11:28:18



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 5.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	2
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	31
Listed Migratory Species:	15

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	4
Regional Forest Agreements:	None
Invasive Species:	30
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Status
Wet Tropics of Queensland	QLD	Declared property

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
Wet Tropics of Queensland	QLD	Listed place
Indigenous		
Wet Tropics World Heritage Area (Indigenous Values)	QLD	Within listed place

Listed Threatened Ecological Communities		[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Broad leaf tea-tree (Melaleuca viridiflora) woodlands in high rainfall coastal north Queensland	Endangered	Community may occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Casuarius casuarius johnsonii		
Southern Cassowary (Australian), Southern Cassowary [25986]	Endangered	Species or species habitat known to occur within area
Erythrotriorchis radiatus		
Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli		
Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
Fish		
Melanotaenia eachamensis		
Lake Eacham Rainbowfish [26185]	Endangered	Species or species habitat may occur within area
Frogs		
Litoria dayi		
Australian Lace-lid, Lace-eyed Tree Frog [86707]	Endangered	Species or species habitat likely to occur within area
Litoria myola		
Kuranda Tree Frog [82063]	Endangered	Species or species habitat known to occur within area
Litoria nannotis		
Waterfall Frog, Torrent Tree Frog [1817]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Litoria nyakalensis Mountain Mistfrog [1820]	Critically Endangered	Species or species habitat likely to occur within area
Litoria rheocola Common Mistfrog [1802]	Endangered	Species or species habitat known to occur within area
Mammals		
Dasyurus hallucatus Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
Dasyurus maculatus gracilis Spotted-tailed Quoll or Yarri (North Queensland subspecies) [64475]	Endangered	Species or species habitat likely to occur within area
Hipposideros semoni Semon's Leaf-nosed Bat, Greater Wart-nosed Horseshoe-bat [180]	Endangered	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat may occur within area
Pteropus conspicillatus Spectacled Flying-fox [185]	Vulnerable	Species or species habitat known to occur within area
Rhinolophus philippinensis (large form) Greater Large-eared Horseshoe Bat [66890]	Endangered	Species or species habitat known to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheathtail Bat [66889]	Critically Endangered	Species or species habitat likely to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Plants		
Archontophoenix myolensis Myola Palm, Myola Archontophoenix [64500]	Endangered	Species or species habitat known to occur within area
Cajanus mareebensis [8635]	Endangered	Species or species habitat may occur within area
Canarium acutifolium [23956]	Vulnerable	Species or species habitat likely to occur within area
Crepidomanes endlicherianum Middle Filmy Fern [65889]	Endangered	Species or species habitat likely to occur within area
Dendrobium bigibbum Cooktown Orchid [10306]	Vulnerable	Species or species habitat may occur within area
Diplazium cordifolium [15585]	Vulnerable	Species or species habitat likely to occur within area
Diplazium pallidum [12764]	Endangered	Species or species habitat likely to occur within area
Phalaenopsis rosenstromii Native Moth Orchid [15984]	Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Phlegmariurus filiformis Rat's Tail Tassel-fern [86551]	Endangered	Species or species habitat likely to occur within area
Polyscias bellendenkerensis [7237]	Vulnerable	Species or species habitat likely to occur within area
Sauropus macranthus [13189]	Vulnerable	Species or species habitat likely to occur within area
Streblus pendulinus Siah's Backbone, Sia's Backbone, Isaac Wood [21618]	Endangered	Species or species habitat likely to occur within area
Zeuxine polygonoides Velvet Jewel Orchid [46794]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Marine Species		
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Pandion cristatus Eastern Osprey [82411]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Reptiles		
Crocodylus porosus		
Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Barron Gorge	QLD
Jumrum Creek	QLD
Kuranda	QLD
Myola Palm	QLD

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata		
Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Annona glabra Pond Apple, Pond-apple Tree, Alligator Apple, Bullock's Heart, Cherimoya, Monkey Apple, Bobwood, Corkwood [6311]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Lepidodactylus lugubris Mourning Gecko [1712]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-16.812 145.607

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix E CVs of team

Simon Danielsen

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ABN: 81 102 990 803

Simon Danielsen is an ecologist with 15 year's experience in ecological consultancy, vegetation management policy and decision making, botanical identification, and ecotourism.

He has been involved at a senior level in field investigations and reporting, and the impact assessment and approval process, for many of the largest proposed infrastructure projects in Queensland in the last 10 years, including the Carmichael River mine and rail project, the Abbott Point development, Hancock's proposed rail link from Alpha to Abbot Point, the Chinalco bauxite proposal (Aurukun), and the development of new gas fields in the Roma area.

Simon's particular strengths are in botanical survey and threatened species searches, regional ecosystem determination/mapping, and providing advice to clients in relation to vegetation management policy and legislation at both Queensland and Commonwealth levels. He has extensive experience in the Brigalow Belt and South East Queensland bioregions, and the North Kennedy district.

Simon is currently the Principal Ecologist/Botanist of Astrebla Ecological Services, a consulting company he started in April 2015. Astrebla Ecological Services offers

- vegetation community surveys and mapping,
- threatened species surveys,
- weed surveys and mapping,
- provision of advice in relation to the vegetation aspects of urban and rural residential development and the development of infrastructure projects, and
- document review, and overflow ecology services, to other consultancies.

Tertiary Education

Griffith University

1999 Bachelor of Science (Australian Environmental Studies)

- Majors in Ecology, Social Policy and Development, and Australian Indigenous Studies,

Simon Danielsen

• • •

Experience

Astrebla Ecological Services | Darra, Queensland

Principal Ecologist/Botanist ***April 2015 – current***

Astrebla is currently engaged in a number of projects, including the provision of botanical survey and advice in relation to the Environmental Impact Study for a major proposed aquaculture project in the north west of the Northern Territory.

Astrebla can provide specialist botanical services for the New South Wales, Queensland, Northern Territory and South East Asian regions. See attachment for Simon's project experience with Astrebla.

Bangkok Forestry Herbarium | 61 Prahonyothin Rd, Chatuchak, Bangkok, 10900 Thailand

Volunteer ***March 2014 – January 2015***

Working as a volunteer at the Bangkok Forest Herbarium (BKF) while on leave from GHD, Simon undertook identification of a backlog of mounted specimens, some over 60 years old. During his time at BKF he completed over 300 official botanical determinations, most to species level, using resources including Flora of Thailand, Flora Malesiana and Flora of China. He also received training in herbarium procedure and plant ID from taxonomist Bob Harwood (formerly DNA, now volunteer at BKF).

GHD Pty Ltd | GPO Box 668 Brisbane 4001

Principal Ecologist ***August 2011 – April 2015***

Senior Ecologist ***March 2006 – August 2011***

Simon's duties at GHD include:

- Prepare/manage job proposals,
- Management of ecological/botanical work, including coordination and liaison with government agencies (Commonwealth and State) and clients, reporting, client relationship management, and overall job delivery,
- Leading teams of ecologists in the field (often in remote areas),
- Preparation of reports and correspondence, including review and quality control of reports written by others,
- Provide expert witness services for legal counsel and clients,
- Mentor and train junior staff.

See attachment for Simon's project experience with GHD.

Simon Danielsen

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Dept. of Natural Resources and Mines (Qld)| 187-209 Stanley St, Townsville 4810
Vegetation Management Officer ***March 2005 – March 2006***

Simon's duties at DNRM involved:

- Assessment of planning applications to clear native vegetation under the *Integrated Planning Act 1997* ,(now superseded by the *Sustainable Planning Act 2009*),
- Provision of verbal and official written advice to the public in relation to the *Vegetation Management Act 1999* and the *Integrated Planning Act 1997*,
- Responding to information requests from government Ministers and Members of Parliament.

He also acted in roles as the Senior Vegetation Management Officer and the Northern Manager, Vegetation Management and Use.

Skyrail Rainforest Canopy| Captain Cook Highway, Caravonica (Cairns), 4878
Environment Manager ***October 2003 – March 2005***
Environment Supervisor ***August 2002 – October 2003***

Simon's duties involved vegetation identification and management, overseeing Skyrail's environmental commitments, reporting to/liaising with government agencies, managing a Ranger team, overseeing the delivery of eco-tour services, representing Skyrail on environmental and indigenous issues, and maintaining Skyrail's international environmental accreditations.

For more details on Simon's career background, and for peer endorsements of his skills, please peruse his Linked In page at http://au.linkedin.com/pub/simon-danielsen/8/3a4/878

Attachments Attachment A – Simon Danielsen - GHD Major Project Experience

Simon Danielsen - Major Project Experience

Astrebla Ecological Services

For all projects Simon was the primary botanical ecologist unless otherwise stated.

Project Sea Dragon Prawn Farm (proposed)

Project Sea Dragon is a proposal for a 10, 000 ha prawn farm to be located on Legune Station in the Northern Territory, near the Western Australian border. If approved, it will be the largest prawn farm yet built in Australia. An EIA for this project is currently being prepared. Astrebla undertook the flora surveys, vegetation mapping and flora impact assessment for this project, which involved the survey of almost 100, 000 ha of native vegetation.

Hanging Swamp Monitoring Surveys, Newnes Plateau, Lithgow

Simon has provided botanical services for RPS in monitoring surveys within hanging and shrub swamps on the Newnes Plateau, near Lithgow.

GHD

For all projects Simon was the primary botanical ecologist unless otherwise stated.

Mining and Gas

- Carmichael River Mine and associated rail link project ecological investigations (Desert Uplands bioregion, approximately 200 km south west of Charters Towers) , including a detailed study into potential impacts on the Great Artesian Basin mound spring complex at Doongmabulla Springs. Seven threatened species and two previously undiscovered species were detected, including one major range extension of a vulnerable palm species (*Livistona lanuginosa*). Revised regional ecosystem (RE) mapping at a 1:25, 000 scale was provided for the entire 50, 000 ha project area.
- Teresa Coal Mine ecological investigations, near Emerald in the Brigalow Belt. This work included revised RE mapping and investigations and mapping of three EPBC listed Threatened Ecological Communities and one threatened plant species. One new *genus* record for Australia was recorded, a genus yet to be formally described.
- Team leader for field ecological investigations and reporting into the 300, 000 ha Origin Energy Spring Gully gas field, north of Roma. Included revised RE mapping at a 1:25, 000 scale for the entire area.
- Multiple separate jobs mapping vegetation and undertaking plant surveys for Origin Energy on gas fields and along proposed gas pipeline feeder routes in the Wandoan area.
- As an assistant botanical ecologist, conducted flora surveys in tall open woodland north of Aurukun in Cape York Peninsula as part of the EIS for Chinalco (Chalco). Simon was directly responsible for providing revised RE mapping for the project area.
- As an assistant botanist/ecologist, undertook ecological investigations into the InterOil gas fields located in the remote Gulf Province in Papua New Guinea.

- Ecological investigations into a major watercourse diversion of Coral Creek near Collinsville for Sonoma Coal. This project involved mapping and impact assessment of the vulnerable black ironbox (*Eucalyptus raveretiana*), a common riparian species in Coral Creek.

Linear Infrastructure

- Job manager and senior ecologist for an EIS for Powerlink for a major 200 km long, proposed greenfield 275 kV transmission line corridor, commencing near Emerald and terminating at the proposed Alpha mine, north of Alpha. This job involved extensive helicopter surveys in order to remap REs and scout terrain.
- Ecological investigations for an EIS for Hancock Prospecting into the route for a 500 km railway to connect the proposed Alpha Coal Mine to Abbott Point, near Bowen. Revised RE mapping at 1:25, 000 scale was provided.
- Ecological investigations for the proposed BHP/BMA rail link from North Goonyella (Moranbah) to Abbot Point (approx. 300 km). Revised RE mapping at 1:25, 000 scale was provided.
- Providing detailed flora surveys, vegetation community mapping and vegetation management advice for the Coal Connect alliance in relation to the 70 km long 'Northern Missing Link' between Newlands Mine and Moranbah.
- Ground truthed RE mapping and prepared the flora section of the EIS for the 160 km Alinta (now Jemena) gas pipeline near Biloela.
- Conducted a weed survey over 160 km of the Jemena Oombabeer to Callide Range gas pipeline easement near Biloela and produced mapping of weed infestations.
- Conducted a weed survey and provided weed mapping for the Yabulu to Ross River Dam Ergon high voltage powerline.
- As a senior ecological team member, undertook numerous field surveys in support of five separate EIS investigations into proposed 275 kV powerlines in the Wandoan-Roma area for Powerlink. This work included a detailed ecological investigation and impact assessment into Woodduck State Forest.
- Ground-truthed REs for the Western Corridor Wastewater Pipeline Project in South East Queensland, and engaged in liaison with NRW in regards to obtaining vegetation clearing permits.

Other Public Infrastructure Development

- As the Senior Botanist, undertook ecological investigations for the Curtis Island Environmental Precinct Ecological and Heritage Study for the Department of Infrastructure and Planning (as part of the Gladstone Port development offset provision).
- Advised the Department of Infrastructure and Planning on offset requirements for clearing of the vulnerable species black ironbox (*Eucalyptus raveretiana*) associated with the proposed Fitzroy Barrages, near Rockhampton.
- Undertook field work and prepared the flora impact report for installation of a non-directional radio beacon by Air Services Australia on Lord Howe Island, a World Heritage-listed site.
- Senior field botanist for the Western Basin EIS for Gladstone Port Authority.

- Undertook aerial and ground surveys as the Senior Botanist in a multi-disciplinary team to identify and assess multiple armour rock quarry sites for the Port of Townsville development.
- Flora survey for the Port of Townsville Environmental Impact Statement (EIS).
- Undertook rare and threatened flora surveys at a number of sites near Agnes Water for a desalination plant for United Utilities. This work involved mapping and research into the vulnerable grass species *Germania capitata*.
- Provided a Review of Environmental Factors including a flora and fauna field assessment for Rockhampton Regional Council in relation to a proposed new regional landfill site at Mulara.
- Led the field flora and fauna survey and reporting for the proposed 'Hope Valley' township, located at Hope Vale near Cooktown, including liaison with the Environmental Protection Agency and Department of Natural Resources in relation to the development approval process.

Private Infrastructure Development

- Prepared the flora section of the EIS for the Dyno Nobel Asia Pacific ammonium nitrate plant at Moranbah, and obtained vegetation clearing approvals from NRM.
- Successfully revised regional ecosystem mapping for properties in the Gladstone region including for Pitman Properties, Tirrawarra Constructions, and numerous private landowners, and managed concurrence agency referrals for vegetation to Queensland's Department of Natural Resources.
- Flora and fauna investigation into a 600 ha site at Yeppoon for the McCamley Woods Yeppoon Development group.
- Preparation of flora impact reports for numerous urban and rural developments across Queensland, such as infrastructure upgrades (Energex, Main Roads, Gold Coast Water), tourism developments (Cherabah Homestead Resort, Castaway Bay), industrial estates (Swanbank/New Chum), power stations (Kogan Creek) and housing developments (Devine, Insight Group, Rogers Parade Apartments, Queensland Property and Investment).
- Prepared numerous Property Vegetation Management Plans (PVMPs) and Property Maps of Assessable Vegetation (PMAV) for private developers and individuals across Queensland, primarily in the South East Queensland and Cook bioregions. Some of these required extensive negotiations with the Queensland Dept. of Natural Resources.
- Prepared and negotiated three successful applications under the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth) (the EPBC Act) in relation to matters of national environmental significance (MNES) in north Queensland. Each involved multiple MNES and had attracted (in some cases significant) community attention. In one case, the application had been previously refused before my involvement.

Expert Witness Reports

- Prepared an expert witness report for Sonoma Coal in support of a waterway diversion proposal for Coral Creek near Collinsville in Central Queensland.
- Provided an expert witness report for an appeal in the Planning and Environment Court at the behest of private developers in relation to a coastal development proposal at Machan's Beach, Cairns, north Queensland.

RÉSUMÉ

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MANOORA QLD 4870

TELEPHONE: (07) 4038 1999 B/H
0497 307 614 (mobile)

E-MAIL: tore.linde@hotmail.com

EDUCATION

1987 - 1990	University of Bergen, Norway **Master of Science in Biology** Majored in Microbiology with an emphasis on algae, particularly cyanobacteria. Supporting subjects in Marine Biology and Applied Mathematics.

OTHER QUALIFICATIONS

Local Botanical Experience

1998 – present	Botanical audits of Skyrail tower sites (25) in Kuranda National Park, Barron Gorge National Park, freehold and Unallocated State Land. Audits conducted every year 1998 – 2005, every 5 years 2005-present.
1998 – present	Training staff for identification of plants and seeds as part of Nursery work (Skyrail managed nursery) and tower access walks.
1998 – present	Identification of trees and other vegetation for as part of assessment for reporting proposed pruning and removal to Department of Parks and Wildlife.
1998 – present	Completed monthly identification of individual trees (approximately 3000 individuals from 300 species over 6 kilometres of transect) and recorded their growth and reproductive behaviours in response to rainfall, using digital imaging software and direct field observations as required for the phenology research paper.
2000 – present	Monthly Nature Diaries (articles regarding rainforest plants for distribution on Skyrail website and to every Skyrail Rainforest Foundation member on a quarterly basis (1200 members registered). Also assist marketing with interpretative collateral

2015	Botanical surveys for proposed new walkway as part of Skyrail's Permit to Occupy for the purpose of investigation as required to comply with Nature Conservation (Wildlife) Regulation 2006
2014	Assisted with identification of rainforest species for planning and establishment of new tourism venture for a new company
2013	Conducted botanical survey for feasibility investigation for a tourism proposal for Skyrail in accordance with state legislation.
2012	Tested new identification key for rainforest plants developed by James Cook University (JCU) and the Australian Tropical Herbarium prior to public release.
2012	Co-Authored scientific article as part of joint research paper between Skyrail, JCU and University of New England investigating effects of climate variables on rainforest canopy species (phenology).
2011	Collected vouchers (pressed specimens and fruits) as part of validation process for identification accuracy (Phenology component of Global Warming Project). Permit for collection from National Parks in own name.

PREVIOUS EMPLOYMENT HISTORY

2011 (6 months)
2010 (3 months)

James Cook University
Position: **Casual Researcher on Global Warming Project**
Collection and analysis of flowering and fruiting data along canopy of Skyrail Rainforest Cableway transect

2000 – 2002

Skyrail Rainforest Cableway, Cairns QLD
Position: **Acting Environmental Supervisor**

1997 - 2000
2002 - present

Skyrail Rainforest Cableway, Cairns QLD
Position: **Ranger** with the following duties:

- Horticulture (particularly Nursery Work)
- Revegetation
- Interpretation
- Environmental Induction of New Staff
- Phenology Survey of Cableway transect (weekly)
- Botanical Audits of tower sites (annually)
- Maintenance of Clivus Multrum Toilets
- Landscaping/Trimming of Rainforest Canopy
- Erosion Control
- Rodent Control
- Rainforest Track Maintenance
- Report writing and assistance with ISO 14001 and Green Globe 21
-General Maintenance of Stations
- - Evacuation readiness at heights

1994 - 1996

Hammerfest Senior High School, Norway
Position: **Teacher in Science, Biology and Mathematics.**

1990 -1991	Department of Environmental Protection, Norway Position: **Office Clerk Assistant.**
1989	University of Bergen, Norway Position: **Assistant Teacher.** (Cell Biology, Genetics & Ecology)
1988	University of Bergen, Norway Position: **Assistant Teacher.** (Botany)
1988	University of Bergen, Norway Position: **Assistant Teacher.** General Microbiology

REFEREES

Evan Tandy
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Caravonica
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Trinity Beach
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Mike Liddell
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Smithfield
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Appendix G:
Hoskin (2016, 2017) Reports

Surveys for endangered frogs and other wildlife on Barnwell Road Holdings

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Surveys conducted for Reever & Ocean Pty Ltd

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Executive Summary

A number of State (NCA) and Federally (EPBC Act) listed endangered species occur in the Kuranda area, including the Kuranda Tree Frog (*Litoria myola*), the Australian Lacelid frog (*Litoria dayi*), the Mistfrog (*Litoria rheocola*), the Southern Cassowary (*Casuarius casuarius*), the Northern Quoll (*Dasyurus hallucatus*), and the Myola Palm (*Archontophoenix myolensis*).

Wildlife surveys were conducted across the property 'Barnwell Road Holdings', with a particular focus on endangered frog species.

89 vertebrate species were detected during the surveys (21-27/01/2016, 25-27/03/2016, 01-03/05/2016), including a diverse frog fauna of 15 species.

In regards to frogs, the habitat of greatest significance on the property is streams and the rainforest associated with these. The property has a diverse assemblage of rainforest frogs, including the endangered species, the Kuranda Treefrog (*Litoria myola*).

The property contains important populations and breeding areas for *Litoria myola*. *Litoria myola* was recorded on three streams on the property: Owen Ck, Haren Ck and a small unnamed creek in the center-north of the property. The locality of these populations is covered in detail herein. *Litoria myola* occurs in the north-west sector of the property, in lots 22N157227, 2RP703984 and 17N157227.

A fourth creek on the property, the small creek downstream of the dam, would almost certainly have had *Litoria myola* until recently. However, sedimentation downstream from the dam has filled this creek in and made it unsuitable for *Litoria myola*. The former extent of *L. myola* on this creek is estimated herein.

The Australian Lacelid frog (*Litoria dayi*) was not detected on the property. It is present at nearby sites in the Myola area, and potentially suitable habitat is present on the property. However, the surveys were conducted during a poor wet season (with little stream flow) and it was not possible to adequately survey these areas of habitat for this species. Further surveys are required for *Litoria dayi* in the areas highlighted herein.

A number of *Archontophoenix* palms were located along the streams and these likely represent *Archontophoenix myolensis* (given the close proximity to known stands). *Archontophoenix myolensis* is an endangered species under the EPBC Act.

Time and access limitations precluded surveying the drier forests in the south-west of the property (lots 131N157491 & 290N157480). The endangered Northern Quoll (*Dasyurus hallucatus*) may occur in this area given the habitat type and proximity to known records.

Background

A number of species in the Kuranda area are listed as threatened at the State (Qld NCA) and Federal/Commonwealth (EPBC) level. Two endangered species are entirely restricted to the Kuranda/Myola area—the Kuranda Tree Frog (*Litoria myola*) and the Myola Palm (*Archontophoenix myolensis*). The Kuranda Tree Frog is restricted to about 10 breeding streams that enter the Barron River between Kuranda and Kowrowa. The most significant stand of the Myola Palm occurs on Warril Ck, with scattered records in nearby areas along the Barron River. Both the Kuranda Tree Frog and the Myola Palm are listed as Endangered at the Queensland (NCA, 2014a; NCA, 2014b) and Federal (EPBC, 2016a; EPBC, 2016b) levels. Other Endangered species known from the Kuranda area include the Australian Lacelid frog (*Litoria dayi*), the Mistfrog (*Litoria rheocola*), the Southern Cassowary (*Casuarius casuarius*), and the Northern Quoll (*Dasyurus hallucatus*). These four species are also all listed as Endangered under the State (NCA) and Federal (EPBC) legislation. The legislation associated with these Acts impacts how developments can proceed in areas containing threatened species; hence thorough surveys are required.

Objectives

1. To survey Barnwell Road Holdings for wildlife, with a particular focus on endangered frog species.
2. To identify species, habitats and areas on the property of particular conservation concern.

Methods

Survey design was based on desktop assessment of the property using Google Earth. Overlays of the property and plot boundaries, broad habitat types (including mapping of remnant and non-remnant vegetation, and past clearing), and drainage lines (creeks and gullies) were used to determine the distribution of survey effort.

On the 21st January 2016 I met with Simon Danielsen for an extended site visit to discuss the objectives and visit various parts of the property. This extended for much of the day and Simon showed me particular habitats and access points to various parts of the property.

The surveys were then conducted in three blocks: (1) seven consecutive nights from the 21st to the 28th of January 2016, (2) two nights from the 25th to the 27th of March 2016, and (3) two nights from the 1st to the 3rd of May 2016. Each day I spent some hours at the site in the afternoon marking access to sites I was to survey that night, and doing opportunistic surveys for reptiles, birds, mammals, and palms. Frog surveys began at approximately 6 pm each night and typically extended to midnight. Additional site visits were conducted during the days to survey reptiles, birds, and tadpoles.

Each frog survey consisted of walking a pre-defined section of a creek or gully (sometimes as short as 100 m, but typically in the order of 500 m to 2 km). Some nights consisted of surveying one long section of creek, while other nights consisted of surveying multiple

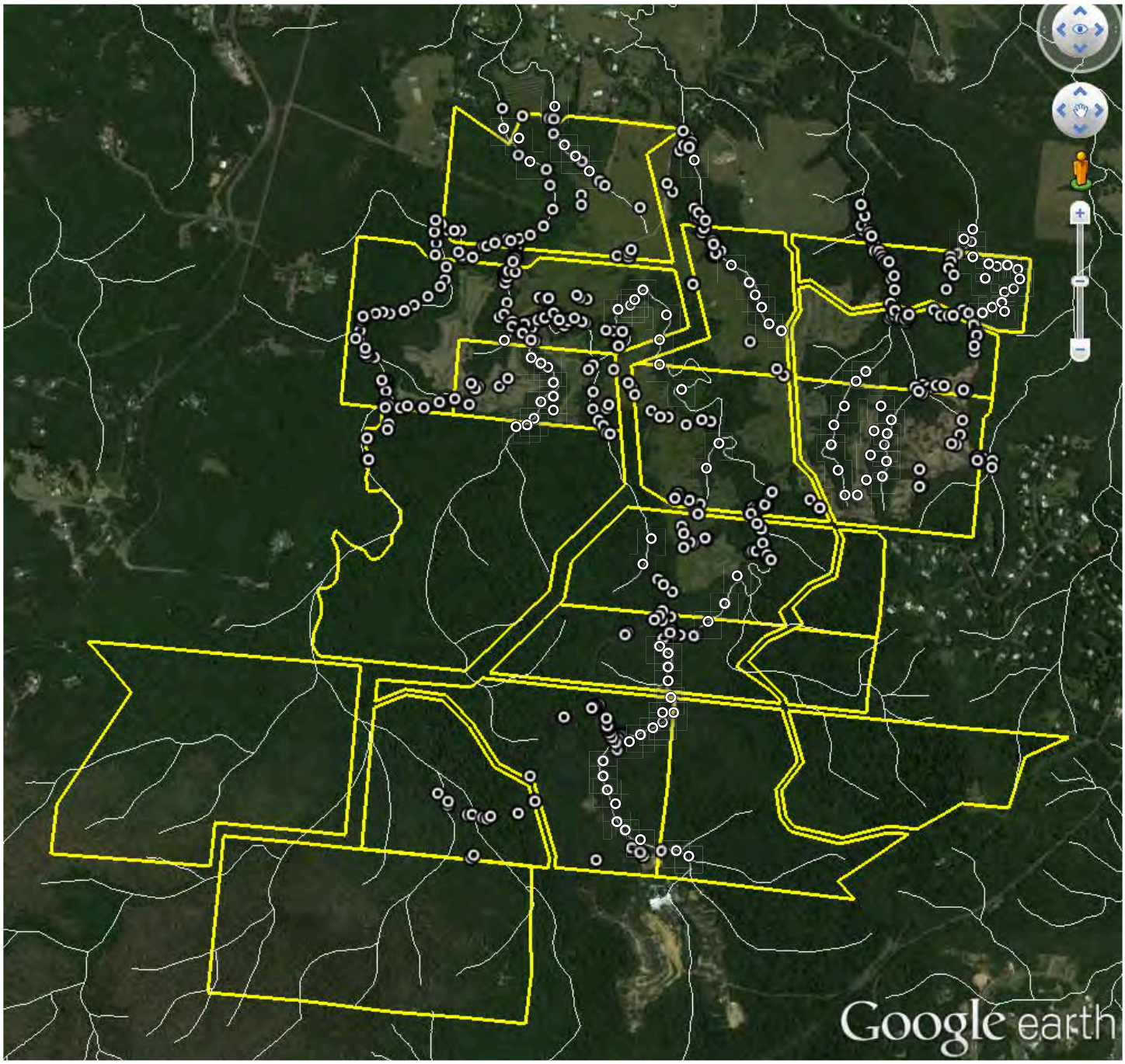

Fig. 1. An indication of survey effort across the property. White symbols are derived from marked sites and a subsample of track logs from the surveys. More survey effort occurred in the northern half of the property.

shorter sections. Each survey was performed by walking up the middle of a creek or gully searching for frogs and other wildlife in two ways: (1) listening for frog calls (which are distinctive for each species), and (2) using a low power head-torch to look for animals, particularly by eyeshine (even small frogs have eyeshine). Regular forays were made away from the creekline to survey for wildlife in the rainforest surrounding the creeks and gullies.

All surveys were performed by myself, with one or two volunteer helpers. All species identifications were by myself. Incidental records of wildlife were also obtained while driving around the property or walking into sites. The location of sites and species records was recorded using a Garmin 60CSX GPS unit. For threatened species and incidental records, a GPS point was taken when they were detected, whereas more common species were generally recorded as present between regularly marked points along the creeks.

Conditions were dry through much of the survey period; there were some moderate showers but the wet season total was very low. Therefore, stream levels were generally low; some large streams that would typically flow in the wet season were not flowing; and small gullies were dry. Larger streams were targeted because they were carrying water, but smaller creeks and gullies were also searched in the hope of finding foraging frogs. Conditions were too dry to survey a number of small gullies. Conditions were also not suitable for surveying for the Australian Lacelid Frog (*Litoria dayi*), which generally only calls along streams during wet periods when they are flowing well. Further targeted surveys are required to cover these gaps in knowledge for the property.

A major objective of this survey was to determine whether the endangered Kuranda Treefrog (*Litoria myola*) occurs on the property. This involved stream surveys to detect males, and then extrapolating from these areas of known presence to estimate the extent of habitat likely used by the species. *Litoria myola* was identified by male call (the definitive form of identification) and by sight (to a trained eye, males are smaller and more slender than the similar species *Litoria serrata*, and females are also smaller than *Litoria serrata* females). Males were targeted because they occur in low vegetation along streams and they call, whereas females are harder to find because they typically occur away from streams up high in trees, and they don’t call.

Survey results

Survey effort focused on creeklines, particularly in the northern half of the property (Fig. 1). 89 vertebrate species were detected in the survey period, comprising 10 species of mammals, 54 species of birds, 10 species of reptiles, and 15 frog species (Appendix 1).

All 15 frog species are breeding on the property, as determined by the presence of calling males. The frog fauna consisted of 8 species of rainforest frogs and 7 frog species more typically associated with open forest or disturbed habitats. The rainforest frogs consisted of 6 stream-breeding species (*Litoria myola, Litoria serrata, Litoria jungguy, Litoria xanthomera, Mixophyes coggeri, Rana daemeli*) and two species (*Austrochaperina pluvialis* and *Cophixalus ornatus*) that breed on land.

The property has a nearly full compliment of the rainforest frogs that occur in the Kuranda region. The Mistfrog (*Litoria rheocola*) and the Australian Lacelid (*Litoria dayi*) were not

detected. *Litoria dayi* is known to occur at sites 1.5 km and 1.8 km from the property. The property has potentially suitable habitat for *Litoria dayi*, particularly on Haren and Owen Creeks (Fig. 4), but weather conditions during the survey period were not suitable for determining whether the species is present or not.

Litoria myola was recorded on three streams on the property: Owen Ck, Haren Ck and a small unnamed creek in the center-north of the property (Figs 2 & 3). All *Litoria myola* were found in the north-west sector of the property, in lots 22N157227, 2RP703984 and 17N157227. *Litoria myola* is generally present at good density along the sections of stream marked in green on Figure 3. Based on the number of frogs detected during the surveys, I would coarsely estimate that 100-200 *Litoria myola* adults are present on the property. However, weather and stream conditions were not ideal during the surveys, so this estimate is coarse and the actual number may be more. The core *Litoria myola* habitat on the property is along lower Owen Creek up to the Owen/Haren junction and at least 1 km upstream of this junction on Owen Ck and at least 500 m upstream on Haren Ck (Fig. 3). This Owen/Haren population would appear to be the third largest breeding population of this species.

The majority of *Litoria myola* found were males, which is typical because males call from rainforest vegetation along the streams. Female *Litoria myola* are very hard to detect because they use the surrounding forest and avoid the streams unless they are breeding. Several breeding females were seen along Owen Ck, three of which were carrying eggs and one of which was in amplexus [breeding] with a male. A female was also seen on Haren Creek. There wasn't sufficient time to survey the surrounding forest to search for females but, based on my knowledge from other areas around Kuranda, the females will be using rainforest up to at least 100 m from the streams (and probably considerably further). Therefore stream buffers for this species need to be at least 100m wide from either side of the creek, and at least 100 m upstream from any known *L. myola* points. The breeding pair of *Litoria myola* found during the survey were found in amplexus on Owen Ck and would have laid a clutch of eggs that night. Possible *Litoria myola* tadpoles were found along stretches of all three creeks on which *Litoria myola* adults were found but these tadpoles couldn't be distinguished with confidence from the co-occurring species *Litoria serrata*.

Litoria myola is restricted to downstream sections of streams flowing into the Barron River, so the areas it was found on the property fit the broader distributional pattern. The most upstream records of *Litoria myola* on each of the streams will be broadly indicative but not precisely accurate. The species could no doubt be found further upstream of the most upstream records on each of these creeks with more survey effort, particularly under wetter conditions. Based on the known records and the habitat along the creeks, I have buffered the upstream limits of *Litoria myola* in yellow on the map (Fig. 3). *Litoria myola* could reasonably be expected to occur in these yellow shaded areas. Further surveys under more ideal weather conditions would refine upstream limits more accurately.

A fourth creek on the property, the small creek downstream of the dam by the homestead, would almost certainly have had *Litoria myola* until recently (marked in red shading on Figure 3). However, sediment from dam construction and the eroding dam wall has filled this creek for hundreds of meters downstream of the dam and the habitat is no longer suitable for *Litoria myola* breeding. The reasons I can be fairly sure this creek had *Litoria myola* are: (1) It is within the typical distance *Litoria myola* occurs upstream from the Barron River; (2) The creeks on either side have *Litoria myola* up to at least this point; and

(3) Assessment of the size and structure of the creek, and associated vegetation, enables me to make an educated estimate of how far upstream they would have bred on the creek. In the adjacent un-named creek, *L. myola* extends to within 300 m of the head of the creek. Using this as a benchmark, I have estimated an upstream extent of the former occurrence of *L. myola* on the creek below the dam (see Figure 3). Remedial works have begun regarding the sediment issue in this creek, and these are ongoing.

Time constraints and unfavourable weather conditions (too dry) precluded surveying some key sections of streams or gullies. The section of Haren Ck that flows through the three road crossings requires further surveys for *Litoria myola* to better determine abundance and upstream limits. Sections of potentially suitable habitat for *Litoria dayi* were identified on lower and mid Haren Ck, Owen Ck, and an upper tributary of Warril Ck (Fig. 4), and these require targeted surveys when the creeks have more flow. *Litoria dayi* occurs nearby in the Myola area, and is a difficult species to detect when not breeding during dry conditions.

A number of *Archontophoenix* palms were located along the streams (Fig. 5). These are likely to be the endangered *Archontophoenix myolensis* given the close proximity to known stands on Warril Ck and nearby areas of the Barron River, and because they are growing in boggy stream-side locations typical of *Archontophoenix myolensis*. *Archontophoenix myolensis* is poorly surveyed for around Kuranda, in part due to similarity to *Archontophoenix alexandrae* (they differ in aspects of growth form and characteristics of the fruit and seed). Identification of the palms located on the property is problematic because only immature individuals were found. A botanist that has expertise in local *Archontophoenix* may be able to identify these immature individuals.

The remnant forest in the southern half of the property was not surveyed in detail due to time constraints and access limitations. However, from the time I spent in this habitat it is clear that it is high quality rainforest with a mature structure. This habitat will contain a good diversity of fauna and flora and certainly appears suitable for Cassowary (either for resident birds or as a corridor for movement of adults and subadults). The remnant forest also buffers the downstream sections of the streams, in terms of maintaining natural water flow, water quality and sedimentation characteristics. It therefore contributes directly to the viability of downstream populations of *Litoria myola* and, potentially, *Archontophoenix myolensis*.

Some of the areas mapped as non-remnant forest are in an advanced state of regeneration, and contain much of the rainforest wildlife expected for this region. I observed areas of high quality regrowth in the north-west (lot 22N157227), west (lot 2RP703984), north-east (lot 17N157227), and east (lot 18N157227) of the property.

The focus of my surveys was frogs in the remnant and non-remnant rainforest vegetation on the property. Time and access constraints precluded wildlife surveys of the drier forest areas of the south-west sector of the property (lots 131N157491 & 290N157480). The habitat on these lots may be suitable for the Northern Quoll, which occurs in sclerophyll forests in the region.

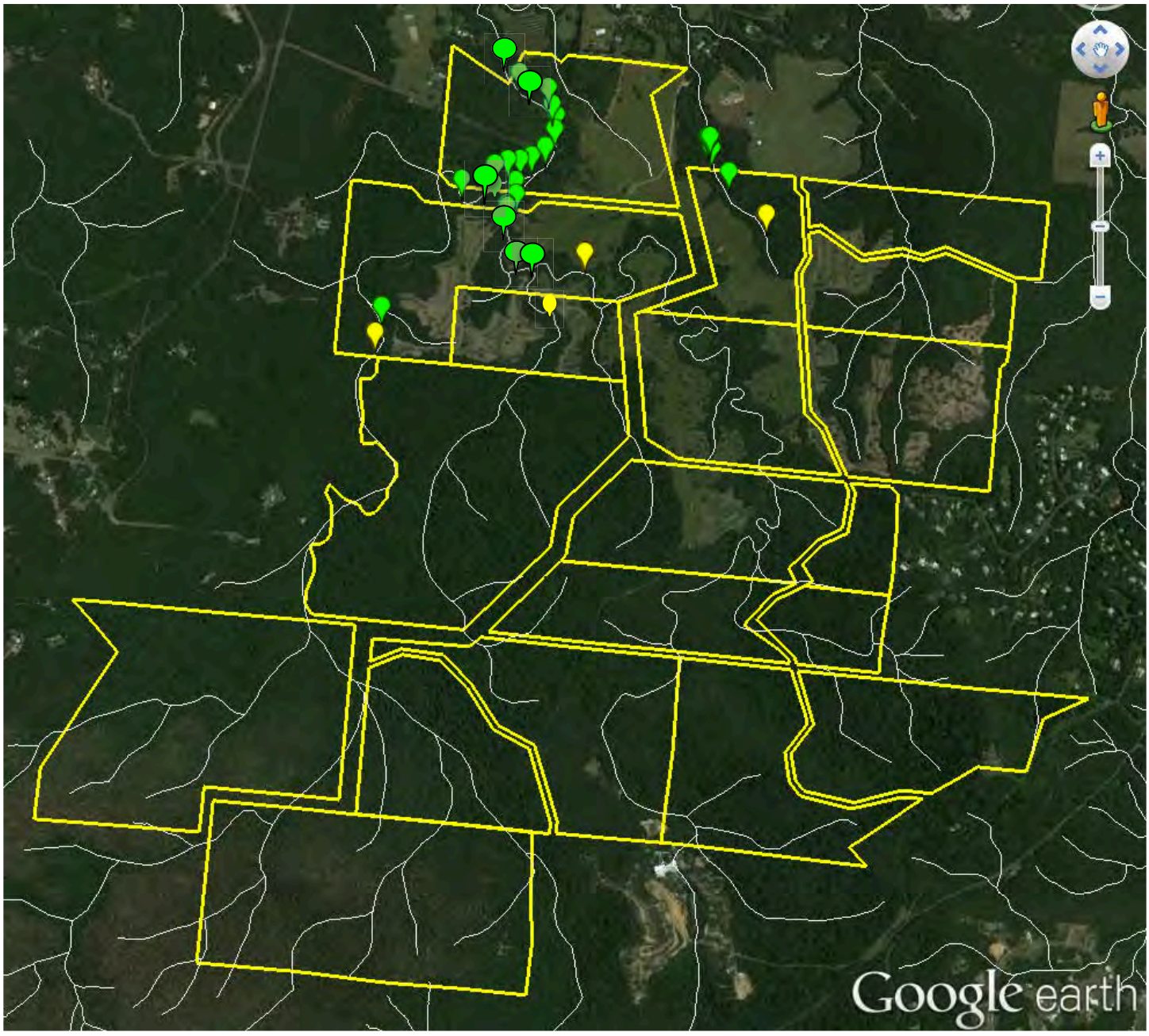

Fig. 2. *Litoria myola* records. *Litoria myola* records are shown as green symbols. Estimated potential upstream extents of *Litoria myola* are shown as yellow symbols.

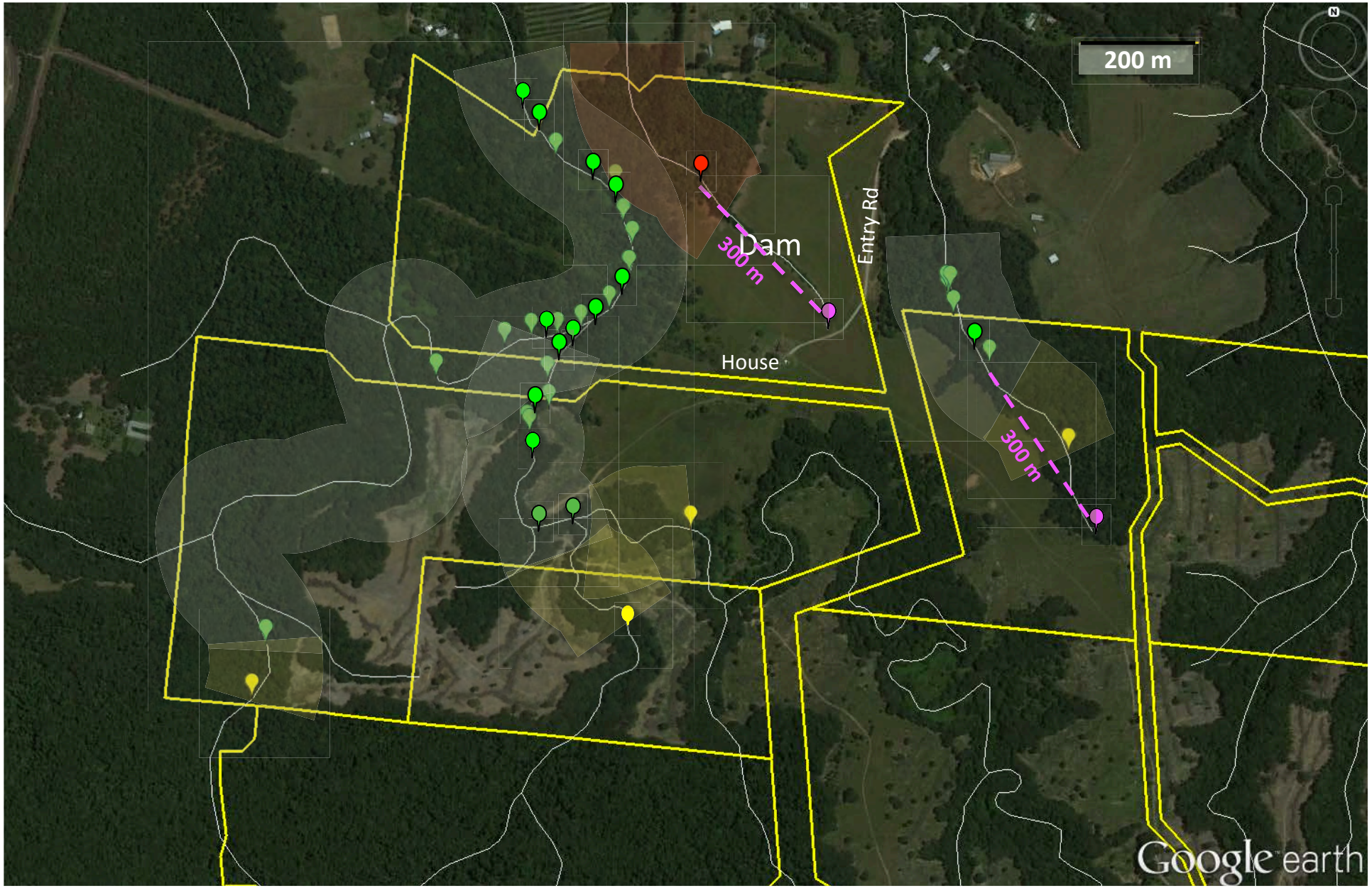

Fig. 3. Close-up of *Litoria myola* records. *Litoria myola* records are shown as green symbols. Transparent green shading shows a buffer of approx. 100 m wide on either side of stretches of creeks where *Litoria myola* was detected. Estimated potential upstream extents of *Litoria myola* are shown as yellow symbols, with a 100 m buffer (yellow shading) on either side of the creeks. The red shaded area is a creek that probably had *Litoria myola* but is now filled with sediment from the dam. The red symbol within this shading shows the potential former upstream extent of *L. myola* on this creek. This was determined as 300 m downstream from the top of this creek, which is the same distance as *L. myola* occurs from the top of the adjacent small creek (pink symbols and dashed lines).

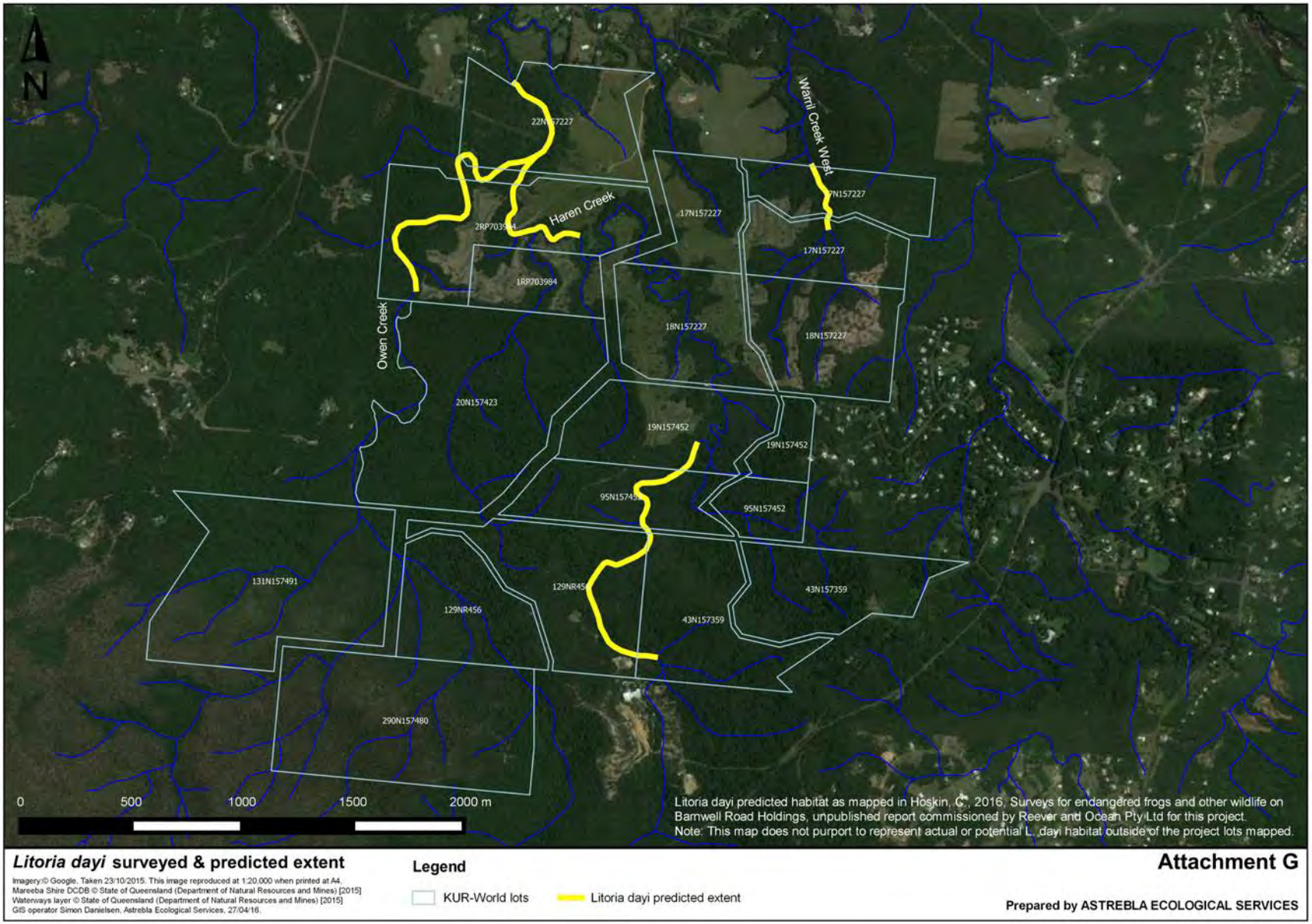

Fig. 4. Potential habitat for the Australian Lacelid frog (*Litoria dayi*). Sections of creek marked in yellow are of potentially suitable habitat for *Litoria dayi*, based on habitat use at nearby sites in the Myola area.
Map prepared by Simon Danielsen (Astrebla Ecological Services), in consultation with Conrad Hoskin (JCU)

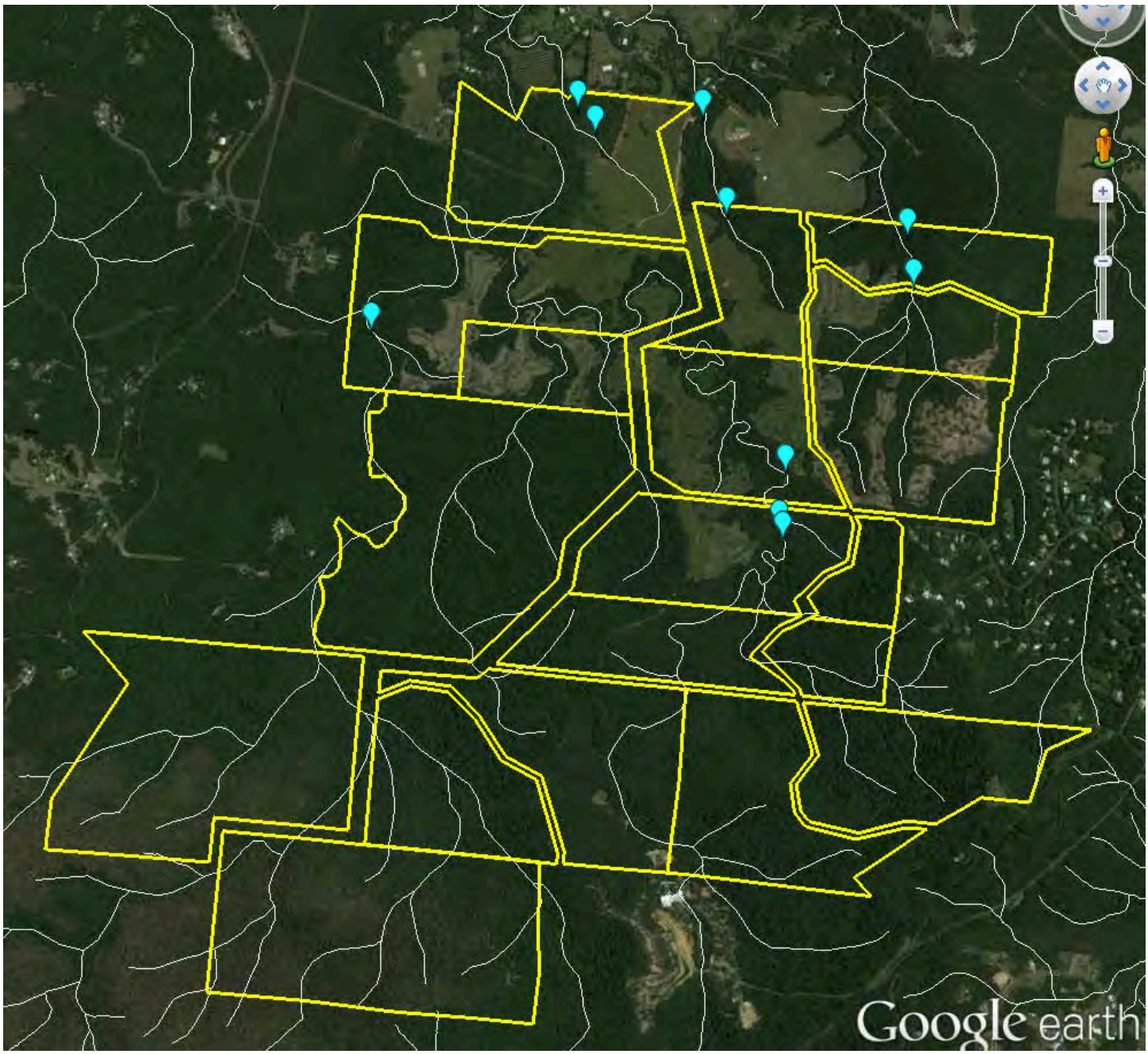

Fig. 5. Palm records. Blue symbols show where palms were encountered during the surveys. These palms may be *Archontophoenix myolensis*.

Suggested actions for further surveys of endangered species

Determine the upstream limits of *Litoria myola* on the three streams it is known to occur (i.e., resolve the areas shaded yellow in Figure 3).

Perform targeted surveys for *Litoria dayi* in identified areas of potentially suitable habitat on Haren Ck, Owen Ck, and upper Warril Ck (Fig. 4).

Resolve the identity of the *Archontophoenix* palms on the property.

Perform targeted surveys for Northern Quolls in lots 131N157491 and 290N157480.

References

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NCA (2014b). NCA profile for *Archontophoenix myolensis*: https://environment.ehp.qld.gov.au/species-search/details/?id=6523

List of tables, figures & data files provided

Appendix 1. Vertebrate species recorded on the property during the survey period.

Figure 1. Map of survey effort on the property during the survey period.

Figure 2. Map of *Litoria myola* records on the property during the survey period.

Figure 3. Detailed map of *Litoria myola* records, estimates of potential distribution, and suggested buffers.

Figure 4. Map of potentially suitable habitat for *Litoria dayi* on the property.

Figure 5. Map of palms located on the property during the survey period.

Electronic file 1. Vertebrate species list for the Barnwell property.

Electronic file 2. *Litoria myola* & palm locality records.

Electronic file 3. Survey site localities, and associated vertebrate data.

Appendix 1. Vertebrate species recorded on the property during the survey period

Group	Scientific name	Common name
Frogs	*Austrochaperina pluvialis*	rain whistling-frog
Frogs	*Cophixalus ornatus*	northern ornate nursery-frog
Frogs	*Limnodynastes peronii*	striped marsh frog
Frogs	*Litoria caerulea*	Green tree frog
Frogs	*Litoria fallax*	Eastern sedge frog
Frogs	*Litoria gracilenta*	graceful tree frog
Frogs	*Litoria infrafrenata*	white-lipped tree frog
Frogs	*Litoria jungguy*	northern stony creek frog
Frogs	*Litoria myola*	Kuranda tree frog
Frogs	*Litoria serrata*	green-eyed tree frog
Frogs	*Litoria xanthomera*	orange-thighed tree frog
Frogs	*Mixophyes coggeri*	Cogger's barred frog
Frogs	*Rana daemeli*	wood frog
Frogs	*Rhinella marina*	Cane toad
Reptiles	*Carlia rubrigularis*	red-throated rainbow-skink
Reptiles	*Hypsilurus boydii*	Boyd's forest dragon
Reptiles	*Lampropholis coggeri*	rainforest sunskink
Reptiles	*Physignathus lesueurii*	eastern water dragon
Reptiles	*Ramphotyphlops polygrammicus*	north-eastern blind snake
Reptiles	*Saproscincus basiliscus*	pale-lipped shadeskink
Reptiles	*Saproscincus tetradactylus*	four-fingered shadeskink
Reptiles	*Stegonotus cucullatus*	slaty-grey snake
Reptiles	*Wollumbinia latisternum*	saw-shelled turtle
Birds	*Ailuroedus melanotis*	Spotted Catbird
Birds	*Alectura lathami*	Australian Brush-turkey
Birds	*Alisterus scapularis*	Australian King-Parrot
Birds	*Anthus novaeseelandiae*	Australasian Pipit
Birds	*Burhinus grallarius*	Bush Stone-curlew
Birds	*Cacatua galerita*	Sulphur-crested Cockatoo
Birds	*Cacomantis variolosus*	Brush Cuckoo
Birds	*Caprimulgus macrurus*	Large-tailed Nightjar
Birds	*Centropus phasianinus*	Pheasant Coucal
Birds	*Ceyx pusilla*	Little Kingfisher
Birds	*Chalcophaps indica*	Emerald Dove
Birds	*Cisticola exilis*	Golden-headed Cisticola
Birds	*Colluricincla megarhyncha*	Little Shrike-thrush
Birds	*Coracina lineata*	Barred Cuckoo-shrike
Birds	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
Birds	*Coracina tenuirostris*	Cicadabird
Birds	*Cracticus quoyi*	Black Butcherbird
Birds	*Cyclopsitta diophthalma*	Double-eyed Fig-Parrot
Birds	*Dendrocygna eytoni*	Plumed Whistling-Duck

Birds	*Eurystomus orientalis*	Dollarbird
Birds	*Geopelia humeralis*	Bar-shouldered Dove
Birds	*Geopelia striata*	Peaceful Dove
Birds	*Gerygone mouki*	Brown Gerygone
Birds	*Haliaeetus leucogaster*	White-bellied Sea-Eagle
Birds	*Hirundo neoxena*	Welcome Swallow
Birds	*Megapodius reinwardt*	Orange-footed Scrubfowl
Birds	*Meliphaga gracilis*	Graceful Honeyeater
Birds	*Meliphaga notata*	Yellow-spotted Honeyeater
Birds	*Neochmia temporalis*	Red-browed Finch
Birds	*Ninox connivens*	Barking Owl
Birds	*Ninox novaeseelandiae*	Southern Boobook
Birds	*Pachycephala simplex*	Grey Whistler
Birds	*Philemon buceroides*	Helmeted Friarbird
Birds	*Pitta versicolor*	Noisy Pitta
Birds	*Podargus papuensis*	Papuan Frogmouth
Birds	*Ptilinopus magnificus*	Wompoo Fruit-Dove
Birds	*Ptilinopus superbus*	Superb Fruit-Dove
Birds	*Sericornis magnirostra*	Large-billed Scrubwren
Birds	*Sphecotheres vieilloti*	Australasian Figbird
Birds	*Symposiarchus trivirgatus*	Spectacled Monarch
Birds	*Tanysiptera sylvia*	Buff-breasted Paradise-Kingfisher
Birds	*Todiramphus macleayii*	Forest Kingfisher
Birds	*Trichoglossus haematodus*	Rainbow Lorikeet
Birds	*Turnix maculosus*	Red-backed Button-quail
Birds	*Tyto tenebricosa*	Sooty Owl
Birds	*Vanellus miles*	Masked Lapwing
Birds	*Xanthotis macleayanus*	Macleay's Honeyeater
Mammals	*Dactylopsila trivirgata*	Striped possum
Mammals	*Melomys cervinipes*	Fawn-footed Melomys
Mammals	*Nyctimene robinsoni*	eastern tube-nosed bat
Mammals	*Perameles nasuta*	Long-nosed Bandicoot
Mammals	*Pteropus conspicillatus*	spectacled flying-fox
Mammals	*Uromys caudimaculatus*	Giant White-tailed Rat

Surveys for Endangered frogs in regards to the Kur-World proposal, and observed and potential impacts of development

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Surveys conducted for NRA Environmental Consultants

26th May 2017

Summary of key points

Frog surveys were conducted on the Kur-World development proposal site, with a particular focus on three State (NCA) and Federally (EPBC) listed Endangered species: the Kuranda Tree Frog (*Litoria myola*), the Lacelid Frog (*Litoria dayi*) and the Mistfrog (*Litoria rheocola*). *Archontophoenix* palms were incidentally surveyed because the site is close to known stands of the Endangered Myola Palm (*Archontophoenix myolensis*).

A significant population of *Litoria myola* was discovered on-site. Locality records and estimates of distribution are provided herein. The population on-site is estimated to be approximately 10% of the global breeding population of this species.

Significant populations of *Litoria myola* were also mapped downstream of the site. Adding these population estimates to those on-site gives an estimate of approximately 50% of the breeding population of this species.

Observed impacts of on-site activities on *Litoria myola* are outlined. These include clearing within *Litoria myola* habitat, construction of road crossings, and sedimentation of breeding habitat both on-site and downstream.

Potential impacts of the proposed development on *Litoria myola* are outlined in detail, both to populations on-site and to significant populations downstream.

Recommendations are provided regarding recovery and conservation of *Litoria myola* on-site and downstream.

Litoria dayi and *Litoria rheocola* were not located on-site but a breeding population of *Litoria dayi* was located downstream of the site on Warril Creek.

Numerous *Archontophoenix* palms were located on-site. These records are presented, as well as those for significant mature stands on creeks downstream of the site (including stands known with certainty to be *Archontophoenix myolensis*).

Definitions and key species names:

Amplexus: frog breeding embrace. The female has chosen a male and they will lay eggs nearby.

Archontophoenix myolensis (Myola Palm): An Endangered palm that is highly localized to the Kuranda area. The type locality (the site where the species was discovered and described) is lower Warril Ck. The palm occurs along streams, gullies and associated moist, earthy areas. Identification is difficult and requires an expert. In this study, the term '*Archontophoenix* palms' is used because the palms were not identified to species by an expert. However, they are assumed to be *Archontophoenix myolensis* due to very close proximity to known stands of this species.

Breeding: frog breeding activity, specifically referring to any of the following: male calling, gravid female beside the creek, male and female in amplexus, egg clutch, and tadpoles.

Creek/stream: These two terms are used interchangeably herein. Both refer to drainage lines that flow permanently (permanent creeks) or for part of the year (ephemeral creeks).

Endangered: Listed on the Queensland NCA or Commonwealth (Federal) EPBC threatened species lists.

Gravid female: a female frog that is carrying a mature egg clutch (as seen through the semi-transparent skin in the lower flank/groin area).

Gully: A small drainage line that only flows during and following rain.

Litoria dayi (Lacelid Frog): An Endangered frog species restricted to the Wet Tropics region. Formerly widespread but declined due to chytrid fungus disease in the late 1980s and early 1990s. Now restricted to lowland rainforest. Indication of limited and patchy recovery into some mid elevation areas, including the Kuranda region. This species requires streams and surrounding rainforest.

Litoria myola (Kuranda Treefrog): An Endangered frog species that is restricted to the Kuranda area. This species requires streams and surrounding rainforest. Males live in vegetation near streams, whereas females live in the rainforest away from streams. Females are rarely found (because they live high up in the trees) but have been found in rainforest at least 100 m from streams. It is important to consider this species as two ecologically different sexes: males along streams, and females in the rainforest away from streams. Breeding occurs in streams. These can be permanent streams or streams that flow only during the wet season following rain. A clutch of eggs is laid in a shallow riffle section (i.e., where the stream flows through gravel or rocks). The tadpoles hatch into the riffles and remain there initially, before moving into adjacent pool sections of the stream to develop into froglets over a couple of months. Metamorph frogs leave the stream and 'disappear' into the forest and are rarely seen until they return to the stream as adults.

Owen/Haren junction: The junction of Owen and Haren Creeks.

Population or *breeding site*: A group of individuals inhabiting an area of connected breeding habitat that is disconnected from other such individuals/areas.

Riffle: A shallow section of stream where water flows through rocks, gravel or sand.

Site: the area covered by the 'Kur-World' proposal.

Background

A number of Endangered species occur species in the Kuranda area. Two of these Endangered species are entirely restricted to the Kuranda/Myola area—the Kuranda Tree Frog (*Litoria myola*) and the Myola Palm (*Archontophoenix myolensis*). The Kuranda Tree Frog is restricted to about 10 breeding streams that enter the Barron River between Kuranda and Oak Forest. The most significant known stand of the Myola Palm occurs on Warril Ck, with scattered records in nearby areas along the Barron River and associated streams. Both the Kuranda Tree Frog and the Myola Palm are listed as Endangered at the Queensland (NCA, 2014a; NCA, 2014b) and Commonwealth/Federal (EPBC Act, 2016a; EPBC, 2016b) levels. Other Endangered species known from the Kuranda area include the Australian Lacelid frog (*Litoria dayi*), the Mistfrog (*Litoria rheocola*), the Southern Cassowary (*Casuarius casuarius*), and the Northern Quoll (*Dasyurus hallucatus*). These four species are also all listed as Endangered under the State (NCA) and Federal (EPBC) legislation. The legislation associated with these Acts impacts how developments can proceed in areas containing threatened species; hence thorough surveys are required.

Objectives

1. To refine knowledge on the distribution and likely habitat usage of *Litoria myola* in the proposal area and in adjacent areas.
2. To survey key areas of habitat for *Litoria dayi* and *Litoria rheocola* under suitable weather and stream flow conditions.
3. To accumulate more incidental records of *Archontophoenix* palms.
4. To contextualize the population of *Litoria myola* on-site in a regional context.
5. To identify current and potential impacts on *Litoria myola* on-site and in downstream areas.
6. Recommend measures to reverse and limit impacts on *Litoria myola* on-site and downstream.

Methods

This report covers two sets of surveys:

1. 2016 surveys conducted on the 21-28th January 2016 for Reever & Ocean Pty Ltd [Report: *Surveys for endangered frogs and other wildlife on Barnwell Road Holdings*. 17th February 2016].
2. 2017 surveys conducted 24-26th Feb, 2-4th March, and 16-18th March 2017 for NRA Environmental Consultants.

While the 2017 surveys are the primary focus of this report, they are put in context of the 2016 surveys in order to build a more complete picture of Endangered frogs on and around this proposal area. Survey methodology was similar for both sets of surveys.

Deciding where to invest survey effort was based on desktop assessment of the proposal area and adjacent areas, using Google Earth. Overlays of the property and plot boundaries, broad habitat types (including mapping of remnant and non-remnant vegetation, and past clearing), and drainage lines (creeks and gullies) were used to determine the distribution of survey effort. Survey effort was refined through accumulation of on-site knowledge regarding stream and

forest characteristics. The 2017 surveys built on the data from the 2016 surveys, so rather than broad surveys across the whole Kur-World proposal area, the surveys targeted key areas for *Litoria myola* and identified potential habitat for *L. dayi* and *L. rheocola* (Fig. 1).

The 2016 surveys were conducted over seven consecutive nights, starting on the 21st of January 2016 and finishing on the night of the 27th of January. The 2017 surveys were conducted in three lots of three nights each: 24-26th February 2017, 2-4th March 2017, and 16-18th March 2017 (i.e., 9 nights total survey effort).

Sites were typically visited in the late afternoon to assess habitat and to look for frog breeding activity (eggs and tadpoles). Frog surveys began at approximately 6:30 pm each night and typically extended to about 11:30 pm. Each frog survey consisted of walking a pre-defined section of a creek or gully (sometimes as short as 100 m, but typically in the order of 500 m to 2 km). Some nights consisted of surveying one long section of creek, while other nights consisted of surveying multiple shorter sections. Each survey was performed by walking along a creek or gully searching for frogs and other wildlife in two ways: (1) listening for frog calls (which are distinctive for each species), and (2) using a low power head-torch to look for animals, particularly by eyeshine (even small frogs have bright eyeshine). Regular forays were made away from the creek to survey for wildlife in the rainforest surrounding the creeks and gullies.

All surveys were performed by myself, with one or two helpers. All species identifications were by myself. Incidental records of wildlife were also obtained while driving around the property or walking into sites. The location of sites and species records was recorded using a Garmin 60CSX GPS unit. For Endangered species and some specific incidental records, a GPS point was taken for each individual, whereas other species were recorded in my field notebook as present in the area surveyed that night.

Conditions in the 2016 surveys were dry through much of the survey period (with little recent rain), and hence stream levels were generally low and some small gullies were dry. Heavy rain fell on the last night of the 2016 surveys but it was so heavy that frog detection was limited (the sound of heavy rain drowns out frog calls, and eyeshine is hard to detect). Temperature during the 2016 surveys was warm and highly suitable for frog activity.

Rainfall and stream flow during the 2017 surveys were generally good for stream frog activity. Heavy rain had fallen prior to the surveys and rainfall continued on and off through the survey period. Streams and small gullies were flowing. Temperatures during the 2017 survey period were initially quite cool (24-26th Feb) but had warmed up a little for the subsequent surveys (2-4th March; 16-18th March). Although at the cooler end for optimal frog activity, stream frog activity was good and breeding activity was observed (males calling, gravid females visiting stream, egg clutch, young tadpoles in stream).

The Endangered Kuranda Treefrog (*Litoria myola*) was identified by male call (the definitive form of identification) and by sight (to a trained eye, males are smaller and more slender than the similar species *Litoria serrata*, and females are also smaller and more ‘squat’ than *Litoria serrata* females).

Archontophoenix palms were not specifically surveyed for. However, because they grow along creeks and I was surveying creeks extensively for frogs, I recorded any *Archontophoenix* palms I encountered. I do not have the expertise to identify these to species but can identify palms to the genus *Archontophoenix*. As sated in the Definition section, these palms on-site and

downstream are assumed to be *Archontophoenix myolensis* (due to very close proximity to known stands of this species) but they need expert identification.

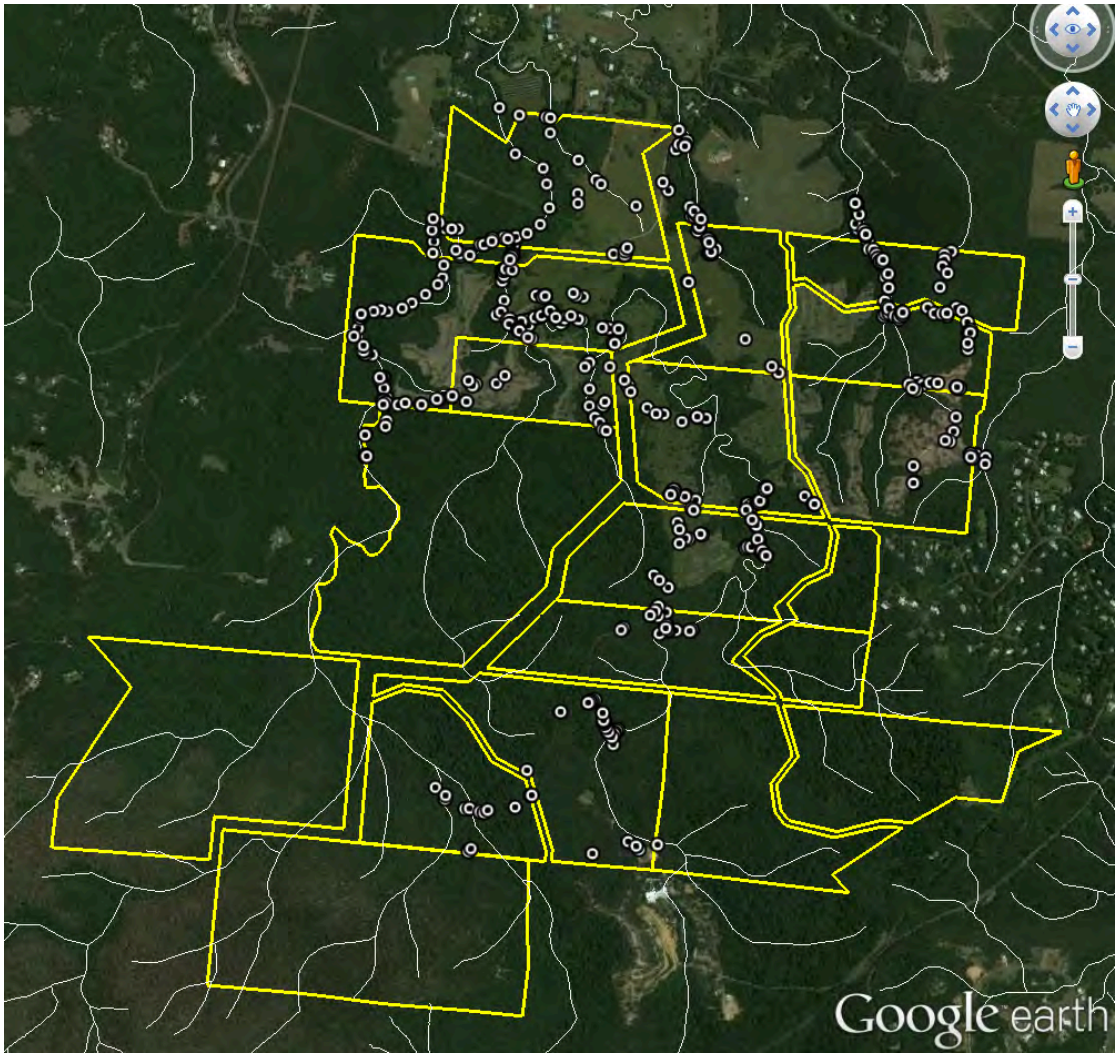

Figure 1a. Map of survey effort on-site during the 2016 surveys. White dots reflect movements and effort.

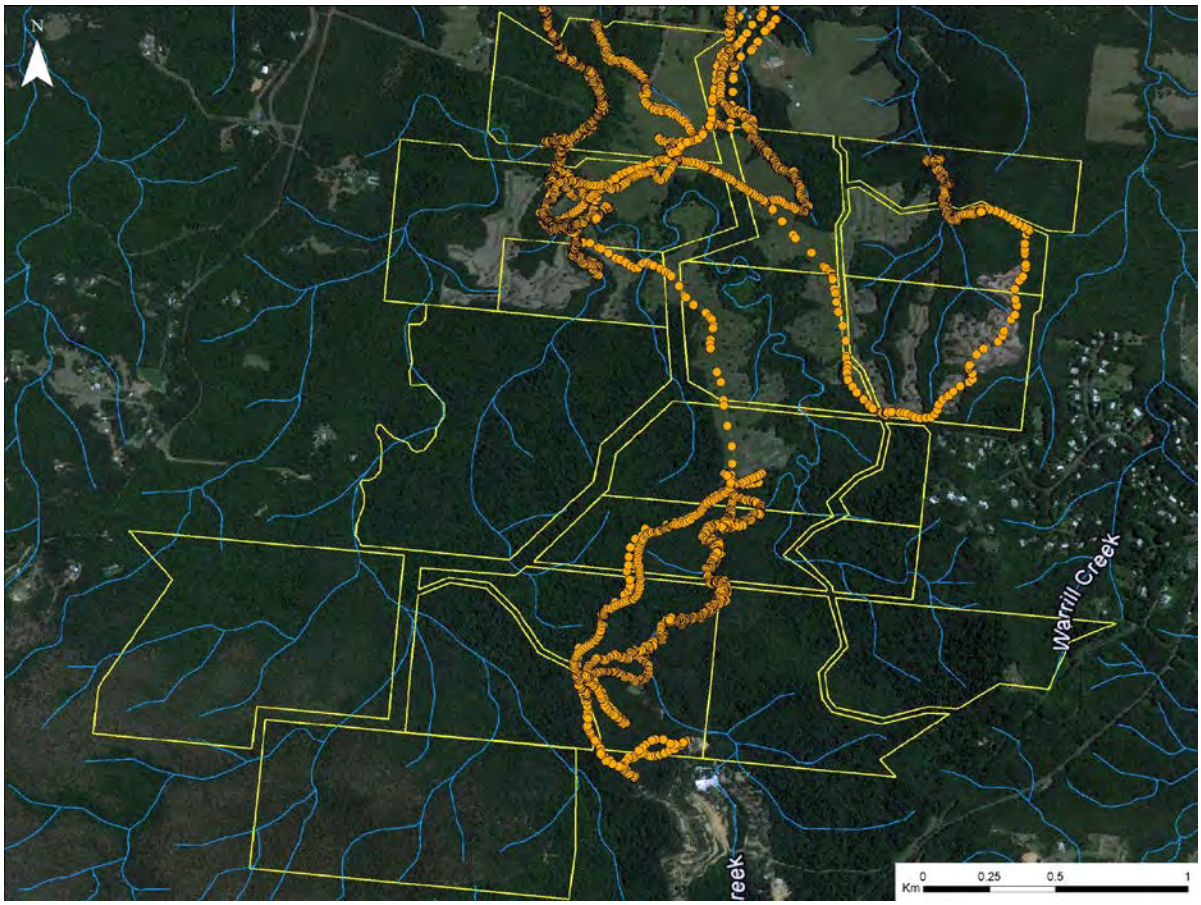

Figure 1b. Map of survey effort on-site during the 2017 surveys. Orange dots reflect movements and effort.

Survey results

Key results:

- The Endangered frog *Litoria myola* was found (including breeding) in the proposal area (on Owen Ck, Haren Ck, and Cain Ck) (Figs 2 & 3). A significant population of this species was found on-site. *Litoria myola* was also found breeding downstream of the proposal area (on Owen Ck, Cain Ck, and Warril Ck) (Fig. 4).

- No other Endangered frog species were detected in the proposal area but the Endangered frog *Litoria dayi* was detected breeding downstream (on Warril Ck) (Fig. 5).

- *Archontophoenix* Palms (most likely the Endangered species *Archontophoenix myolensis*) were detected in creeks and gullies across the proposal area (Fig. 6). Palms, including stands of mature individuals were found downstream of the proposal area (on Owen Ck, Cain Ck, and Warril Ck) (Fig. 6).

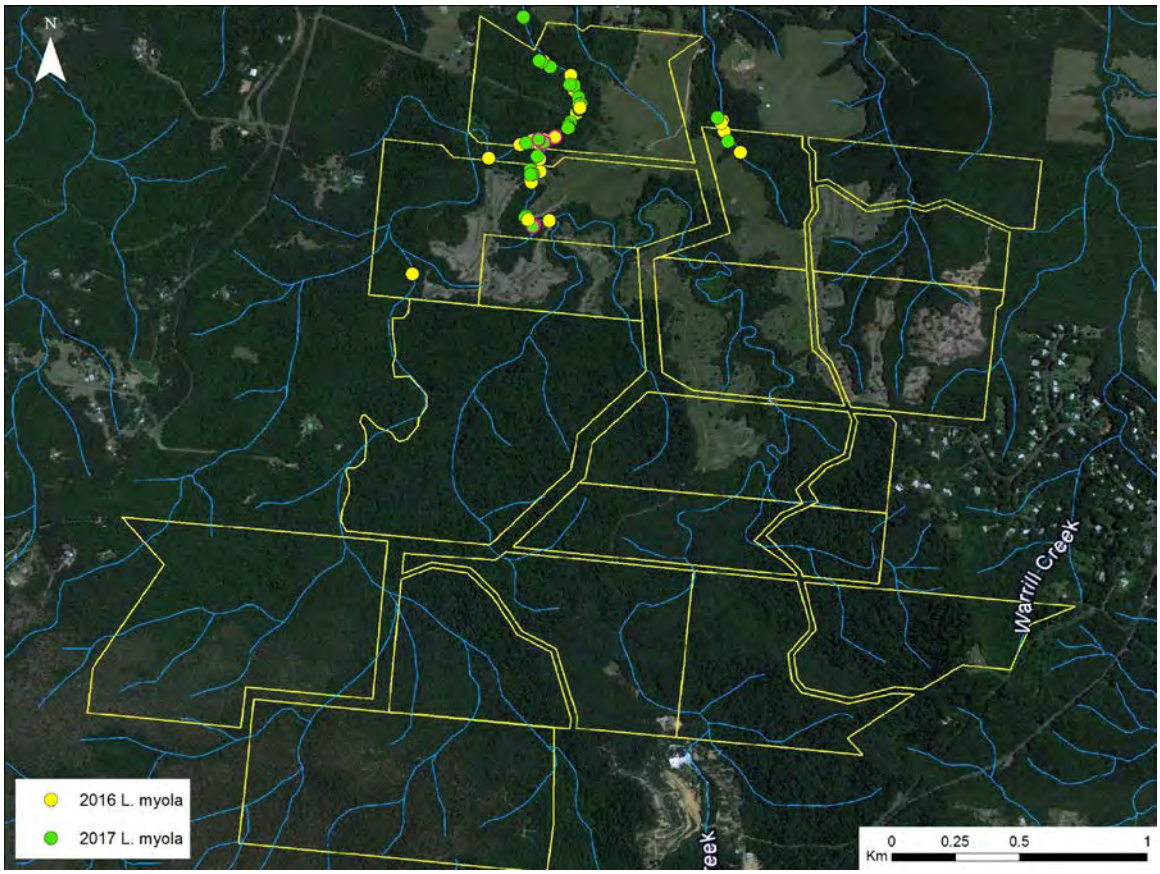

Figure 2. Map of *Litoria myola* records on-site during the 2016 surveys (yellow dots) and 2017 surveys (green dots). Pink-rimmed dots show the location of females and tadpoles observed. All other dots were calling males.

The Kuranda Treefrog (*Litoria myola*)

(i) Litoria myola on-site:

Litoria myola were located in two areas on the site:

1. Owen & Haren Creek. A large population of *L. myola* extends from the NW corner of the site up Owen Ck, past the junction of Owen and Haren Creeks, and up each of Haren and Owen Creeks for some distance (Figs 2 & 3). The upper extent of breeding habitat on Haren Ck is the old weir (Fig. 3). The upper extent of breeding habitat on Owen Ck is probably where the most upstream *L. myola* male was detected in 2016 (because the creek habitat is unsuitable for a considerable distance upstream from this point) (Fig. 3). Downstream of this record there is a gap to the records near the Owen/Haren junction (Fig. 3). This is because as you travel downstream from that record the stream habitat is mostly long pools, and rocky riffles are rare. Suitable habitat (rocky riffle) becomes more regular and continuous as you approach the Owen/Haren junction, and *L. myola* is present through this habitat. Nonetheless, *L. myola* males likely disperse along this section of Owen Ck and females no doubt occur along this stretch. Therefore, this stretch of Owen Ck should be considered *L. myola* habitat and hence it is shaded in Figure 3.

2. Cain Ck. *Litoria myola* was found along Cain Ck (Figs 3 & 4). This population is lower density and significantly smaller than the Owen/Haren population. Nonetheless, the presence of calling adult males shows that this is a breeding population.

The majority of *Litoria myola* found were males. This is typical because males call from low rainforest vegetation along streams, which means they are readily detected under good conditions. Female *Litoria myola* are very hard to detect because they live up trees in the surrounding forest and avoid the streams unless they are visiting to breed. Females are usually only seen when they are gravid (i.e., carrying mature eggs) and visit the streams to choose a male, amplex, and lay their eggs. Only four females were found in the surveys: two in 2016 and two in 2017. These females were found along the streams: two were gravid and in amplexus, one was gravid but not in amplexus, and one was not carrying eggs (but may have just laid them). There wasn't sufficient time to survey the surrounding forest to search for females and, regardless, females are too hard to detect in the forest for such surveys to be productive.

Breeding can be assumed to occur wherever calling males are present. The majority of records in these surveys were of breeding males and this gives an accurate indication of where the breeding habitat is (Fig. 3). Females can be assumed to be present in the rainforest surrounding the areas where males are calling. Direct evidence of breeding was observed in the Owen/Haren population (marked as pink-rimmed records on Fig. 3). This consisted of the following records: two pairs in amplexus (with the female in each case being visibly gravid), a gravid female down low beside the stream, and probable *L. myola* tadpoles evident in a shallow stream pool. These four records were all in the vicinity of the Owen/Haren junction and just upstream on Haren Ck (Fig. 3).

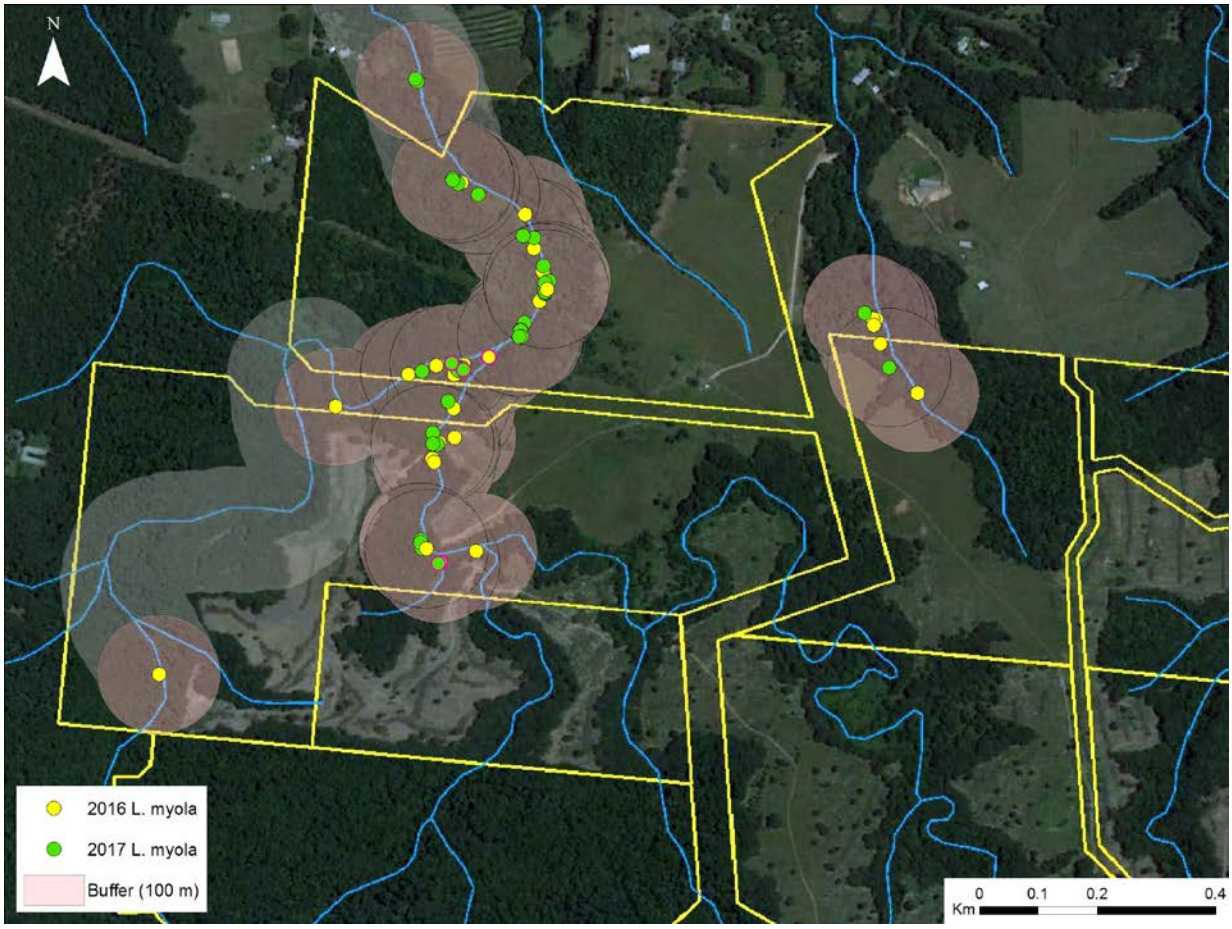

Figure 3. Detailed map of *Litoria myola* records on-site: 2016 records are yellow dots; 2017 records are green dots. Pink-rimmed dots show the location of females and tadpoles observed. All other dots were calling males. A 100 m radius buffer is shown around each record. Additionally, a 100 m width buffer (on each side of the creek) is shown along sections of creek that link *Litoria myola* records.

(ii) Litoria myola downstream of the site:

Surveys were conducted downstream of the Kur-World site on Owen Ck, Cain Ck and Warril Ck. *Litoria myola* were detected on all three of these creeks (Fig. 4). On Owen Ck, *L. myola* was detected fairly continuously from the site boundary all the way down to the Barron River. The surveys suggest that on Owen Ck about an equal number of *L. myola* occur on-site and downstream of the site (see estimates below). On Cain Ck, there is a small population on-site and just downstream of the site boundary, and then no *L. myola* were detected except two calling males near the confluence of Cain Ck and the Barron River (Fig. 4). No *L. myola* were detected on the upper sections of Warril Ck on-site. My previous surveys have also failed to find *L. myola* through the mid sections of Warril Ck. However, a high density population is present on lower Warril Ck, particularly between Myola Rd and the Barron River (Fig. 4). This stretch of Warril Ck from Myola Rd, under the rail-line, and to the Barron River is also where *Litoria dayi* occurs (see below; Fig. 5) and contains an important stand of the Myola Palm (*Archontophoenix myolensis*) (Fig. 6). This is therefore an extremely important site, with three Endangered species.

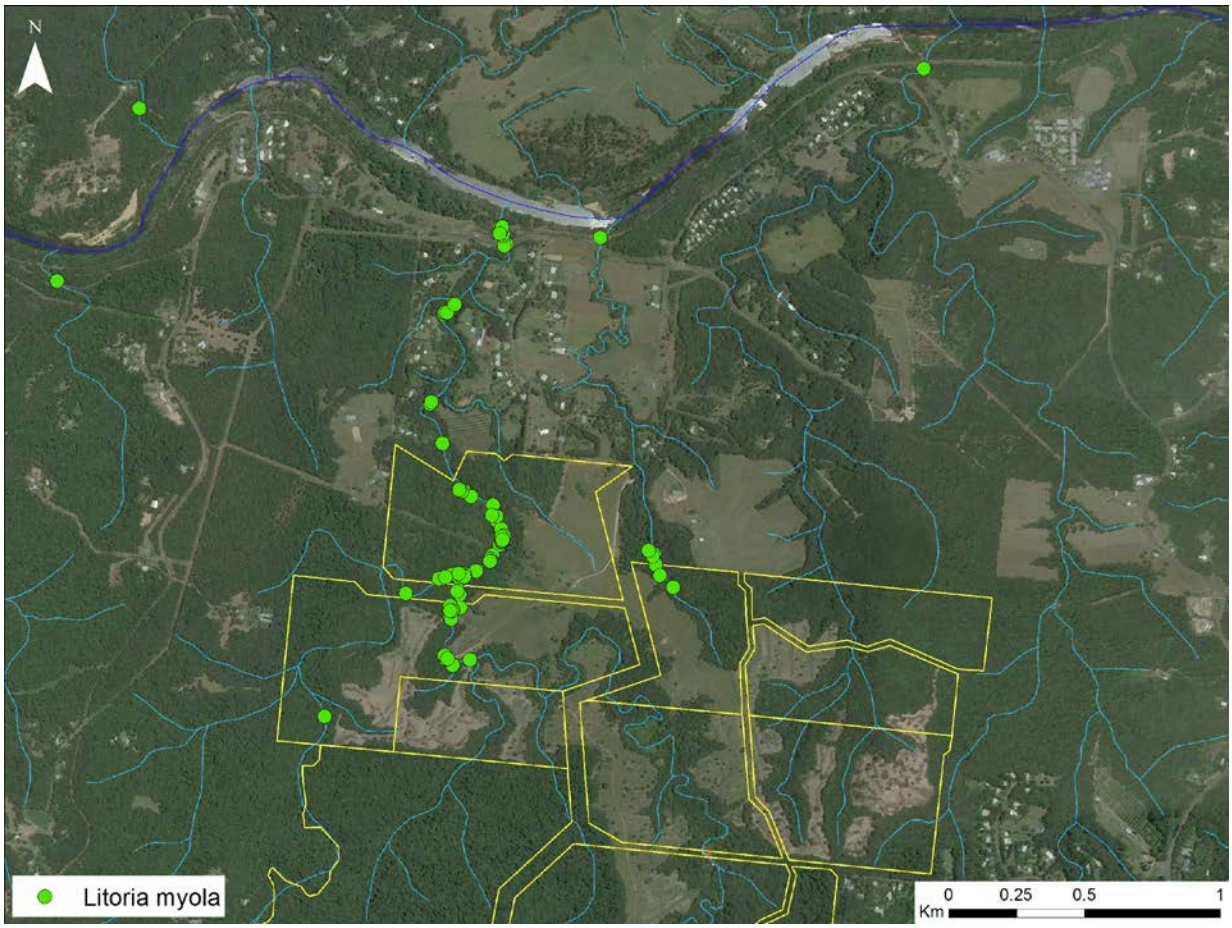

Figure 4. Map of all *Litoria myola* records on-site and downstream on Owen Ck, Cain Ck and Warril Ck. In this figure all records are green dots (both 2016 and 2017).

(iii) Contextualizing the Litoria myola populations on-site:

It is important to consider the Kur-World project in context of the total global distribution and population of *Litoria myola* (Fig. 5). This should be considered in terms of both the population on-site and also including the populations downstream of the site (i.e., all populations that could be impacted by this development). The surveys enabled estimation of occurrence and

density on-site and in downstream areas, and these can be placed in context of similar estimates from concurrent and previous surveys of other *L. myola* populations.

In order to work out the following estimates some basic assumptions were used. Repeated surveys of some sections of creek (including from Owen/Haren junction upstream to the Haren weir) revealed that surveys give fairly repeatable estimates of numbers of males. However, it is clear from long-term monitoring sites in the Kuranda area that estimates of male abundance peak under ideal conditions (several days after rain, hot weather, moderate to low stream flow). Given that surveys are rarely under the most optimal conditions (including the 2016 and 2017 surveys), estimates of the number of males were multiplied by 1.5. This accounts for males that weren't calling that night, males that went quiet when you walked through, and males that you missed by eye-shine. Once an estimate of adult males was derived for a population, this was doubled to give the total adult population (based on the assumption of a 50:50 sex ratio).

Based on the average density of male *L. myola* during the surveys along the stretches of creeks they occur, and using the assumptions above, I estimate the adult population on-site is approximately 65 frogs for the Owen/Haren population and approximately 5-10 adults for the Cain Ck population. This should be considered as a coarse estimate with approximate bounds of 50-100 breeding adult *L. myola* on-site.

Based on the survey down Owen Ck all the way to the Barron River (Fig. 4), I'd estimate an approximately equal number of *L. myola* adults downstream of the site on Owen Ck (i.e., approximately 65 adults). This gives a total Owen/Haren Ck population estimate of approximately 130 breeding adult *L. myola*, of which approximately half are on-site and half downstream of the site.

Only two male *L. myola* were detected downstream on Cain Ck and these were all the way down near the confluence with the Barron River (Fig. 4). The intervening habitat along Cain Ck consists of a very thin riparian strip through cleared land (Fig. 4), a strip that is too narrow to support *L. myola* (in particular, due to the lack of surrounding rainforest habitat for females and subadults). The only two areas of suitable habitat are: on-site to just downstream of the site boundary, and then down near the Barron R where frogs can utilize an extensive area of forest between the Myola/Oak Forest Rd, the railway-line and the Barron River (Fig. 4). Based on the handful of males found on-site on Cain Ck, several heard just downstream of the site, and the two near the Barron, I'd estimate an adult population on Cain Ck of about 10-15. Most of these frogs are on-site or just over the boundary downstream to Barnwell Rd.

Although no *L. myola* were found on Warril Ck on-site, a localized but high-density population breeds in lower Warril Ck (Figs 4 & 5). Most *L. myola* on Warril Ck occur from Myola Rd down to the Barron River, although some also occur upstream from Myola Rd for some distance. Based on surveys of this stretch of Warril Ck during this survey period, and using the assumptions above, I'd estimate the adult population of *L. myola* on Warril Ck to be approximately 200 individuals, all of which occur on lower Warril Ck (Figs 4 & 5).

Putting this all in context of the approximately 10 breeding populations that comprise the total known global distribution/population of *L. myola* (Fig. 5), the Jumrum Ck population is the largest (estimated at 300 adults, potentially more), the Warril Ck population is second largest (approx. 200 adults), the Owen Ck population is third largest (approx.130 adults), and the remaining sites have smaller populations, generally in the order of < 50 adults and some probably < 20 adults. I'd coarsely estimate a current total adult *L. myola* population size of approximately 750 individuals. Therefore, the estimate of approximately 75 adults on-site represents potentially 10% of the total adult population of this species. And if you consider all

sites that could be potentially impacted by this development (i.e., including downstream areas of Owen Ck, Cain Ck, and Warril Ck), the estimate would be approximately 50% of the total adult population of this species.

Summary list of breeding adult population estimates (see above for detail):
Owen/Haren Ck population on-site: 65
Owen Ck downstream of the site: 65
Cain Ck on-site: 5-10
Cain Ck downstream of the site: 5-10
Warril Ck downstream of the site: 200
Jumrum Ck: 300
Litoria myola breeding adult population on-site: 75 (50-100)
Total global *L. myola* breeding adult population: 750

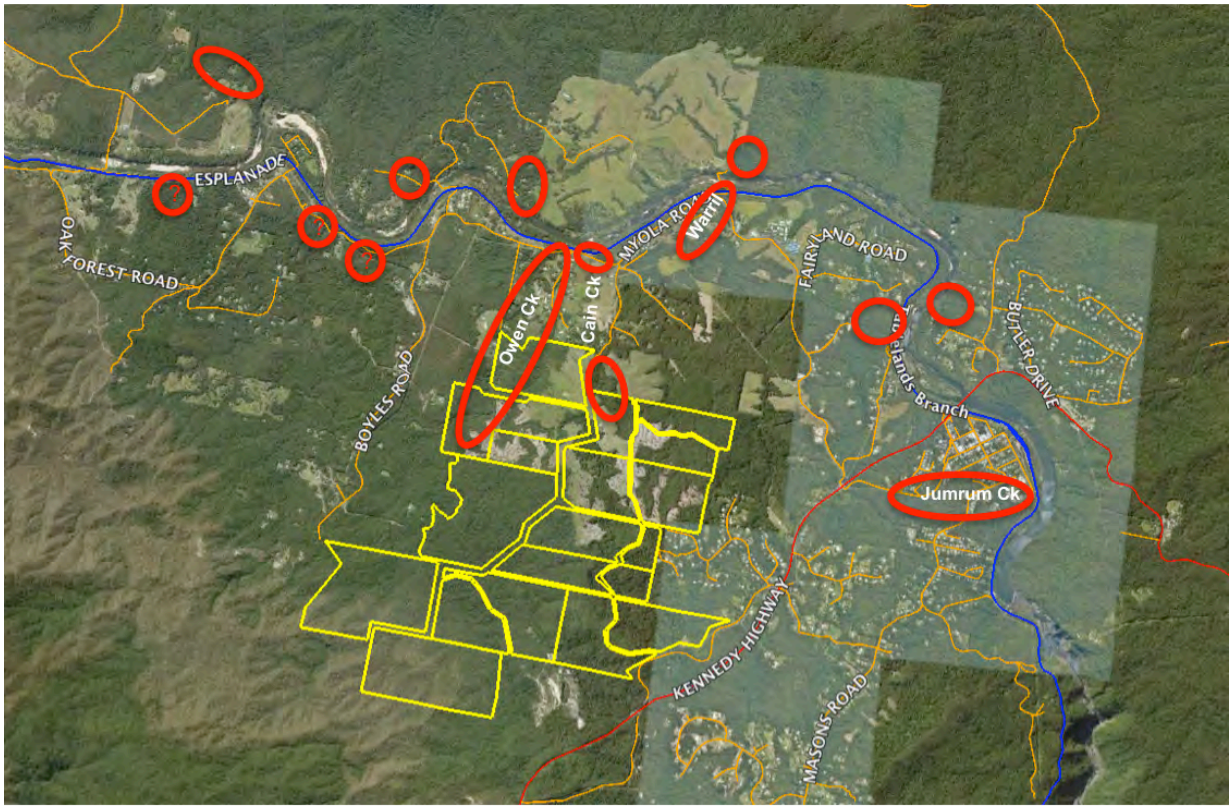

Figure 5. Map of Kuranda region showing approximate location of all known *Litoria myola* breeding populations (red ellipses). Populations referred to in the text are labeled: Owen Ck, Cain Ck, Warril Ck, Jumrum Ck. Three populations are marked with a question mark because their continued existence is not known. The property boundaries associated with the proposed Kur-World site are shown in yellow.

(iv) Comparing Litoria myola distribution and abundance between 2016 & 2017 surveys:

Litoria myola was found in similar areas in 2016 and 2017 (Figs 2 & 3). This suggests we have a good handle on the distribution on-site. Figure 3 would suggest one notable exception, being the upstream Owen Ck record in 2016 and lack of similar records in 2017. However, this area was not resurveyed in 2017 (see Figures 1a and 1b for survey effort for 2016 and 2017). *Litoria myola* is highly likely to still occur at that point on Owen Ck and to utilize Owen Ck and surrounding forest from there down to the higher density records near Owen/Haren junction (as shaded in Figure 3).

The surveys were not set up to accurately assess density change between 2016 and 2017, and comparing density over short periods is complicated for frogs due to weather and stream conditions at the time of survey (long-term surveys are required for frogs). However, the survey technique was the same and the weather and stream conditions similar enough to comment on broad similarities and differences between the two sets of surveys. Density of calling male *L. myola* (and of its ecologically similar sister species *L. serrata*) was similar around Owen/Haren junction and down Owen Ck to the boundary of the site. However, density of both *L. myola* and *L. serrata* was noticeably lower upstream on Haren Ck, from the '1st Haren crossing' (the road crossing just upstream from the Owen/Haren junction) up to the old weir on Haren Ck. Figure 3 doesn't convey this because I put a lot more effort in on this stretch in the 2017 surveys than the 2016 surveys, and the figure doesn't show *L. serrata* records. However, what had been a moderate density stretch in the 2016 surveys (mostly *L. serrata* and some *L. myola*) was a low density stretch in the 2017 surveys.

Other Endangered frogs (*L. dayi* and *L. rheocola*)

Two other Endangered rainforest, stream-breeding frogs are present in the Kuranda area. These are *Litoria dayi* and *Litoria rheocola*. Both these species declined from the late 1980s due to an introduced fungul disease ('chytrid'). *Litoria rheocola* occurs at one site just to the east of Kuranda and *L. dayi* occurs at scattered sites along the Barron River and associated creeks upstream from Kuranda. Habitat on-site was not deemed suitable for *L. rheocola* but sections of Owen, Haren and Warril Creeks were deemed potentially suitable for *L. dayi*. Targeted surveys along these stretches did not reveal any *L. dayi* on-site. However, a breeding population of *L. dayi* occurs on lower Warril Ck, downstream of the site (Fig. 6). On-going collaborative surveys with the community group Kuranda Envirocare reveal that this population is locally significant and appears to be increasing in abundance.

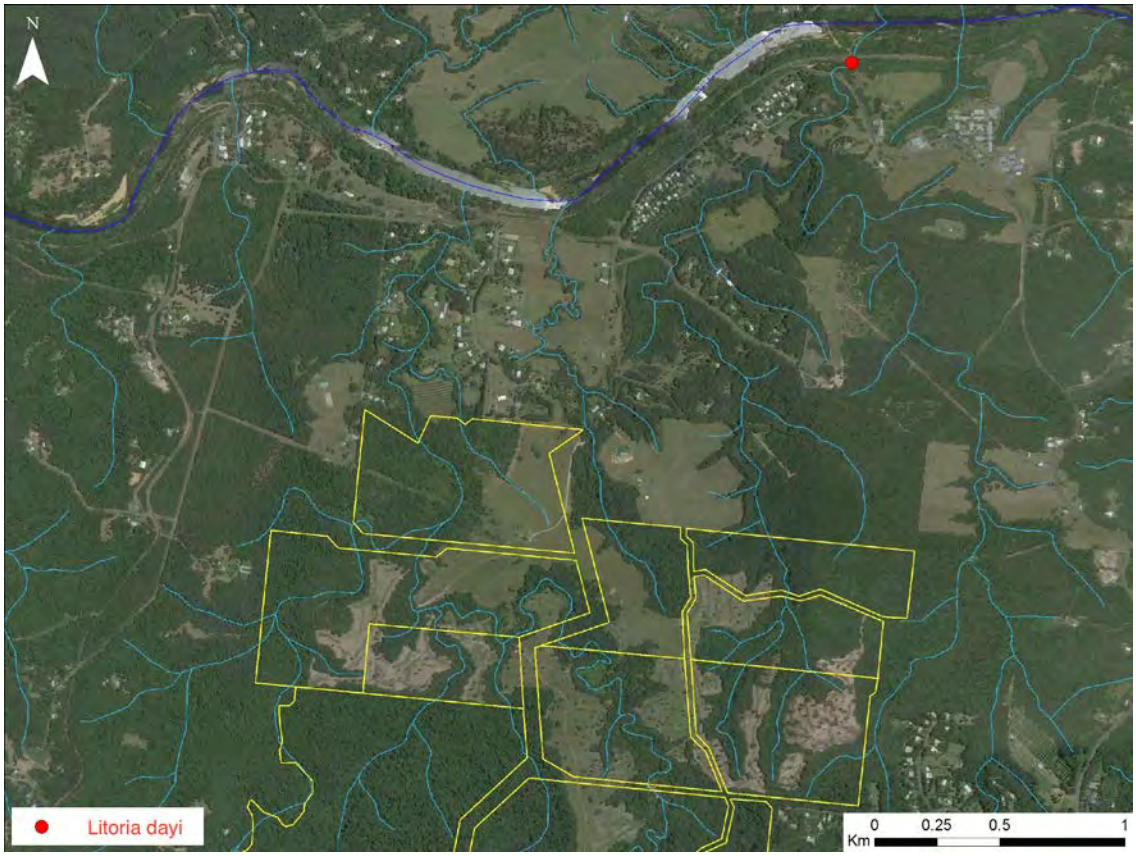

Figure 6. Map of *Litoria dayi* record (red dot) downstream of the site on Warril Ck.

Archontophoenix palms

More records of *Archontophoenix* palms were accumulated during the 2017 surveys. These palms occur widely across the site, particularly on the creeks and gullies on the northern half of the site, including Owen Ck, Haren Ck, Cain Ck, the un-named creek below the dam, and upper Warril Ck (Fig. 7). All palms encountered on-site were immature but significant stands of mature palms (including flowering) were found downstream on Owen Ck and are known from lower Warril Ck (Fig. 7). As sated previously, the palms on-site and downstream on Owen Ck are assumed to be *Archontophoenix myolensis* (due to very close proximity to known stands of this species) but need expert identification. It is interesting to note that the palms located on-site were all immature (i.e., of fairly small size). I believe this reflects slow recolonization of the creeks by this species following extensive historic clearing in this area. Upstream recolonization by this species may be fairly slow as it is reliant on bird dispersal.

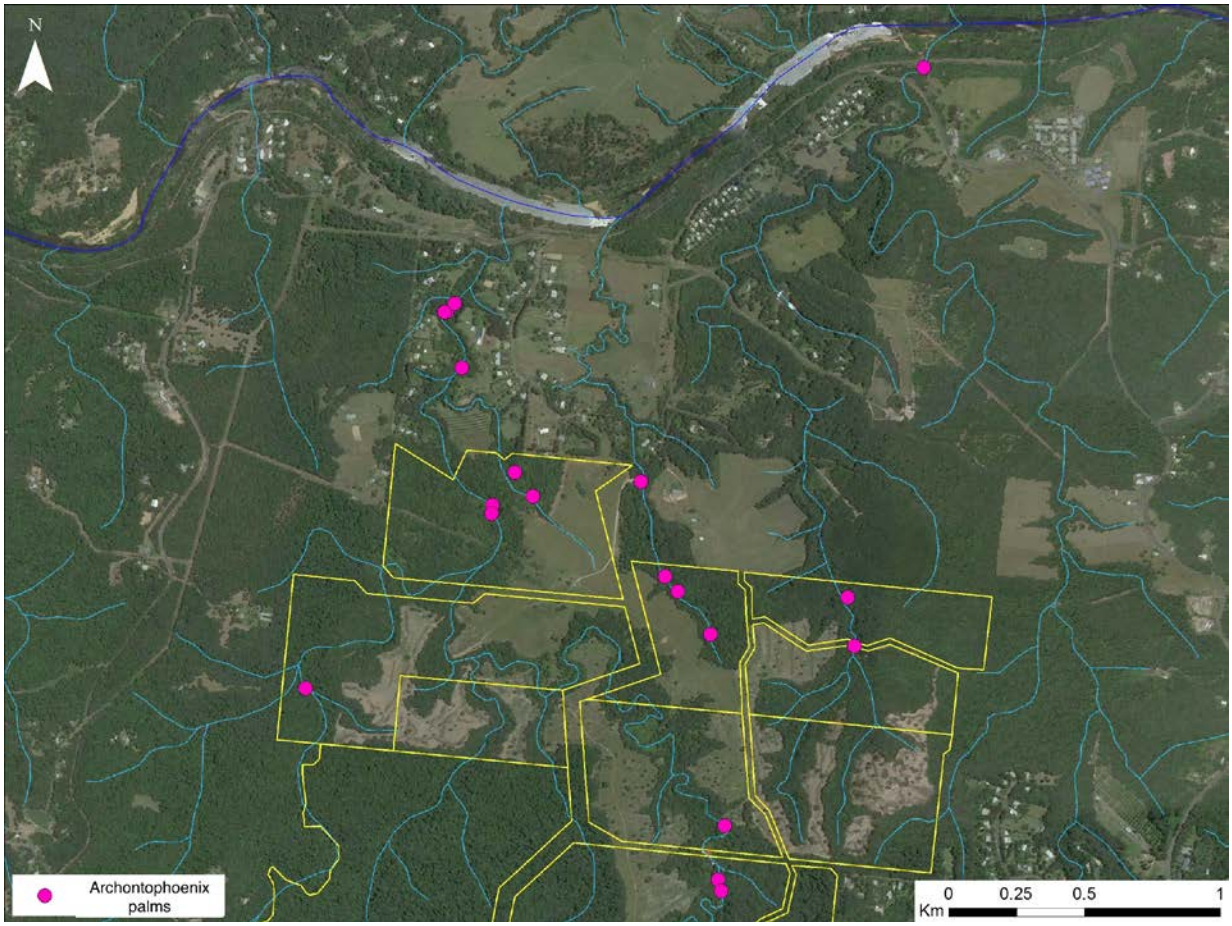

Figure 7. Map of all *Archontophoenix* records (pink dots) on-site and downstream on Owen Ck, Cain Ck and Warril Ck.

Potential impacts of development on *Litoria myola*

The Kuranda Treefrog (*Litoria myola*) requires flowing rainforest streams for breeding and significant areas of adjacent rainforest (particularly for females). Key potential impacts include:

(i) Changes in stream flow,
(ii) Changes water quality,
(iii) Increased sedimentation input into streams,
(iv) Loss of rainforest (particularly within 100 m of streams),
(v) Changes in creek structure, and
(vi) Invasive species (particularly introduced fish and ants).

These impacts can occur directly in *L. myola* habitat, or a breeding population can be impacted due to these impacts occurring upstream in the catchment.

(i) Changes in Stream flow

Litoria myola only breeds in flowing water. Bigger streams generally have bigger populations (Jumrum Ck, Warril Ck, Owen Ck) than small streams, and this is probably because there is more breeding habitat on larger creeks and the breeding season is longer on creeks that flow all year. Streams flow well following wet season rainfall but then continue to flow through much or all of the long dry season. This flow is dependent on continual input of water from the catchment ground water. This constant seepage occurs from the earth and is particularly evident on some gullies that are 'spring fed'. Natural catchments are characterized by water gradually entering the creeks and hence creek flow remains similar over long periods (months), even without rain. This is the case for creeks like Owen, Haren, Cain and Warril.

Hard surfaces and drainage

Development and human activities can impact stream flow in a number of key ways. Rain falling onto rainforest enters the stream gradually due to the effect of the forest, leaf litter and complex fine-scale ground structure slowing water flow off the land surface, and due to a considerable portion of the rain entering the porous soil. In contrast, human modified landscapes have the effect of sending water rapidly off the land surface and into streams. This is due to clearing of the forest, simplification, smoothing and hardening of the land surface, coverage of significant areas by impermeable surfaces (roofs, concrete, roads, etc), and engineering to rapidly move water off built landscapes (hard surface sloping, gutters, storm water drains, etc.). Ultimately, the effect on creeks, in terms of flow, is that they receive very high flow during and immediately following rainfall and less flow over longer periods following rainfall (i.e., water pulses through the system rather than gradually percolating through). This will potentially impact *L. myola* through creek flushing and then a shortened period of stream flow for breeding.

This impact is equally pertinent to *L. myola* breeding populations on-site and those downstream on Owen, Cain and Warril Creeks.

Bores, ground water pumping, and pumping from creeks

A development like Kur-World would need large amounts of water and there will presumably be plans to obtain some of that from on-site sources. Pumping directly from creeks will likely impact *L. myola* by shortening the period over which the creek flows. Equally, sinking bores to pump ground water may have significant impacts on *L. myola* if the ground water is linked to

the creeks. This is almost certainly the case on-site, where creek flow through the dry season is dependent on water percolating out of the earth as seepage and springs. As for pumping directly from the creek, any reduction in stream flow quantity and duration will likely impact *L. myola*.

This impact is equally pertinent to *L. myola* breeding populations on-site and those downstream on Owen, Cain and Warril Creeks.

Dams

Dams can significantly impact water flow on creeks, particularly small creeks like those on-site, because they lock up water that should flow downstream and hence effectively reduce the size of the catchment area. Additionally, there are potentially significant impacts of downstream sedimentation from dam construction and erosion of dam walls (covered below), and impacts from invasive species that are introduced to dams (fish, which are predators of frog eggs and tadpoles) or utilize dams (toads, which don't breed in flowing streams but thrive and breed around dams).

This impact is equally pertinent to *L. myola* breeding populations on-site and those downstream on Owen, Cain and Warril Creeks. There is a significant current issue with erosion from a dam on-site (covered in Sedimentation section below).

A weir is present on Haren Ck and has likely been in place for decades. This weir marks the upstream extent of *L. myola* records on Haren Ck, and upstream of the weir wall water backs up for a considerable distance. This dammed section of Haren Ck contains considerable amounts of sludgy organic matter that has accumulated over many years. However, this sits undisturbed in the weir and stream flow continues through the weir and out of an outlet on the weir wall. This flow appears to continue all year, maintaining flow to *L. myola* breeding habitat downstream. In my opinion, removal of the weir would be more detrimental to *L. myola* than leaving it in place because it would send large quantities of organic matter (and potentially sediment) downstream into important *L. myola* breeding habitat. This will affect stream structure and ecology. Any attempts to remove this organic matter from the weir would also potentially have negative impacts on *L. myola* because organic matter and sediment would be mobilized in the process and downstream water quality would be impacted. A consideration would then be to stop water flow from the weir during removal of material; however, this would impact *L. myola* by reducing or stopping downstream water flow for some period, and would once again likely impact downstream water quality once flow resumes. In my opinion, this material should be left 'locked up' in the weir because any disturbance could significantly impact *L. myola* downstream.

(ii) Changes in water quality

Litoria myola breeds in small rainforest streams/creeks. Rainforest streams generally have clear, cool water that is also low in pollutants. Development can impact water quality through changes in nutrient input (e.g., fertilizers, pet or farm animal waste, eroded soil and sediment) and the in-flow of chemicals (e.g., petrol, oil, detergent, chlorine, mold remover, insect poisons, herbicides, paint, emptying of swimming pool water).

These impacts can come from any human activities but are magnified by several key land uses, including urban development, farms and equestrian activities, and golf courses. All of these land uses involve high nutrient and chemical inputs on the land and these will readily wash into gutters, storm water drains, gullies, and ultimately into the creeks. Nutrient and chemical input

into creeks impact key parameters of water quality and general creek ecology, both of which will impact *L. myola*.

Dams also impact water quality because they typically have higher water temperature, lower dissolved oxygen levels, and higher nutrient levels than natural creek water. Therefore, water flowing out of dams will impact downstream creek water quality. This appears to be the case for water flowing downstream from the dam on upper Haren Ck upstream of the site at 'Billabong/KangaVenture'.

Water quality impacts are equally pertinent to *L. myola* breeding populations on-site and those downstream on Owen, Cain and Warril Creeks.

(iii) Increased sedimentation input into streams

Sedimentation is a key impact on creeks and *Litoria myola*. Development increases sediment input into creeks, both during the construction phase and afterwards. Sediment settles in creeks and fills in the creek structure. Severe sedimentation can completely cover streambeds to the point where the water is no longer evident on the surface (except after heavy rain). Even light to moderate sediment input can be enough to cover the shallow riffle zones where *L. myola* breeds. Additionally, fine sediment impacts stream ecology because it covers the rock surfaces and leaf-litter on bottom of the stream, where *L. myola* tadpoles feed, and because it decreases water clarity.

There is a severe issue on-site in regards to erosion from the dam wall near the entrance and homestead. This sediment has been deposited down the unnamed gully/creek below the dam and all the way to down into Owen Ck, and down to the Barron River. This sedimentation has completely filled in the gully/creek below the dam for hundreds of meters to well past the site boundary and into the downstream neighbouring properties. The natural gully/creek is buried below the sediment and no water is evident on the surface. This creek was not surveyed prior to dam construction, so it is not possible to know whether *L. myola* previously occurred on this gully/creek. However, it should be noted that *L. myola* extends south of this point on both adjacent creeks (Owen Ck and Cain Ck), so there is reason to believe it may have used this creek and surrounding rainforest.

Further to this issue, the sediment from this dam construction and subsequent dam erosion has sent large quantities of sediment all the way down the Owen Ck system. In the last year this sediment has become evident at the mouth of Owen Ck, about 1.5 km streamline distance downstream of the dam. This sediment has built up in Owen Ck between the Myola/Oak Forest Rd bridge and the Barron R as banks that now have invasive grass growing on them. This has altered a key breeding area for *L. myola*. What was formerly ideal shallow rocky riffle habitat is now covered in places and banked up into deeper sections. Invasive *Tilapia* were observed in these deeper sections and these fish will prey on *L. myola* eggs and tadpoles. This sediment is unlikely to shift naturally with stream flushing during heavy flow because the Barron River rises and backs up through this downstream section during these periods (hence reducing stream velocity and causing the deposition of sediment). The huge quantities of sediment currently in the Owen Ck catchment due to the dam issue will be having significant effects on *L. myola*.

Other current sediment issues come from land clearing and road construction. Clearing has exposed slopes and sediment run-off is evident during rain. Significant issues with sediment run-off has also been observed down the dirt roads and creek crossings on-site during rain, and

fine sediment has entered the creeks through the *L. myola* breeding areas on Haren and Owen Creeks. This fine sediment will likely impact *L. myola* and stream ecology more broadly.

(iv) Loss of rainforest (particularly within 100 m of streams)

Litoria myola requires rainforest around creeks, with females using rainforest out to at least 100 m from streams, and no doubt further. Rainforest clearing on-site in the last couple of years has included areas cleared well within 100 m of sections of stream on which *L. myola* breeds. This is particularly the case on Haren and Owen Creeks upstream from the Owen/Haren junction (Fig. 3). This clearing would have directly impacted *L. myola* when it occurred and will have continued to impact *L. myola* since. It was stated above that *L. myola* and the ecologically similar species *L. serrata* were observed to be less abundant on Haren Ck upstream of the Owen/Haren junction in the 2017 surveys compared to the 2016 surveys. The most likely reason for this is that habitat suitability along this stretch was impacted by clearing and this impact has steadily played out on *L. myola* abundance through time such that it is more evident in 2017 than 2016. Future clearing on-site, particularly within 100 m of *L. myola* creek sections would further impact the species.

(v) Changes in creek structure

Litoria myola requires shallow riffle areas to breed. Any changes to creek structure that impact these riffle areas will likely impact the species. As covered above, sedimentation is a key impact in this regard. Another impact is changes in water flow. As covered above, water tends to pulse off cleared and developed areas and can scour creeks where it enters at high velocity from storm water drains, or where it flows out of concrete pipes and causeways in creeks. Changes in creek structure can also occur where roads are constructed through creeks. This can impact shallow riffle sections where roads directly cross. Roads through creeks also often have the effect of damming creeks due to material piled into the creek with insufficient flow through it. Road crossings can have negative impacts to creeks both upstream and downstream of the road crossing.

Some of these issues are evident on-site and downstream. Sedimentation has impacted creek structure on-site and downstream at a *L. myola* breeding site. Two road crossings have been constructed through Haren Creek in *L. myola* habitat. Issues regarding creek structure impacts are also pertinent to future development considerations.

(vi) Invasive species (particularly introduced fish and ants).

The impact of invasive species on *L. myola* is not resolved. However, based on the ecology of *L. myola* and the invasive species, and based on impacts demonstrated in other species, several invasive species should be considered a potential threat to the species. Many invasive fish will eat frog eggs and tadpoles and hence the introduction of these into the *L. myola* streams poses a threat. Introduction can occur from dams stocked with fish that are washed downstream in heavy rain, and also commonly occurs around urban areas when pet fish are released down drains or directly into nearby creeks and establish wild populations. Another potential threat is yellow crazy ants. This invasive species is currently present south of Cairns and at Russet Park, just north of the site. Yellow crazy ant introduction occurs via humans (e.g., in soil and landscape supplies, on machinery, and when people move pot plants) and development and urban activities pose a risk of introduction. The ant poses a risk to *L. myola* both directly and indirectly through competition for small vertebrate food.

Recommendations

No further clearing within 100 m of the creek along the stretches of creeks identified as *Litoria myola* habitat.

Replanting and rehabilitation of rainforest in areas cleared within 100 m of the creek along the stretches of creeks identified as *Litoria myola* habitat.

Preservation of rainforest from the 100 m buffer on Owen Ck to the western boundary of the site (i.e., the western area of plot 22N157227 and north-western area of plot 2RP703984). In conjunction with the 100 m buffers, this will add two areas of rainforest as additional habitat for *Litoria myola*.

Removal and rehabilitation of the road crossing on Haren Ck just above the Owen/Haren junction.

Recognition of the severe sediment issue down the gully/creek below the dam and down Owen Ck to the Barron River. Removal of this sediment and rehabilitation of affected areas, including the *L. myola* breeding site between the Myola/Oak Forest Rd and the railway bridge.

Assessment of the dam in reference to continued and potential future sedimentation and stream flow issues.

Urgent assessment and mitigation of all sources of sediment on-site, including run-off from cleared areas and roads, and issues around road crossings.

Detailed consideration of all potential impacts on *Litoria myola* raised above, both in terms of potential impacts on-site and to downstream populations. This involves detailed assessment of potential impacts to water flow, water quality, sedimentation, rainforest clearing, impacts to creek structure, and invasive species.

Expert assessment of the link between ground water and stream flow on-site, and the potential impacts of sinking and pumping from bores on stream flow for *Litoria myola* breeding.

Resolve the identity of the *Archontophoenix* palms on-site. If these can't be resolved (because they are immature) then assume they are the endangered species, *Archontophoenix myolensis*, based on the proximity to known stands. Assess current and potential impacts on this Endangered species, both on-site and downstream.

Recognize potential impacts to Endangered species well downstream of the site, including the *Litoria myola* and *Archontophoenix* palm populations on lower Owen Ck, and the breeding populations of three Endangered species on lower Warril Ck (*Litoria myola*, *Litoria dayi*, and *Archontophoenix myolensis*). This is relevant to all on-site activities that may impact stream flow, water quality, and sedimentation.

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List of tables, figures & data files provided

Appendix 1. Vertebrate species recorded on-site during 2016 & 2017 surveys.

Figure 1a. Map of survey effort on-site during the 2016 surveys. White dots reflect movements and effort.

Figure 1b. Map of survey effort on-site during the 2017 surveys. Orange dots reflect movements and effort.

Figure 2. Map of *Litoria myola* records on-site during the 2016 surveys (yellow dots) and 2017 surveys (green dots). Pink-rimmed dots show the location of females and tadpoles observed. All other dots were calling males.

Figure 3. Detailed map of *Litoria myola* records on-site: 2016 records are yellow dots; 2017 records are green dots. Pink-rimmed dots show the location of females and tadpoles observed. All other dots were calling males. A 100 m radius buffer is shown around each record. Additionally, a 100 m width buffer (on each side of the creek) is shown along sections of creek that link *Litoria myola* records.

Figure 4. Map of all *Litoria myola* records on-site and downstream on Owen Ck, Cain Ck and Warril Ck. In this figure all records are green dots (both 2016 and 2017).

Figure 5. Map of Kuranda region showing approximate location of all known *Litoria myola* breeding populations (red ellipses). Populations referred to in the text are labeled: Owen Ck, Cain Ck, Warril Ck, Jumrum Ck. Three populations are marked with a question mark because their continued existence is not known. The property boundaries associated with the proposed Kurworld site are shown in yellow.

Figure 6. Map of *Litoria dayi* record (red dot) downstream of the site on Warril Ck.

Figure 7. Map of all *Archontophoenix* records (pink dots) on-site and downstream on Owen Ck, Cain Ck and Warril Ck.

Electronic file 1. File 1_2017 KurWorld GPS records.xlsx

Electronic file 2. File 2_2016 & 2017 Litoria myola data.xlsx

Electronic file 3. File 3_2016 & 2017 palm data.xlsx

Electronic file 4. File 4_KurWorld vertebrate records_2016&2017_Conrad Hokin.xlsx

Appendix 1. Vertebrate species recorded on-site during the 2016 & 2017 surveys

Group	Scientific name	Common name	
Frogs	*Austrochaperina pluvialis*	rain whistling-frog	rainforest species
Frogs	*Cophixalus ornatus*	northern ornate nursery-frog	rainforest species
Frogs	*Limnodynastes peronii*	striped marsh frog	open forest species
Frogs	*Litoria caerulea*	Green tree frog	open forest species
Frogs	*Litoria fallax*	Eastern sedge frog	open forest species
Frogs	*Litoria gracilenta*	graceful tree frog	open forest species
Frogs	*Litoria infrafrenata*	white-lipped tree frog	open forest species
Frogs	*Litoria jungguy*	northern stony creek frog	rainforest species
Frogs	*Litoria myola*	Kuranda tree frog	rainforest species
Frogs	*Litoria rothii*	northern laughing tree frog	open forest species
Frogs	*Litoria serrata*	green-eyed tree frog	rainforest species
Frogs	*Litoria xanthomera*	orange-thighed tree frog	rainforest species
Frogs	*Mixophyes coggeri*	Cogger's barred frog	rainforest species
Frogs	*Rana daemeli*	wood frog	rainforest species
Frogs	*Rhinella marina*	Cane toad	open forest species
Reptiles	*Carlia rubrigularis*	red-throated rainbow-skink	
Reptiles	*Cyclodomorphus gerrardii*	pink-tongue skink	
Reptiles	*Hypsilurus boydii*	Boyd's forest dragon	
Reptiles	*Lampropholis coggeri*	rainforest sunskink	
Reptiles	*Physignathus lesueurii*	eastern water dragon	
Reptiles	*Ramphotyphlops polygrammicus*	north-eastern blind snake	
Reptiles	*Saltuarius cornutus*	northern leaf-tailed gecko	
Reptiles	*Saproscincus basiliscus*	pale-lipped shadeskink	
Reptiles	*Saproscincus tetradactylus*	four-fingered shadeskink	
Reptiles	*Stegonotus cucullatus*	slaty-grey snake	
Reptiles	*Wollumbinia latisternum*	saw-shelled turtle	
Birds	*Ailuroedus melanotis*	Spotted Catbird	
Birds	*Alectura lathami*	Australian Brush-turkey	
Birds	*Alisterus scapularis*	Australian King-Parrot	
Birds	*Anthus novaeseelandiae*	Australasian Pipit	
Birds	*Burhinus grallarius*	Bush Stone-curlew	
Birds	*Cacatua galerita*	Sulphur-crested Cockatoo	
Birds	*Cacomantis variolosus*	Brush Cuckoo	
Birds	*Caprimulgus macrurus*	Large-tailed Nightjar	
Birds	*Centropus phasianinus*	Pheasant Coucal	
Birds	*Ceyx pusilla*	Little Kingfisher	
Birds	*Chalcophaps indica*	Emerald Dove	
Birds	*Cisticola exilis*	Golden-headed Cisticola	
Birds	*Colluricincla megarhyncha*	Little Shrike-thrush	
Birds	*Coracina lineata*	Barred Cuckoo-shrike	
Birds	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	
Birds	*Coracina tenuirostris*	Cicadabird	
Birds	*Cracticus quoyi*	Black Butcherbird	

Birds	*Cyclopsitta diophthalma*	Double-eyed Fig-Parrot
Birds	*Dendrocygna eytoni*	Plumed Whistling-Duck
Birds	*Eurystomus orientalis*	Dollarbird
Birds	*Geopelia humeralis*	Bar-shouldered Dove
Birds	*Geopelia striata*	Peaceful Dove
Birds	*Gerygone mouki*	Brown Gerygone
Birds	*Haliaeetus leucogaster*	White-bellied Sea-Eagle
Birds	*Hirundo neoxena*	Welcome Swallow
Birds	*Megapodius reinwardt*	Orange-footed Scrubfowl
Birds	*Meliphaga gracilis*	Graceful Honeyeater
Birds	*Meliphaga notata*	Yellow-spotted Honeyeater
Birds	*Neochmia temporalis*	Red-browed Finch
Birds	*Ninox connivens*	Barking Owl
Birds	*Ninox rufa*	Rufous Owl
Birds	*Ninox novaeseelandiae*	Southern Boobook
Birds	*Pachycephala simplex*	Grey Whistler
Birds	*Philemon buceroides*	Helmeted Friarbird
Birds	*Pitta versicolor*	Noisy Pitta
Birds	*Podargus papuensis*	Papuan Frogmouth
Birds	*Ptilinopus magnificus*	Wompoo Fruit-Dove
Birds	*Ptilinopus superbus*	Superb Fruit-Dove
Birds	*Sericornis magnirostra*	Large-billed Scrubwren
Birds	*Sphecotheres vieilloti*	Australasian Figbird
Birds	*Symposiarchus trivirgatus*	Spectacled Monarch
Birds	*Tanysiptera sylvia*	Buff-breasted Paradise-Kingfisher
Birds	*Todiramphus macleayii*	Forest Kingfisher
Birds	*Trichoglossus haematodus*	Rainbow Lorikeet
Birds	*Turnix maculosus*	Red-backed Button-quail
Birds	*Tyto tenebricosa*	Sooty Owl
Birds	*Vanellus miles*	Masked Lapwing
Birds	*Xanthotis macleayanus*	Macleay's Honeyeater
Mammals	*Dactylopsila trivirgata*	Striped possum
Mammals	*Melomys cervinipes*	Fawn-footed Melomys
Mammals	*Nyctimene robinsoni*	eastern tube-nosed bat
Mammals	*Perameles nasuta*	Long-nosed Bandicoot
Mammals	*Petaurus breviceps*	Sugar Glider
Mammals	*Pogonomys mollipilosus*	prehensile-tailed rat
Mammals	*Pteropus conspicillatus*	spectacled flying-fox
Mammals	*Uromys caudimaculatus*	Giant White-tailed Rat

Appendix H:
Wildlife Online and Atlas of Living Australia Fauna Database Search Results

Wildlife Online and Atlas of Living Australia Fauna Database Search Results

Class	Family	Scientific Name	Common Name	I	Q	A	WO Count	ALA Count
Amphibians	Bufonidae	*Rhinella marina*	Cane Toad	Y			1	1
Amphibians	Hylidae	*Cyclorana alboguttata*	Greenstripe Frog		C		1	0
Amphibians	Hylidae	*Litoria bicolor*	Northern Sedgefrog		C		1	1
Amphibians	Hylidae	*Litoria caerulea*	Common Green Treefrog		C		1	1
Amphibians	Hylidae	*Litoria dayi*	Australian Lacelid		E	E	1	1
Amphibians	Hylidae	*Litoria eucnemis*	Growling Green Eyed Frog		C		0	1
Amphibians	Hylidae	*Litoria fallax*	Eastern Sedgefrog		C		1	1
Amphibians	Hylidae	*Litoria gracilenta*	Graceful Treefrog		C		1	1
Amphibians	Hylidae	*Litoria inermis*	Bumpy Rocketfrog		C		1	1
Amphibians	Hylidae	*Litoria infrafrenata*	White Lipped Treefrog		C		1	1
Amphibians	Hylidae	*Litoria jungguy*	Northern Stony Creek Frog		C		1	1
Amphibians	Hylidae	*Litoria latopalmata*	Broad Palmed Rocketfrog		C		1	1
Amphibians	Hylidae	*Litoria lesueuri sensu lato*	Stony Creek Frog		C		1	1
Amphibians	Hylidae	*Litoria microbelos*	Javelin Frog		C		1	1
Amphibians	Hylidae	*Litoria myola*	Kuranda Treefrog		E	E	1	1
Amphibians	Hylidae	*Litoria nannotis*	Waterfall Frog		E	E	1	1
Amphibians	Hylidae	*Litoria nasuta*	Striped Rocketfrog		C		1	1
Amphibians	Hylidae	*Litoria nigrofrenata*	Tawny Rocketfrog		C		1	1
Amphibians	Hylidae	*Litoria nyakalensis*	Mountain Mistfrog		E	CE	1	1
Amphibians	Hylidae	*Litoria rheocola*	Common Mistfrog		E	E	1	1
Amphibians	Hylidae	*Litoria rothii*	Northern Laughing Treefrog		C		1	1
Amphibians	Hylidae	*Litoria rubella*	Ruddy Treefrog		C		1	1
Amphibians	Hylidae	*Litoria serrata*	Tapping Green Eyed Frog		V		1	1
Amphibians	Hylidae	*Litoria wilcoxii*	Eastern Stony Creek Frog		C		1	1
Amphibians	Hylidae	*Litoria xanthomera*	Orange Thighed Treefrog		C		1	1
Amphibians	Limnodynastidae	*Limnodynastes convexiusculus*	Marbled Frog		C		1	1
Amphibians	Limnodynastidae	*Limnodynastes peronii*	Striped Marshfrog		C		1	1
Amphibians	Limnodynastidae	*Limnodynastes terraereginae*	Scarlet Sided Pobblebonk		C		1	1
Amphibians	Limnodynastidae	*Platyplectrum ornatum*	Ornate Burrowing Frog		C		1	1
Amphibians	Microhylidae	*Austrochaperina fryi*	Peeping Whistlefrog		C		1	1
Amphibians	Microhylidae	*Austrochaperina pluvialis*	White Browed Whistlefrog		C		1	1
Amphibians	Microhylidae	*Austrochaperina robusta*	Robust Whistlefrog		C		1	1
Amphibians	Microhylidae	*Cophixalus infacetus*	Creaking Nurseryfrog		C		0	1
Amphibians	Microhylidae	*Cophixalus ornatus*	Northern Ornate Nursery-frog		C		1	1
Amphibians	Myobatrachidae	*Crinia deserticola*	Chirping Froglet		C		1	1
Amphibians	Myobatrachidae	*Crinia remota*	Northern Froglet		C		0	1
Amphibians	Myobatrachidae	*Mixophyes coggeri*	Mottled Barred Frog		C		1	1
Amphibians	Myobatrachidae	*Mixophyes schevilli sensu lato*	Northern Barred Frog		C		1	1
Amphibians	Myobatrachidae	*Taudactylus acutirostris*	Sharp Snouted Dayfrog		PE	EX	1	1
Amphibians	Myobatrachidae	*Uperoleia mimula*	Mimicking Gungan		C		1	1
Amphibians	Ranidae	*Papurana daemeli*	Australian Woodfrog		C		1	1
Birds	Numididae	*Numida meleagris*	Helmeted Guineafowl	Y			0	1
Birds	Acanthizidae	*Acanthiza (Geobasileus) reguloides*	Buff-rumped Thornbill		C		0	1
Birds	Acanthizidae	*Acanthiza (Subacanthiza) nana*	Yellow Thornbill		C		0	1
Birds	Acanthizidae	*Acanthiza katherina*	Mountain Thornbill		C		1	1
Birds	Acanthizidae	*Gerygone magnirostris*	Large-billed Gerygone		C		1	1
Birds	Acanthizidae	*Gerygone mouki*	Brown Gerygone		C		1	1
Birds	Acanthizidae	*Gerygone olivacea*	White-throated Gerygone		C		1	1
Birds	Acanthizidae	*Gerygone palpebrosa*	Fairy Gerygone		C		1	1
Birds	Acanthizidae	*Oreoscopus gutturalis*	Fernwren		C		1	1
Birds	Acanthizidae	*Sericornis citreogularis*	Yellow-throated Scrubwren		C		1	1
Birds	Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren		C		1	1
Birds	Acanthizidae	*Sericornis keri*	Atherton Scrubwren		C		1	1
Birds	Acanthizidae	*Sericornis magnirostra*	Large-billed Scrubwren		C		1	1
Birds	Acanthizidae	*Smicrornis brevirostris*	Wee Bill		C		0	1
Birds	Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk		C		1	1
Birds	Accipitridae	*Accipiter fasciatus*	Brown Goshawk		C		1	1
Birds	Accipitridae	*Accipiter novaehollandiae*	Grey Goshawk		C		1	1
Birds	Accipitridae	*Aquila audax*	Wedge-tailed Eagle		C		1	1
Birds	Accipitridae	*Aviceda subcristata*	Pacific Baza		C		1	1
Birds	Accipitridae	*Circus assimilis*	Spotted Harrier		C		0	1
Birds	Accipitridae	*Elanus axillaris*	Black-shouldered Kite		C		1	1
Birds	Accipitridae	*Elanus scriptus*	Letter-winged Kite		C		0	1
Birds	Accipitridae	*Erythrotriorchis radiatus*	Red Goshawk		E	V	1	1
Birds	Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-eagle		C		1	1
Birds	Accipitridae	*Haliastur indus*	Brahminy Kite		C		1	1
Birds	Accipitridae	*Haliastur sphenurus*	Whistling Kite		C		1	1
Birds	Accipitridae	*Hieraaetus morphnoides*	Little Eagle		C		1	1
Birds	Accipitridae	*Lophoictinia isura*	Square-tailed Kite		C		1	1
Birds	Accipitridae	*Milvus migrans*	Black Kite		C		1	1
Birds	Accipitridae	*Pandion cristatus*	Eastern Osprey		SL		1	1
Birds	Acrocephalidae	*Acrocephalus (Acrocephalus) australis*	Australian Reed Warbler		C		0	1
Birds	Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar		C		1	1
Birds	Alaudidae	*Mirafra javanica*	Horsfield's Bushlark		C		1	1
Birds	Alcedinidae	*Ceyx azureus*	Azure Kingfisher		C		1	1
Birds	Alcedinidae	*Ceyx pusillus*	Little Kingfisher		C		1	1
Birds	Anatidae	*Anas castanea*	Chestnut Teal		C		0	1
Birds	Anatidae	*Anas gracilis*	Grey Teal		C		1	1
Birds	Anatidae	*Anas platyrhynchos*	Northern Mallard	Y			0	1
Birds	Anatidae	*Anas rhynchotis*	Australan Shoveleer		C		0	1
Birds	Anatidae	*Anas superciliosa*	Pacific Black Duck		C		1	1
Birds	Anatidae	*Aythya australis*	Hardhead		C		1	1
Birds	Anatidae	*Chenonetta jubata*	Australian Wood Duck		C		1	1
Birds	Anatidae	*Cygnus atratus*	Black Swan		C		0	1
Birds	Anatidae	*Dendrocygna arcuata*	Wandering Whistling-duck		C		1	1
Birds	Anatidae	*Dendrocygna eytoni*	Plumed Whistling-duck		C		1	1
Birds	Anatidae	*Malacorhynchus membranaceus*	Pink-eared Duck		C		1	1
Birds	Anatidae	*Nettapus coromandelianus*	Cotton Pygmy-goose		C		1	1
Birds	Anatidae	*Nettapus pulchellus*	Green Pygmy-goose		C		1	1
Birds	Anatidae	*Stictonetta naevosa*	Freckled Duck		C		0	1

Class	Family	Scientific Name	Common Name	I	Q	A	WO Count	ALA Count
Birds	Anatidae	*Tadorna radjah*	Radjah Shelduck		C		0	1
Birds	Anhingidae	*Anhinga novaehollandiae*	Australasian Darter		C		1	1
Birds	Anseranatidae	*Anseranas semipalmata*	Magpie Goose		C		1	1
Birds	Apodidae	*Aerodramus terraereginae*	Australian Swiftlet		C		1	1
Birds	Apodidae	*Apus pacificus*	Fork-tailed Swift		SL		1	1
Birds	Apodidae	*Hirundapus caudacutus*	White-throated Needletail		SL		1	1
Birds	Ardeidae	*Ardea alba modesta*	Eastern Great Egret		C		1	1
Birds	Ardeidae	*Ardea intermedia*	Intermediate Egret		C		1	1
Birds	Ardeidae	*Ardea pacifica*	White-necked Heron		C		1	1
Birds	Ardeidae	*Ardea sumatrana*	Great-billed Heron		C		1	1
Birds	Ardeidae	*Bubulcus ibis*	Cattle Egret		C		1	1
Birds	Ardeidae	*Butorides striata*	Striated Heron		C			
Birds	Ardeidae	*Egretta garzetta*	Little Egret		C		1	1
Birds	Ardeidae	*Egretta novaehollandiae*	White-faced Heron		C		1	1
Birds	Ardeidae	*Egretta picata*	Pied Heron		C		0	1
Birds	Ardeidae	*Egretta sacra*	Eastern Reef Egret		C		1	1
Birds	Ardeidae	*Ixobrychus flavicollis*	Black Bittern		C		1	1
Birds	Ardeidae	*Nycticorax caledonicus*	Nankeen Night-heron		C		1	1
Birds	Artamidae	*Artamus cinereus*	Black-faced Woodswallow		C		1	1
Birds	Artamidae	*Artamus cyanopterus*	Duscky Woodswallow		C		0	1
Birds	Artamidae	*Artamus leucorynchus*	White-breasted Woodswallow		C		1	1
Birds	Artamidae	*Artamus personatus*	Masked Woodswallow		C		0	1
Birds	Artamidae	*Artamus superciliosus*	White-browed Woodswallow		C		1	1
Birds	Artamidae	*Cracticus nigrogularis*	Pied Butcherbird		C		0	1
Birds	Artamidae	*Cracticus quoyi*	Black Butcherbird		C		1	1
Birds	Artamidae	*Cracticus tibicen*	Australian Magpie		C		1	1
Birds	Artamidae	*Cracticus torquatus*	Grey Butcherbird		C		0	1
Birds	Artamidae	*Strepera graculina*	Pied Currawong		C		1	1
Birds	Burhinidae	*Burhinus grallarius*	Bush Stone-curlew		C		1	1
Birds	Burhinidae	*Esacus magnirostris*	Beach Stone-curlew		V		1	1
Birds	Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo		C		1	1
Birds	Cacatuidae	*Cacatua sanguinea*	Little Corella		C		1	1
Birds	Cacatuidae	*Cacatua tenuirostris*	Long-billed Corella	Y	C		1	1
Birds	Cacatuidae	*Calyptorhynchus banksii*	Red-tailed Black-cockatoo		C		1	1
Birds	Cacatuidae	*Eolophus roseicapilla*	Galah		C			
Birds	Cacatuidae	*Nymphicus hollandicus*	Cockatiel		C		0	1
Birds	Campephagidae	*Coracina lineata*	Barred Cuckoo-shrike		C		1	1
Birds	Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		C		1	1
Birds	Campephagidae	*Coracina papuensis*	White-bellied Cuckoo-shrike		C		1	1
Birds	Campephagidae	*Coracina tenuirostris*	Cicadabird		C		1	1
Birds	Campephagidae	*Lalage leucomela*	Varied Triller		C		1	1
Birds	Campephagidae	*Lalage tricolor*	White-winged Triller		C		1	1
Birds	Caprimulgidae	*Caprimulgus macrurus*	Large-tailed Nightjar		C		1	1
Birds	Caprimulgidae	*Eurostopodus argus*	Spotted Nightjar		C		0	1
Birds	Caprimulgidae	*Eurostopodus mystacalis*	White-throated Nightjar		C		0	1
Birds	Casuariidae	*Casuarius casuarius johnsonii* (southern population)	Southern Cassowary (Southern Population)		E	E	1	1
Birds	Casuariidae	*Dromaius novaehollandiae*	Emu		C		0	1
Birds	Charadriidae	*Charadrius leschenaultii*	Greater Sand Plover		V	V	0	1
Birds	Charadriidae	*Charadrius mongolus*	Lesser Sand Plover		E	E	0	1
Birds	Charadriidae	*Charadrius ruficapillus*	Red-capped Plover		C			
Birds	Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel		C		1	1
Birds	Charadriidae	*Erythrogonys cinctus*	Red-kneed Dotterel		C		1	1
Birds	Charadriidae	*Pluvialis fulva*	Pacific Golden Plover		SL		0	1
Birds	Charadriidae	*Vanellus miles*	Masked Lapwing		C		1	1
Birds	Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork		C		1	1
Birds	Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola		C		1	1
Birds	Climacteridae	*Climacteris picumnus*	Brown Tree Creeper		C		0	1
Birds	Climacteridae	*Cormobates leucophaea minor*	White-throated Treecreeper (Northern)		C		1	1
Birds	Columbidae	*Chalcophaps indica*	Emerald Dove		C		1	1
Birds	Columbidae	*Columba leucomela*	White-headed Pigeon		C		1	1
Birds	Columbidae	*Columba livia*	Rock Dove	Y			1	1
Birds	Columbidae	*Ducula bicolor*	Pied Imperial-pigeon		C		1	1
Birds	Columbidae	*Geopelia cuneata*	Diamon Dove		C		0	1
Birds	Columbidae	*Geopelia humeralis*	Bar-shouldered Dove		C		1	1
Birds	Columbidae	*Geopelia striata*	Peaceful Dove		C		1	1
Birds	Columbidae	*Geophaps scripta peninsulae*	Squatter Pigeon (Northern Subspecies)		C		1	1
Birds	Columbidae	*Lopholaimus antarcticus*	Topknot Pigeon		C		1	1
Birds	Columbidae	*Macropygia amboinensis*	Brown Cuckoo-dove		C		1	1
Birds	Columbidae	*Ocyphaps lophotes*	Crested Pigeon		C		0	1
Birds	Columbidae	*Phaps chalcoptera*	Common Bronzewing		C		1	1
Birds	Columbidae	*Ptilinopus magnificus*	Wompoo Fruit-dove		C		1	1
Birds	Columbidae	*Ptilinopus regina*	Rose-crowned Fruit-dove		C		1	1
Birds	Columbidae	*Ptilinopus superbus*	Superb Fruit-dove		C		1	1
Birds	Columbidae	*Streptopelia chinensis*	Spotted Dove	Y			1	1
Birds	Coraciidae	*Eurystomus orientalis*	Dollarbird		C		1	1
Birds	Corcoracidae	*Struthidea cinerea*	Apostlebird		C		1	1
Birds	Corvidae	*Corvus orru*	Torresian Crow		C		1	1
Birds	Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo		C		1	1
Birds	Cuculidae	*Cacomantis pallidus*	Pallid Cuckoo		C		1	1
Birds	Cuculidae	*Cacomantis variolosus*	Brush Cuckoo		C		1	1
Birds	Cuculidae	*Centropus phasianinus*	Pheasant Coucal		C		1	1
Birds	Cuculidae	*Chalcites basalis*	Horsfield's Bronze-cuckoo		C		1	1
Birds	Cuculidae	*Chalcites lucidus*	Shining Bronze-cuckoo		C		1	1
Birds	Cuculidae	*Chalcites minutillus*	Little Bronze-cuckoo		C		1	1
Birds	Cuculidae	*Chalcites osculans*	Black-eared Cuckoo		C		1	1
Birds	Cuculidae	*Cuculus optatus*	Oriental Cuckoo		SL		0	1
Birds	Cuculidae	*Eudynamys orientalis*	Eastern Koel		C		1	1
Birds	Cuculidae	*Scythrops novaehollandiae*	Channel-billed Cuckoo		C		1	1
Birds	Cuculidae	*Urodynamis taitensis*	Long-tailed Cuckoo		C		0	1
Birds	Dicruridae	*Dicrurus bracteatus*	Spangled Drongo		C		1	1
Birds	Estrildidae	*Erythrura trichroa*	Blue-faced Parrot-finch		NT		1	1

Class	Family	Scientific Name	Common Name	I	Q	A	WO Count	ALA Count
Birds	Estrildidae	*Lonchura castaneothorax*	Chestnut-breasted Mannikin		C		1	1
Birds	Estrildidae	*Lonchura punctulata*	Nutmeg Mannikin	Y			1	1
Birds	Estrildidae	*Neochmia modesta*	Plum-headed Finch		C		1	1
Birds	Estrildidae	*Neochmia phaeton phaeton*	Crimson Finch		C		1	1
Birds	Estrildidae	*Neochmia temporalis*	Red-browed Finch		C		1	1
Birds	Estrildidae	*Poephila cincta*	Black-throated Finch		C		0	1
Birds	Estrildidae	*Taeniopygia bichenovii*	Double-barred Finch		C		1	1
Birds	Estrildidae	*Taeniopygia guttata*	Zebra Finch		C		0	1
Birds	Falconidae	*Falco berigora*	Brown Falcon		C		1	1
Birds	Falconidae	*Falco cenchroides*	Nankeen Kestrel		C		1	1
Birds	Falconidae	*Falco hypoleucos*	Grey Falcon		V		1	1
Birds	Falconidae	*Falco longipennis*	Australian Hobby		C		1	1
Birds	Falconidae	*Falco peregrinus*	Peregrine Falcon		C		1	1
Birds	Fregatidae	*Fregata ariel*	Lesser Frigatebird		SL		1	1
Birds	Fregatidae	*Fregata minor*	Great Frigatebird		SL		1	1
Birds	Gruidae	*Grus antigone*	Sarus Crane		C		0	1
Birds	Gruidae	*Grus rubicunda*	Brolga		C		1	1
Birds	Haematopodidae	*Haematopus longirostris*	Australian Pied Oystercatcher		C		1	1
Birds	Halcyonidae	*Dacelo leachii*	Blue-Winged Kookaburra		C		1	1
Birds	Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra		C		1	1
Birds	Halcyonidae	*Tanysiptera sylvia*	Buff-breasted Paradise-kingfisher		C		1	1
Birds	Halcyonidae	*Todiramphus chloris*	Collared Kingfisher		C		0	1
Birds	Halcyonidae	*Todiramphus macleayii*	Forest Kingfisher		C		1	1
Birds	Halcyonidae	*Todiramphus pyrrhopygius*	Red-Backed Kingfisher		C		1	1
Birds	Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher		C		1	1
Birds	Halcyonidae	*Todiramphus sordidus*	Torresian Kingfisher		C		1	0
Birds	Hirundinidae	*Petrochelidon ariel*	Fairy Martin		C		1	1
Birds	Hirundinidae	*Petrochelidon nigricans*	Tree Martin		C		1	1
Birds	Hirundinidae	*Hirundo neoxena*	Welcome Swallow		C		0	1
Birds	Jacanidae	*Irediparra gallinacea*	Comb-crested Jacana		C		1	1
Birds	Laridae	*Anous minutus*	Black Noddy		C		0	1
Birds	Laridae	*Anous stolidus*	Common Noddy		SL		0	1
Birds	Laridae	*Chroicocephalus novaehollandiae*	Silver Gull		C		1	1
Birds	Laridae	*Gelochelidon nilotica*	Gull-billed Tern		SL		1	1
Birds	Laridae	*Hydroprogne caspia*	Caspian Tern		SL		1	1
Birds	Laridae	*Onychoprion anaethetus*	Bridled Tern		SL		0	1
Birds	Laridae	*Onychoprion fuscata*	Sooty Tern		C		0	1
Birds	Laridae	*Sterna dougallii*	Roseate Tern		SL		0	1
Birds	Laridae	*Sterna sumatrana*	Black-naped Tern		SL		0	1
Birds	Laridae	*Sternula albifrons*	Little Tern		SL		1	1
Birds	Laridae	*Thalasseus bengalensis*	Lesser Crested Tern		C		1	1
Birds	Laridae	*Thalasseus bergii*	Crested Tern		SL		1	1
Birds	Maluridae	*Malurus amabilis*	Lovely Fairy-wren		C		1	1
Birds	Maluridae	*Malurus melanocephalus*	Red-backed Fairy-wren		C		1	1
Birds	Megaluridae	*Megalurus timoriensis*	Tawny Grassbird		C		1	1
Birds	Megapodiidae	*Alectura lathami*	Australian Brush-turkey		C		1	1
Birds	Megapodiidae	*Megapodius reinwardt*	Orange-footed Scrubfowl		C		1	1
Birds	Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill		C		0	1
Birds	Meliphagidae	*Bolemoreus frenatus*	Bridled Honeyeater		C		1	1
Birds	Meliphagidae	*Caligavis chrysops*	Yellow-faced Honeyeater		C		1	1
Birds	Meliphagidae	*Cissomela pectoralis*	Banded Honeyeater		C		0	1
Birds	Meliphagidae	*Conopophila rufogularis*	Rufous-throated Honeyeater		C		0	1
Birds	Meliphagidae	*Entomyzon cyanotis*	Blue-faced Honeyeater		C		1	1
Birds	Meliphagidae	*Gavicalis versicolor*	Varied Honeyeater		C		1	1
Birds	Meliphagidae	*Gliciphila melanops*	Tawny-crowned Honeyeater		C		0	1
Birds	Meliphagidae	*Lichmera indistincta*	Brown Honeyeater		C		1	1
Birds	Meliphagidae	*Manorina melanocephala*	Noisy Miner		C		1	1
Birds	Meliphagidae	*Meliphaga gracilis*	Graceful Honeyeater		C		1	1
Birds	Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater		C		1	1
Birds	Meliphagidae	*Meliphaga notata*	Yellow-spotted Honeyeater		C		1	1
Birds	Meliphagidae	*Melithreptus albogularis*	White-throated Honeyeater		C		1	1
Birds	Meliphagidae	*Melithreptus lunatus*	White-naped Honeyeater		C		1	1
Birds	Meliphagidae	*Myzomela erythrocephala*	Red-headed Honeyeater		C		0	1
Birds	Meliphagidae	*Myzomela obscura*	Dusky Honeyeater		C		1	1
Birds	Meliphagidae	*Myzomela sanguinolenta*	Scarlet Honeyeater		C		1	1
Birds	Meliphagidae	*Philemon argenticeps*	Silver-crowned Friarbird		C		1	1
Birds	Meliphagidae	*Philemon buceroides*	Helmeted Friarbird		C		1	1
Birds	Meliphagidae	*Philemon citreogularis*	Little Friarbird		C		1	1
Birds	Meliphagidae	*Philemon corniculatus*	Noisy Friarbird		C		1	1
Birds	Meliphagidae	*Phylidonyris niger*	White-cheeked Honeyeater		C		1	1
Birds	Meliphagidae	*Ptilotula fusca*	Fuscous Honeyeater		C		1	1
Birds	Meliphagidae	*Ramsayornis fasciatus*	Bar-breasted Honeyeater		C		1	1
Birds	Meliphagidae	*Ramsayornis modestus*	Brown-backed Honeyeater		C		1	1
Birds	Meliphagidae	*Stomiopera flava*	Yellow Honeyeater		C		1	1
Birds	Meliphagidae	*Xanthotis macleayanus*	Macleay's Honeyeater		C		1	1
Birds	Meropidae	*Merops ornatus*	Rainbow Bee-eater		C		1	1
Birds	Monarchidae	*Arses kaupi*	Pied Monarch		C		1	1
Birds	Monarchidae	*Carterornis leucotis*	White-eared Monarch		C		1	1
Birds	Monarchidae	*Grallina cyanoleuca*	Magpie-lark		C		1	1
Birds	Monarchidae	*Machaerirhynchus flaviventer*	Yellow-breasted Boatbill		C		1	1
Birds	Monarchidae	*Monarcha melanopsis*	Black-faced Monarch		SL		1	1
Birds	Monarchidae	*Myiagra alecto*	Shining Flycatcher		C		1	1
Birds	Monarchidae	*Myiagra cyanoleuca*	Satin Flycatcher		SL		1	1
Birds	Monarchidae	*Myiagra inquieta*	Restless Flycatcher		C		1	1
Birds	Monarchidae	*Myiagra rubecula*	Leaden Flycatcher		C		1	1
Birds	Monarchidae	*Symposiachrus trivirgatus*	Spectacled Monarch		SL		1	1
Birds	Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit		C		1	1
Birds	Motacillidae	*Motacilla flava sensu lato*	Yellow Wagtail		SL		1	1
Birds	Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird		C		1	1
Birds	Nectariniidae	*Nectarinia jugularis*	Olive-backed Sunbird		C		1	1
Birds	Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella		C		1	1

Class	Family	Scientific Name	Common Name	I	Q	A	WO Count	ALA Count
Birds	Oriolidae	*Oriolus flavocinctus*	Yellow Oriole		C		1	1
Birds	Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole		C		1	1
Birds	Oriolidae	*Sphecotheres vieilloti*	Australasian Figbird		C		1	1
Birds	Orthonychidae	*Orthonyx spaldingii*	Chowchilla		C		1	1
Birds	Orthonychidae	*Orthonyx temminckii*	Australian Logrunner		C		0	1
Birds	Otididae	*Ardeotis australis*	Australian Bustard		C		0	1
Birds	Pachycephalidae	*Colluricincla boweri*	Bower's Shrike-thrush		C		1	1
Birds	Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush		C		1	1
Birds	Pachycephalidae	*Colluricincla megarhyncha*	Little Shrike-thrush		C		1	1
Birds	Pachycephalidae	*Falcunculus frontatus*	Crested Shrike-tit		C		0	1
Birds	Pachycephalidae	*Pachycephala melanura*	Mangrove Golden Whistler		C		0	1
Birds	Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler		C		1	1
Birds	Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler		C		1	1
Birds	Pachycephalidae	*Pachycephala simplex peninsulae*	Grey Whistler		C		1	1
Birds	Paradisaeidae	*Phonygammus keraudrenii*	Trumpet Manucode		C		1	1
Birds	Paradisaeidae	*Ptiloris victoriae*	Victoria's Riflebird		C		1	1
Birds	Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote		C		1	1
Birds	Pardalotidae	*Pardalotus rubricatus*	Red-browed Pardalote		C		0	1
Birds	Pardalotidae	*Pardalotus striatus*	Striated Pardalote		C		1	1
Birds	Passeridae	*Passer domesticus*	House Sparrow	Y			1	1
Birds	Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican		C		1	1
Birds	Petroicidae	*Drymodes superciliaris*	Northern Scrub-robin		C		1	1
Birds	Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin		C		1	1
Birds	Petroicidae	*Heteromyias cinereifrons*	Grey-headed Robin		C		1	1
Birds	Petroicidae	*Microeca fascinans*	Jacky Winter		C		1	1
Birds	Petroicidae	*Microeca flavigaster*	Lemon-bellied Flycatcher		C		1	1
Birds	Petroicidae	*Poecilodryas superciliosa*	White-browed Robin		C		0	1
Birds	Petroicidae	*Tregellasia capito*	Pale-yellow Robin		C		1	1
Birds	Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant		C		1	1
Birds	Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant		C		1	1
Birds	Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant		C		1	1
Birds	Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant		C		0	1
Birds	Phasianidae	*Coturnix ypsilophora*	Brown Quail		C		1	1
Birds	Phasianidae	*Gallus gallus*	Red Junglefowl	Y			0	1
Birds	Phasianidae	*Pavo cristatus*	Indian Peafowl	Y			1	1
Birds	Pittidae	*Pitta versicolor*	Noisy Pitta		C		1	1
Birds	Podargidae	*Podargus papuensis*	Papuan Frogmouth		C		1	1
Birds	Podargidae	*Podargus strigoides*	Tawny Frogmouth		C		1	1
Birds	Podargidae	*Podiceps cristatus*	Great Crested Grebe		C		0	1
Birds	Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe		C		1	1
Birds	Pomatostomidae	*Pomatostomus temporalis*	Grey-Crowned Babbler		C		0	1
Birds	Psittacidae	*Alisterus scapularis*	Australian King-Parrot		C		1	1
Birds	Psittacidae	*Aprosmictus erythropterus*	Red-winged Parrot		C		1	1
Birds	Psittacidae	*Cyclopsitta diophthalma macleayana*	Macleay's Fig-Parrot		V		1	1
Birds	Psittacidae	*Eclectus roratus*	Eclectus Parrot		V		0	1
Birds	Psittacidae	*Melopsittacus undulatus*	Budgerigar		C		0	1
Birds	Psittacidae	*Parvipsitta pusilla*	Little Lorikeet		C		1	1
Birds	Psittacidae	*Platycercus adscitus*	Pale-headed Rosella		C		1	1
Birds	Psittacidae	*Platycercus elegans*	Crimson Rosella		C		1	1
Birds	Psittacidae	*Psitteuteles versicolor*	Varied Lorikeet		C		1	1
Birds	Psittacidae	*Trichoglossus chlorolepidotus*	Scaly-breasted Lorikeet		C		1	1
Birds	Psittacidae	*Trichoglossus haematodus moluccanus*	Rainbow Lorikeet		C		1	1
Birds	Psophodidae	*Psophodes olivaceus*	Eastern Whipbird		C		1	1
Birds	Ptilonorhynchidae	*Ailuroedus crassirostris*	Green Catbird		C		0	1
Birds	Ptilonorhynchidae	*Ailuroedus maculosus*	Spotted Catbird		C		0	1
Birds	Ptilonorhynchidae	*Amblyornis newtonianus*	Golden Bowerbird		C			
Birds	Ptilonorhynchidae	*Ptilonorhynchus maculatus*	Spotted Bowerbird		C		1	1
Birds	Ptilonorhynchidae	*Ptilonorhynchus nuchalis*	Great Bowerbird		C		0	1
Birds	Ptilonorhynchidae	*Ptilonorhynchus violaceus*	Satin Bowerbird		C		1	1
Birds	Ptilonorhynchidae	*Scenopoeetes dentirostris*	Tooth-billed Bowerbird		C		1	1
Birds	Ptilonorhynchidae	*Sericulus chrysocephalus*	Regent Bowerbird		C		0	1
Birds	Rallidae	*Amaurornis cinerea*	White-browed Crake		C		1	1
Birds	Rallidae	*Amaurornis moluccana*	Pale-vented Bush-hen		C		1	1
Birds	Rallidae	*Fulica atra*	Eurasian Coot		C		1	1
Birds	Rallidae	*Gallinula tenebrosa*	Dusky Moorhen		C		0	1
Birds	Rallidae	*Gallirallus philippensis*	Buff-Banded Rail		C		1	1
Birds	Rallidae	*Porphyrio porphyrio*	Purple Swamphen		C		0	1
Birds	Rallidae	*Rallina tricolor*	Red-Necked Crake		C		1	1
Birds	Recurvirostridae	*Himantopus himantopus*	Black-Winged Stilt		C		1	1
Birds	Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail		C		1	1
Birds	Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail		C		1	1
Birds	Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail		SL		1	1
Birds	Rhipiduridae	*Rhipidura rufiventris*	Northern Fantail		C		1	1
Birds	Scolopacidae	*Actitis hypoleucos*	Common Sandpiper		SL		1	1
Birds	Scolopacidae	*Arenaria interpres*	Ruddy Turnstone		SL		0	1
Birds	Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper		SL		1	1
Birds	Scolopacidae	*Calidris canutus*	Red Knot		E	E	0	1
Birds	Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper		E	CE	0	1
Birds	Scolopacidae	*Calidris ruficollis*	Red-necked Stint		SL		1	1
Birds	Scolopacidae	*Calidris tenuirostris*	Great Knot		E	CE	0	1
Birds	Scolopacidae	*Gallinago hardwickii*	Latham's Snipe		SL		0	1
Birds	Scolopacidae	*Limosa lapponica baueri*	Western Alaskan Bar-tailed Godwit		V	V	1	1
Birds	Scolopacidae	*Limosa limosa*	Black-tailed Godwit		SL		1	1
Birds	Scolopacidae	*Numenius madagascariensis*	Eastern Curlew		E	CE	1	1
Birds	Scolopacidae	*Numenius minutus*	Little Curlew		SL		0	1
Birds	Scolopacidae	*Numenius phaeopus*	Whimbrel		SL		1	1
Birds	Scolopacidae	*Tringa brevipes*	Grey-tailed Tattler		SL		1	1
Birds	Scolopacidae	*Tringa glareola*	Wood Sandpiper		SL		1	1
Birds	Scolopacidae	*Tringa nebularia*	Common Greenshank		SL		0	1
Birds	Scolopacidae	*Tringa stagnatilis*	Marsh Sandpiper		SL		1	1
Birds	Scolopacidae	*Xenus cinereus*	Terek Sandpiper		SL		0	1

Class	Family	Scientific Name	Common Name	I	Q	A	WO Count	ALA Count
Birds	Strigidae	*Ninox boobook*	Southern Boobook		C		1	1
Birds	Strigidae	*Ninox connivens*	Barking Owl		C		1	1
Birds	Strigidae	*Ninox rufa queenslandica*	Rufous Owl (Southern Subspecies)		C		1	1
Birds	Strigidae	*Struthio camelus*	Ostrich	Y			0	1
Birds	Sturnidae	*Acridotheres tristis*	Common Myna	Y			1	1
Birds	Sturnidae	*Aplonis metallica*	Metallic Starling		C		1	1
Birds	Sturnidae	*Sturnus vulgaris*	Common Starling	Y			1	1
Birds	Sulidae	*Sula leucogaster*	Brown Booby		SL		1	1
Birds	Threskiornithidae	*Platalea flavipes*	Yellow Spoonbill		C		0	1
Birds	Threskiornithidae	*Platalea regia*	Royal Spoonbill		C		1	1
Birds	Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis		SL		1	1
Birds	Threskiornithidae	*Threskiornis molucca*	Australian White Ibis		C		1	1
Birds	Threskiornithidae	*Threskiornis spinicollis*	Straw-Necked Ibis		C		1	1
Birds	Timaliidae	*Zoothera lunulata*	Bassian Thrush		C		0	1
Birds	Timaliidae	*Zosterops lateralis*	Silvereye		C		1	1
Birds	Timaliidae	*Zosterops lateralis vegetus*	Silvereye (Cape York Peninsula)		C		1	1
Birds	Turnicidae	*Turnix olivii*	Buff-Breasted Button-quail		E	E	1	1
Birds	Turnicidae	*Turnix varius*	Patined Button Quail		C		0	1
Birds	Tytonidae	*Tyto javanica*	Eastern Barn Owl		C		0	1
Birds	Tytonidae	*Tyto novaehollandiae kimberli*	Masked Owl (Northern)		V	V	0	1
Birds	Tytonidae	*Tyto tenebricosa multipunctata*	Lesser Sooty Owl		C		1	1
Mammals	Acrobatidae	*Acrobates pygmaeus*	Feathertail Glider		C		1	1
Mammals	Bovidae	*Bos sp.*	Cattle	Y			1	0
Mammals	Canidae	*Canis familiaris*	Dog	Y			0	1
Mammals	Canidae	*Canis lupus dingo*	Dingo	Y			1	1
Mammals	Dasyuridae	*Antechinus flavipes rubeculus*	Yellow-Footed Antechinus (North-east Queensland)		C		1	0
Mammals	Dasyuridae	*Dasyurus hallucatus*	Northern Quoll		C	E	1	1
Mammals	Dasyuridae	*Planigale maculata*	Common Planigale		C		0	1
Mammals	Emballonuridae	*Taphozous troughtoni*	Troughton's Sheathtail Bat		C		1	1
Mammals	Felidae	*Felis catus*	Cat	Y			1	1
Mammals	Hipposideridae	*Hipposideros ater aruensis*	Eastern Dusky Leaf-nosed Bat		C		1	1
Mammals	Hipposideridae	*Hipposideros diadema reginae*	Diadem Leaf-nosed Bat		NT		1	1
Mammals	Hypsiprymnodontidae	*Hypsiprymnodon moschatus*	Musky Rat-kangaroo		C		1	1
Mammals	Leporidae	*Oryctolagus cuniculus*	Rabbit	Y			1	1
Mammals	Macropodidae	*Dendrolagus lumholtzi*	Lumholtz's Tree-kangaroo		NT		1	0
Mammals	Macropodidae	*Macropus agilis*	Agile Wallaby		C		1	1
Mammals	Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo		C		0	1
Mammals	Macropodidae	*Macropus parryi*	Whiptail Wallaby		C		0	1
Mammals	Macropodidae	*Thylogale stigmatica*	Red-legged Pademelon		C		1	1
Mammals	Macropodidae	*Thylogale thetis*	Red-necked Pademelon		C		1	0
Mammals	Macropodidae	*Wallabia bicolor*	Swamp Wallaby		C		1	1
Mammals	Megadermatidae	*Macroderma gigas*	Ghost Bat		E	V	1	1
Mammals	Miniopteridae	*Miniopterus australis*	Little Bent-wing Bat		C		1	1
Mammals	Miniopteridae	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat		C		1	1
Mammals	Molossidae	*Chaerephon jobensis*	Northern Freetail Bat		C		1	1
Mammals	Molossidae	*Mormopterus lumsdenae*	Northern Free-tailed Bat		C		1	1
Mammals	Molossidae	*Mormopterus ridei*	Eastern Free-tailed Bat		C		1	1
Mammals	Muridae	*Hydromys chrysogaster*	Water Rat		C		1	1
Mammals	Muridae	*Melomys burtoni*	Grassland Melomys		C		1	1
Mammals	Muridae	*Melomys cervinipes*	Fawn-footed Melomys		C		1	1
Mammals	Muridae	*Mesembriomys gouldii*	Black-footed Tree Rat		C	V	0	1
Mammals	Muridae	*Mus musculus*	House Mouse	Y			0	1
Mammals	Muridae	*Pogonomys sp.*	Tree Mouse		C		1	0
Mammals	Muridae	*Rattus fuscipes*	Bush Rat		C		1	1
Mammals	Muridae	*Rattus leucopus*	Cape York Rat		C		1	1
Mammals	Muridae	*Rattus lutreolus*	Swamp Rat		C		1	1
Mammals	Muridae	*Rattus rattus*	Black Rat	Y			1	0
Mammals	Muridae	*Rattus sordidus*	Canefield Rat		C		1	1
Mammals	Muridae	*Rattus tunneyi*	Pale Field-Rat		C		1	1
Mammals	Muridae	*Uromys caudimaculatus*	Giant White-tailed Rat		C		1	1
Mammals	Ornithorhynchidae	*Ornithorhynchus anatinus*	Platypus		SL		1	1
Mammals	Peramelidae	*Isoodon macrourus*	Northern Brown Bandicoot		C		1	1
Mammals	Peramelidae	*Perameles pallescens*	Northern Long-nosed Bandicoot		C		1	1
Mammals	Petauridae	*Dactylopsila trivirgata*	Striped Possum		C		1	1
Mammals	Petauridae	*Petaurus breviceps*	Sugar Glider		C		1	1
Mammals	Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum		C		1	1
Mammals	Phascolarctidae	*Phascolarctos cinereus*	Koala		V	V	1	0
Mammals	Potoroidae	*Aepyprymnus rufescens*	Rufous Bettong		C		1	1
Mammals	Potoroidae	*Bettongia tropica*	Northern Bettong		E	E	1	1
Mammals	Pseudocheiridae	*Petauroides volans*	Greater Glider		V	V	0	1
Mammals	Pseudocheiridae	*Pseudocheirus peregrinus*	Common Ringtail Possum		C		1	1
Mammals	Pseudocheiridae	*Pseudochirops archeri*	Green Ringtail Possum		C		1	1
Mammals	Pteropodidae	*Macroglossus minimus*	Northern Blossom Bat		C		1	1
Mammals	Pteropodidae	*Nyctimene robinsoni*	Eastern Tube-nosed Bat		C		1	1
Mammals	Pteropodidae	*Pteropus conspicillatus*	Spectacled Flying-fox		V	V	1	1
Mammals	Pteropodidae	*Syconycteris australis*	Eastern Blossom Bat		C		1	1
Mammals	Rhinolophidae	*Rhinolophus megaphyllus*	Eastern Horseshoe-bat		C		1	1
Mammals	Suidae	*Sus scrofa*	Pig	Y			1	1
Mammals	Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna		SL		1	1
Mammals	Vespertilionidae	*Kerivoula papuensis*	Golden-tipped Bat		C		1	1
Mammals	Vespertilionidae	*Murina florium*	Tube-nosed Insectivorous Bat		V		1	1
Mammals	Vespertilionidae	*Myotis macropus*	Large-footed Myotis		C		1	1
Mammals	Vespertilionidae	*Nyctophilus bifax*	Northern Long-eared Bat		C		1	1
Mammals	Vespertilionidae	*Vespadelus pumilus*	Eastern Forest Bat		C		1	1
Reptiles	Agamidae	*Chlamydosaurus kingii*	Frilled Lizard		C		1	1
Reptiles	Agamidae	*Diporiphora australis*	Tommy Roundhead		C		0	1
Reptiles	Agamidae	*Hypsilurus boydii*	Boyd's Forest Dragon		C		0	1
Reptiles	Agamidae	*Hypsilurus spinipes*	Southern Angle-headed Dragon		C		0	1
Reptiles	Agamidae	*Intellagama lesueurii*	Eastern Water Dragon		C		1	1
Reptiles	Agamidae	*Lophosaurus boydii*	Boyd's Forest Dragon		C		1	0
Reptiles	Boidae	*Antaresia maculosa*	Spotted Python		C		1	0

Class	Family	Scientific Name	Common Name	I	Q	A	WO Count	ALA Count
Reptiles	Boidae	*Morelia spilota*	Carpet Python		C		1	1
Reptiles	Boidae	*Simalia kinghorni*	Amethystine Python (Australian Form)		C		1	1
Reptiles	Carphodactylidae	*Saltuarius cornutus*	Northern Leaf-tailed Gecko		C		1	1
Reptiles	Chelidae	*Emydura macquarii krefftii*	Krefft's River Turtle		C		1	1
Reptiles	Chelidae	*Wollumbinia latisternum*	Saw-shelled Turtle		C		1	1
Reptiles	Colubridae	*Boiga irregularis*	Brown Tree Snake		C		1	1
Reptiles	Colubridae	*Dendrelaphis calligastra*	Northern Tree Snake		C		1	1
Reptiles	Colubridae	*Dendrelaphis punctulatus*	Green Tree Snake		C		1	1
Reptiles	Colubridae	*Stegonotus cucullatus*	Slaty-grey Snake		C		1	1
Reptiles	Colubridae	*Tropidonophis mairii*	Freshwater Snake		C		1	1
Reptiles	Crocodylidae	*Crocodylus johnstoni*	Australian Freshwater Crocodile		C		1	1
Reptiles	Crocodylidae	*Crocodylus porosus*	Estuarine Crocodile		V		1	1
Reptiles	Diplodactylidae	*Oedura coggeri*	Northern Spotted Velvet Gecko		C		0	1
Reptiles	Elapidae	*Acanthophis praelongus*	Northern Death Adder		C		0	1
Reptiles	Elapidae	*Antaioserpens albiceps*	North-Eastern Plain-nosed Burrowing Snake		C		1	1
Reptiles	Elapidae	*Cacophis churchilli*	Northern Dwarf Crowned Snake		C		0	1
Reptiles	Elapidae	*Cryptophis nigrescens*	Eastern Small-eyed Snake		C		1	1
Reptiles	Elapidae	*Cryptophis nigrostriatus*	Black-striped Snake		C		0	1
Reptiles	Elapidae	*Demansia psammophis*	Yellow-faced Whipsnake		C		1	1
Reptiles	Elapidae	*Furina tristis*	Brown-headed Snake		C		0	1
Reptiles	Elapidae	*Hemiaspis signata*	Black-bellied Swamp Snake		C		1	1
Reptiles	Elapidae	*Oxyuranus scutellatus*	Coastal Taipan		C		1	1
Reptiles	Elapidae	*Pseudechis australis*	King Brown Snake		C		1	1
Reptiles	Elapidae	*Pseudechis porphyriacus*	Red-bellied Black Snake		C		1	1
Reptiles	Elapidae	*Tropidechis carinatus*	Rough-scaled Snake		C		0	1
Reptiles	Gekkonidae	*Gehyra dubia*	Dubious Dtella		C		1	1
Reptiles	Gekkonidae	*Hemidactylus frenatus*	House Gecko	Y			1	1
Reptiles	Gekkonidae	*Lepidodactylus lugubris*	Mourning Gecko		C		1	1
Reptiles	Gekkonidae	*Nactus cheverti*	Chevert Gecko		C		1	1
Reptiles	Pygopodidae	*Delma tincta*	Excitable Delma		C		1	1
Reptiles	Pygopodidae	*Lialis burtonis*	Burton's Legless Lizard		C		1	1
Reptiles	Scincidae	*Bellatorias frerei*	Major Skink		C		1	1
Reptiles	Scincidae	*Carlia jarnoldae*	Lined Rainbow-skink		C		1	1
Reptiles	Scincidae	*Carlia longipes*	Closed-litter Rainbow-skink		C		1	1
Reptiles	Scincidae	*Carlia rhomboidalis*	Blue-throated Rainbow-skink		C		0	1
Reptiles	Scincidae	*Carlia rostralis*	Black-throated Rainbow-skink		C		1	1
Reptiles	Scincidae	*Carlia rubrigularis*	Red-throated Rainbow-skink		C		1	1
Reptiles	Scincidae	*Carlia storri*	Storr's Rainbow-skink		C		1	1
Reptiles	Scincidae	*Coeranoscincus frontalis*	Limbless Snake-tooth Skink		C		1	1
Reptiles	Scincidae	*Concinnia brachysoma*	Northern Bar-sided Skink		C		1	1
Reptiles	Scincidae	*Concinnia tenuis*	Bar-sided Skink		C		0	1
Reptiles	Scincidae	*Concinnia tigrina*	Yellow-blotched Forest-skink		C		1	1
Reptiles	Scincidae	*Cryptoblepharus litoralis*	Coastal Snake-eyed Skink		C		0	1
Reptiles	Scincidae	*Cryptoblepharus metallicus*	Metallic Snake-eyed Skink		C		1	1
Reptiles	Scincidae	*Cryptoblepharus virgatus sensu lato*	Striped Snake-eyed Skink		C		0	1
Reptiles	Scincidae	*Ctenotus robustus*	Robust Ctenotus		C		0	1
Reptiles	Scincidae	*Ctenotus spaldingi*	Straight-browed Ctenotus		C		1	1
Reptiles	Scincidae	*Cyclodomorphus gerrardii*	Pink-tongued Lizard		C		1	1
Reptiles	Scincidae	*Eulamprus quoyii*	Eastern Water Skink		C		1	1
Reptiles	Scincidae	*Glaphyromorphus fuscicaudis*	Brown-tailed Bar-lipped Skink		C		1	1
Reptiles	Scincidae	*Glaphyromorphus nigricaudis*	Black-tailed Bar-lipped Skink		C		1	1
Reptiles	Scincidae	*Gnypetoscincus queenslandiae*	Prickly Forest Skink		C		1	1
Reptiles	Scincidae	*Lampropholis coggeri*	Rainforest Sunskink		C		1	1
Reptiles	Scincidae	*Lampropholis delicata*	Dark-flecked Garden Sunskink		C		1	1
Reptiles	Scincidae	*Lygisaurus aeratus sensu lato*			C		1	0
Reptiles	Scincidae	*Lygisaurus foliorum*	Tree-base Litter-skink		C		1	1
Reptiles	Scincidae	*Lygisaurus laevis*	Rainforest Edge Litter-skink		C		1	1
Reptiles	Scincidae	*Lygisaurus malleolus*	Firedart Litter-skink		C		0	1
Reptiles	Scincidae	*Morethia taeniopleura*	Fire-tailed Skink		C		1	1
Reptiles	Scincidae	*Saproscincus basiliscus*	Basilisk Shadeskink		C		1	1
Reptiles	Scincidae	*Saproscincus czechurai*	Wedge-snouted Shadeskink		C		1	1
Reptiles	Scincidae	*Saproscincus tetradactylus*	Four-fingered Shadeskink		C		1	1
Reptiles	Typhlopidae	*Anilios torresianus*	North-eastern Blind Snake		C		1	1
Reptiles	Varanidae	*Varanus scalaris*	Spotted Tree Monitor		C		1	1
Reptiles	Varanidae	*Varanus varius*	Lace Monitor		C		1	1

Appendix I:
Field Survey Flora Species List

Secondary transect surveys

Site name:	SO1	**Date:**	26/01/2017
Survey type:	Secondary	**Location:**	Crest slope
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	12%	**Aspect:**	SE
Mapped RE:	7.11.13	**Observed RE:**	7.11.13
Notes:	Very little *Corymbia torelliana* though still close match with 7.11.13; *Eucalyptus tereticornis* locally dominant & intergrading from surrounding 7.11.44.		

Strata	Height Range (m)	Cover	Species
Tree 1	20-28	96%	*Acacia celsa* *Alstonia muelleriana* *Calamus australis* *Eucalyptus tereticornis* *Flagellaria indica L. var. divaricata* *Guioa acutifolia* *Levieria acuminata* *Mischocarpus lachnocarpus* *Platycerium bifurcatum* *Smilax australis* *Syzygium luehmannii*
Tree 2		30%	*Cerbera floribunda* *Corymbia torelliana* *Drynaria rigidula* *Paraserianthes toona* *Polyscias elegans*
Tree 3		30%	*Carnarvonia araliifolia* *Tetracera nordtiana*
Shrub 1	1-3m	50%	*Alyxia ruscifolia* *Ardisia brevipedata* *Calamus moti* *Codiaeum variegatum* *Cryptocarya mackinnoniana* *Diospyros hebecarpa* *Drynaria rigidula* *Eustrephus latifolius* *Glochidion harveyanum* *Jasminum didymum* *Melicope elleryana* *Melodinus australis* *Podocarpus grayae* *Rhodamnia sessiliflora* *Rhodomyrtus pervagata* *Steganthera laxiflora* *Sterculia quadrifida* *Toona ciliata* *Xylopia maccreae*
Ground	<1	10%	*Gahnia aspera* *Pseuderanthemum variabile*

Basal Area Count:	
Acacia celsa	5
Alstonia muelleriana	4
Cerbera floribunda	5
Codiaeum variegatum	1
Eucalyptus tereticornis	2
Platycerium bifurcatum	1

Site name:	SO3	**Date:**	26/01/2017
Survey type:	Secondary	**Location:**	Hillslope below crest
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	6%	**Aspect:**	NE
Mapped RE:	7.11.44	**Observed RE:**	7.11.44
Notes:	*Eucalyptus tereticornis* woodland.		

Strata	**Height Range (m)**	**Cover**	**Species**
Tree 1	18-25m		*Eucalyptus tereticornis*
Tree 2	8-18m		*Acacia celsaa* *Acacia mangium* *Allocasuarina torulosa* *Corymbia clarksoniana* *Eucalyptus tereticornis* *Lophostemon suaveolens* *Melaleuca leucadendra*
Shrub 1	1-6m		*Allocasuarina torulosa* *Alphitonia petriei* *Alstonia muelleriana* *Breynia stipitata* *Corymbia torelliana* *Elaeodendron melanocarpum* *Guioa acutifolia* *Lantana camara* *Lophostemon suaveolens* *Macaranga sp.* *Polyscias elegans* *Trema tomentosa*
Ground	<1m		*Ageratum houstonianum* *Aristolochia sp.* *Cheilanthes sp.* *Dianella bambusifolia* *Gahnia aspera* *Hibbertia sp.* *Imperata cylindrica* *Melodinus australis* *Phyllanthus sp.* *Macroptilium atropurpureum* *Themeda triandra*

Basal Area Count:	
Acacia celsa	2
Allocasuarina torulosa	1
Eucalyptus tereticornis	9
Lophostemon suaveolens	1

Site name:	SO2	**Date:**	26/01/2017
Survey type:	Secondary	**Location:**	Slope below crest
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	14%	**Aspect:**	N
Mapped RE:	7.11.33	**Observed RE:**	7.11.51
Notes:	No *Eucaplyptus reducta* observed. Closer match to RE 7.11.51. South slope merges with RE 7.11.13 +/- *Corymbia torelliana* with vine forest elements.		

Strata	**Height Range (m)**	**Cover**	**Species**
Tree 1	15-23m		*Corymbia clarksoniana* *Eucalyptus tereticornis*
Tree 2	6-12m		*Acacia crassicarpa* *Allocasuarina torulosa* *Eucalyptus platyphylla* *Lophostemon suaveolens*
Shrub 1	1-6m		*Acacia mangium* *Acacia melanoxylon* *Alphitonia petriei* *Alstonia muelleriana* *Breynia oblongifolia* *Bursaria spinosa* *Clerodendrum floribundum* *Darlingia darlingiana* *Grevillea parallela* *Lantana camara* *Maytenus fasciculiflora* *Persoonia falcata* *Planchonia careya* *Polyscias elegans*
Ground	<1		*Abelmoschus moschatus* *Ageratum houstonianum* *Breynia cernua* *Cleistanthus apodus* *Dianella bambusifolia* *Grewia retusifolia* *Hypoxis sp.* *Imperata cylindrica* *Lantana camara* *Lomandra longifolia* *Themeda triandra*

Basal Area Count:	
Eucalyptus platyphylla	1
Corymbia clarksoniana	7
Eucalyptus tereticornis	8

Site name:	SO4	**Date:**	27/01/2017
Survey type:	Secondary	**Location:**	Hill slope below broad crest
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	3%	**Aspect:**	N
Mapped RE:	7.11.51a	**Observed RE:**	7.11.51a
Notes:	*Corymbia clarksoniana* / *Eucalyptus spp.* open woodland to 20m.		

Strata	**Height Range (m)**	**Cover**	**Species**
Tree 1	18-20m		*Corymbia clarksoniana* *Dendrobium canaliculatum* *Eucalyptus platyphylla* *Eucalyptus tereticornis*
Tree 2	6-12m		*Allocasuarina torulosa* *Corymbia clarksoniana* *Lophostemon suaveolens* *Melaleuca viridiflora*
Shrub 1	0.5-6m		*Alstonia muelleriana* *Melastoma malabathricum* *Acacia mangium* *Melaleuca viridiflora* *Alphitonia petriei* *Breynia stipitata* *Allocasuarina torulosa* *Polyscias elegans* *Coelospermum reticulatum* *Planchonia careya* *Acacia melanoxylon*
Ground	<0.5m		*Ageratum houstonianum* *Arundinella nepalensis* *Cheilanthes sp.* *Dianella bambusifolia* *Indigofera sp.* *Lomandra longifolia* *Pellaea sp.* *Phyllanthus sp.* *Rhynchosia sp.* *Themeda triandra*

Basal Area Count:	
Corymbia clarksoniana	9
Allocasuarina torulosa	1
Platycerium hillii	2
Acacia crassicarpa	1

Site name:	SO5	**Date:**	27/01/2017
Survey type:	Secondary	**Location:**	Side of crest of low hill
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	2%	**Aspect:**	W
Mapped RE:	7.11.7a	**Observed RE:**	7.11.7a
Notes:	Leaf litter depth 20mm.		

Strata	**Height Range (m)**	**Cover**	**Species**
Emergent	~ 30m		*Agathis robusta*
Tree 1	20-25m		*Acacia crassicarpa* *Argyrodendron trifoliolatum* *Corymbia torelliana* *Drynaria rigidula* *Elaeocarpus eumundi* *Platycerium bifurcatum*
Tree 2	9-20m		*Acacia crassicarpa* *Acronychia acidula* *Alyxia ruscifolia* *Argyrodendron trifoliolatum* *Calamus caryotoides* *Calamus moti* *Cerbera floribunda* *Codiaeum variegatum* *Corymbia torelliana* *Drynaria rigidula* *Elaeocarpus eumundi* *Platycerium bifurcatum* *Podocarpus grayae*
Tree 3	5-9m		*Acronychia acidula* *Alyxia ruscifolia* *Calamus caryotoides* *Calamus moti* *Codiaeum variegatum* *Endiandra sp.* *Podocarpus grayae*
Shrub 1	1-5m		*Alyxia ruscifolia* *Argyrodendron trifoliolatum* *Darlingia sp.* *Diospyros hebecarpa* *Dysoxylum sp.* *Elaeocarpus eumundi* *Garcinia sp.* *Glochidion sp.* *Mallotus philippensis* *Melodinus australis* *Mischocarpus lachnocarpus*
Ground	<1m		*Pseuderanthemum variabile* *Dianella caerulea* *Tetracera nordtiana* *Steganthera laxiflora* *Gahnia aspera*

Basal Area Count:			
Acacia crassicarpa	3	*Corymbia torelliana*	2
Argyrodendron peralatum	4	*Elaeocarpus eumundi*	5
Cerbera floribunda	1	*Platycerium hillii*	1

Site name:	SO6	**Date:**	28/01/2017
Survey type:	Secondary	**Location:**	Top of broad low hill
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	<2%	**Aspect:**	NE
Mapped RE:	7.11.7a	**Observed RE:**	7.11.7a
Notes:	Consistent with mapped RE. Mature forest with little evidence of disturbance except along edges. No *Acacia* spp.		

Strata	**Height Range (m)**	**Cover**	**Species**
Emergent	35m		*Agathis robusta*
Tree 1	25-30m		*Flindersia ifflaiana* *Elaeocarpus eumundi* *Argyrodendron trifoliolatum* *Platycerium bifurcatum* *Pothos longipes* *Pyrrosia longifolia*
Tree 2	2-20m		*Flindersia ifflaiana* *Elaeocarpus eumundi* *Argyrodendron trifoliolatum* *Platycerium bifurcatum* *Pothos longipes* *Pyrrosia longifolia*
Shrub1	0.5-2m		*Calamus caryotoides* *Acronychia laevis* *Polyscias elegans* *Cryptocarya sp.* *Calamus australis* *Calamus moti* *Darlingia darlingiana* *Cryptocarya grandis* *Dendrocnide excelsa* *Ardisia crenata* *Ficus racemosa* *Flagellaria indica L. var. divaricata* *Guioa acutifolia* *Xylopia maccreae* *Aristolochia sp.* *Melicope elleryana* *Diospyros hebecarpa* *Cupaniopsis foveolata* *Palmeria scandens* *Sterculia quadrifida* *Cyclophyllum coprosmoides* *Melodinus sp.*
Ground			*Pseuderanthemum variabile* *Piper macropiper*

Basal Area Count:			
Agathis robusta	5	*Elaeocarpus eumundi*	3
Argyrodendron trifoliolatum	1	*Elaeocarpus sp.*	1
Diospyros hebecarpa	1	*Flindersia ifflaiana*	6

Site name:	S07	**Date:**	22/05/2017
Survey type:	Secondary	**Location:**	Access Rd alignment
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red kandosol
Slope:	3-5%	**Aspect:**	SE
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Broad ridge and gentle slope to drainage line.		

Strata	Height Range(m)	Cover	Species
Emergent	18.5	40%	*Acacia celsa*
Tree 1	15-16.5	65%	*Acacia celsa* *Alstonia muelleriana* *Cerbera floribunda* *Elaeocarpus angustifolius*
Tree 2	10.5-13.5	70%	*Alstonia muelleriana* *Carnarvonia araliifolia* *Darlingia darlingiana* *Polyscias australiana*
Tree 3	6%	60%	*Carnarvonia araliifolia* *Ganophyllum falcatum* *Polyscias australiana*
Shrub 1	3	30%	*Alphitonia petriei* *Ardisia brevipedata* *Benstonea monticola* *Cryptocarya grandis* *Cryptocarya murrayi* *Ganophyllum falcatum* *Mackinlaya macrosciadea* *Melicope elleryana* *Melodorum uhrii* *Mischocarpus grandissimus* *Neolitsea dealbata* *Rhodamnia sessiliflora*
Ground	<1	<10%	*Blechnum occidentale* *Colysis ampla* *Gahnia aspera* *Schizaea dichotoma*
Vines			*Aristolochia thozetii* *Calamus caryotoides* *Capparis lanceolaris* *Cissus repens* *Dichapetalum papuanum* *Eustrephus latifolius* *Hypserpa laurina* *Melodinus acutiflorus* *Smilax blumei* *Tetracera nordtiana*

Basal Area Count:	
Acacia celsa	9
Polyscias australiana	3
Alstonia muelleriana	6

Site name:	S08	**Date:**	22/05/2017
Survey type:	Secondary	**Location:**	Road reserve on Dodds
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red dermosol
Slope:	10-15%	**Aspect:**	SE
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:			

Strata	Height Range (m)	Cover	Species
Emergent	30	50%	*Pinus caribeae* *Acacia celsa*
Tree 1	15-18	45-60%	*Alstonia muelleriana* *Cerbera floribunda* *Elaeocarpus angustifolius* *Syzygium hemilamprum*
Tree 2	6	30-45%	*Alstonia muelleriana* *Polyscias australiana*
Tree 3	4	30%	*Alstonia muelleriana* *Ganophyllum falcatum* *Polyscias australiana*
Shrub 1	2-3	30%	*Acacia celsa* *Alstonia muelleriana* *Ardisia brevipedata* *Cryptocarya grandis* *Cryptocarya murrayi* *Mackinlaya macrosciadea* *Melastoma malabathricum* *Melicope elleryana* *Melodorum uhrii*
Ground	<1	<5%	*Colysis ampla* *Gahnia aspera*
Vines			*Calamus australis* *Calamus moti* *Hibbertia scandens* *Lygodium reticulatum* *Melodinus australis* *Rubus alceifolius* *Tetracera nordtiana*

Basal Area Count:	
Alstonia muelleriana	9
Cerbera floribunda	3
Acacia celsa	2
Pinus caribeae	4

Site name:	S09	**Date:**	22/05/2017
Survey type:	Secondary	**Location:**	120m west of 4WD track adjacent Owen Ck
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red kandosol
Slope:	3-5%	**Aspect:**	NW
Mapped RE:	7.11.13	**Observed RE:**	7.11.13
Notes:	Gentle to mid slope.		

Strata	Height Range (m)	Cover	Species
Emergent	25-29	20%	*Corymbia torelliana* *Endiandra acuminata*
Tree 1	20-23	45-70%	*Acacia celsa* *Acacia cincinnata* *Eucalyptus tereticornis*
Tree 2	8-10	45-70%	*Cryptocarya clarksoniana* *Ganophyllum falcatum* *Mischocarpus grandissimus* *Scolopia braunii*
Tree 3	4-6	45-70%	*Acronychia laevis* *Carnarvonia araliifolia* *Cupaniopsis foveolata* *Polyalthia nitidissima* *Polyscias australiana* *Scolopia braunii* *Sloanea langii* *Toechima daemelianum*
Shrub 1	1-3	45%	*Acronychia laevis* *Alyxia ruscifolia* *Carissa ovata* *Cerbera floribunda* *Cordyline cannifolia* *Cryptocarya clarksoniana* *Cryptocarya murrayi* *Cupaniopsis foveolata* *Cyclophyllum coprosmoides* *Elaeodendron melanocarpum* *Geitonoplesium cymosum* *Gossia myrsinocarpa* *Guioa acutifolia* *Harpullia rhyticarpa* *Mackinlaya macrosciadea* *Melodorum uhrii* *Palmeria scandens* *Randia audasii* *Myrsine porosa* *Scolopia braunii* *Steganthera laxiflora* *Sterculia quadrifida* *Syzygium luehmannii* *Xylopia maccreae*
Ground	<1	<5%	*Colysis ampla* *Gahnia aspera* *Oplismenus undulatifolius* *Taenitis pinnata*
Vines			*Aristolochia thozetii* *Calamus caryotoides* *Capparis lanceolaris* *Cissus repens* *Dichapetalum papuanum* *Eustrephus latifolius*

			Hypserpa laurina *Melodinus acutiflorus* *Smilax blumei* *Tetracera nordtiana*

Basal Area Count:	
Acacia celsa	6
Scolopia braunii	4
Corymbia torelliana	2
Syziguim tierneyanum	1

Site name:	S10	**Date:**	24/05/2017
Survey type:	Secondary	**Location:**	Lot 131
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Brown dermosol
Slope:	<1%	**Aspect:**	SW
Mapped RE:	7.11.44	**Observed RE:**	7.11.44
Notes:	Ridge ecotone to *Corymbia torelliana*. Fire scarring evident to 1.2m (*ie* ground layer burnt out).		

Strata	**Height Range (m)**	**Cover**	**Species**
Emergent	20-25	20%	*Eucalyptus tereticornis*
Tree 1	6-8	20%	*Allocasuarina torulosa* *Corymbia clarksoniana* *Melaleuca leucadendra*
Tree 2	5	10%	*Acacia cincinnata* *Polyscias elegans*
Shrub 1	2	25%	*Acacia mangium* *Alphitonia whitei* *Alstonia muelleriana* *Breynia oblongifolia* *Breynia stipitata* *Glochidion harveyanum* *Lantana camara* *Lophostemon suaveolens* *Mallotus polyadenos* *Melastoma malabathricum* *Polyscias elegans*
Ground	1	40%	*Cheilanthes sieberi* *Curculigo ensifolia* *Dianella bambusifolia* *Flemingia parviflora* *Phyllanthus sp.*
Vines			*Melodinus australis* *Parsonsia straminea*

Basal Area Count:	
Eucalyptus tereticornis	6
Corymbia clarksonia	5
Allocasuarina torulosa	4
Lophostemon suaveolens	1
Melaleuca leucadendra	1

Site name:	S11	**Date:**	24/05/2017
Survey type:	Secondary	**Location:**	SW corner of site
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red dermosol
Slope:	5-8%	**Aspect:**	SW
Mapped RE:	7.11.51a	**Observed RE:**	7.11.51a
Notes:	SW corner of site, open woodland. Lot of surface disturbcane (digging).		

Strata	Height Range (m)	Cover	Species
Tree 1	24-26	5%	*Allocasuarina torulosa* *Corymbia clarksoniana* *Eucalyptus crebra* *Lophostemon suaveolens*
Tree 2	8-10	20%	*Acacia crassicarpa* *Allocasuarina torulosa* *Melaleuca viridiflora*
Tree 3	4-6	15%	*Acacia melanoxylon* *Alphitonia petriei*
Shrub 1	1.5-3	15%	*Acacia mangium* *Alphitonia petriei* *Alstonia muelleriana* *Breynia oblongifolia* *Breynia stipitata* *Coelospermum reticulatum* *Lantana camara*
Ground	0.5	20%	*Ageratum conyzoides* *Arundinella nepalensis* *Cheilanthes sieberi* *Curculigo ensifolia* *Dianella bambusifolia* *Flemingia parviflora* *Indigofera sp.* *Paspalidium distans* *Phyllanthus sp.* *Schelhammera multiflora* *Themeda triandra* *Vernonia sp.*

Basal Area Count:	
Corymbia clarksonia	2
Eucalyptus crebra	8
Allocasuarina torulosa	3

Site name:	S12	**Date:**	24/05/2017
Survey type:	Secondary	**Location:**	Near boundary of Remnant/Non-remnant forest
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red kandosol
Slope:	12%	**Aspect:**	SE
Mapped RE:	7.11.7a	**Observed RE:**	7.11.7a
Notes:	Hill mid slope.		

Strata	Height Range (m)	Cover	Species
Emergent	30	30%	*Acacia celsa*
Tree 1	25	30%	*Carnarvonia araliifolia* *Cryptocarya laevigata* *Guioa lasioneura* *Polyscias australiana*
Tree 2	16-20	30%	*Acronychia laevis* *Alstonia muelleriana* *Atractocarpus fitzalanii* *Cyclophyllum coprosmoides* *Polyscias australiana* *Rhodamnia sessiliflora* *Scolopia braunii* *Syzygium luehmannii*
Tree 3	8-10	25-30%	*Atractocarpus fitzalanii* *Elaeocarpus foveolatus* *Sloanea langii*
Shrub 1	2-6	20%	*Acronychia laevis* *Acronychia acidula* *Alphitonia whitei* *Alstonia muelleriana* *Cerbera floribunda* *Cryptocarya clarksoniana* *Cyclophyllum coprosmoides* *Elaeocarpus foveolatus* *Gossia myrsinocarpa* *Jagera pseudorhus* *Mackinlaya macrosciadea* *Mischocarpus lachnocarpus* *Neolitsea dealbata* *Sarcotoechia serrata* *Sloanea australis* *Sloanea langii*
Ground	0.6	15%	*Colysis ampla* *Gahnia aspera*
Vines			*Calamus australis* *Calamus caryotoides* *Flagellaria indica var. divaricata* *Hypserpa laurina* *Lygodium reticulatum* *Melodinus australis* *Salacia disepala* *Smilax australis* *Tetracera nordtiana*

Basal Area Count:	
Acacia celsa	6
Polyscias australiana	2
Cryptocarya laevigata	2

Site name:	S13	**Date:**	29/05/2017
Survey type:	Secondary	**Location:**	Nymoobi Farm on boundary
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red dermosol
Slope:	1%	**Aspect:**	E
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	On boundary of possible road corridor. Storm damage in gully, ridge intact.		

Strata	Height Range (m)	Cover	Species
Tree 1	25-30	80%	*Acacia celsa* *Elaeocarpus angustifolius*
Tree 2	18-20	60%	*Carnarvonia araliifolia* *Polyscias elegans*
Tree 3	7-12	50%	*Acronychia acidula* *Cryptocarya grandis* *Polyscias australiana* *Rhodamnia sessiliflora*
Shrub 1	1-5	30%	*Acronychia laevis* *Alphitonia whitei* *Alstonia muelleriana* *Angiopteris evecta* *Archidendron hendersonii* *Benstonea monticola* *Elaeocarpus eumundi* *Ficus copiosa* *Carnarvonia araliifolia* *Cerbera floribunda* *Cordyline cannifolia* *Cryptocarya clarksoniana* *Cupaniopsis foveolata* *Cyclophyllum coprosmoides* *Elaeocarpus eumundi* *Sloanea australis* *Cyatheacooperi* *Steganthera laxiflora* *Guioa lasioneura* *Harpullia rhyticarpa* *Lasianthus chlorocarpus* *Linospadix minor* *Mackinlaya macrosciadea* *Melastoma malabathricum* *Melicope bonwickii* *Melodorum uhrii* *Neolitsea dealbata* *Palmeria scandens* *Pittosporum revolutum* *Randia audasii* *Myrsine porosa* *Rhodamnia sessiliflora* *Syzygium divaricatum* *Syzygium luehmannii*
Ground	<0.1	<5%	*Ageratum conyzoides* *Gahnia aspera* *Oplismenus undulatifolius*
Vines			*Calamus australis* *Calamus moti* *Flagellaria indica var. divaricata* *Freycinetia excelsa* *Hypserpa laurina* *Lygodium reticulatum* *Melodinus australis* *Oxera splendida* *Rubus alceifolius*

	Scaevola enantophylla *Tetracera nordtiana*

Basal Area Count:	
Cryptocarya grandis	3
Elaeocarpus angustifolius	2

Site name:	S14	**Date:**	29/05/2017
Survey type:	Secondary	**Location:**	Warril Drive approx 100m from forest edge
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red dermosol
Slope:	1-3%	**Aspect:**	N
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Ridge. Possibly remnant but not complex enough. Dominated by pioneer spp.		

Strata	Height Range (m)	Cover	Species
Emergent	29.5	40	*Acacia celsa*
Tree 1	25.5	80%	*Acacia celsa*
Tree 2	11.5	50%	*Alstonia muelleriana* *Elaeocarpus angustifolius* *Garcinia dulcis* *Melicope elleryana* *Polyscias australiana* *Syzygium luehmannii*
Tree 3	7.5	50%	*Acronychia acidula* *Agathis robusta* *Cryptocarya clarksoniana* *Cryptocarya grandis* *Elaeocarpus eumundi* *Guioa lasioneura* *Polyscias australiana* *Myrsine porosa* *Rhodamnia sessiliflora* *Steganthera laxiflora* *Syzygium luehmannii*
Shrub1	3-4	50%	*Acacia celsa* *Benstonea monticola*
Shrub 2	1-3	10%	*Acronychia laevis* *Alphitonia whitei* *Archidendron hendersonii* *Benstonea monticola* *Brachychiton acerifolius* *Chionanthus ramiflorus* *Cordyline cannifolia* *Cryptocarya grandis* *Mackinlaya macrosciadea* *Melicope elleryana* *Melodorum uhrii* *Neolitsea dealbata* *Polyscias australiana* *Syzygium luehmannii*
Ground	1	70-80%	*Colysis ampla*
Vines			*Calamus moti* *Hypserpa laurina* *Lygodium reticulatum* *Melodinus australis* *Oxera splendida* *Tetracera daemeliana*

Basal Area Count:	
Alstonia muelleriana	1
Elaeocarpus angustifolius	3
Cryptocarya clarksoniana	5
Acacia celsa	3

Site name:	S15	**Date:**	29/05/2017
Survey type:	Secondary	**Location:**	Off Hillview Drive
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red dermosol
Slope:	10%	**Aspect:**	NW
Mapped RE:	7.11.1a	**Observed RE:**	7.11.1a
Notes:	Mid slope. Mapped as Remnant - more Non-remnant. *Acacia celsa* emergent.		

Strata	**Height Range (m)**	**Cover**	**Species**
Emergent	36	40%	*Acacia celsa*
Tree 1	30	60%	*Cryptocarya vulgaris* *Elaeocarpus angustifolius* *Syzygium hemilamprum*
Tree 2	13	70%	*Polyscias australiana*
Tree 3	6.5	70%	*Cryptocarya clarksoniana* *Cryptocarya grandis* *Garcinia dulcis* *Melicope bonwickii* *Melicope elleryana* *Polyalthia nitidissima* *Polyscias australiana* *Rhodamnia sessiliflora* *Scolopia braunii* *Syzygium luehmannii*
Shrub 1	3-4	50%	*Archidendron hendersonii* *Benstonea monticola* *Carnarvonia araliifolia* *Cerbera floribunda* *Cordyline cannifolia* *Cryptocarya grandis* *Elaeocarpus eumundi* *Linospadix minor* *Melicope bonwickii* *Myrsine porosa* *Rhodamnia sessiliflora* *Scolopia braunii*
Ground	1	40%	*Gahnia aspera*
Epiphytes			*Cymbidium madidum*
Vines			*Calamus australis* *Flagellaria indica var. divaricata* *Hypserpa laurina* *Lygodium reticulatum* *Melodinus australis* *Piper hederaceum*

Basal Area Count:	
Melicope elleryana	2
Elaeocarpus angustifolius	5
Cryptocarya vulgaris	5
Acacia celsa	4

Site name:	S16	**Date:**	29/05/2017
Survey type:	Secondary	**Location:**	Off Billabong Access Tourist Park
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Orthis tenosol/Red dermosol
Slope:	15%	**Aspect:**	SE
Mapped RE:	7.11.7	**Observed RE:**	7.11.7a
Notes:	Steep slope adjacent upper Haren Creek.		

Strata	**Height Range (m)**	**Cover**	**Species**
Emergent	33		*Acacia celsa*
Tree 1	32	50%	*Argyrodendron peralatum* *Cryptocarya murrayi* *Elaeocarpus angustifolius*
Tree 2	18	50%	*Syzygium hemilamprum*
Tree 3	12-15	70%	*Acronychia acidula* *Litsea bindoniana*
Shrub 1	3-5	25%	*Acronychia laevis* *Carnarvonia araliifolia* *Cerbera floribunda* *Cupaniopsis foveolata* *Myristica insipida* *Palmeria scandens* *Polyscias australiana* *Rhodamnia sessiliflora* *Sloanea australis* *Sterculia quadrifida* *Sloanea langii*
Ground	1	10%	
Epiphytes			*Asplenium nidus*
Vines			*Calamus australis* *Calamus moti* *Freycinetia excelsa* *Hypserpa laurina* *Melodinus australis* *Oxera splendida* *Piper hederaceum* *Pothos longipes*

Basal Area Count:	
Melicope elleryana	1
Elaeocarpus angustifolius	1
Cryptocarya grandis	2
Acronychia acidula	2
Acacia celsa	1
Argyrodendron peralatum	2
Sloanea langii	1

Site name:	S17	**Date:**	29/05/2017
Survey type:	Secondary	**Location:**	Road reserve outside E boundary
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red dermosol
Slope:	5-8%	**Aspect:**	SE
Mapped RE:	7.11.1a	**Observed RE:**	7.11.1a
Notes:	Beside tributary of Warril Ck.		

Strata	**Height Range (m)**	**Cover**	**Species**
Emergent			*Acacia celsa* *Argyrodendron peralatum*
Tree 1	29.5-35	70%	*Syzygium cormiflorum*
Tree 2	21.5	65-70%	*Carnarvonia araliifolia* *Polyscias australiana* *Syzygium luehmannii*
Tree 3	9.5	50%	*Melicope bonwickii* *Neolitsea dealbata* *Polyscias australiana* *Rhodamnia sessiliflora*
Shrub 1	3-4	40%	*Alphitonia whitei* *Archidendron hendersonii* *Benstonea monticola* *Calophyllum calaba var. australianum* *Codiaeum variegatum* *Cryptocarya clarksoniana* *Linospadix minor* *Mackinlaya macrosciadea* *Palmeria scandens* *Syzygium luehmannii* *Syzygium tierneyanum*
Ground	1	10%	*Pandanus conicus*
Epiphytes			*Drynaria sparsisora*
Vines			*Calamus australis* *Flagellaria indica var. divaricata* *Lygodium reticulatum* *Mucuna gigantea* *Pothos longipes* *Tetracera nordtiana*

Basal Area Count:	
Melicope elleryana	1
Elaeocarpus angustifolius	2
Cryptocarya clarksonia	4
Acronychia acidula	1
Acacia celsa	1
Argyrodendron peralatum	2
Syzygium cormiflorum	2

Site name:	S18	**Date:**	5/06/2017
Survey type:	Secondary	**Location:**	Non remnant forest adjacent to Paint Ball Park
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red kandosol
Slope:	20%	**Aspect:**	NE
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	T132 run to show quality of Non-remnant		

Strata	Height Range (m)	Cover	Species
Emergent	35	30%	*Acronychia acidula* *Eucalyptus grandis*
Tree 1	27	35-40%	*Acacia celsa* *Alstonia muelleriana* *Cryptocarya grandis* *Cryptocarya murrayi* *Darlingia darlingiana* *Melicope elleryana*
Tree 2	18-20	40%	*Alstonia muelleriana* *Cryptocarya murrayi* *Polyscias australiana* *Rhodamnia sessiliflora*
Tree 3	8-14	60%	*Acronychia acidula* *Carnarvonia araliifolia* *Cerbera floribunda* *Chionanthus ramiflorus* *Cryptocarya laevigata* *Guioa acutifolia* *Mangifera indica* *Polyscias australiana* *Tabernaemontana pandacaqui*
Shrub 1	3-6	60%	*Acronychia laevis* *Clerodendrum floribundum* *Cryptocarya clarksoniana* *Cryptocarya grandis* *Mackinlaya macrosciadea* *Mischocarpus grandis* *Myristica insipida* *Palmeria scandens* *Sloanea langii*
Ground	1	10%	*Gahnia aspera*
Vines			*Calamus australis* *Calamus moti* *Epipremnum pinnatum* *Freycinetia scandens* *Hypserpa laurina* *Melodinus australis* *Melodorum uhrii* *Mucuna gigantea* *Piper hederaceum* *Tetracera daemeliana* *Tetracera nordtiana*

Site name:	S19	**Date:**	5/06/2017
Survey type:	Secondary	**Location:**	Clearing adjacent Owen Creek at start of track network
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red dermosol
Slope:	10%	**Aspect:**	E
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Area of Non-remnant close to Remnant as *Elaeocarpus* spp. here taken place of *Acacia celsa* in canopy.		

Strata	Height Range (m)	Cover	Species
Emergent	30-35	35%	*Corymbia torelliana* *Oxera splendida*
Tree 1	25-30	40%	*Acacia celsa* *Acronychia acidula* *Carnarvonia araliifolia* *Cerbera floribunda* *Cryptocarya murrayi* *Elaeocarpus angustifolius*
Tree 2	15-18	35%	*Acronychia acidula* *Cryptocarya clarksoniana* *Cryptocarya murrayi* *Neolitsea dealbata* *Syzygium luehmannii*
Tree 3	8	40%	*Acronychia laevis* *Cryptocarya murrayi*
Shrub1	3-6	30%	*Acronychia laevis* *Archidendron hendersonii* *Carnarvonia araliifolia* *Cryptocarya clarksoniana* *Elaeocarpus eumundi* *Guioa lasioneura* *Levieria acuminata* *Linospadix minor* *Mackinlaya macrosciadea* *Rhodamnia sessiliflora* *Sloanea langii* *Sterculia quadrifida* *Syzygium luehmannii*
Ground	1	5%	*Colysis ampla*
Vines			*Calamus australis* *Calamus caryotoides* *Calamus moti* *Capparis lanceolaris* *Eustrephus latifolius* *Mucuna gigantea* *Tetracera nordtiana*

Basal Area Count:	
Elaeocarpus angustifolius	4
Acacia celsa	1
Corymbia torelliana	3
Cryptocarya murrayi	1
Polyscias australiana	1

Quaternary transect surveys

Site name:	Q1	**Date:**	27/01/2017
Survey type:	Quaternary	**Location:**	
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red kandosol
Slope:		**Aspect:**	W
Mapped RE:	7.11.44	**Observed RE:**	7.11.51
Notes:	Mapped as *Eucalyptus tereticornis* woodland. Very open canopy, many shrubs but not dense foliage cover (above head height). Thick mat of leaf litter. Possibly closer match to RE 7.11.51 (*Corymbia clarksoniana* dominant).		

Strata	Height Range (m)	Cover	Species
Tree 1	20-25m		*Corymbia clarksoniana*
Tree 2	8-15m		*Acacia crassicarpa* *Allocasuarina torulosa* *Alphitonia petriei* *Alstonia muelleriana* *Corymbia intermedia* *Eucalyptus tereticornis* *Polyscias elegans*
Shrub 1	0.5 - 8?		*Acacia crassicarpa* *Alstonia muelleriana* *Breynia stipitata* *Codiaeum variegatum* *Guioa acutifolia* *Lantana camara* *Lophostemon suaveolens* *Mackinlaya macrosciadea* *Parsonia sp.* *Polyscias elegans* *Smilax australis* *Tetracera nordtiana* *Xylopia maccreae*
Ground	<0.5m		*Calamus moti* *Dianella bambusifolia* *Gahnia aspera* *Imperata cylindrica* *Ottochloa sp.*

Site name:	Q2	**Date:**	27/01/2017
Survey type:	Quaternary	**Location:**	Pitfall trap site
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:		**Aspect:**	E
Mapped RE:	7.11.44	**Observed RE:**	7.11.44
Notes:	Leaf litter, very high grasses.		

Strata	Height Range (m)	Cover	Species
Tree 1	20-27m		*Corymbia clarksoniana* *Eucalyptus tereticornis*
Tree 2	5-15m		*Acacia crassicarpa* *Allocasuarina torulosa* *Alphitonia petriei* *Alstonia muelleriana* *Canarium australasicum* *Corymbia clarksoniana* *Guioa acutifolia* *Polyscias australiana* *Polyscias elegans*
Shrub 1			*Alphitonia petriei* *Alstonia muelleriana* *Lantana camara* *Mackinlaya macrosciadea* *Melodinus australis* *Melodorum uhrii* *Polyscias australiana* *Scolopia braunii* *Tetracera nordtiana*
Ground			*Aristolochia sp.* *Dianella bambusifolia* *Gahnia aspera* *Imperata cylindrica* *Lomandra longifolia* *Ottochloa sp.*

Site name:	Q3	**Date:**	27/01/2017 & 05/09/2017
Survey type:	Quaternary	**Location:**	Trapping Site
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Brown dermosol
Slope:		**Aspect:**	W
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Originally simple-complex notophyll vine forest. Has suffered extensive storm damage in the past.		

Strata	Height Range (m)	Cover	Species
Emergent	19.5-29.75	55%	*Acacia crassicarpa*
Tree 1	14.5-17	60%	*Acacia crassicarpa* *Cerbera floribunda*
Tree 2	12.5	65%	*Allocasuarina torulosa* *Alstonia muelleriana* *Calamus australis* *Calamus moti* *Melodinus sp.* *Polyscias australiana* *Polyscias elegans*
Tree 3	6	50%	*Rainforest spp.*
Shrub 1	3	30%	*Coffea arabica* *Guioa acutifolia* *Hypserpa decumbens* *Rhodomyrtus sp.* *Scolopia braunii* *Syzygium sp.* *Tetracera nordtiana*
Ground	0.5	5%	

Site name:	Q4	**Date:**	28/01/2017
Survey type:	Quaternary	**Location:**	Creekline below dam.
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:		**Aspect:**	NE
Mapped RE:	Non remnant	**Observed RE:**	Non-remnant
Notes:	Above high bank of creek within riparian zone.		

Strata	**Height Range (m)**	**Cover**	**Species**
Tree 1	6-10m		*Cerbera floribunda* *Guioa acutifolia* *Polyscias elegans* *Ficus copiosa* *Alstonia muelleriana* *Syzygium tierneyanum* *Garcinia sp.* *Macaranga involucrata* *Elaeocarpus angustifolius* *Alphitonia petriei*
Shrub 1	0.5-4m		*Cordyline cannifolia* *Diplazium cordifolium* *Lantana camara* *Lygodium reticulatum* *Psidium guajava* *Rhodamnia sessiliflora* *Rubus alceifolius* *Senna sp.* *Syagrus romanzoffiana* *Tetracera nordtiana*
Ground	< 0.5		*Adiantum hispidulum* *Dianella caerulea* *Diplazium cordifolium* *Imperata cylindrica*

Ground cover:	
FPC	
litter	95%
veg	3%
soil	2%

Site name:	Q5	**Date:**	28/01/2017
Survey type:	Quaternary	**Location:**	Trap site
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:		**Aspect:**	NE
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Low hillslope leading gradually to creek. Fence lower towards creek may indicate historical clearing. Also storm damage obvious - very broken canopy. *Duranta erecta* starting to establish here under canopy. *Rubus* and *Lantana* under canopy here.		

Strata	**Height Range (m)**	**Cover**	**Species**
Emergent	17-19	20%	*Acacia celsa*
Tree 1	15	40%	*Acacia celsa* *Alphitonia petriei*
Tree 2	7.5	60%	*Alstonia muelleriana* *Deplanchea tetraphylla* *Guioa acutifolia* *Polyscias australiana* *Syzigium sp.*
Tree 3	3.5	50%	*Polyscias australiana*
Shrub 1	2.5	30%	*Benstonea monticola* *Calamus moti* *Cryptocarya grandis* *Endiandra sp.* *Hypserpa sp.* *Macaranga involucrata* *Melicope elleryana* *Melodinus sp.* *Mischocarpus grandissimus* *Neolitsea dealbata* *Polyscias elegans* *Rubus alceifolius* *Tetracera nordtiana*
Ground	1	<10%	*Lygodium reticulatum* *Melastoma malabathricum* *Oplismenus undulatifolius*

Ground cover:	
FPC	
litter	90%
veg	5%
soil	5%

Site name:	Q6	**Date:**	28/01/2017
Survey type:	Quaternary	**Location:**	Mid-hillslope
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:		**Aspect:**	SW
Mapped RE:	7.11.1a	**Observed RE:**	7.11.1a
Notes:	Dense stands of *Calamus* spp. (precludes ready access). Highly disturbed (storm damage).		

Strata	**Height Range (m)**	**Cover**	**Species**
Tree 1	20-25m		*Acacia celsa* *Albizia procera* *Alstonia muelleriana* *Elaeocarpus eumundi* *Flagellaria indica L. var. divaricata* *Platycerium bifurcatum* *Sloanea woollsii*
Tree 2	15-20m		*Alstonia muelleriana* *Dysoxylum parasiticum* *Garcinia sp.* *Polyscias australiana*
Tree 3	10-15m		*Polyscias australiana* *Rhodamnia sessiliflora*
Shrub 1	0.5-5m		*Benstonea monticola* *Calamus australis* *Calamus moti* *Cerbera floribunda* *Cordyline manners-suttoniae* *Cryptocarya grandis* *Cryptocarya murrayi* *Myristica insipida* *Neolitsea brassii* *Neolitsea dealbata* *Oxera splendida* *Scolopia braunii* *Syzygium sp.* *Toechima daemelianum*
Ground	<0.5m		*Cissus sp.*
Ground cover:			
FPC			
litter	75%		
veg	5%		
soil	20%		

Site name:	Q7	**Date:**	28/01/2017
Survey type:	Quaternary	**Location:**	Owen Creek
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:		**Aspect:**	W
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Highly disturbed to east. More intact to west. Riparian Zone. Correctly mapped as Non-rem. Could not cross creek to check RE 7.11.1a; however, RE 7.11.1a may be present to the west.		

Strata	**Height Range (m)**	**Cover**	**Species**
Tree 1	10-15m		*Acacia celsa* *Buckinghamia celsissima* *Darlingia darlingiana* *Melaleuca leucadendra* *Syzygium tierneyanum* *Tristaniopsis laurina*
Tree 2	8-10m		*Calamus australis* *Flagellaria indica L. var. divaricata* *Melicope elleryana* *Oxera splendida* *Polyscias australiana* *Syzygium tierneyanum*
Shrub 1	0.5-5m		*Argyrodendron trifoliolatum* *Benstonea monticola* *Calamus moti* *Cryptocarya grandis* *Ficus copiosa* *Glochidion harveyanum* *Lygodium reticulatum* *Mackinlaya sp.* *Polyscias elegans* *Rubus alceifolius* *Tetracera nordtiana*
Ground	< 0.5m		*Gahnia aspera* *Megathyrsus maximus* *Oplismenus undulatifolius*
Ground cover:			
FPC			
litter	60%		
veg	10%		
soil	30%		

Site name:	Q8	**Date:**	28/01/2017
Survey type:	Quaternary	**Location:**	Low undulating hills disected by drainage lines
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	2-3%	**Aspect:**	SW
Mapped RE:	7.11.7a	**Observed RE:**	7.11.7a
Notes:	Intact simple-complex mesophyll-notophyll vine forest.. Previous disturbance from selective clearing, storm damage to canopy and edge effects.		

Strata	Height Range (m)	Cover	Species
Tree 1	25-30m		*Argyrodendron trifoliolatum* *Elaeocarpus eumundi* *Elaeocarpus angustifolius* *Flindersia ifflaiana*
Tree 2	15-18m		*Calamus australis* *Cryptocarya grandis* *Garcinia sp.* *Platycerium bifurcatum* *Platycerium hillii* *Sloanea woollsii*
Tree 3			*Calamus australis* *Cryptocarya sp.* *Garcinea sp.* *Polyscias australiana* *Syzygium sp.*
Shrub1			*Acronychia laevis* *Benstonea monticola* *Carnarvonia araliifolia* *Hypserpa sp.* *Linospadix minor* *Mackinlaya sp.* *Pittosporum sp.* *Pittosporum wingii* *Podocarpus grayae* *Sterculia quadrifida*
Ground	< 0.5m		*Gahnia aspera*

Ground cover:	
FPC	
litter	90%
veg	5%
soil	5%

Site name:	Q9	**Date:**	28/01/2017
Survey type:	Quaternary	**Location:**	Boyles Road
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:		**Aspect:**	SW
Mapped RE:	7.11.13	**Observed RE:**	7.11.13
Notes:			

Strata	Height Range (m)	Cover	Species
Tree 1	20-25m		*Argyrodendron trifoliolatum* *Corymbia torelliana* *Drynaria sparsisora* *Flindersia ifflaiana* *Platycerium hillii*
Tree 2	15-17m		*Corymbia torelliana* *Delonix regia*
Tree 3	5-12m		*Acacia celsa* *Corymbia torelliana* *Macaranga tanarius*
Shrub 1	0.5-5m		*Acronychia acidula* *Alyxia ruscifolia* *Capparis sp.* *Codiaeum variegatum* *Corymbia torelliana* *Dioscorea transversa* *Guioa acutifolia* *Lantana camara* *Mallotus philippensis* *Pavetta australiensis* *Polyscias elegans* *Scolopia braunii*
Ground	<0.5		*Calamus caryotoides* *Gahnia aspera* *Megathyrsus maximus* *Stachytarpheta jamaicensis*

Site name:	Q10	**Date:**	28/01/2017
Survey type:	Quaternary	**Location:**	SW corner of property adjacent Warril Dr.
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red kandosol
Slope:		**Aspect:**	SE
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Disturbed simple-complex notophyll vine forest above creekline. Regrowth after clearing obvious directly adjacent. Clearing damage to top of high bank with *Acacia celsa* and *Calamus spp*. dominant. Forest regenerating from historical clearing.		

Strata	Height Range (m)	Cover	Species
Emergent	20	40%	*Acacia celsa*
Tree 1	18	65%	*Acacia celsa*
Tree 2	9.5	70%	*Cerbera floribunda* *Polyscias australiana* *Argyrodendron trifoliolatum* *Cryptocarya grandis* *Carnarvonia sp.* *Hypserpa decumbens* *Calamus australis*
Tree 3	6.5	40%	*Rhodamnia sessiliflora*
Shrub 1	3	40%	*Cryptocarya grandis* *Darlingia darlingiana* *Tetracera daemeliana* *Calamus moti* *Calamus australis* *Myristica insipida* *Lygodium reticulatum* *Syzygium hemilamprum* *Atractocarpus fitzalanii* *Alstonia muelleriana* *Melodinus sp.* *Rubus alceifolius* *Alphitonia petriei* *Licuala ramsayi*
Ground	1	<10%	*Calamus Sp.*

Ground cover:	
FPC	
litter	95%
veg	1%
soil	4%

Site name:	Q11	**Date:**	22/05/2017
Survey type:	Quaternary	**Location:**	Riparian area downstream from existing dam
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	30-45%	**Aspect:**	E
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Gully/drainage line. Targeted search.		

Strata	Height Range (m)	Cover	Species
Tree 1	12	40%	*Acacia celsa*
Tree 2	7.5	65%	*Alstonia muelleriana* *Cerbera floribunda* *Elaeocarpus angustifolius* *Ficus hispida* *Guioa acutifolia* *Polyscias australiana*
Tree 3	5	40%	*Ficus copiosa* *Macaranga involucrata var. mallotoides* *Polyscias elegans* *Myrsine porosa*
Shrub 1	3	40%	*Adiantum hispidulum* *Angiopteris evecta* *Blechnum occidentale* *Duranta erecta* *Flagellaria indica var. divaricata* *Hibbertia scandens* *Lantana camara* *Lygodium reticulatum* *Melastoma malabathricum* *Rubus alceifolius* *Senna septemtrionalis* *Smilax australis* *Cyathea cooperi* *Tetracera nordtiana* *Urena lobata*
Ground	1	90%	*Ageratum conyzoides* *Brachiaria decumbens* *Crassocephalum crepidioides* *Dianella caerulea* *Dicranopteris linearis* *Gahnia aspera* *Mimosa pudica* *Megathyrsus maximus* *Passiflora foetida* *Polygala paniculata* *Stachytarpheta jamaicensis*

Ground cover:	
FPC	
litter	60%
rock	20%
soil	20%

Site name:	Q12	**Date:**	22/05/2017
Survey type:	Quaternary	**Location:**	Road reserve
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	30-45%	**Aspect:**	E
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Storm damaged *Acacia celsa* forest. Canopy intermittent. Canopy gaps allow sunlight to forest floor.		

Strata	Height Range (m)	Cover	Species
Emergent	22-25	50%	*Acacia celsa*
Tree 1	15-20	60-70%	*Argyrodendron peralatum* *Cerbera floribunda* *Carnarvonia araliifolia* *Elaeocarpus angustifolius*
Tree 2	9	50%	*Asplenium nidus* *Calamus moti* *Calophyllum calaba var. australianum* *Cryptocarya grandis* *Drynaria rigidula* *Melicope elleryana* *Sloanea langii*
Tree 3	6		*Archidendron hendersonii* *Cryptocarya murrayi* *Melicope bonwickii* *Neolitsea dealbata* *Piper hederaceum* *Pittosporum rubiginosum* *Polyscias australiana* *Pothos longipes* *Smilax australis* *Tetracera daemeliana* *Tetracera nordtiana*
Shrub 1	<3		*Ardisia brevipedata* *Benstonea monticola* *Calamus australis* *Colysis ampla* *Cordyline cannifolia* *Cymbidium madidum* *Epipremnum pinnatum* *Flagellaria indica var. divaricata* *Hibbertia scandens* *Hypserpa laurina* *Linospadix minor* *Lygodium reticulatum* *Melodorum uhrii* *Oxera splendida*
Ground	<1		*Gahnia aspera* *Mackinlaya macrosciadea*

Ground cover:			
FPC			
litter	100%	rock	

Site name:	Q13	**Date:**	24/05/2017
Survey type:	Quaternary	**Location:**	SW of site in DNRM 7.11.33 polygon
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Orthic tenosol/Red dermosol
Slope:	10%	**Aspect:**	W
Mapped RE:	7.11.33	**Observed RE:**	7.11.51a
Notes:	With additional *Eucalyptus tereticornis*, *Corymbia tessellaris*, *Lophostemon suaveolens* , *Planchonia careya*, and *Acacia flavescens*. Lantana in shrub layer.		

Strata	Height Range (m)	Cover	Species
Tree 1	25	40%	*Acacia mangium* *Corymbia clarksoniana* *Corymbia tessellaris* *Eucalyptus tereticornis*
Tree 2	10-16	50%	*Acacia crassicarpa* *Acacia melanoxylon* *Alphitonia petriei* *Alstonia muelleriana* *Lophostemon suaveolens* *Mallotus polyadenos* *Melaleuca leucadendra* *Polyscias australiana* *Polyscias elegans*
Tree 3	6-8	55%	*Allocasuarina torulosa* *Breynia stipitata* *Ficus opposita* *Harpullia rhyticarpa* *Pittosporum revolutum* *Planchonia careya* *Rapanea porosa*
Shrub 1	2.5		*Acacia flavescens* *Breynia oblongifolia* *Hibbertia scandens* *Lantana camara* *Lantana camara* *Melastoma malabathricum* *Myrsine porosa* *Rhynchosia sp.*
Ground	0.7		*Ageratum conyzoides* *Cheilanthes sieberi* *Curculigo ensifolia* *Dianella bambusifolia* *Grewia retusifolia* *Heteropogon triticeus* *Themeda triandra* *Vernonia sp.*

Ground cover:	
FPC	
litter	100%

Site name:	Q14	**Date:**	5/06/2017 & 05/09/2017
Survey type:	Quaternary	**Location:**	Proposed crossing of Haren Creek
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	3-8%	**Aspect:**	E
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Creekline. Steep defining banks. *Rubus* sp. on alluvial in stream bank.		

Strata	Height Range (m)	Cover	Species
Emergent	19-21	40%	*Acacia celsa*
Tree 1	13-15	25%	*Acacia celsa* *Cerbera floribunda*
Tree 2	8	35%	*Alstonia muelleriana* *Carnarvonia araliifolia* *Cryptocarya grandis* *Darlingia darlingiana* *Drynaria rigidula* *Garcinia dulcis* *Melicope elleryana* *Neolitsea dealbata* *Planchonella chartacea* *Polyalthia australis*
Tree 3	5	50%	*Acronychia laevis* *Archontophoenix myolensis* *Bursaria incana* *Chionanthus ramiflorus* *Cryptocarya clarksoniana* *Cryptocarya murrayi* *Ficus copiosa* *Glochidion harveyanum* *Guioa acutifolia* *Pandanus cookii* *Piper hederaceum* *Polyscias australiana* *Polyscias elegans* *Streblus glaber* *Syzygium luehmannii* *Syzygium tierneyanum* *Tabernaemontana pandacaqui* *Tristaniopsis exiliflora*
Shrub 1	2	10%	*Ampelocissus acetosa* *Clerodendrum floribundum* *Colysis ampla* *Citrus x jambhiri* *Duranta erecta* *Flagellaria indica var. divaricata* *Freycinetia excelsa* *Freycinetia scandens* *Hoya australis* *Hypserpa laurina* *Lantana camara* *Lygodium reticulatum* *Melodinus australis* *Rhodamnia sessiliflora*

			Rubus alceifolius *Smilax australis* *Cyathea cooperi* *Tetracera nordtiana* *Xylopia maccreae*
Ground	0.5	10%	*Adiantum hispidulum* *Cheilanthes sieberi* *Cymbidium madidum* *Dianella caerulea* *Gahnia aspera* *Hyptis capitata* *Lomandra longifolia* *Oplismenus undulatifolius* *Pseuderanthemum variabile* *Selaginella kraussiana* *Sphagneticola trilobata*
Ground cover:			
FPC			
litter	100%		

Site name:	Q15	**Date:**	29/05/2017 & 05/09/2017
Survey type:	Quaternary	**Location:**	Proposed bridge crossing of Warill Creek
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	8%	**Aspect:**	E
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Large slope.		

Strata	Height Range (m)	Cover	Species
Emergent	20-21.7	25%	*Acacia celsa*
Tree 1	13-15	35%	*Cryptocarya grandis*
Tree 2	7-8	50%	*Alphitonia whitei* *Alstonia muelleriana* *Cryptocarya clarksoniana* *Cryptocarya murrayi* *Harpullia rhyticarpa* *Neolitsea dealbata* *Piper caninum* *Polyscias australiana* *Pyrrosia longifolia* *Sloanea australis* *Syzygium hemilamprum* *Syzygium luehmannii*
Tree 3	6	30%	*Aristolochia deltantha* *Calamus australis* *Carnarvonia araliifolia* *Cyathea rebeccae* *Cyclophyllum coprosmoides* *Ficus copiosa* *Flagellaria indica var. divaricata* *Hypserpa laurina* *Melodinus australis* *Melodorum uhrii* *Piper hederaceum* *Rhodamnia sessiliflora* *Tetracera daemeliana*
Shrub 1	3	30%	*Benstonea monticola* *Freycinetia excelsa* *Freycinetia scandens* *Lygodium reticulatum* *Mackinlaya macrosciadea* *Rubus alceifolius*
Ground	1	15%	*Dicranopteris linearis* *Gahnia aspera*

Ground cover:	
FPC	
litter	95%
rock	
soil	5%

Site name:	Q16	**Date:**	5/06/2017
Survey type:	Quaternary	**Location:**	Proposed crossing of Haren Creek
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:	8%	**Aspect:**	E
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Current crossing #1.		

Strata	Height Range (m)	Cover	Species
Tree 1	10-12	50%	*Acacia celsa* *Acronychia acidula* *Alphitonia petriei* *Cerbera floribunda* *Carnarvonia araliifolia* *Lophostemon suaveolens* *Neolitsea dealbata* *Syzygium luehmannii*
Tree 2	8	60%	*Bursaria incana* *Clerodendrum floribundum* *Ficus racemosa* *Garcinia dulcis* *Glochidion harveyanum* *Guioa acutifolia* *Harpullia rhyticarpa* *Melicope xanthoxyloides* *Platycerium bifurcatum* *Polyscias australiana* *Polyscias elegans* *Myrsine porosa* *Tristaniopsis exiliflora*
Tree 3	6	60%	*Alstonia muelleriana* *Archontophoenix alexandrae* *Aristolochia deltantha* *Atractocarpus fitzalanii* *Breynia cernua* *Calamus moti* *Cryptocarya laevigata* *Ficus copiosa* *Flagellaria indica var. divaricata* *Freycinetia excelsa* *Freycinetia scandens* *Hypserpa laurina* *Melodinus australis* *Pandanus cookii* *Rhodamnia sessiliflora* *Xylopia maccreae*
Shrub 1	1-3	30%	*Ampelocissus acetosa* *Colysis ampla* *Hibbertia scandens* *Lantana camara* *Lygodium reticulatum* *Mackinlaya macrosciadea* *Melastoma malabathricum* *Mischocarpus lachnocarpus* *Rubus alceifolius* *Cyathea cooperi* *Stephania japonica* *Tetracera daemeliana* *Tetracera nordtiana*

Ground	*Adiantum hispidulum* *Cheilanthes sieberi* *Dianella caerulea* *Dicranopteris linearis* *Gahnia aspera* *Lomandra longifolia* *Oplismenus undulatifolius* *Polygala paniculata* *Schelhammera multiflora* *Spermacoce remota* *Sphagneticola trilobata* *Stachytarpheta jamaicensis*

Ground cover:	
FPC	
litter	70%
rock	10%
soil	20%

Site name:	Q17	**Date:**	30/08/2017
Survey type:	Quaternary	**Location:**	Access Rd Alignment 150m NW from S07
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red Kandasol
Slope:	3-5%	**Aspect:**	
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Non-remnant - low biodiversity of pioneer species. Dominant species in each strata are listed.		

Strata	Height Range (m)	Cover	Species
Emergent	19.5-20.5	40%	*Acacia celsa* *Grevillea baileyana*
Tree 1	13.5	60%	*Acacia celsa*
Tree 2	6.5	60%	*Alstonia muelleriana* *Polyscias australiana* *Grevillea baileyana*
Tree 3	5	40%	*Alstonia muelleriana* *Polyscias australiana* *Aleurites rockinghamensis*
Shrub 1	3	40%	*Alstonia muelleriana* *Polyscias australiana*
Ground	1	<10%	*Grevillea baileyana* *Seedlings* *Aleurites rockinghamensis*

Site name:	Q18	**Date:**	30/08/2017
Survey type:	Quaternary	**Location:**	Access Rd Alignment 150m W from S07
Geology:	Metamorphic Hodgkinson Formation	**Soil:**	Red Kandasol
Slope:	3-5%	**Aspect:**	
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Mapped as Non-emnant but possibly now RE 7.11.1b as canopy is well developed, there is a higher biodiversity of non-pioneer species, and a higher abundance of vines.		

Strata	Height Range (m)	Cover	Species
Emergent	23	40%	*Acacia celsa* *Grevillea baileyana*
Tree 1	13.5-15.5	65-70%	*Acacia celsa* *Elaeocarpus angustifolius* *Grevillea baileyana*
Tree 2	10.5	65-70%	*Aleurites rockinghamensis* *Darlingia darlingiana*
Tree 3	6.5	65-70%	*Aleurites rockinghamensis* *Darlingia darlingiana*
Shrub 1	3	20%	*Cyathea cooperi* *Polyscias australiana*
Ground	1	10%	*Calamus sp.* *Seedlings* *Piper hederaceum*

Site name:	Q19	**Date:**	30/08/2017
Survey type:	Quaternary	**Location:**	Q5 service area
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	Red dermosol
Slope:		**Aspect:**	NE
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Very broken canopy. Lantana, Rubus, and Duranta all under canopy here.		

Strata	Height Range (m)	Cover	Species
Tree 1	17-18.5	20%	*Acacia celsa* *Alphitonia petriei*
Tree 2	10.5	50%	*Alstonia muelleriana* *Deplanchea tetraphylla* *Guioa acutifolia* *Polyscias australiana* *Syzygium sp.*
Tree 3	7.5	50%	*Polyscias australiana*
Shrub 1	2.5-3	40-60%	*Benstonea monticola* *Calamus moti* *Cryptocarya grandis* *Endiandra sp.* *Hypserpa sp.* *Macaranga involucrata* *Melicope elleryana* *Melodinus sp.* *Mischocarpus grandissimus* *Neolitsea dealbata* *Polyscias elegans* *Duranta erecta* *Lantana camara* *Rubus alceifolius* *Tetracera nordtiana*
Ground	1	20%	*Lygodium reticulatum* *Melastoma malabathricum* *Oplismenus undulatifolius*

Ground cover:	
FPC	
litter	90%
veg	5%
soil	5%

Site name:	Q20	**Date:**	5/09/2017
Survey type:	Quaternary	**Location:**	
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	
Slope:		**Aspect:**	
Mapped RE:		**Observed RE:**	
Notes:	Harley road.		

Strata	Height Range (m)	Cover	Species
Emergent	27-30.5	30%	*Acacia celsa*
Tree 1	23.5-25.5	60%	*Alstonia muelleriana* *Rainforest spp.*
Tree 2	12	55%	*Rainforest spp.*
Tree 3	6.5	50%	*Rainforest spp.*
Shrub 1	4	20%	*Pandanus sp.* *Calamus sp.*
Ground	<1	15%	*Fern sp.* *Calamus sp.*

Site name:	Q21	**Date:**	5/09/2017
Survey type:	Quaternary	**Location:**	
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	
Slope:		**Aspect:**	
Mapped RE:		**Observed RE:**	
Notes:	Harley road, RE 7.11.1a Remnant (Riparian)		

Strata	Height Range (m)	Cover	Species
Emergent	42	40%	*Acacia celsa* *Flindersia sp.*
Tree 1	28	60%	*Elaeocarpus sp.*
Tree 2	18	40%	*Rainforest spp.*
Tree 3	9	30%	*Rainforest spp.*
Shrub 1	2.5	20%	*Rainforest spp.*
Ground	1	15%	*Fern sp.* *Calamus sp.*

Site name:	Q22	**Date:**	5/09/2017
Survey type:	Quaternary	**Location:**	
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	
Slope:		**Aspect:**	
Mapped RE:		**Observed RE:**	
Notes:	Water res. Myola Road, RE 7.11.1a Remnant.		

Strata	Height Range (m)	Cover	Species
Emergent	31.5	30%	*Acacia celsa*, *Rainforest spp.*
Tree 1	20.5-27	45%	*Elaeocarpus sp.*
Tree 2	16-18	50%	*Rainforest spp.*
Tree 3	8	50%	*Darlingia sp.*
Shrub 1	2.5-4	20%	*Calamus sp.*
Ground	1	25%	*Fern sp.*

Site name:	Q23	**Date:**	5/09/2017
Survey type:	Quaternary	**Location:**	
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	
Slope:		**Aspect:**	
Mapped RE:		**Observed RE:**	
Notes:	Non-remnant between Q18-Q10		

Strata	Height Range (m)	Cover	Species
Emergent	21.5-23.5	40%	*Acacia celsa* *Rainforest spp.*
Tree 1	16-17.5	45%	*Rainforest spp.*
Tree 2	12.5	30%	*Polyscias sp.*
Tree 3	7	25%	*Rainforestspp.*
Shrub 1	3.5	30%	*Polyscias sp.* *Darlingia sp.*
Ground	1	15%	*Gahnia aspera*

Site name:	Q24	**Date:**	5/09/2017
Survey type:	Quaternary	**Location:**	
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	
Slope:		**Aspect:**	
Mapped RE:		**Observed RE:**	
Notes:	South end of Warril Creek (edge of high bank)		

Strata	Height Range (m)	Cover	Species
Emergent	34	25%	*Acacia celsa*
Tree 1	18-19	40%	*Rainforest spp.*
Tree 2	11	60%	*Rainforest spp.*
Tree 3	8	40%	*Polyscias sp.*
Shrub 1	3.5	30%	*Alphitonia sp.*
Ground	1	15%	*Vines* *Rubus alceifolius*

Site name:	Q25	**Date:**	5/09/2017
Survey type:	Quaternary	**Location:**	
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	
Slope:		**Aspect:**	
Mapped RE:		**Observed RE:**	
Notes:			

Strata	Height Range (m)	Cover	Species
Emergent	19	55%	*Acacia celsa*
Tree 1	11.5-13.5	60%	*Alphitonia sp.*
Tree 2	8	55%	*Polyscias sp.*
Tree 3	6	40%	*Alstonia muelleriana*
Shrub 1	4	30%	*Homalanthus novoguineensis*
Ground	0.5	20%	*Lantana camara* Seedlings

Site name:	Q26	**Date:**	29/09/2017
Survey type:	Quaternary	**Location:**	
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	
Slope:		**Aspect:**	
Mapped RE:	Non-remnant	**Observed RE:**	RE 7.11.44
Notes:	In gully near S18. Forest development patchy, canopy taller and more dense in gullies (cf adjacent low ridges).		

Strata	Height Range (m)	Cover	Species
T1	30	40%	*Acacia celsa* *Eucalyptus tereticornis*
T2	20	40%	*Acacia celsa* *Polyscias elegans* *Cryptocarya grandis*
T3	15	60%	*Polyscias elegans* *Calamus moti* *Sloanea langii*
S1	3-4	50%	*Calamus moti* *Polyscias elegans*
G	1	20%	*Seedlings*

Site name:	Q27	**Date:**	29/09/2017
Survey type:	Quaternary	**Location:**	
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	
Slope:		**Aspect:**	
Mapped RE:	Non-remnant	**Observed RE:**	RE 7.11.7a
Notes:	Near S19 along track network. Canopy patchy, partly due to fallen Acacia. Well established Lianas present.		

Strata	Height Range (m)	Cover	Species
T1	25-35	50%	*Acacia celsa (25m)* *Elaeocarpus edmundi* *Elaeocarpus angustifolius (35m)* *Melicope elleryana*
T2	20	55-60%	*Acacia celsa* *Cryptocarya murrayi*
T3	15	60%	*Polyscias elegans* *Cryptocarya clarksoniana*
S1	3-4	70%	*Calamus moti* *Polyscias elegans* *Rubus alceifolius*
G	1	20%	*Calamus moti* *Rubus alceifolius*

Site name:	Q28	**Date:**	29/09/2017
Survey type:	Quaternary	**Location:**	
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	
Slope:		**Aspect:**	
Mapped RE:	Non-remnant	**Observed RE:**	RE 7.11.1b
Notes:	Gully near homestead. Forest development patchy, canopy taller and more dense along narrow gullies (cf adjacent low ridges).		

Strata	Height Range (m)	Cover	Species
E	25	50%	*Acacia celsa* *Alstonia muelleriana* *Alphitonia petriei*
T1	20-22	50%	*Acacia celsa* *Alstonia muelleriana* *Alphitonia petriei*
T2	10-12	70%	*Cyathea cooperi* *Polyscias elegans* *Cryptocarya clarksoniana*
T3	8-10	70%	*Malotus sp.* *Cryptocarya clarksoniana*
S1	1.5-3	60%	*Cordyline sp.* *Rubus alceifolius* *Cryptocarya sp.*
G	1	20%	*Rubus alceifolius* *Melastoma cyanoides* *Gahnia aspera*

Site name:	Q29	**Date:**	29/09/2017
Survey type:	Quaternary	**Location:**	
Geology:	Metamorphic (Hodgkinson Formation)	**Soil:**	
Slope:		**Aspect:**	
Mapped RE:	Non-remnant	**Observed RE:**	Non-remnant
Notes:	Low ridge near Q28. Forest is low regrowth on ridge.		

Strata	Height Range (m)	Cover	Species
T1	14-16	40%	*Acacia celsa*
T2	4-12	40-60%	*Acacia celsa* *Polyscias elegans* *Alstonia muelleriana* *Alphitonia petriei*
S1	1.5-3	40-60%	*Cordyline sp.* *Rubus alceifolius* *Alstonia muelleriana*

Appendix J:
Flora Species List

Flora species list

Family	Species name	Common name
Acanthaceae	*Brunoniella acaulis*	Brunoniella
Acanthaceae	*Pseuderanthemum variabile*	Love Flower
Acanthaceae	*Rostellularia adscendens*	Pink Tongues
Anacardiaceae	*Blepharocarya involucrigera*	
Anacardiaceae	*Mangifera indica*	Mango
Anacardiaceae	*Pleiogynium timoriense*	Burdekin Plum
Annonaceae	*Melodorum uhrii*	
Annonaceae	*Polyalthia australis*	Canary Beech
Annonaceae	*Polyalthia nitidissima*	Shiny Leaf Tree
Annonaceae	*Xylopia maccreae*	Orange Jacket
Apocynaceae	*Alstonia muelleriana*	Hard Cheesewood
Apocynaceae	*Alstonia scholaris*	White Cheesewood
Apocynaceae	*Alyxia ruscifolia*	Chain Fruit
Apocynaceae	*Alyxia spicata*	Chain Fruit
Apocynaceae	*Carissa ovata*	Kunkerberry
Apocynaceae	*Cerbera floribunda*	Cassowary Plum
Apocynaceae	*Hoya australis*	Australian Waxvine
Apocynaceae	*Hoya macgillivrayi*	
Apocynaceae	*Hoya pottsii*	Claret Hoya
Apocynaceae	*Melodinus acutiflorus*	White-flowered Melodinus
Apocynaceae	*Melodinus australis*	Bellbird Vine
Apocynaceae	*Parsonsia velutina*	Hairy Silkpod
Apocynaceae	*Parsonsia latifolia*	
Araceae	*Epipremnum pinnatum*	Native Monstera
Araceae	*Pothos longipes*	Pothos
Araceae	*Rhaphidophora australasica*	
Araliaceae	*Delarbrea michieana*	Blue Nun
Araliaceae	*Mackinlaya macrosciadea*	Blue Umbrella
Araliaceae	*Polyscias australiana*	Ivory Basswood
Araliaceae	*Polyscias elegans*	Celerywood
Araliaceae	*Polyscias purpurea*	
Araliaceae	*Schefflera actinophylla*	Umbrella Tree
Araucariaceae	*Agathis robusta*	Queensland Kauri
Arecaceae	*Archontophoenix alexandrae*	Alexandra Palm
Arecaceae	*Archontophoenix myolensis*	Myolan Alexandra Palm
Arecaceae	*Calamus australis*	Hairy Mary
Arecaceae	*Calamus caryotoides*	Fish Tail Lawyer Vine
Arecaceae	*Calamus moti*	Yellow Lawyer
Arecaceae	*Licuala ramsayi*	Kuranda Fan Palm
Arecaceae	*Linospadix minor*	Walking Stick palm
Arecaceae	*Linospadix palmerianus*	Palmer's Walking Stick palm
Arecaceae	*Syagrus romanzoffiana*	Queen Palm
Aristolochiaceae	*Aristolochia deltantha*	Mountain Dutchman's Pipe
Aristolochiaceae	*Aristolochia thozetii*	Dutchmans Pipe
Aristolochiaceae	*Pararistolochia deltantha*	
Asparagaceae	*Cordyline cannifolia*	Palm Lily
Asparagaceae	*Cordyline manners-suttoniae*	Giant Palm Lily
Asparagaceae	*Eustrephus latifolius*	Wombat Berry

Family	Species name	Common name
Asparagaceae	*Lomandra longifolia*	Long-leaved Matrush
Aspleniaceae	*Asplenium australasicum*	
Aspleniaceae	*Asplenium nidus*	Bird's Nest Fern
Asteraceae	*Ageratum conyzoides*	Billygoat Weed
Asteraceae	*Ageratum houstonianum*	
Asteraceae	*Bidens pilosa*	Cobbler's Pegs
Asteraceae	*Coronidium rupicola*	Yellow Button
Asteraceae	*Crassocephalum crepidioides*	Redflower ragleaf
Asteraceae	*Sphagneticola trilobata*	Singapore Daisy
Balanophoraceae	*Balanophora fungosa*	
Bignoniaceae	*Deplanchea tetraphylla*	Golden Bouqquet Tree
Bignoniaceae	*Dolichandra unguis-cati*	Cat's Claw Creeper
Bignoniaceae	*Neosepicaea jucunda*	
Bignoniaceae	*Pandorea pandorana*	
Bignoniaceae	*Spathodea campanulata*	African Tulip
Blechnaceae	*Blechnum cartilagineum*	
Blechnaceae	*Blechnum occidentale*	Hammock Fern
Blechnaceae	*Blechnum orientale*	Midsorus Fern
Burseraceae	*Canarium australasicum*	Mango Bark
Calophyllaceae	*Calophyllum calaba var australianum*	Pink Calophyllum
Cannabaceae	*Trema tomentosa*	Native Peach
Capparaceae	*Capparis lanceolaris*	Native Caper
Casuarinaceae	*Allocasuarina torulosa*	Forest She-oak
Celastraceae	*Elaeodendron melanocarpum*	Black Olive Plum
Celastraceae	*Hedraianthera porphyropetala*	Purple-flowered Hedraianthera
Celastraceae	*Hippocratea barbata*	Knot Vine
Celastraceae	*Maytenus fasciculiflora*	Orangebark
Clusiaceae	*Garcinia dulcis*	Claudie Mangosteen
Clusiaceae	*Garcinia warrenii*	Native Mangosteen
Colchicaceae	*Schelhammera multiflora*	Schelhammera
Combretaceae	*Combretum indicum*	Rangoon Creeper
Commelinaceae	*Aneilema acuminatum*	Native Wandering Jew
Connaraceae	*Connarus conchocarpus*	
Costaceae	*Cheilocostus speciosus*	Crepe Ginger
Cunoniaceae	*Davidsonia pruriens*	Davidson's Plum
Cyatheaceae	*Cyathea cooperi*	
Cyatheaceae	*Cyathea rebeccae*	Black Tree Fern
Cyatheaceae	*Cyathea woollsiana*	Queensland Tree Fern
Cyatheaceae	*Sphaeropteris cooperi*	Scaly Tree Fern
Cyperaceae	*Gahnia aspera*	Large Seeded Gahnia
Cyperaceae	*Gahnia sieberiana*	Red-fruited Sawsedge
Cyperaceae	*Scleria polycarpa*	
Dennstaedtiaceae	*Pteridium esculentum*	
Dichapetalaceae	*Dichapetalum papuanum*	Papuan Dichapetalum
Dilleniaceae	*Dillenia alata*	
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower
Dilleniaceae	*Tetracera daemeliana*	Large-leaved Fire Vine
Dilleniaceae	*Tetracera nordtiana*	Small-leaved Fire Vine
Dioscoreaceae	*Dioscorea transversa*	
Ebenaceae	*Diospyros cupulosa*	
Ebenaceae	*Diospyros hebecarpa*	Scrub Ebony
Elaeocarpaceae	*Aceratium megalospermum*	

Family	Species name	Common name
Elaeocarpaceae	*Elaeocarpus angustifolius*	Blue Quandong
Elaeocarpaceae	*Elaeocarpus bancroftii*	
Elaeocarpaceae	*Elaeocarpus eumundi*	Smooth-leaved Quandong
Elaeocarpaceae	*Elaeocarpus foveolatus*	White Quandong
Elaeocarpaceae	*Elaeocarpus grahamii*	
Elaeocarpaceae	*Sloanea australis*	Blush carabeen
Elaeocarpaceae	*Sloanea langii*	White Carabeen
Euphorbiaceae	*Claoxylon tenerifolium*	Queensland Brittlewood
Euphorbiaceae	*Codiaeum variegatum*	Croton
Euphorbiaceae	*Homalanthus novoguineensis*	
Euphorbiaceae	*Macaranga involucrata*	Brown Macaranga
Euphorbiaceae	*Macaranga subdentata*	Needle Bark
Euphorbiaceae	*Macaranga tanarius*	Blush Macaranga
Euphorbiaceae	*Mallotus philippensis*	Red Kamala
Euphorbiaceae	*Mallotus polyadenos*	Kamala
Euphorbiaceae	*Omphalea queenslandiae*	
Euphorbiaceae	*Rockinghamia angustifolia*	
Fabaceae	*Acacia celsa*	Brown Salwood
Fabaceae	*Acacia cincinnata*	Lancewood
Fabaceae	*Acacia crassicarpa*	Broadleaf Salwood
Fabaceae	*Acacia flavescens*	Red Wattle
Fabaceae	*Acacia mangium*	Sally Wattle
Fabaceae	*Acacia melanoxylon*	Tasmanian Blackwood
Fabaceae	*Albizia procera*	White Siris
Fabaceae	*Archidendron hendersonii*	White Laceflower
Fabaceae	*Austrosteenisia blackii*	Blood Vine
Fabaceae	*Austrosteenisia stipularis*	
Fabaceae	*Centrosema molle*	Common Centro
Fabaceae	*Crotolaria pallida*	Rattlepod
Fabaceae	*Delonix regia*	Poinciana
Fabaceae	*Derris trifoliata*	Threeleaf Derris
Fabaceae	*Desmodium tortuosum*	Beggarweed
Fabaceae	*Flemingia parviflora*	Flemingia
Fabaceae	*Indigofera sp.*	
Fabaceae	*Macroptilium atropurpureum*	Siratro
Fabaceae	*Mimosa pudica*	Sensitive Weed
Fabaceae	*Paraserianthes toona*	Mackay Cedar
Fabaceae	*Senna septemtrionalis*	Smooth Senna
Fabaceae	*Stylosanthes scabra*	Shrubby Stylo
Flagellariaceae	*Flagellaria indica L. var. divaricata*	Branching Supplejack
Gleicheniaceae	*Dicranopteris linearis*	Coral Fern
Gleicheniaceae	*Sticherus flabellatus*	Umbrella Fern
Goodeniaceae	*Scaevola enantophylla*	Climbing Fan Flower
Hemerocallidaceae	*Dianella atraxis*	Northern Flax Lily
Hemerocallidaceae	*Dianella bambusifolia*	Bamboo Blue Flax Lily
Hemerocallidaceae	*Dianella caerulea*	Blue Flax-lily
Hemerocallidaceae	*Geitonoplesium cymosum*	Scrambling Lily
Hymenophyllaceae	*Abrodictyum obscurum*	Bristle Fern
Hymenophyllaceae	*Cephalomanes atrovirens*	Dark Green Filmy Fern
Hypoxidaceae	*Curculigo ensifolia*	Brahmin Ginseng
Icacinaceae	*Apodytes brachystylis*	Buff Alder
Lamiaceae	*Clerodendrum floribundum*	Lolly Bush
Lamiaceae	*Hyptis capitata*	Buttonweed

Family	Species name	Common name
Lamiaceae	*Oxera splendida*	Glory Vine
Lauraceae	*Beilschmiedia bancroftii*	
Lauraceae	*Cinnamomum laubatii*	
Lauraceae	*Cryptocarya clarksoniana*	Clarkson's Laurel
Lauraceae	*Cryptocarya grandis*	White Laurel
Lauraceae	*Cryptocarya laevigata*	Glossy Laurel
Lauraceae	*Cryptocarya mackinnoniana*	Mackinnon's Laurel
Lauraceae	*Cryptocarya murrayi*	Murray's Laurel
Lauraceae	*Cryptocarya vulgaris*	
Lauraceae	*Endiandra acuminata*	Brown Walnut
Lauraceae	*Endiandra hypotephra*	
Lauraceae	*Litsea bindoniana*	Round-leaved Bollywood
Lauraceae	*Litsea leefeana*	
Lauraceae	*Neolitsea brassii*	
Lauraceae	*Neolitsea dealbata*	White Bolly Gum
Lecythidaceae	*Planchonia careya*	Cocky Apple
Leptaulaceae	*Citronella moorei*	
Lindsaeaceae	*Lindsaea ensifolia*	Graceful Necklace Fern
Loranthaceae	*Amyema queenslandica*	
Lygodiaceae	*Lygodium reticulatum*	Coarse Climbing Fern
Maesaceae	*Maesa dependens*	
Malvaceae	*Abelmoschus moschatus*	Native Rosella
Malvaceae	*Argyrodendron peralatum*	Red Tulip Oak
Malvaceae	*Brachychiton acerifolius*	Illawara Flame Tree
Malvaceae	*Commersonia bartramia*	Brown Kurrajong
Malvaceae	*Grewia retusifolia*	Emu Berry
Malvaceae	*Heritiera polyandra*	Brown Tulip Oak
Malvaceae	*Sida rhombifolia*	Common Sida
Malvaceae	*Sterculia quadrifida*	Red-fruited Kurrajong
Malvaceae	*Triumfetta rhomboidea*	Chinese Burr
Malvaceae	*Urena lobata*	Pink Burr
Marattiaceae	*Angiopteris evecta*	King Fern
Melastomataceae	*Melastoma cyanoides*	
Melastomataceae	*Melastoma malabathricum*	Native Lasiandra
Meliaceae	*Dysoxylum oppositifolium*	
Meliaceae	*Melia azedarach*	White Cedar
Menispermaceae	*Hypserpa laurina*	Laurel-leaved Hypserpa
Menispermaceae	*Stephania japonica*	Snake Vine
Menispermaceae	*Tinospora smalicina*	Snake Vine
Menyanthaceae	*Nymphoides indica*	Water Snowflake
Monimiaceae	*Austromatthaea elegans*	
Monimiaceae	*Levieria acuminata*	Straw Beech
Monimiaceae	*Palmeria scandens*	Anchor Vine
Monimiaceae	*Steganthera laxiflora*	Tetra Beech
Monimiaceae	*Tetrasynandra longipes*	
Moraceae	*Ficus copiosa*	Plentiful Fig
Moraceae	*Ficus destruens*	
Moraceae	*Ficus fraseri*	
Moraceae	*Ficus hispida*	Hairy Fig
Moraceae	*Ficus opposita*	Sandpaper Fig
Moraceae	*Ficus racemosa*	Cluster Fig
Moraceae	*Streblus glaber*	Smooth Streblus
Moraceae	*Trophis scandens*	

Family	Species name	Common name
Myristicaceae	*Myristica insipida*	Queensland Nutmeg
Myrsinaceae	*Embelia caulialata*	
Myrsinaceae	*Myrsine subsessilis*	
Myrtaceae	*Archirhodomyrtus beckleri*	
Myrtaceae	*Corymbia clarksoniana*	Clarkson's Bloodwood
Myrtaceae	*Corymbia dallachiana*	Dallachy's Gum
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood
Myrtaceae	*Corymbia tessellaris*	Moreton Bay Ash
Myrtaceae	*Corymbia torelliana*	Cadaghi
Myrtaceae	*Decaspermum humile*	
Myrtaceae	*Eucalyptus platyphylla*	White Gum
Myrtaceae	*Eucalyptus grandis*	Rosegum
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Myrtaceae	*Gossia myrsinocarpa*	Malanda Ironwood
Myrtaceae	*Lophostemon suaveolens*	Swamp Mahogany
Myrtaceae	*Melaleuca leucadendra*	Weeping Paperbark
Myrtaceae	*Melaleuca viridiflora*	Broad Leaved Paperbark
Myrtaceae	*Psidium cattleianum*	Cherry guava
Myrtaceae	*Psidium guajava*	Guava
Myrtaceae	*Rhodamnia glauca*	Northern Malletwood
Myrtaceae	*Rhodamnia sessiliflora*	Iron Malletwood
Myrtaceae	*Rhodamnia spongiosa*	
Myrtaceae	*Rhodomyrtus macrocarpa*	
Myrtaceae	*Rhodomyrtus pervagata*	Rusty Rhodomyrtus
Myrtaceae	*Syzygium claviflorum*	Grey Satinash
Myrtaceae	*Syzygium divaricatum*	Cassowary Satinash
Myrtaceae	*Syzygium fibrosum*	
Myrtaceae	*Syzygium hemilamprum*	Broad-leaved Lilly Pilly
Myrtaceae	*Syzygium kuranda*	
Myrtaceae	*Syzygium luehmannii*	Small-leaved Lilly Pilly
Myrtaceae	*Syzygium suborbiculare*	
Myrtaceae	*Syzygium tierneyanum*	River Cherry
Myrtaceae	*Syzygium wilsonii*	
Myrtaceae	*Tristaniopsis exiliflora*	Watergum
Oleaceae	*Chionanthus ramiflorus*	Northern Olive
Oleaceae	*Jasminum didymum*	Native Jasmine
Oleaceae	*Jasminum elongatum*	Native Jasmine
Orchidaceae	*Cymbidium madidum*	Buttercup Orchid
Orchidaceae	*Dendrobium teretifolium*	Pencil Orchid
Pandanaceae	*Benstonea monticola*	Urchinfruited Pandan
Pandanaceae	*Freycinetia excelsa*	Giant Climbing Pandan
Pandanaceae	*Freycinetia scandens*	Climbing Pandan
Pandanaceae	*Pandanus cookii*	Cook's Screw Palm
Passifloraceae	*Passiflora edulis*	
Passifloraceae	*Passiflora foetida*	Stinking Passionflower
Passifloraceae	*Passiflora kuranda*	
Phyllanthaceae	*Breynia cernua*	Fart Bush
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush
Phyllanthaceae	*Breynia stipitata*	Dwarf Fartbush
Phyllanthaceae	*Cleistanthus apodus*	Weeping Cleistanthus
Phyllanthaceae	*Glochidion harveyanum*	Harvey's Buttonwood
Phyllanthaceae	*Glochidion sumatranum*	

Family	Species name	Common name
Phyllanthaceae	*Phyllanthus sp.*	
Phyllanthaceae	*Sauropus albiflorus*	Showy Sauropus
Pinaceae	*Pinus caribeae*	Caribbean Pine
Piperaceae	*Piper caninum*	Common Pepper
Piperaceae	*Piper hederaceum*	Giant Pepper
Pittosporaceae	*Bursaria incana*	Native Box
Pittosporaceae	*Bursaria spinosa*	Spiny Bursaria
Pittosporaceae	*Pittosporum rubiginosum*	Hairy Red Pittosporum
Poaceae	*Arundinella nepalensis*	Reed Grass
Poaceae	*Bambusa vulgaris*	Common Bamboo
Poaceae	*Brachiaria decumbens*	Signal Grass
Poaceae	*Eragrostis spartioides*	Broom Lovegrass
Poaceae	*Heteropogon triticeus*	Giant Speargrass
Poaceae	*Imperata cylindrica*	Blady Grass
Poaceae	*Megathyrsus maximus*	
Poaceae	*Melinis minutiflora*	Molassus Grass
Poaceae	*Melinis repens*	
Poaceae	*Oplismenus undulatifolius*	Wavyleaf Basketgrass
Poaceae	*Ottochola sp.*	
Poaceae	*Panicum maximum*	Guinea Grass
Poaceae	*Paspalidium distans*	Spreading Panicum
Poaceae	*Themeda triandra*	Kangaroo Grass
Poaceae	*Urochloa decumbens*	
Podocarpaceae	*Podocarpus grayae*	Brown Pine
Polygalaceae	*Polygala paniculata*	Island Snake-root
Polygalaceae	*Xanthophyllum fragrans*	
Polygalaceae	*Xanthophyllum octandrum*	
Polypodiaceae	*Colysis ampla*	Colysis Fern
Polypodiaceae	*Drynaria rigidula*	Basket Fern
Polypodiaceae	*Platycerium bifurcatum*	Elkhorn Fern
Polypodiaceae	*Platycerium hillii*	Stiff Staghorn Fern
Polypodiaceae	*Pyrrosia longifolia*	Strapleaf Fern
Primulaceae	*Ardisia brevipedata*	Rambling Spearflower
Primulaceae	*Ardisia crenata*	Coral Berry
Primulaceae	*Myrsine porosa*	Northern Muttonwood
Primulaceae	*Rapanea subsessilis*	Red Muttonwood
Proteaceae	*Cardwellia sublimis*	Bull Oak
Proteaceae	*Carnarvonia araliifolia*	Caledonian Oak
Proteaceae	*Darlingia darlingiana*	Brown Silky Oak
Proteaceae	*Grevillea baileyana*	Bailey's Silky Oak
Proteaceae	*Grevillea hilliana*	White Silky Oak
Proteaceae	*Grevillea parallella*	Silver Oak
Proteaceae	*Musgravea heterophylla*	
Proteaceae	*Opisthiolepis heterophylla*	
Proteaceae	*Persoonia falcata*	Geebung
Proteaceae	*Placospermum coriaceum*	
Psilotaceae	*Psilotum nudum*	Skeleton Fork Fern
Pteridaceae	*Adiantum diaphanum*	Small Maidenhair Fern
Pteridaceae	*Adiantum hispidulum*	Rough Maidenhair
Pteridaceae	*Cheilanthes sieberi*	Mulga Fern
Pteridaceae	*Cheilosoria tenuifolia*	Narrow-leaved Lipfern
Pteridaceae	*Pellaea nana*	Dwarf Sicle Fern
Pteridaceae	*Taenitis pinnata*	Morse Fern

Family	Species name	Common name
Pteridaceae	*Vittaria elongata*	Stiff Shoestring Fern
Rhamnaceae	*Alphitonia petriei*	Pink Almond
Rhamnaceae	*Alphitonia whitei*	
Rhizophoraceae	*Carallia brachiata*	
Ripogonaceae	*Ripogonum album*	Forest Supplejack
Rosaceae	*Rubus alceifolius*	Giant Bramble
Rousseaceae	*Abrophyllum ornans*	Native Hydrangea
Rubiaceae	*Aidia racemosa*	
Rubiaceae	*Atractocarpus fitzalanii*	Brown Gardenia
Rubiaceae	*Coelospermum paniculatum*	
Rubiaceae	*Coelospermum reticulatum*	Medicine Bush
Rubiaceae	*Coffea arabica*	Arabica Coffee
Rubiaceae	*Coffea liberica*	
Rubiaceae	*Cyclophyllum coprosmoides*	Coast Canthium
Rubiaceae	*Gardenia ovularis*	
Rubiaceae	*Lasianthus chlorocarpus*	Blue Rubi
Rubiaceae	*Pavetta australiensis*	Butterfly Bush
Rubiaceae	*Psydrax attenuata*	
Rubiaceae	*Randia audasii*	Daintree Gardenia
Rubiaceae	*Spermacoce alata*	Borreria
Rubiaceae	*Spermacoce latifolia*	
Rubiaceae	*Spermacoce remota*	Woodland False Buttonweed
Rutaceae	*Acronychia acidula*	Lemon Aspen
Rutaceae	*Acronychia acronychioides*	White Aspen
Rutaceae	*Acronychia laevis*	Glossy Acronychia
Rutaceae	*Brombya platynema*	
Rutaceae	*Citrus x jambhiri*	Lemon
Rutaceae	*Flindersia bourjotiana*	
Rutaceae	*Flindersia ifflaiana*	Hickory Ash
Rutaceae	*Flindersia pimenteliana*	Maple Silkwood
Rutaceae	*Medicosma fareana*	
Rutaceae	*Melicope bonwickii*	Yellow Evodia
Rutaceae	*Melicope elleryana*	Pink Euodia
Rutaceae	*Melicope xanthoxyloides*	
Rutaceae	*Micromelum minutum*	Lime Berry
Rutaceae	*Pitaviaster haplophyllus*	
Rutaceae	*Tarenna dallachiana*	
Salicaceae	*Scolopia braunii*	Flintwood
Sapindaceae	*Castanospora alphandii*	
Sapindaceae	*Cupaniopsis foveolata*	White Tamarind
Sapindaceae	*Elattostachys microcarpa*	
Sapindaceae	*Ganophyllum falcatum*	Scaly-bark Ash
Sapindaceae	*Guioa acutifolia*	Glossy Tamarind
Sapindaceae	*Guioa lasioneura*	Silky tamarind
Sapindaceae	*Harpullia rhyticarpa*	Slender Harpullia
Sapindaceae	*Jagera pseudorhus*	Foambark Tree
Sapindaceae	*Mischocarpus exangulatus*	
Sapindaceae	*Mischocarpus grandissimus*	Giant-leaved Tamarind
Sapindaceae	*Mischocarpus lachnocarpus*	Wooly Pear Fruit
Sapindaceae	*Rhysotoechia robertsonii*	
Sapindaceae	*Sarcopteryx reticulata*	

Family	Species name	Common name
Sapindaceae	*Sarcotoechia serrata*	Fern-leaved Tamarind
Sapindaceae	*Synima cordierorum*	
Sapindaceae	*Toechima daemelianum*	Cape Tamarind
Sapindaceae	*Toechima erythrocarpum*	
Sapotaceae	*Planchonella chartacea*	
Sapotaceae	*Planchonella pohlmaniana*	
Schizaeaceae	*Schizaea dichotoma*	Fan Fern
Selaginellaceae	*Selaginella australiensis*	Australian Selaginella
Selaginellaceae	*Selaginella kraussiana*	African Clubmoss
Selaginellaceae	*Selaginella longipinna*	Electric Fern
Smilacaceae	*Smilax australis*	Austral Sarsaparilla
Smilacaceae	*Smilax blumei*	Broad-leaved Sarsaparilla
Solanaceae	*Solanum mauritianum*	Wild Tobacco
Solanaceae	*Solanum torvum*	Devil's Fig
Sparrmanniaceae	*Trichospermum pleiostigma*	
Sterculiaceae	*Franciscodendron laurifolium*	
Strychnaceae	*Strychnos minor*	Snakewood
Symplocaceae	*Symplocos puberula*	
Thelypteridaceae	*Christella dentata*	Soft Fern
Thymelaeaceae	*Lethedon setosa*	
Thymelaeaceae	*Wikstroemia indica*	Tiebush
Urticaceae	*Dendrocnide moroides*	Gympie Stinger
Verbenaceae	*Duranta erecta*	Sky Flower
Verbenaceae	*Lantana camara*	Lantana
Verbenaceae	*Stachytarpheta jamaicensis*	Snakeweed
Vitaceae	*Ampelocissus acetosa*	Wild Grape
Vitaceae	*Cissus hypoglauca*	Five-leaved Native Grape
Vitaceae	*Cissus penninervis*	
Vitaceae	*Cissus repens*	Variegated Grape
Winteraceae	*Bubbia semecarpoides*	
Xanthorrhoeaceae	*Xanthorrhoea johnsonii*	Northern Forest Grasstree
Zingiberaceae	*Alpinia arctiflora*	Pleated Ginger
Zingiberaceae	*Alpinia caerulea*	Native Ginger

Appendix K:
Fauna Species List

Fauna species list

Class	Family	Scientific Name	Common Name				NRA	NRA	NRA (Unique Incidental)	Hoskin 2017	Ebner & Vallance 2017
				I	Q	A	Jan-17	May-17	Incidental -Unique Species Only	Incidental	Incidental
Amphibians	Bufonidae	*Rhinella marina*	Cane Toad	Y			1	1		1	
Amphibians	Hylidae	*Litoria caerulea*	Common Green Treefrog		C		1	1		1	
Amphibians	Hylidae	*Litoria fallax*	Eastern Sedgefrog		C		1			1	
Amphibians	Hylidae	*Litoria gracilenta*	Graceful Treefrog		C		1			1	
Amphibians	Hylidae	*Litoria infrafrenata*	White Lipped Treefrog		C		1			1	
Amphibians	Hylidae	*Litoria jungguy*	Northern Stony Creek Frog		C				1	1	
Amphibians	Hylidae	*Litoria myola*	Kuranda Treefrog		E	E			1	1	
Amphibians	Hylidae	*Litoria rothii*	Northern Laughing Treefrog		C				1	1	
Amphibians	Hylidae	*Litoria serrata*	Tapping Green Eyed Frog		V			1		1	
Amphibians	Hylidae	*Litoria xanthomera*	Orange Thighed Treefrog		C				1	1	
Amphibians	Microhylidae	*Austrochaperina pluvialis*	White Browed Whistlefrog		C				1	1	
Amphibians	Microhylidae	*Cophixalus ornatus*	Northern Ornate Nursery-frog		C				1	1	
Amphibians	Myobatrachidae	*Mixophyes coggeri*	Mottled Barred Frog		C		1	1		1	
Amphibians	Ranidae	*Papurana daemeli*	Australian Woodfrog		C		1			1	1
Birds	Acanthizidae	*Acanthiza reguloides*	Buff-rumped Thornbill		C			1			
Birds	Acanthizidae	*Gerygone mouki*	Brown Gerygone		C					1	
Birds	Acanthizidae	*Gerygone palpebrosa*	Fairy Gerygone		C		1	1			
Birds	Acanthizidae	*Sericornis magnirostra*	Large-billed Scrubwren		C		1	1		1	
Birds	Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk		C			1			
Birds	Accipitridae	*Accipiter novaehollandiae*	Grey Goshawk		C		1	1			
Birds	Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle		C					1	
Birds	Accipitridae	*Haliastur sphenurus*	Whistling Kite		C			1			
Birds	Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar		C		1	1			
Birds	Alaudidae	*Mirafra javanica*	Horsfield's Bushlark		C		1				
Birds	Alcedinidae	*Ceyx azureus*	Azure Kingfisher		C		1				
Birds	Alcedinidae	*Ceyx pusillus*	Little Kingfisher		C					1	
Birds	Anatidae	*Dendrocygna eytoni*	Plumed Whistling-duck		C					1	
Birds	Anatidae	*Anas superciliosa*	Pacific Black Duck		C		1	1			
Birds	Apodidae	*Aerodramus terraereginae*	Australian Swiftlet		C		1	1			
Birds	Ardeidae	*Ardea pacifica*	White-necked Heron		C			1			
Birds	Ardeidae	*Bubulcus ibis*	Cattle Egret		C			1			
Birds	Artamidae	*Artamus leucorynchus*	White-breasted Woodswallow		C		1	1			
Birds	Artamidae	*Cracticus quoyi*	Black Butcherbird		C		1	1		1	
Birds	Burhinidae	*Burhinus grallarius*	Bush Stone-curlew		C		1	1		1	
Birds	Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo		C		1	1		1	
Birds	Cacatuidae	*Calyptorhynchus banksii*	Red-tailed Black-cockatoo		C		1				
Birds	Campephagidae	*Coracina lineata*	Barred Cuckoo-shrike		C		1			1	
Birds	Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		C					1	
Birds	Campephagidae	*Coracina papuensis*	White-bellied Cuckoo-shrike		C		1	1			
Birds	Campephagidae	*Coracina tenuirostris*	Cicadabird		C		1			1	
Birds	Campephagidae	*Lalage leucomela*	Varied Triller		C		1	1			
Birds	Caprimulgidae	*Caprimulgus macrurus*	Large-tailed Nightjar		C					1	
Birds	Charadriidae	*Vanellus miles*	Masked Lapwing		C		1	1		1	
Birds	Cisticolidae	*Cisticola exilis*	Golden-headed Cisticola		C		1	1		1	
Birds	Columbidae	*Chalcophaps indica*	Emerald Dove		C		1	1		1	
Birds	Columbidae	*Columba leucomela*	White-headed Pigeon		C		1				
Birds	Columbidae	*Geopelia humeralis*	Bar-shouldered Dove		C		1	1		1	

Class	Family	Scientific Name	Common Name				NRA	NRA	NRA (Unique Incidental)	Hoskin 2017	Ebner & Vallance 2017
				I	Q	A	Jan-17	May-17	Incidental -Unique Species Only	Incidental	Incidental
Birds	Columbidae	*Geopelia striata*	Peaceful Dove		C		1			1	
Birds	Columbidae	*Macropygia amboinensis*	Brown Cuckoo-dove		C		1	1			
Birds	Columbidae	*Ptilinopus magnificus*	Wompoo Fruit-dove		C		1	1		1	
Birds	Columbidae	*Ptilinopus superbus*	Superb Fruit-dove		C		1			1	
Birds	Coraciidae	*Eurystomus orientalis*	Dollarbird		C					1	
Birds	Cuculidae	*Cacomantis variolosus*	Brush Cuckoo		C					1	
Birds	Cuculidae	*Centropus phasianinus*	Pheasant Coucal		C		1	1		1	
Birds	Cuculidae	*Chalcites minutillus*	Little Bronze-cuckoo		C		1	1			
Birds	Dicruridae	*Dicrurus bracteatus*	Spangled Drongo		C		1				
Birds	Estrildidae	*Neochmia temporalis*	Red-browed Finch		C		1	1		1	
Birds	Estrildidae	*Erythrura gouldiae*	Gouldian Finch		E	E			1		
Birds	Falconidae	*Falco berigora*	Brown Falcon		C			1			
Birds	Falconidae	*Falco cenchroides*	Nankeen Kestrel				1	1			
Birds	Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra		C		1	1			
Birds	Halcyonidae	*Tanysiptera sylvia*	Buff-Breasted Paradise-kingfisher		C		1			1	
Birds	Halcyonidae	*Todiramphus macleayii*	Forest Kingfisher		C		1	1		1	
Birds	Hirundinidae	*Hirundo neoxena*	Welcome Swallow		C		1	1		1	
Birds	Maluridae	*Malurus amabilis*	Lovely Fairy-wren		C		1	1			
Birds	Maluridae	*Malurus melanocephalus*	Red-backed Fairy-wren		C		1				
Birds	Megapodiidae	*Alectura lathami*	Australian Brush-turkey		C		1	1		1	
Birds	Megapodiidae	*Megapodius reinwardt*	Orange-footed Scrubfowl		C		1	1		1	
Birds	Meliphagidae	*Bolemoreus frenatus*	Bridled Honeyeater		C		1				
Birds	Meliphagidae	*Lichmera indistincta*	Brown Honeyeater		C		1	1			
Birds	Meliphagidae	*Meliphaga gracilis*	Graceful Honeyeater		C		1	1		1	
Birds	Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater		C		1	1			
Birds	Meliphagidae	*Meliphaga notata*	Yellow-spotted Honeyeater		C		1	1		1	
Birds	Meliphagidae	*Melithreptus albogularis*	White-throated Honeyeater		C			1			
Birds	Meliphagidae	*Myzomela obscura*	Dusky Honeyeater		C		1	1			
Birds	Meliphagidae	*Myzomela sanguinolenta*	Scarlet Honeyeater		C		1	1			
Birds	Meliphagidae	*Philemon buceroides*	Helmeted Friarbird		C			1		1	
Birds	Meliphagidae	*Stomiopera flava*	Yellow Honeyeater		C			1			
Birds	Meliphagidae	*Xanthotis macleayanus*	Macleay's Honeyeater		C		1	1		1	
Birds	Meropidae	*Merops ornatus*	Rainbow Bee-eater		C		1	1			
Birds	Monarchidae	*Carterornis leucotis*	White-eared Monarch		C			1			
Birds	Monarchidae	*Grallina cyanoleuca*	Magpie-lark		C		1	1			
Birds	Monarchidae	*Machaerirhynchus flaviventer*	Yellow-breasted Boatbill		C		1	1			
Birds	Monarchidae	*Myiagra inquieta*	Restless Flycatcher		C			1			
Birds	Monarchidae	*Myiagra rubecula*	Leaden Flycatcher		C		1				
Birds	Monarchidae	*Symposiachrus trivirgatus*	Spectacled Monarch		SL		1	1		1	
Birds	Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit		C		1	1		1	
Birds	Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird		C		1	1			
Birds	Nectariniidae	*Nectarinia jugularis*	Olive-backed Sunbird		C		1	1			
Birds	Oriolidae	*Sphecotheres vieilloti*	Australasian Figbird		C		1	1		1	
Birds	Orthonychidae	*Orthonyx spaldingii*	Chowchilla		C			1			
Birds	Pachycephalidae	*Colluricincla megarhyncha*	Little Shrike-thrush		C		1	1		1	
Birds	Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler		C			1			
Birds	Pachycephalidae	*Pachycephala simplex peninsulae*	Grey Whistler		C		1	1		1	
Birds	Paradisaeidae	*Ptiloris victoriae*	Victoria's Riflebird		C			1			
Birds	Petroicidae	*Poecilodryas superciliosa*	White-browed Robin		C			1			

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Birds	Petroicidae	*Tregellasia capito*	Pale-yellow Robin		C		1	1			
Birds	Pittidae	*Pitta versicolor*	Noisy Pitta		C		1			1	
Birds	Podargidae	*Podargus papuensis*	Papuan Frogmouth		C					1	
Birds	Psittacidae	*Alisterus scapularis*	Australian King-parrot		C					1	
Birds	Psittacidae	*Cyclopsitta diophthalma macleayana*	Macleay's Fig-parrot		V		1	1		1	
Birds	Psittacidae	*Trichoglossus chlorolepidotus*	Scaly-breasted Lorikeet		C		1	1			
Birds	Psittacidae	*Trichoglossus haematodus moluccanus*	Rainbow Lorikeet		C		1	1		1	
Birds	Psophodidae	*Psophodes olivaceus*	Eastern Whipbird		C		1	1			
Birds	Ptilonorhynchidae	*Ailuroedus maculosus*	Spotted Catbird		C		1	1		1	
Birds	Ptilonorhynchidae	*Scenopoeetes dentirostris*	Tooth-billed Bowerbird		C		1				
Birds	Rallidae	*Rallina tricolor*	Red-necked Crake		C		1				
Birds	Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail		C			1			
Birds	Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail		C			1			
Birds	Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail		SL			1			
Birds	Strigidae	*Ninox boobook*	Southern Boobook		C			1		1	
Birds	Strigidae	*Ninox connivens*	Barking Owl		C			1		1	
Birds	Strigidae	*Ninox rufa queenslandica*	Rufous Owl (southern subspecies)		C					1	
Birds	Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis		C			1			
Birds	Timaliidae	*Zosterops lateralis*	Silvereye		C		1	1			
Birds	Turnicidae	*Turnix maculosus*	Red-backed Button-quail		C					1	
Birds	Tytonidae	*Tyto tenebricosa tenebricosa*	Sooty Owl		C			1		1	
Mammals	Canidae	*Canis lupus dingo*	Dingo				1	1			
Mammals	Canidae	*Canis* sp.	Dog or Dingo				1	1			
Mammals	Emballonuridae	*Saccolaimus saccolaimus*	Bare-rumped Sheathtail Bat		E	V	1				
Mammals	Hypsiprymnodontidae	*Hypsiprymnodon moschatus*	Musky Rat-kangaroo		C			1			
Mammals	Macropodidae	*Macropus agilis*	Agile Wallaby		C			1			
Mammals	Macropodidae	*Thylogale stigmatica*	Red-legged Pademelon		C		1	1			
Mammals	Macropodidae	*Wallabia bicolor*	Swamp Wallaby		C			1			
Mammals	Miniopteridae	*Miniopterus australis*	Little Bent-wing Bat		C		1	1			
Mammals	Miniopteridae	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat		C		1				
Mammals	Molossidae	*Chaerephon jobensis*	Northern Freetail Bat		C		1	1			
Mammals	Molossidae	*Mormopterus lumsdenae*	Northern Free-tailed Bat		C		1	1			
Mammals	Molossidae	*Mormopterus ridei*	Eastern Free-tailed Bat		C		1				
Mammals	Molossidae	*Mormopterus ridei* or *M. halli*	Eastern Free-tailed Bat or Cape York Free-tailed Bat		C			1			
Mammals	Muridae	*Melomys burtoni*	Grassland Melomys		C		1	1			
Mammals	Muridae	*Melomys cervinipes*	Fawn-footed Melomys		C			1		1	
Mammals	Muridae	*Pogonomys* sp.	Tree Mouse		C				1	1	
Mammals	Muridae	*Rattus fuscipes*	Bush Rat		C		1	1			
Mammals	Muridae	*Uromys caudimaculatus*	Giant White-tailed Rat		C		1	1		1	
Mammals	Peramelidae	*Isoodon macrourus*	Northern Brown Bandicoot		C		1	1			
Mammals	Peramelidae	*Perameles pallescens*	Northern Long-nosed Bandicoot		C		1	1			
Mammals	Petauridae	*Dactylopsila trivirgata*	Striped Possum		C		1	1		1	
Mammals	Petauridae	*Petaurus breviceps*	Sugar Glider		C			1		1	
Mammals	Pseudocheiridae	*Pseudochirops archeri*	Green Ringtail Possum		C		1				
Mammals	Pteropodidae	*Nyctimene robinsoni*	Eastern Tube-nosed Bat		C		1			1	
Mammals	Pteropodidae	*Pteropus conspicillatus*	Spectacled Flying-fox		V	V	1			1	
Mammals	Rhinolophidae	*Rhinolophus megaphyllus*	Eastern Horseshoe-bat		C		1	1			
Mammals	Rhinolophidae	*Rhinolophus philippinensis*	Greater Large-eared Horseshoe Bat		E	V		1			
Mammals	Suidae	*Sus scrofa*	Pig	Y			1	1			

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Mammals	Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna		SL		1	1			
Mammals	Vespertilionidae	*Murina florium*	Tube-nosed Insectivorous Bat		V		1				
Mammals	Vespertilionidae	*Chalinolobus nigrogriseus* or *Scotorepens sanborni*	Hoary Wattled Bat or Scotorepens Sanborni		C		1	1			
Mammals	Vespertilionidae	*Nyctophilus bifax*	Northern Long-eared Bat		C		1	1			
Mammals	Vespertilionidae	*Nyctophilus* sp.	Long-eared Bat		C		1	1			
Mammals	Vespertilionidae	*Vespadelus pumilus*	Eastern Forest Bat		C		1	1			
Mammals	Vespertilionidae	*Vespadelus troughtoni*	Eastern Cave Bat		C		1				
Reptiles	Agamidae	*Intellagama lesueurii*	Eastern Water Dragon		C		1			1	1
Reptiles	Agamidae	*Lophosaurus boydii*	Boyd's Forest Dragon		C					1	
Reptiles	Boidae	*Simalia kinghorni*	Amethystine Python (Australian form)		C		1	1			
Reptiles	Carphodactylidae	*Saltuarius cornutus*	Northern Leaf-tailed Gecko		C			1		1	
Reptiles	Chelidae	*Wollumbinia latisternum*	Saw-shelled Turtle		C					1	
Reptiles	Colubridae	*Pseudoferania polylepis*	Macleay's Water Snake		C						1
Reptiles	Colubridae	*Stegonotus cucullatus*	Slaty-grey Snake		C			1		1	
Reptiles	Elapidae	*Pseudechis porphyriacus*	Red-bellied Black Snake		C			1			
Reptiles	Scincidae	*Carlia jarnoldae*	Lined Rainbow-skink		C			1			
Reptiles	Scincidae	*Carlia rostralis*	Black-throated Rainbow-skink		C		1	1			
Reptiles	Scincidae	*Carlia rubrigularis*	Red-throated Rainbow-skink		C		1	1		1	
Reptiles	Scincidae	*Cyclodomorphus gerrardii*	Pink-tongued Lizard		C					1	
Reptiles	Scincidae	*Concinnia brachysoma*	Northern Bar-sided Skink		C		1				
Reptiles	Scincidae	*Concinnia tenuis*	Bar-sided Skink		C		1				
Reptiles	Scincidae	*Glaphyromorphus fuscicaudis*	Brown-tailed Bar-lipped Skink		C		1				
Reptiles	Scincidae	*Lampropholis coggeri*	Rainforest Sunskink		C		1			1	
Reptiles	Scincidae	*Lygisaurus aeratus*	Large-disced Litter-skink		C			1			
Reptiles	Scincidae	*Saproscincus basiliscus*	Basilisk Shadeskink		C		1	1		1	
Reptiles	Scincidae	*Saproscincus tetradactylus*	Four-fingered Shadeskink		C		1			1	
Reptiles	Typhlopidae	*Anilios torresianus*	North-eastern Blind Snake		C		1			1	
Reptiles	Varanidae	*Varanus scalaris*	Spotted Tree Monitor		C		1	1			

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